ERAWATCH Country Report 2009
Analysis of policy mixes to foster R&D investment and to contribute to the ERA

Iceland

Claire Nauwelaers
The mission of the JRC-IPTS is to provide customer-driven support to the EU policy-making process by developing science-based responses to policy challenges that have both a socio-economic as well as a scientific/technological dimension.
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Iceland
Analysis of policy mixes to foster R&D investment and to contribute to the ERA

ERAWATCH Network – University of Maastricht and United Nations University (UNU-MERIT)

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Acknowledgements and further information

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Executive Summary

Knowledge accumulated through investment in R&D, innovation and education is a key driver of long-term growth. Hence, a central task of ERAWATCH is the production of analytical country reports to support the mutual learning process and the monitoring of the efforts in increasing R&D investments and improving the performance of national research systems.

The main objective of the report is to characterise and assess the evolution of the national policy mixes in the perspective of the national goals for R&D investments, and for the contribution to the realisation of the European Research Area, as associate country. This report is building on a synthesis of information from the ERAWATCH Research Inventory and other important available information sources.

Iceland is evolving towards a knowledge-based economy and has established a complete research and innovation system

Over the last two decades, Iceland has experienced a remarkable shift from a natural resources-based economy (based on exploitation of fish stocks and geo- and hydro-energy resources) in the direction of a knowledge-based economy. While the share of activities based on primary resources exploitation in GDP and exports remains high, the growth of R&D-based activities has been significant, shifting the GERD/GDP ratio from 1.1% in 1991 to the mythic Barcelona target of 3% in 2001.

The level of education of the workforce is generally high, especially at tertiary level. A large part of graduate education is traditionally acquired abroad. The number of students enrolled at universities has increased dramatically in the last decade: the growth rate from 1997 till 2005 reached 75%, and went even further higher in the recent crisis months. In times of budgetary cuts, this places an extreme pressure on quality of teaching and research at Icelandic universities.

A fully-fledged research and innovation system is in place in Iceland, with the Science and Technology Policy Council (STPC) established in 2003, as a key strategic institution for S&T policy; a range of Public Research Institutions specialized in key domains of importance for the Icelandic economy; one main and several smaller universities; several competitive funding programmes; a central agency in charge of supporting the system and managing funds, Rannis; and a vibrant, but limited, set of R&D-intensive companies in niche activities (medical equipment, food processing machineries, and biotechnology).

<table>
<thead>
<tr>
<th>Barriers to R&amp;D investment</th>
<th>Opportunities and Risks generated by the policy mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of risk funding for NTBFs</td>
<td>Support to venture capital funds</td>
</tr>
<tr>
<td>Lack of attractiveness of the country for inward R&amp;D investments</td>
<td>Better coordination of macroeconomic policy with innovation policy</td>
</tr>
<tr>
<td>Low number of R&amp;D-active domestic firms</td>
<td>Cooperative research programmes, user-oriented research programmes, innovation stimulation programmes Direct R&amp;D funding for companies: challenge of additionality</td>
</tr>
</tbody>
</table>

Policy orientations for the knowledge economy in Iceland: the public side

1 The figure dropped since then, and reaches 2.8% in 2005 (latest official figure, Rannis).
On the policy side, research, technology and innovation have climbed high on the policy agenda. The key policy orientations adopted during the two terms of office of the STPC (2003-2006 and 2006-2009) reflect a policy will to improve the quality and effectiveness of the research and innovation system. The long term goal of Icelandic science and technology policy refers to societal objectives. The main accents at the outset of the Council’s establishment in 2003 concerned a better organisation, in view of improved performance, of the public research system, focusing on three main types of action: increasing the share of competitive funding in total public R&D funding; strengthening the role of universities as research institutions; reviewing the organisation and work methods of public research institutions. These goals are progressively implemented.

However, challenges still remain. Evolution towards more performance-based funding systems for PROs and universities is visible, but still relatively marginal in view of the large share of institutional funding, notably for governmental research organizations. Regarding the intended switch towards competitive funding sources, despite positive evolutions, in budgetary terms, targeted research programmes still account for a limited share of total public R&D funding. Mergers and restructuring of universities and PROs may still be carried out further. And finally, the current deep economic crisis places a string on public budgets necessary to promote these goals.

**Policy orientations for the knowledge economy in Iceland: the private side**

Policy attention has been so far mostly concentrated on the public R&D side. The share of private investments in total R&D is low (approx. 50%) and concentrated in handful of firms, and there are few governmental support mechanisms for it. This causes policy concern. Overall, the government sees its role with respect to private R&D investment as a facilitator. Regulatory barriers are notably reported for activities in the health sector. This points towards the need for coordinated actions in the policy domains of Education, macroeconomic policy and financial markets. This is where a broader “policy mix” view and where coordination of policy domains become crucial.

The lack of appropriate funding available for New Technology-Based Firms emerged as a growing concern in recent years. The government invested, without much success, in a New Business Venture Fund, and is taking new steps with the creation of a new Fund, Frumtak, in 2008. It remains to be seen whether this will be sufficient to respond to innovative companies’ financial needs, in view of the crisis situation.

**Policy orientations for the knowledge economy in Iceland: the necessary evolution towards a more horizontal view on STI**

During the very recent years, the policy focus has been evolving gradually towards a more holistic view of the innovation system, trying to create linkages between R&D producers and companies, involving users’ views in the policy design process (e.g. for the definition of targeted programmes or for the adoption of new STPC resolution), and turning attention to other bottlenecks in the innovation system than the identified challenges for public R&D funding and reforms of PROs and HEIs.

Practical steps are taken to increase research conducted in collaboration between public and private actors. Ensuring exploitability of knowledge in S&T policy is sought through two mechanisms: applying a combination of scientific and socio-economic benefits criteria for project selection in competitive funding procedures; and adding “third mission” types of indicators in the list of target indicators included in the agreement adopted by the University of Iceland and the Ministry.
The Icelandic Innovation Centre and IMPRA, its service centre for entrepreneurs and SMEs, have a broad support mission, focusing not only on technology transfer but also on support for business development, management, export, financing innovation, etc. There is no independent feedback from beneficiaries on the visibility, relevance, completeness, usefulness and impact of their action. This domain is not yet tightly linked to the other questions treated by the mainstream S&T policy: the need to bridge technology and market opportunities is not yet firmly integrated in policy orientation, though recent developments point towards such evolutions.

**Policy priorities between broad routes for increasing R&D in Iceland**

The main policy priority of the Icelandic S&T policy goes towards increasing and better managing R&D investments in the public sector. However, market failures in the financing of New-Technology-Based Firms have been identified in recent times too, and are given growing priority in the Icelandic STI portfolio. Cooperative R&D is given some policy attention, but few instruments are attached to it. The other routes, targeting existing and foreign companies to invest in R&D in Iceland, are given low priority attention in the Icelandic policy mix, but this might change if the move towards an innovation system approach for policy is gaining pace.

**The difficulty in research prioritisation**

The question of priority setting in public R&D funding is a haunting one in Iceland, which proves difficult to implement. After a Foresight process carried out in 2007, the Council adopted a declaration, in which three areas - Natural resources, environment and sustainable development; Health and well-being; and Strengths of a small nation, augmented by a number of others (notably creative industries and socio-cultural research on Icelandic cultural heritage) were mentioned as presenting important opportunities. These priorities have been turned down into a specific programme, the “Centres of Excellence and Research Clusters” programme: this provides for funding for a limited number of large projects, for up to seven years. Cooperation between universities, public research institutions, companies, and users is a core feature of the envisaged centres. Such an initiative represents a concrete step forward on the research prioritisation road.

Meanwhile, there are currently several new research prioritisation processes going on: in Iceland, which seem to be running largely in parallel, a situation which raises questions on the effectiveness of this prioritisation.

**The challenge of policy coordination in Iceland**

The above two points – a dissociation between knowledge creation and knowledge absorption in policy, and the difficulty faced by the prioritisation process – point towards persistent fragmentation in policy-making in Iceland, despite progress made with the establishment of the cross-ministerial STPC: a number of evolutions show that the coordinating role of the Council has not yet reached high effectiveness. There is more to coordinate than R&D instruments: the example of the experiment with an employment scheme used for innovation promotion might pave the way towards the kind of policy interlinkages that could foster a synergetic use of public resources and the building of more efficient “policy mixes”.

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Internationalisation of the Icelandic STI system

The objective of internationalisation of the research system is key for Iceland: international participation of Icelandic researchers in science, technology and innovation activities is a cornerstone of Icelandic S&T policy. The European Research space is not the only focus for Icelandic S&T policy: Iceland places a high emphasis on its integration in Nordic R&D co-operation programmes, including the Nordic Research and Innovation Area. Many research linkages and large funding flows also take place with the US.

The approach of Icelandic policy towards ERA can be called an “implicit” one: by reinforcing its research institutions, encouraging (mostly outward) mobility of researchers, stimulating international partnerships for researchers in PROs and universities, Iceland is reinforcing its knowledge creation structures and potential, which it brings to the Economic space. However, aligning with, or opening domestic research programmes to foreign research activities, is not really on the agenda. Research internationalization in Iceland follows mainly an outward-oriented approach: stimulating inward investments in research and inward mobility of people to Iceland for knowledge activities are still underdeveloped roads.

| Labour market for researchers | Barriers for incoming mobility | Important to ensure renewal of human resources | Policies for outwards mobility |
| Governance of research infrastructures | Due to small size, important opportunity for internationalisation | | Move towards more critical masses and research specialisation |
| Performance of research institutions | A key issue for placing Iceland on the ERA map | | Subject of priority policy attention |
| Opening up of national research programmes | Outward opening rather than inward opening | | Few developments |

The need for more policy intelligence tools in Iceland

An important direction identified for future progress in Icelandic STI policy concerns the development of strategic policy intelligence tools. Monitoring and evaluation of the Icelandic innovation system and associated policies are still under-developed: the depth and frequency of data collected on R&D and R&D policy are insufficient to properly assess evolutions and achievements in terms of research quality and excellence. Neither has evaluation of the impacts of R&D programmes become common practice. Many aspects of the system are not well-documented, such as the extent of public-private cooperation, the various features of international mobility, etc. Evolving in this direction is a necessary ingredient for more evidence-based policy-making, for the evolution towards more efficient policy mixes, and for the identification of priorities for innovation policies.

The way forward: the crisis as an opportunity for the knowledge-based economy

The current situation in Iceland is characterised by a very severe financial and economic crisis, caused by the complete collapse of the banking and financial sector in October 2008. But this situation provides also a rather new context for science and technology policy in the country, with impacts not only on financial and human resources mobilisation, but also on general orientations of the S&T policy.
The shock generated a host of, mostly private, initiatives to support the emergence and success of New Technology-Based Firms. This image of “Iceland rebuilding through the creation of high-tech firms born on the ruins of the economy” became very popular, and can provide strong support and new impetus for the policy towards a knowledge-based economy in Iceland. Interestingly, the proposed budgets for competitive research funding have been maintained in the 2009 budget. Even if competitive funding channels are still a minor part of total R&D funding, under which hard cuts do take place, those are positive signals. The plans for mergers and rationalisation of PROs and universities might also get a new impulse due to the shortage of resources: untapped synergies might well be put at the forefront, notably between universities. Finally, setting up user-oriented public-private partnership experiments, such as the Centres of Excellence, which embed the idea of value creation from research, is likely to receive more support in times of economy recovery.

**Six future core policy directions for a knowledge-based economy in Iceland**

To conclude, the pressing need for economic recovery and the current and expected financial shortages create a sense of urgency, and release creativity, that could speed up and encourage difficult decisions to be taken under six core future directions for S&T policy. These six challenges have been presented briefly in the above paragraphs and are discussed in detail successively in the various chapters of the report, and wrapped together in section 2.4. They are all interlinked.

**Box 1: Six core future directions for Icelandic S&T policy**

1. **Value creation** from science and technology (from S&T to innovation policy): “centres of excellence” versus “competitiveness poles”?

2. **Policy alignment**, between the various Ministries, both at decision-making and at implementation stages: achieving balanced and open “policy mixes”;

3. **Research prioritisation** (concentration of funds and efforts into a targeted set of activities);

4. Shift towards **performance-based funding** for R&D (not only through the competitive funds, also addressing institutional funding);

5. **Evidence-based policy-making** fuelled by enhanced monitoring, analysis and evaluation systems;

6. **Increasing outward orientation** of the Icelandic research and innovation system.
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1 Introduction

Knowledge accumulated through investment in R&D, innovation and education is a key driver of long-term growth. Hence, a central task of ERAWATCH is the production of analytical country reports to support the mutual learning process and the monitoring of the efforts in increasing R&D investments and improving the performance of national research systems.

The main objective of the report is to characterise and assess the evolution of the national policy mixes in the perspective of the national goals for R&D investments, and for the contribution to the realisation of the European Research Area, as associate country. This report is building on a synthesis of information from the ERAWATCH Research Inventory and other important available information sources.

In this report we characterise and assess the performance of the Icelandic national research system and national research policies. In order to do so, the system analysis focuses on key processes relevant for system performance. Four policy-relevant domains of the research system have been distinguished, namely resource mobilisation, knowledge demand, knowledge production and knowledge circulation. The analysis within each domain is guided by a set of generic "challenges", common to all research systems, which unravel possible bottlenecks, system failures and market failures a research system has to cope with. It ends up with the identification of strengths and weaknesses of the system, opportunities and threats, and directions for the future. This analysis is the subject of Chapter 2.

The need for an effective research policy, appropriately co-ordinated with education, innovation, and other types of policies, is also widely recognised: the policy mix concept underscores the fact that R&D is influenced by a wide set of policies, from the R&D domain, but also from other domains. In addition, in line with the globalisation of the economy and technology, research policies are becoming increasingly international in nature. In particular, associated countries, while not being part of the European Union, do also contribute and link to the European Research Area.

Therefore, we focus on the following two analytical issues:

- The assessment of the national policy mixes for the achievement of national objectives for the STI system. Particular attention is paid to policies fostering private R&D and addressing barriers to R&D investments (Chapter 3).
- The assessment of national policies contributing to the realisation of the European Research Area, as associate country (Chapter 4).

Chapter 5 sets out the conclusions from the analysis.
2 Characteristics of the national research system and assessment of recent policy changes

2.1 Structure of the national research system and its governance

Iceland, a small country with a population of 320,000 inhabitants, nevertheless hosts a well-developed national research system. The country benefits from a complete set of R&D policies, institutions and regulations, as well as a range of public and private sector R&D performers.

Over the last two decades, the country experienced a remarkable shift from a natural resources-based economy (based on exploitation of fish stocks and geo- and hydro-energy resources) in the direction of a knowledge-based economy. During this period, R&D-based activity started to grow exponentially, from a level that was very low at the beginning of the nineties. The Barcelona target of 3% of R&D expenses on GDP was reached in 2001 (the figure was 1.1% in 1990). The latest figure for GERD/GDP is 2.8% in 2005, mainly due to fierce GDP growth (R&D expenditures remained stable during the period). Total R&D expenditures rose from ISK3.6m in 1990 to ISK28.4b (€363m\(^2\)) in 2005.

Due to the structure of the economy, dominated by exports of fish and aluminium, the share of exports of high-tech products in total exports is low (8.9% in 2006). Such a figure, however, hides a range of R&D based developments in high-tech activities in specific niche activities: medical equipment, food processing machineries, and biotechnology, in which world leaders are active in Iceland.

The system is also characterised by internationalisation. Following the journeys of the fishermen, there is a strong tradition, for people and organisations, of “going abroad” and opening up to the world. R&D-intensive companies are very active overseas, and most students get their third-level education degrees in foreign countries, bringing the benefits of a large network of contacts back to the country. There is no brain-drain problem, since both individuals and organisations tend to maintain strong links with their home base and return to the country. Inward R&D investments and people flows however are less intense (see Chapter 4).

Main actors and institutions in research governance

Figure 1 below depicts the main actors and institutions, as well as funding flows within the Icelandic research system.

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\(^{2}\) 1 €=78.23 ISK, 2005 official exchange rate from European Central Bank.
Figure 1: Overview of the governance structure of the Icelandic research system

Parliament

Science and Technology Policy Council

Government

Ministry of Education, Science and Culture

Ministry of Business Affairs

Science Committee

Technology Committee

Other Ministries

Research Institute

Research Institute

Research Institute

University of Iceland

Other universities

Research Institute

Research Institute

Research Institute

Added Value for Seafood

RANNIS
The Icelandic Center for Research

Fund for Research Training and Graduate Studies

Targeted Funds

Research Fund

Technology Development Fund

Biotech Fund

New Business Venture Fund

FRUM TAK

Innovation Centre + IMPRA

R&D-active firms

Source: ERAWATCH inventory. Black solid arrows: control and structural funding; red dotted arrows: competitive funding. Number of Research Institutes is indicative.
On the policy design level, the Science and Technology Policy Council (STPC) is the key strategic body at the core of the R&D policy system in Iceland. It includes 20 members and is headed by the prime minister. The role of this body is to define the strategic orientations for science and technology policy in Iceland.

The Council is organised in two committees, the Science Committee and the Technology Committee, which prepare the decisions of the Council. There is an overlap between members of these two committees in order to foster synergies.

Each Minister with responsibilities in R&D activities takes decisions with respect to R&D institutions and funds under its own control. The main instruments for funding research in Iceland are: block grants to universities and research institutions, on the one hand, and competitive funding programmes on the other hand. There are no R&D tax incentives in Iceland.

On the operational level, the Icelandic Centre for Research, RANNIS, reporting to the Ministry of Education, Science and Culture, is an important agent for the implementation of the policy: it provides technical support to the council and its committees, to the funding bodies, and manages and follows up implementation of most research programmes.

Competitive funds active on the scientific side are: the Research Fund, closely linked to the Research Equipment Fund, and the Fund for Research and Graduate Education. These are governed by a Board appointed by the Ministry of Education, Science and Culture. The competitive fund targeting technology is the Technology Development Fund, governed by a board appointed by the Ministry of Industry and Commerce. In addition, targeted research programmes are launched for a limited duration, and focus on specific areas, such as, currently, nanotechnology and post-genomic biomedicine and a Centre of Excellence programme. The Added Value for Seafood (AVS) Programme is managed by the Ministry of Agriculture and Fisheries.

Private R&D performers receive limited government funding for research: they can access competitive funds (mainly Technology Development Fund, AVS and targeted programmes) but they do not benefit from dedicated funding sources. The government has invested in a venture capital fund, the New Business Venture Fund. The Icelandic Innovation Centre, under the control of the Ministry of Business Affairs, is in charge of technology development, technology transfer to companies and support to innovative businesses.

Public as well as private R&D performers access R&D funding from abroad (from the EU FP, Nordic funds, US funds and private sources). The share of R&D funding from abroad amounted to 11% of total R&D funding in 2005.

**Main research performer groups**

The public research side in Iceland includes universities and public research organisations. On both sides, recent mergers have been implemented to rationalise the public research landscape.

Iceland hosts one major university, the only one with a complete range of disciplines, the University of Iceland, and several smaller specialised university or university-level institutions. The universities are financed and controlled by the Ministry of Education, Science and Culture. Until recently, universities had limited research activities, but this is currently changing, as more focus has been placed, and new instruments developed, to enhance the research-side of universities. The major R&D performer on the public side is the University of Iceland. The University Hospital is also an
important research actor, with extensive research co-operation with the medical faculty of the University of Iceland.

Specialised governmental research institutes are owned by several Ministries, according to their domain of competence. The largest research institute is the Marine Research Institute, under the Ministry of Fisheries and Agriculture, others are Matis, a private food research company owned by the government, the National Energy Authority, the Iceland Geosurvey, the Icelandic Meteorological Office, the Icelandic Institute of Natural History, and the Institute of Earth Science.

On the private side, a single company is responsible for a large share of business R&D in Iceland: deCODE, a biopharmaceutical company, applying its discoveries in human genetics to the development of drugs for common diseases. The country hosts several biotech companies, a few pharmaceutical companies and medtech companies, as well as marine biotech companies, most of them clustered in Reykjavik around the University of Iceland and the national hospital. Other important private R&D spenders belong to the machinery and equipment sector (for food and medical industry) and software.

### 2.2 Strengths and weaknesses of the research system

The analysis in this section is based on the methodological approach of ERAWATCH, which characterises and assesses the performance of the national research systems. In order to do so, the system analysis focuses on key processes relevant for system performance. Four policy-relevant domains of the research system are distinguished, namely resource mobilisation, knowledge demand, knowledge production and knowledge circulation. The analysis within each domain has been guided by a set of generic "challenges", common to all research systems, which reflect possible bottlenecks, system failures and market failures a research system has to cope with. The complete analysis of the research system can be found in the Annex.

This analysis provides an assessment of the situation in each domain, taking into account long-lasting trends and driving forces at play in the last decade or so, while the next section focuses on recent changes which have occurred since 2008.

2003 was a watershed for STI policy in Iceland, with the adoption of three laws by the Icelandic Parliament. These laws first established the Science and Technology Policy Council (STPC) with a mission to develop a vision and formulate science and technology policy for the country, and second, established several competitive funds to support research and technology development.

These events brought about changes and new visions concerning all 4 system functions considered in this chapter: mobilising new and increased resources for STI activity; identifying drivers of knowledge demand; ensuring quality and exploitability of knowledge production; and facilitating knowledge circulation and absorption.

Since then, increased priority has been put on R&D and STI in the general government agenda. Icelanders have found that fluctuations in fish stocks, volatility of the currency, combined with increasing global competition, place significant threats on the small-size domestic economy. The success stories of several high-tech companies, the availability of a highly educated population, and of important public research resources, are driving attention towards knowledge-based activities as an alternative to resource-based activities and as a new source of growth.
The summary of the analysis appears in Table 1. For space reasons and to harmonise the report with other EU countries ERAWATCH reports for which such an analysis has been produced already in 2008, the full analysis is presented in the Annex, to which the reader is referred.

**Table 1: Summary assessment of strengths and weaknesses of the national research system**

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<tr>
<th>Domain</th>
<th>Challenge</th>
<th>Assessment of strengths and weaknesses</th>
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<tbody>
<tr>
<td>Resource mobilisation</td>
<td>Justifying resource provision for research activities</td>
<td>• Rising status of knowledge-based industries as sources of growth</td>
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<tr>
<td></td>
<td></td>
<td>• Highly educated population requires highly qualified jobs</td>
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<td></td>
<td>Securing long term investment in research</td>
<td>• Role of STPC to secure long-term investment in S&amp;T, maintain high-level policy interest across ministries</td>
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<td></td>
<td></td>
<td>• Effective increase in competitive funding sources</td>
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<td></td>
<td>Dealing with barriers to private R&amp;D investment</td>
<td>• Good generic conditions for business R&amp;D, low general business tax rate</td>
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<td></td>
<td></td>
<td>• No specific funding channel for private R&amp;D, no tax incentives</td>
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<td></td>
<td></td>
<td>• Lack of funding for NTBFs and start-ups</td>
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<td>• Few policy attention to demand-oriented policies</td>
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<td></td>
<td>Providing qualified human resources</td>
<td>• Highly educated population, educated abroad, good return of the brains</td>
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<td>• Measures taken at university to increase quality and supply of high education</td>
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<td>• Low availability of S&amp;E graduates</td>
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<td>• Difficulty to attract foreigners to settle in Iceland</td>
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<tr>
<td>Knowledge demand</td>
<td>Identifying the drivers of knowledge demand</td>
<td>• Limited formal channels and few evidence base for identifying knowledge demand from businesses</td>
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<td></td>
<td></td>
<td>• Gradual opening of design process for S&amp;T policy favours inclusion of users views</td>
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<td></td>
<td></td>
<td>• Progress achieved on the road of research prioritisation: still a minor part of R&amp;D funding portfolio</td>
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<td></td>
<td>Co-ordination and channelling knowledge demands</td>
<td>• Limited influence of business representatives in STPC</td>
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<td></td>
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<td>• Informal channels are effective in a small community</td>
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<td>• STPC has not yet succeeded in breaking walls between Ministries</td>
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<td>• Emerging impact of a Foresight exercise in terms of research prioritisation</td>
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<td>Monitoring of demand fulfilment</td>
<td>• No explicit mechanism for ensuring a match between knowledge production and demand</td>
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<td>• Evaluation culture is underdeveloped; lack of evidence-based policy-making</td>
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<tr>
<td>Domain</td>
<td>Challenge</td>
<td>Assessment of strengths and weaknesses</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>------------------------------------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Knowledge production</td>
<td>Ensuring quality and excellence of knowledge production</td>
<td>• Increase in competitive funding in absolute and relative share; however still a minor part of total public R&amp;D funding  &lt;br&gt;• Increase in size of funded R&amp;D projects  &lt;br&gt;• Successful mergers and reorganisation of PROs and universities  &lt;br&gt;• Internal performance targets for University of Iceland, not for other universities nor PROs  &lt;br&gt;• Progress to be made in monitoring and evaluation of R&amp;D institutions and programmes</td>
</tr>
<tr>
<td>Ensuring exploitability of knowledge</td>
<td></td>
<td>• New law on IPR improves exploitability of knowledge produced at PROs  &lt;br&gt;• Difficulty to combine academic criteria and economic exploitation criteria in R&amp;D projects selection</td>
</tr>
<tr>
<td>Knowledge circulation</td>
<td>Facilitating circulation between university, PRO and business sectors</td>
<td>• Only one recent programme with specific Public-private cooperation requirement  &lt;br&gt;• Small size of research community favours knowledge circulation - share of cooperative projects under the main Funds probably high  &lt;br&gt;• Third mission goal of university of Iceland not yet translated in career management  &lt;br&gt;• Reorganisation process between universities and PROs likely to improve knowledge circulation in public sector  &lt;br&gt;• Need to monitor cooperative research in competitive funds</td>
</tr>
<tr>
<td>Profiting from international knowledge</td>
<td></td>
<td>• Strong degree of international connection of the Icelandic research system</td>
</tr>
<tr>
<td>Enhancing absorptive capacity of knowledge users</td>
<td></td>
<td>• Mission of Icelandic Innovation Centre and IMPRA – not evaluated  &lt;br&gt;• Need for instruments aiming at bridging technology and market opportunities</td>
</tr>
</tbody>
</table>

2.3 Analysis of recent policy changes since 2008

The focus of the section is on the analysis of main recent policy changes which may have a relevant impact on the four policy-related domains discussed in the preceding section.

The current situation in Iceland is characterised by a very severe financial and economic crisis, caused by the complete collapse of the banking and financial sector in October 2008. The worldwide financial crisis hit the Icelandic economy to an extreme degree, and the situation of the country has provided a model case of the upper limit of the crisis impact on an economy.

The disintegration of the huge Icelandic banking sector (with activities totalling, according to some estimates, more than 10 times the GDP) has had a dramatic impact on the whole economy. Following the October 2008 bank collapse, vast movements of dissatisfaction and strong criticisms started to grow in the population, concerning the way the government handled the crisis and the management of the Central Bank. A political crisis added to the financial and economic ones during the Winter 2008-2009, and this led to the resign of the government at the end of January 2009. A new transitory government took office in February 2009, and after the elections of April 2009, was established formally in May 2009.
As of March 2009, the Icelandic economy is slowing down, perspectives are very dark on all fronts, unemployment is increasing and inflation rocketing, and the Icelandic krona has lost half of its value in only a few weeks time. In its January 2009 macroeconomic forecast, the Ministry of Finance predicted a GDP contraction of 9.6% for 2009, which is a dramatic reversal from the trend of recent years, together with a drop in private consumption as high as 24% in real terms. Discussions are going on among the government about the possibility for Iceland to join the European Union and adopt the Euro, and this is a crucial item on the agenda of the new government.

During the first months of the storm, priority attention of the government logically has been placed on rebuilding the financial sector and to emergency measures to ensure continuity of business life and easing the daily life for citizens.

But this situation provides also a rather new context for science and technology policy in the country, with impacts not only on financial and human resources mobilisation, but also on general orientations of the S&T policy.

Policy-makers are not isolated on this front. As a consequence of the crisis, the image of the public sector and of the government deteriorated rapidly and trust of the public in its institutions has been significantly eroded. The support from the wider society to drive the country on the road of a knowledge-based society will be essential in the front of competing demands from all sectors which will be facing difficulties.

In this respect, it is interesting to note that the shock created by the financial and economic crisis in Iceland generated a host of, mostly private, initiatives to support the emergence and thrive of New Technology-Based Firms. The wish is strong to re-build prosperity on real and tangible assets and activities, drawing lessons from the crash of values that were underpinned by virtual and intangible assets. This image of “Iceland rebuilding through the creation of high-tech firms born on the ruins of the economy” became very popular in the public, and should not be neglected or considered only as a poetic idea (even Iceland’s most renowned artist, the singer Björk, was at the forefront of an innovation initiative in that spirit). This is rather a reflection of the entrepreneurial spirit of Icelanders and of an existing innovative capacity, unleashed by the hard times. This provides a favourable context for future policy decisions putting a priority in investing in the knowledge economy Iceland.

2.3.1 Resource mobilisation

Before resigning, the Icelandic government in office in 2008 had adopted a crisis budget for 2009, displaying an overall cut of 10% across the board, compared to earlier budget proposals. The budgets proposed for competitive research funding have been maintained in the 2009 budget, representing an increase with respect to 2008 (in nominal terms). This is one of the few budget lines which have been saved from the hard cuts visible throughout the State budget. In particular, the line for targeted funding shows a large increase, notably to allow the launch of a new Centre of Excellence programme, described in the next section.

Institutional funding for research has been maintained or slightly decreased (in nominal terms), but all research actors are aware that a further deteriorating situation has still to come, and are preparing themselves for further budget cuts in 2010. The agreements for additional funding to be granted to the University of Iceland over a
period of five years have been halted. Revenues from capital university funds have also deteriorated, placing further strain on the public research sector.

Rising unemployment trends since the end of 2008 have pushed a high number of people to go (back) to university. This phenomenon, combined with budget cuts, places an extreme pressure on universities.

The Minister of Science, Education and Culture has established two “crisis think thanks”, one composed of domestic actors, one of foreign experts, to provide recommendations on the way to manage the policy in view of the changing circumstances. One key question for the advisory panels relates to the ways and means to mobilise resources for the university system. The reports from the panels (Taxell et al. 2009) provided recommendations for consideration by the new government: they make a strong plea for continuous investment in education, research and innovation; recommend further merger of the universities, a reinforcement of performance-based funding mechanisms and of the share of competitive funding sources for public research, more focus on innovation, more policy intelligence and clearer prioritisation.

The current economic situation is so severe that it is impossible to predict how resource mobilisation for S&T will evolve in the coming months and years. The positive signals which have been sent with the fulfilment of government’s commitment for a growth in competitive funding, should however be acknowledged. The work of the STPC has certainly helped to maintain the high status of S&T on the policy agenda, but it should be further reinforced for this to continue in even more difficult budgetary times. The wide consultation exercises that took place before the adoption of the 2006-2009 Council resolution proved to be beneficial in two respects:

- Solidifying the policy interest in S&T and knowledge economy;
- Broadening the views beyond the science system, to encompass S&T activities for the public good (see also section 2.4 below).

In terms of funding for private R&D, the current crisis times are marked by a growing attention to what was called in the December 2007 declaration of the STPC: “the worst market failure RTD is facing in Iceland”, referring to the financing of early exploitation plans for companies who intend to exploit research results. The portfolio of instruments available to this aim is discussed further in the next “policy mix” Chapter. A new Fund, Frumtak, was established in 2008, addressing innovative NTBFs. Adjusted selection criteria have been agreed for the Technology Development Fund for the category of NTBFs, and it has been decided that 10% of its budget is reserved for support to start-ups.

On the human resources side, Iceland is discovering the largely unknown phenomenon of unemployment. As mentioned, it is now expected that S&T graduates released by the ailing banking sector would become available to take research positions.

A number of regulations on the labour market have been adopted as an immediate reaction to the crisis: among them, an amendment has been passed through which unemployed people taking a position in a company in view of developing an innovative project, would be entitled to keep part of their unemployment benefits: this is meant to encourage employers to offer new positions for innovation, by decreasing salary costs by about 50%. The incentive has been set up for a 6 month period, renewable once. This will ease the situation of innovative companies which find it
harder to finance their innovative projects. This is a concrete example of “policy mix” effort, whereby an initiative under one policy domain (employment policy) effectively contributes to goals in other domains (R&D and innovation).

Various actions in the area of education have also been taken. Notably, unemployed persons can receive the unemployment benefits they are entitled to, while pursuing certain studies or attending courses.

Table 2: Main policy changes in the resource mobilisation domain

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Main Policy Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Justifying resource provision for research activities</td>
<td>• Drastic public budget cuts place a strain on public funding for R&amp;D</td>
</tr>
<tr>
<td>Securing long term investments in research</td>
<td>• Persistent increase in nominal competitive funding despite financial crisis</td>
</tr>
<tr>
<td></td>
<td>• New targeted programme launched with a 7-years perspective</td>
</tr>
<tr>
<td>Dealing with barriers to private R&amp;D investments</td>
<td>• Growing attention to NTBFs funding</td>
</tr>
<tr>
<td></td>
<td>• Establishment of new venture fund, Frumtak, for NTBFs</td>
</tr>
<tr>
<td></td>
<td>• New provisions for NTBFs in the Technology Development Fund</td>
</tr>
<tr>
<td>Providing qualified human resources</td>
<td>• New financial incentives for hiring qualified workers released on the labour market</td>
</tr>
<tr>
<td></td>
<td>• Stimulation of education for the unemployed</td>
</tr>
</tbody>
</table>

2.3.2 Knowledge demand

As a result of the participative Icelandic Foresight exercise, the December 2007 declaration of the STPC placed emphasis on several key areas where Icelandic research and innovation actors should jointly concentrate their efforts to spur competitive advantages of the nation. This was turned into more concrete terms in the June 2008 declaration of the Council, which announced the launch of the “Centres of Excellence and Research Clusters” programme: this provided for funding for a limited number of projects, in the areas emerging from the Foresight, for up to seven years with a budget of up to ISK80m3 each year. Cooperation between universities, public research institutions, companies, and users is a core feature of the envisaged centres. The two-steps selection procedure generated three projects, selected in February 2009:

- The Icelandic Institute for Intelligent Machines - IIIM (with a focus on artificial intelligence and simulation technologies);
- The Geothermal Research Group;
- The Centre of Excellence in Gender, Equality and Diversity Research.

While the latter two centres fall explicitly into the Council’s prioritised areas, this is less clear for the first one, which specialises on transversal technology with possible applications in a large variety of domains. Direct connection with industry is most visible in the plans for the first centre, but also for the second one. Due to the nature of the field covered by the third initiative, the business sector is less at the forefront but wider societal groups are expected to participate in the Centre.

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3 Equivalent to €0.55m at European Central Bank exchange rate 2008.
Such an initiative represents a **concrete step forward on the research prioritisation road**, concentrating funds in a long-term mode, into specialised pools of expertise gathering financial and human resources from various corners of the society. It will be necessary to follow-up these individual experiments very closely to check if, beyond their stated objectives, they respond in practice to the ambitious goals set to the programme.

Another key question to investigate with these initiatives is whether they are also able to create **synergies with other existing complementary resources** and expertise that might not be included in the proposals at the outset, as well as with international expertise, a dimension which does not feature high in the programme documents, but is supposed to play an important role in the Icelandic “Centres of Excellence” model.

The remark has already been made above that targeted programmes represent only 14% of total public funding for R&D in Iceland. This figure included the budget for the above programme: hence the real synergetic effects of the programme with other resources will be determinant to provide more teeth to the prioritisation process.

As mentioned, changes have also been brought during winter 2008-2009, to the Technology Development Fund. In addition to provision for NTBFs support, another envelope of 10% of the Fund has been earmarked, at the request of the Ministry of Industry, for activities in the areas of sustainable fuels and sustainable buildings.

Currently, there are currently **several new research prioritisation processes going on:**

1. The one induced by the Centres of Excellence Programme;
2. Internal prioritisation at University of Iceland (see next section);
3. Priorities set under the Technology Development Fund.

These various prioritisation processes seem to be running largely in parallel, a situation which raises questions on the **effectiveness of this prioritisation.**

There is also the instrument of “Grant of Excellence” under the Research fund, for which the selection criterion is, logically, the scientific impact. This raises the question whether such an instrument might remain disconnected from the new options taken under the Centres of Excellence programme.

**Table 3: Main policy changes in the knowledge demand domain**

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Main Policy Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifying the drivers of knowledge demand</td>
<td>No recent changes</td>
</tr>
</tbody>
</table>
| Co-ordinating and channelling knowledge demands | • Centres of Excellence Programme intends to foster research prioritisation  
• New priorities under the Technology Development Fund |
| Monitoring demand fulfilment        | No recent changes                                        |

### 2.3.3 Knowledge production

The idea behind the Centres of Excellence programme is to **fund larger and more stable structures rather than small ad hoc projects**. In effect, three such structures have been selected, with a funding extending over a period of seven years. This conforms to the objective of a better targeting and concentration of funds, towards domains where R&D in Iceland can gain a competitive edge. However, as
already mentioned, this does only cover a small part of total public expenditures for research.

The plans for mergers and rationalisation of PROs and universities might also get a new impulse due to the shortage of resources: untapped synergies might well be put at the forefront, notably between universities. This was indeed one of the main points put forward by the recent expert panel convened by the Ministry of Education, Science and Culture to run the crisis situation (Taxell et al. 2009).

Concerning exploitability of knowledge production, the Centres of Excellence Programme embeds within its own rationale the idea of value creation from research.

There are also institutional responses with important impacts on the research system. **Within the University of Iceland, prioritisation is also taking place:** because of dramatically falling budgetary resources, the university has to take drastic measures to cope with the ambitious challenges that it had set itself with its 2006-2011 strategy, which should drive the university towards a leading research and education institution with wider recognition at worldwide level. The supplementary government allocations foreseen in the agreement were cut by half for 2009. Shrinking available funding is now distributed more strictly on the basis of research performance, taking into account criteria such as capacity to attract competitive funding grants. A selection of three priority fields of research is being done based on internal competition.

### Table 4: Main policy changes in the knowledge production domain

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Main Policy Changes</th>
</tr>
</thead>
</table>
| Improving quality and excellence of knowledge production | • Larger and more structural projects/structures funded under the Centre of Excellence programme  
• More focus on excellence in internal research funding procedure at University of Iceland. |
| Ensuring exploitability of knowledge production       | • Centres of Excellence Programme aiming at creating value added from research        |

#### 2.3.4 Knowledge circulation

The mandate for the “crisis think tanks” established at the beginning of 2009 by the Minister of Science, Education and Culture includes a question referring to the ways to mobilize national funds for research and innovation with the view of strengthening closer cooperation between the public sector research organizations and private sector organizations “to stimulate innovation in the short term as well as underpin long term knowledge-based growth and future competitiveness of the economy”. This indicates the central concern from policy authorities for creating linkages between the science base and the economy. This is already an item that surfaced from several evaluations of the Icelandic S&T system and policies (OECD 2006, Forss and Taxell 2007, Ingthorsson 2007 and 2008), it has indeed been re-stated by the crisis think thanks (Taxell et al. 2009).

The new “Centres of Excellence” programme, starting in 2009 includes as a key objective the idea of fostering knowledge circulation between university, PRO and business sectors. The endeavours under the funded projects should span a whole range of scientific, technological and innovation activities. The link with innovative businesses and high-tech industries needs to be present at the heart of the projects. Users are to be closely associated to the Centres, in order to ensure a good flow of knowledge and user-driven orientation of the centres. For example, the
Icelandic Institute for Intelligent Machines foresees a “target of 60/40 ratio between externally and internally motivated research projects”. This is an innovative feature for Icelandic programmes, and will need to be monitored specifically.

Table 5: Main policy changes in the knowledge circulation domain

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Main Policy Changes</th>
</tr>
</thead>
</table>
| Facilitating knowledge circulation between university, PRO and business sectors | • Collaborative research as a core criterion of Centres of Excellence programme  
|                                                  | • Explicit policy concern for the Ministry “crisis think tank” |
| Profiting from access to international knowledge |                                                                 |
| Absorptive capacity of knowledge users          | • Introduction of users in projects selected in the Centres of Excellence Programme |

2.4 Policy opportunities and risks related to knowledge demand and knowledge production: an assessment

Overall, the above analysis indicates that the current deep crisis faced by Iceland might provide also opportunities for more brave and determinate choices for STI policy, which impact on all system functions taken as an analytical tool for this report.

As mentioned, the context seems favourable for policy-makers to take these opportunities for putting higher priority on developing knowledge-based activities in Iceland, since spontaneous initiatives and developments are taking place in NTBF support, driven by individuals or private organizations.

The pressing need for economic recovery and the current and expected financial shortages create a sense of urgency, and release creativity, that could speed up and encourage difficult decisions to be taken under five core future directions for S&T policy. These five challenges emerge directly from the analysis in the previous pages, and the link with the analysis is made below. They are all interlinked. Box 2 lists these challenges.

Box 2: Five core future directions for Icelandic S&T policy

1. **Value creation** from science and technology (from S&T to innovation policy): “centres of excellence” versus “competitiveness poles”?
2. **Policy alignment**, between the various Ministries, both at decision-making and at implementation stages: achieving balanced and open “policy mixes”;
3. **Research prioritisation** (concentration of funds and efforts into a targeted set of activities);
4. Shift towards **performance-based funding** for R&D (not only through the competitive funds, also addressing institutional funding);
5. **Evidence-based policy-making** fuelled by enhanced monitoring, analysis and evaluation systems.

The first two challenges refer to the need to broaden the view on S&T policy to encompass the wider innovation system. This widening reflects the enlarged view adopted in the second STPC declaration, particularly compared to the first one. At a certain point, it was even envisaged that Council’s name could be changed towards Science and Innovation Council, which would have sent a clear signal to the whole society, that the work of the Council is motivated by the wish to manage the S&T
system for the benefit of the whole society. The STPC is currently preparing its new S&T strategy for the coming period: the above-analysis points towards the need to put clearer focus on the “secondary” (innovation-related) issues that progressively appeared in its statements, next to its initial “science funding and reorganisation” focus. Winning public, and hence, political support, for Iceland as a knowledge-based economy, goes along with such a de-fragmented view on science, research, technology and innovation issues. This would reinforce the public perception that investments in science, research and technology are useful for the public good, and not only for the science and research community.

The first challenge refers to the need to bridge market and technology opportunities: sponsored R&D activities would have to combine more explicitly the criteria of research excellence and potential for economic value. In times of scarce resources, and when the country needs to rebuild its economic assets, it is even more appropriate and urgent to set such a double objective to R&D funding principles. This would involve a broadening of scope from typical R&D instruments to other innovation-related instruments, a core idea of the “policy mix” concept developed in the next Chapter. R&D investments and performance, in particular on the private side, are influenced not only by R&D specific measures, but also by many other elements of the business environment.

The approach followed with the latest policy initiative, the Centres of Excellence programme, which can be regarded as a policy innovation, gives rise to a number of important questions: how far are those centres going to facilitate “co-generation” of new knowledge, where the views of industrialists and scientists are effectively integrated with the aim of new developments? How does this compare with a “Competitiveness Pole” approach, in the sense of placing a clearer balance between market and technology opportunities? It is difficult to judge at this early stage what balance would indeed be at play with the selected Centres of Excellence, but the crisis situation will certainly help to put more pressure on reaching such a balance.

A fundamental question to be addressed is the extent to which Iceland needs a true innovation policy, well coordinated with the S&T policy orientations developed to date? This echoes Ingthorsson's view that Iceland has not yet developed a fully-fledged innovation policy (Ingthorsson 2008).

The second challenge follows from the first one: if instruments from several policy fields need to be fine-tuned to each other, this demands coordination both at policy design level and at policy implementation level. The establishment of the STPC has helped to move coordination further on the policy design level (intentions are shared), but gaps are still visible on policy implementation level. But there is more to coordinate than R&D instruments: the example of the experiment with an employment scheme used for innovation promotion might pave the way towards the kind of policy interlinkages that could foster a synergetic use of public resources towards the building of a knowledge-based economy. One could, e.g. study the feasibility of alternative human resources funding schemes for innovation, which are not necessarily linked to unemployment status. The point on policy alignment is dealt with extensively in the next “policy mix” Chapter.

The third challenge –research prioritisation- was already at the core of policy making in the pre-crisis times: the small absolute size of human, infrastructural and financial resources for R&D in Iceland, makes it necessary to target funding to areas where sufficient potential could be gathered to reach high quality outputs. Declining resources provide a dramatic stimulus for bringing the prioritisation moves
forward. The reported case of University of Iceland’s plans for internal reorganisation of research funding testifies that such a move is inescapable. Here too, the coordinating function of the STPC is crucial to ensure that efforts are aligned towards the few fields where the Icelandic knowledge society can thrive, based on enhanced R&D and innovation efforts. Using the Centre of Excellence experiment as a tool for effective prioritisation, and ensuring that all resources in the relevant fields are truly put in motion under those roofs, will form an essential test case for the commitment towards prioritisation.

The fourth challenge is not new, as it was present from the inception stage of the STPC work: increasing the share of performance-based funding in public research funds as a way to increase research quality, was amongst the key core issues in 2003, when the STPC and the competitive funds were established. The objective remains valid in the current crisis. However the new challenge at stake is linked to augmented pressure for raising research quality in response to international competition (notably for international funding sources, a domain where Icelanders have traditionally been quite successful). Hence the **extension of performance-based criteria for funding in the institutional part** of public R&D funding (the 86% share left when the 14% competitive funding is subtracted from total funding) becomes an urgent task.

The fifth, but no less important, challenge relates to an essential issue which was repeated at several points in our analysis: the policy design process, the implementation of existing and new measures, would need to be supported by a **robust, detailed and independent monitoring, analysis and evaluation system**, which is still not yet sufficiently developed today, despite several claims in this direction from earlier analyses or studies, and from the STPC. Closing the existing gap between policy declarations and policy implementation, requires analytical tools and quantitative data to demonstrate the gaps in an objective way. Advancing further on the road of research prioritisation would need to be supported by objective data for assessing research performance and research relevance. Selecting programmes and projects in “priority” areas necessitates independent selection panels, which in turns means internationalisation.

To these challenges, a **sixth challenge will be added relating to the internationalisation of the S&T system**. This question will be discussed in the last Chapter, dealing with the ERA dimension in the domestic policy approach and portfolio of instruments.
Box 3: Five core future directions for Icelandic S&T policy

Those five challenges are put into the context of the four system functions in Table 6 below.

Table 6: Summary of main policy related opportunities and risks

<table>
<thead>
<tr>
<th>Domain</th>
<th>Main policy-related opportunities</th>
<th>Main policy-related risks</th>
</tr>
</thead>
</table>
| Resource mobilisation | • A reinforced STPC Council, with a mandate extended to innovation policy, would help mobilise funds for research, which are competing with other lines in the State budget  
  • Wider societal mobilisation as a condition for more priority to knowledge-based economy de-fragmented view on science, research, technology and innovation issues.  
  • Other human resources-oriented funding mechanisms | • Drastic cuts in public budgets, competition with other policy areas (power intensive industry) might result in negative impacts on R&D funding  
  • Too narrow attention on competitive funds might fail to protect the whole GBOARD from budget cuts  
  • Lack of monitoring, analysis and evaluation mechanisms limit possibilities to demonstrate benefits from STI investments |
| Knowledge demand      | • Centres of Excellence: a move towards wide-reaching research specialisation?  
  • Enhancing prioritisation in research funding in the system as a whole, including institutional funding  
  • Enhancing prioritisation in research funding within institutions (notably the University of Iceland) | • Centres of Excellence programme: an isolated, ad hoc experiment?  
  • Centres of Excellence: how to ensure real integration of users needs into the endeavours? |
| Knowledge production  | • Extension of performance-based funding mechanisms beyond competitive funding programmes         | • Further fragmentation of knowledge production system due to lack of prioritisation  
  • Sub-optimal quality of knowledge production due to weak links between funding and performance |
| Knowledge circulation | • Broader view on STI policy helps mobilise policy attention to knowledge investments: need for more public-partnerships in R&D  
  • New views on knowledge “co-generation” rather than circulation | • Lack of evidence on quality, direction, barriers and stimuli on knowledge flows impede development of well-designed policies and programmes |
3 National policy mixes towards R&D investment goals

The aim of this Chapter, as stated by ERAWATCH, is to deepen the analysis of national policy mixes with a focus on public and in particular private R&D investment. R&D investment is seen as important yardstick for the capacity of an economy to turn the results of science and research into the commercially viable production of goods and services and hence knowledge into growth. Corresponding investment policies are mainly pursued at national level and determined with a national focus. The international dimension will be studied in the next Chapter.

The contribution of research and research policies to national goals (as well as to other societal objectives) goes beyond the fostering of R&D investment. It is therefore important to also analyse how other remaining shortcomings or weaknesses of the research system are addressed by the research policy mix.

An important dimension of the policy mix concept is that of coordination and synergies between policies. As mentioned before, R&D is influenced by many other factors and instruments from other policy fields than R&D. This will be covered in the discussions below.

This chapter is structured around five questions, which are treated in turn in the following sections:

1. What are the specific barriers that prevent reaching the Lisbon goal? What barriers exist to prevent reaching the specific targets, particularly related to the private sector R&D investments?
2. Given the above, what are the policy objectives and goals of the government that aim to tackle these barriers?
3. What Policy Mix routes are chosen to address the barriers and which specific instruments and programmes are in operation to implement these policies?
4. What have been the achievements in reaching the above-mentioned R&D investment objectives and goals?
5. What are the reasons for not reaching the objectives, adaptation of the goals?

3.1 Barriers in the research system for the achievement of R&D investment objectives

As mentioned already, quantitative R&D investments targets play a minor role in the policy framework set out in Iceland. R&D investment objectives similar to the 3% Barcelona objective adopted in the EU, do not act as an incentive for Icelandic S&T policy, even if one STPC declaration refers to it. What is emphasised is not merely quantity, but also quality and performance of these investments.

Much effort has been made, and a fair degree of success obtained, to increase quantity, and raise the effectiveness of R&D investments on the public side, as discussed at length in the previous chapter. However, the conditions for private R&D investment have received less policy attention. Private R&D investments are fluctuating according to business strategies and market evolutions. A handful of firms is responsible for the majority of private R&D investments in Iceland: the last available figures (2005) indicate that roughly half of R&D expenditures in the country were made by one company, deCODE, a biopharmaceutical company.
R&D investments are dependent on the fate and success of a very small number of firms. That company is precisely in a difficult position in the current crisis situation, and this shows how vulnerable the country position is with respect to private R&D investments.

The way governments can hope to influence private R&D is not straightforward. Not only the number of innovative firms, but also the nature of their innovative activity, impinges on the total R&D intensity of a country. The Pavitt taxonomy is a widely used way to characterise the diversity of innovation patterns across an industry (Pavitt 1984). He distinguishes between the following categories of firms: science-based firms: mostly large firms, innovating in good connection with the science base (universities, research centres) and owning their internal R&D laboratories, often engaged in patenting; scale-intensive firms: large firms for which innovation comes mainly from interactions with customers, and relying on tacit knowledge much more than codified knowledge such as patents or publications; supplier-dominated firms: smaller firms, with few internal R&D capacities, involved in process innovations more frequently than in product innovations, and in imitation strategies rather than genuine innovation; and specialised suppliers: small or medium-sized firms, connected with the science base but for which the innovation sources are mostly the customers, which combine internal and external sources of R&D.

It would take too much space here to enter into detail in the differences between the innovation regimes faced by these types of firms, but the important point here is that the adequate policy portfolio adopted for fostering R&D or innovation will vary a lot according to the types of firms. Or conversely, that various types of firms would respond differently to a given policy portfolio. The other important point is that the role of formal R&D differs according to firm types: it is crucial for science-based firms, and of much less importance for supplier dominated firms. This fuels our earlier proposal for a more open approach to policy, aligning concerns for science, technology, research and innovation, instead of focusing most exclusively on the reorganisation of the public R&D sector (see first core future direction for Icelandic S&T policy in section 2.4).

Many policy frameworks place a priority on the first category of firms as the archetypes of high-tech, technology-based firms, but the reality is more complex, and the sources, barriers and stimuli for innovation are different according to each category. This is no different in Iceland, where firms of the various types co-exist. We discuss in section 3.3 below how the current policy portfolio adapts to this diversity.

### 3.2 Policy objectives addressing R&D investment and barriers

Policy objectives with respect to S&T in Iceland have been expressed clearly in the two resolutions of the STPC, and have been discussed above in Chapter 2.

The additional point dealt with in this Chapter relates to the policy mix question, which was introduced by the discussion in the above section: for policy to adapt to the diversity of innovative firms’ situations, there is a need for aligning policy goals and instruments, not only from the R&D policy domain, but also from other domains. Achieving an effective balance of policy instruments in view of effectiveness of the whole policy portfolio, lies at the heart of the policy mix issue.

The policy mix concept relies on the idea that it is the combination of policy instruments interacting among each other, which influences R&D, rather than
instruments taken in isolation. The other key idea is that R&D is not only influenced by policies from that policy sphere (such as direct funding or fiscal incentives, etc.) but that R&D is also influenced by policies from other domains, such as, for example, environmental regulations influencing R&D activities (Nauwelaers et al. 2009).

Hence, in the “policy mix” debate, **the question of policy coordination becomes a crucial one**: for a policy mix to be effective, synergies and complementarity across instruments from various policy domains should be ensured (see second core future direction for Icelandic S&T policy in section 2.4).

Such a high-level policy coordination objective was at the heart of the role assigned to the STPC, as mentioned at several occasions in the previous Chapter. The evaluation of the first term of the Council concluded with a mitigated assessment on this question: “...coordination between different ministries on policy issues related to science and technological development has significantly increased. Policy development has been very well coordinated. But the operational coordination has not been equally developed” (Forss and Taxell 2007, Taxell et al. 2009). Indeed a number of evolutions show that **the coordinating role of the Council has not yet reached high effectiveness:**

- The point was made in Chapter 2 that several R&D prioritisation processes seem to run in parallel, with the STPC having grip on only part of them. Progress in research prioritisation is influenced also by forces outside of the STPC, as testified by the recent decisions regarding dedicated envelopes within the Technology Development Fund;

- The policy objective to link up the work of the AVS fund, run by the Ministry of Fisheries and Agriculture, with the other competitive Funds managed by Rannis has met resistance and has not been fulfilled;

- Some of the discussions around mergers between PROs and universities have taken place largely outside of the STPC arena;

- The agreement between the University of Iceland and the Ministry of Education, Science and Culture, was negotiated directly between the two parties, but some members of the Council would have preferred that more discussions would have taken place within it;

- The work of the recent “crisis panels” convened by the Minister for Science, Education and Research might be seen as shadowing, at least partially, the role of the Council;

- The position of Rannis, reporting to the Ministry of Science, Education and culture only, does not facilitate cross-border coordination across Ministries.

Besides these issues which relate to the internal S&T policy field, there are also untapped synergies with other policy areas. The next section discusses this in more detail, in the course of, and at the end of the “routes” analysis. Here we mention relevant policy areas which interact with S&T policy stricto sensu, and are important for the objectives of bringing Iceland on the road of a knowledge-based economy:

- Employment policy;
- Education policy;
- Economic policy;
- Environmental policy;
Regional development policy;
...and this list is not meant to be exhaustive.

3.3 **Characteristics of the policy mix to foster R&D investment**

This section is about the characterisation and governance of the national policy and instrument mix chosen to foster public and private R&D investment. While policy goals are often stated at a general level, the policy mix analysis enquires about how these policy goals are implemented in practice. The question is what tools and instruments have been set up and are in operation to achieve the policy goals?

### 3.3.1 Overall funding mechanisms

Funding mechanisms for public and private R&D have been presented in section 2.1 above, and their relevance for the system functions discussed in sections 2.2, 2.3 and 2.4. In the next section, we take another approach, which focuses on target groups and priorities in the policy mix for R&D, using the notion of "policy mix routes".

### 3.3.2 Policy Mix Routes

The “Policy Mix Project” identified the following six ‘routes’ to stimulate R&D investment:

1. promoting the establishment of new indigenous R&D performing firms;
2. stimulating greater R&D investment in R&D performing firms;
3. stimulating firms that do not perform R&D yet;
4. attracting R&D-performing firms from abroad;
5. increasing extramural R&D carried out in cooperation with the public sector or other firms;
6. increasing R&D in the public sector.

The routes cover the major ways of increasing public and private R&D expenditures in a country. Each route is associated with a different target group, though there are overlaps across routes. The routes are not mutually exclusive as, for example, competitiveness poles or cluster strategies aim to act on several routes at a time. Within one ‘route’, the policy portfolio varies from country to country and region to region depending on policy traditions, specific needs of the system, etc.

**Route 1: Promoting the establishment of new indigenous R&D performing firms**

As mentioned already, attention to establishment of NTBFs and research-based spin-offs is receiving growing attention in the Icelandic policy mix.

The Federation of Icelandic Industries has for several years devoted much effort through a number of events and has put pressure on policy stakeholders to bring this category of actors to the forefront of attention. A high-tech and seed companies **forum** has been put in place, with the participation of the Ministry of Education, Science and Culture, the Ministry of Industry, the Ministry of Finance and the Ministry of Foreign Affairs. The members are seed companies’ organizations, and the federations of industries. The Federation has presented figures on the growing contribution of high-tech industry to Icelandic prosperity, highlighted the cumbersome
character of the support system for start-ups, and the need for more efficient funding sources.

These arguments have found their way into the policy mix, and the recent start of the crisis is now popularising the idea of start-ups, and more specifically innovative start-ups, as one option to revive economic activity.

Funding for this category of firms was identified as a weakness in the 2007 STPC declaration. This was also pointed out as a weakness in the OECD analysis of financial markets in Iceland (Tulip 2007). The government had invested in the New Business Venture Fund, but bad investments had generated losses and the company had been unable to meet its target of investing in early stage innovation-oriented companies. In 2008, the company created a new capital Fund, Frumtak, meant to fill a gap in the system at the stage of the launch of commercial activities by companies.

On the soft side, many initiatives are flourishing to provide support and incubator space for new entrepreneurs, notably using spaces left free by the banking activities (Klak, the Knowledge Square, the House of Ideas, etc.). The University of Iceland has an industry liaison office and runs an incubator, and students have launched their own start-up support service, consisting mainly of advice (Innovit). IMPRA, part of the Icelandic Innovation Center, offers soft support to entrepreneurs but its mission is mostly geared towards the rural areas of Iceland.

The latter instrument points towards the search for more synergies between regional development and innovation policy, but this is a controversial area, given the low potential and low density of population and firms in the rural parts of the country. The Ministry of Industry of the previous government placed an important stress on developing rural knowledge centres, with apparently a certain degree of success in the most developed parts of the country.

The contribution of a sounding board from companies with respect to the effectiveness of this mix or measures, coupled with some external evaluations, would be invaluable in assessing whether the above policy mix is adequate to respond to the needs of this specific target group.

Route 2: Stimulating greater R&D investment in R&D performing firms

Icelandic R&D performing firms do not benefit from specific R&D funding channels but are de facto primary beneficiaries of the Technology Development Fund. Firms in the Fisheries and Fish processing industry can also access the AVS Fund run by the Ministry of Agriculture and Fisheries. The question of establishing R&D tax incentives has been discussed at several occasions but no decision has been taken in this direction. The Norwegian Skattefun tax scheme provided some inspiration for the debates in Iceland but these have not been conclusive.

Conditions for R&D-active firms in Iceland are of course not only related to the quality of R&D financing, but also determined by general business environment conditions, rules, regulations, labour market conditions. This is where a broader “policy mix” view comes into play.

Work of the federation of the Icelandic industries with the high-tech industry delivered the following factors of success for these firms:

- A stable business environment;
- More emphasis on the needs of the high-tech industry in education (Msc and PhD) and public research;
• Stronger cooperation between industry-education and the research system;
• Availability of capital: stronger venture funds and tax incentives.

This points towards the need for actions in the policy domains of Education, macroeconomic policy and financial markets.

According to the Global Competitiveness Report 2008-2009, Iceland is ranked very highly in terms of labour market efficiency and institutions indicators (sixth out of 134 countries surveyed for both composite indicators). Macroeconomic conditions are less favourable, due notably to inflation and interest rates spread. Other areas linked to human resources and quality of life point towards excellent environment (the country has rank 2 on health and primary education indicators, and rank 4 for the higher education and training composite indicator). In the Global Competitiveness Report’s enquiry on most problematic factors for doing business, only two factors were reported as being problematic: “access to financing”; and “inflation”. Financing through local equity markets is one of the few indicators that appear as problematic. The few factors where Iceland ranks poorly are: market size (obviously), macroeconomic stability (for the reasons mentioned above). A number of factors relate to conditions for FDI, and we return to these under Route 4.

These elements point towards the relevance of the stance taken by the government on the way to support R&D-active firms in Iceland, giving priority to “facilitate economic stability and create favourable business environment for companies in order to foster innovation and growth” (S&T Policy 2006-2009 from the STPC). The question of business financing for R&D and innovation would need further investigation, to determine whether, with the new initiatives, there are still gaps in the innovation funding chain.

**Route 3: Stimulating firms that do not perform R&D yet**

This route receives least priority in the Icelandic policy mix portfolio for R&D. Arguably, this is also the most difficult to pursue since public authorities cannot substitute to private managers for taking strategic decisions such as starting R&D activities with uncertain returns.

The fact that this is not a policy priority can probably be explained by policy inertia linked to the configuration of the Icelandic productive fabric. This can be characterised as a dual structure: one the one hand, resource-based companies which have in the past succeeded to thrive based on the exploitation of these resources without much investments in knowledge, and, on the other hand, a few high-tech and science-based companies. The policy mix portfolio has given priority to science-based companies (to return to the Pavitt taxonomy presented earlier) but does not really address specialised supplier firms such as those active in food processing machineries or specialised medical equipment.

Technology transfer activities from the Innovation Centre, or the new Icelandic Institute for Intelligent Machinery selected under the Centre of Excellence Programme, are policy instruments which could lead some companies to engage in R&D activities (even if this is not an explicit goal of those centres). It would indeed be interesting to know more about the effective needs of these companies, and the way the technology institutions respond to such needs. Here the international dimension plays a key role: lead companies in Iceland should develop their absorptive capacities for sources of information on a worldwide, rather than domestic basis.
Innovation coaching for entrepreneurs, and local clusters initiatives, developed in the wake of the regional development agreements, are also instruments run by IMPRA, that might contribute to this relatively unexplored Route 3.

The new unemployment mechanism that has been adopted as a quick response to the crisis, whereby unemployment benefits can partly be used to subsidy personnel hired by companies for innovative projects, might be an interesting scheme for the Route 3 objective. It addresses a well-known barrier for mundane companies to engage in innovation activities: the “lack of time”, or rather a lack of appreciation of possible windows of opportunities for engaging in innovation and an internal organization which is not giving much room to innovative practices. Other countries have experimented positively with such temporary subsidy schemes of “innovation officers”, which can help to open such windows of opportunities. This mechanism has been set up with a dual goal in mind: fighting unemployment and promoting innovation. Follow-up and evaluation of results would be needed to decide whether the mechanisms is efficient in both respects.

**Route 4: Attracting R&D-performing firms from abroad**

Attracting foreign companies to establish bases in Iceland to conduct R&D is not the main explicit priority with respect to internationalisation in research. As will be developed in the next Chapter, the main approach is for Icelandic R&D performers to seek collaboration abroad.

However, other factors, such as quality of domestic human resources for research, or favourable corporation tax conditions might be more relevant towards this goal.

The Global Competitiveness Report 2008-2009 ranked Iceland quite low on the following indicators: FDI and technology transfer (rank 93 out of 134 countries), prevalence of foreign ownership (rank 103), and business impact on rules for FDI (rank 95). It goes beyond the remit of this report to analyse the underlying causes for such low rankings, but this indicates the presence of barriers to inwards flows of investments in R&D.

**Route 5: Increasing extramural R&D carried out in cooperation with the public sector**

This route has been discussed in Chapter 2, mostly under the “knowledge circulation” function. There, the argument was developed that, while the priority for cooperative research is repeatedly stated in policy documents, few mechanisms do exist in reality to promote this cooperation. The extent to which this occurs naturally, due to convergence of research interest and the small size of the research system is probably high, but cannot be evidenced in the absence of adequate indicators to measure it. The new Centres of Excellence programme puts this objective as a prerequisite, and it remains to be seen how effective this initiative will be to foster new, relevant cooperative ventures.

As argued earlier, companies’ innovation trajectories differ according to the nature of their knowledge base: fostering public-private partnerships in R&D should certainly not be a universal goal for all types of companies. When such cooperation is relevant, there is no reason either to restrict it to domestic cooperation.

**Route 6: Increasing R&D in the public sector**

As discussed at length in the previous Chapter, increasing R&D, not only on the quantitative side, but also in terms of its performance, has been and remains the top
priority in Icelandic S&T policy over the last years. The range of instruments available towards this route, and their strengths and weaknesses have been discussed above mostly under the “knowledge production” function. We refer the reader to the discussions in section 2.2.3 on institutional versus performance-based funding; to the question of research prioritisation; and to the issue of reaching critical masses in research through mergers, reorganisations, and support to larger and targeted research centres. Those issues are, together with the increase of quantitative funding, the main instruments used in Iceland for increasing quality and performance of public research.

**The importance of other policies, notably education and innovation policies**

Innovation policy displays the closest connections with R&D policy: this is especially important for those companies which are innovating with few connections to the research base, like the supplier dominated companies. The rationale for developing a closer connection between this policy area and S&T policy is obvious.

Under Economic policy, the key role of macroeconomic conditions for businesses to settle and invest in R&D in Iceland (see above discussion), cannot be underestimated, certainly in the current crisis period. A volatile currency, high inflation rates, shaky financial sector, are all serious problems in the environment, that cannot be compensated by R&D-specific incentives.

Next comes Education policy, with its key role in providing qualified manpower, not only researchers, to the innovative segment of the productive fabric. The shortages in science and engineering graduates are evidenced both in official figures and by company representatives. But other types of qualifications are also needed and there is no formal channel today for the education system to systematically identify the needs in this respect (as discussed in section 2.2 before).

Employment policy has already been mentioned as an area where possible synergies could be reached with innovation promotion goals, notably under Route 3.

Regional development policy and Environmental policy are also very much interlinked with the debate on RDTI policy for the knowledge economy: investing in resource-based industries, most notably the aluminium industry based on the exploitation of cheap hydro-electric power sources, is an option that is currently followed in Iceland, with several large investments implemented and planned around the country. The question of priority between such industries versus knowledge-based industries is politically very sensitive:

- Environmental considerations play a large part in the criticisms placed against the huge investments with large environmental impacts;
- Regional development considerations are used to support investment in power intensive industries, since they are spread around the country and could contribute to the policy goals of maintaining population in the sparsely populated areas outside of Reykjavik;
- S&T policy options include a regional dimension, and this is also present in the internal strategy of the University of Iceland: the establishment of regional knowledge centres is progressing, but a consensus on the relevance and feasibility of this option is not reached.

Solutions to those dilemmas would necessarily involve political choices at a certain point. The availability of a strong evidence base on the role and contribution of the
knowledge base sector, including in the regions, and on the effectiveness and international competitiveness of the research system, would be necessary to found credible arguments in favour of the “Knowledge society road for Iceland”.

Assessment of the importance of policy mix routes and their balance

As evidenced by the above discussion, and summarised in Table 7 below, the main policy priority of the Icelandic S&T policy goes towards Route 6: increasing and better managing R&D investments in the public sector. This is indeed where the market failures justification for public intervention is clearest, and where most of the policy statements and actions have been directed to in the recent years of Icelandic STI policy.

However, market failures in the financing of new-technology-based firms have been identified in recent times too, and are given growing priority in the Icelandic STI portfolio, hence indicating a growing priority on Route 1.

Cooperative R&D under Route 5 is given policy attention, but few instruments are attached to it.

The other routes, 2, 3, and 4 targeting existing and foreign companies to invest in R&D in Iceland, are given low priority attention in the Icelandic policy mix, but this might change if the move towards an innovation system approach for policy is gaining pace.

Table 7: Importance of routes in the national policy and recent changes

<table>
<thead>
<tr>
<th>Route</th>
<th>Short assessment of the importance of the route in the national policy</th>
<th>Main policy changes since 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Growing importance</td>
<td>Frumtak, investment company launched in 2008 and maintained over the bank crash</td>
</tr>
<tr>
<td></td>
<td></td>
<td>More resources for entrepreneurship support in rural areas</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dedicated envelope for start-ups in Technology Development Fund</td>
</tr>
<tr>
<td>2</td>
<td>Relatively low priority</td>
<td>No recent changes</td>
</tr>
<tr>
<td>3</td>
<td>Low priority</td>
<td>Financial incentive for hiring unemployed person for an innovative project</td>
</tr>
<tr>
<td></td>
<td></td>
<td>New Centre of Excellence IIM?</td>
</tr>
<tr>
<td>4</td>
<td>Low priority</td>
<td>Centre of Excellence Programme</td>
</tr>
<tr>
<td>5</td>
<td>Important policy priority but few instruments</td>
<td>Increase in competitive funding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Centre of Excellence Programme</td>
</tr>
<tr>
<td>6</td>
<td>Top priority</td>
<td>Centre of Excellence Programme</td>
</tr>
</tbody>
</table>
3.4 Progress towards national R&D investment targets

Table 8 summarises main barriers to R&D investments in the private sector and opportunities and risks generated by the policy mix.

Table 8: Main barriers to private R&D investments and respective policy opportunities and risks

<table>
<thead>
<tr>
<th>Barriers to R&amp;D investment</th>
<th>Opportunities and Risks generated by the policy mix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of risk funding for NTBFs</td>
<td>Support to venture capital funds</td>
</tr>
<tr>
<td>Lack of attractiveness of the country for inward R&amp;D investments</td>
<td>Better coordination of macroeconomic policy with innovation policy</td>
</tr>
<tr>
<td>Low number of R&amp;D-active domestic firms</td>
<td>Cooperative research programmes, user-oriented research programmes, innovation stimulation programmes Direct R&amp;D funding for companies: challenge of additionality</td>
</tr>
</tbody>
</table>

4 Contributions of national policies to the European Research Area

This Chapter provides a thorough discussion of the national contributions to the realisation of the European Research Area (ERA). An important background policy document for the definition of ERA policies is the Green paper on ERA\(^4\) which comprises six policy dimensions, the so-called six pillars of ERA. Based on the Green Paper and complementing other ongoing studies and activities, this chapter investigates the main national policy activities contributing to the following four dimensions-pillars of ERA:

- Developing a European labour market of researchers facilitating mobility and promoting researcher careers
- Building world-class infrastructures accessible to research teams from across Europe and the world
- Modernising research organisations, in particular universities, with the aim to promote scientific excellence and effective knowledge sharing
- Opening up and co-ordination of national research programmes

In the ERA dimension, the wider context of internationalization of R&D policies is also an issue related to all ERA policy pillars and is normally present in the dynamics of national ERA-relevant policies in many countries.

The objective of internationalisation of the research system is key for Iceland: international participation of Icelandic researchers in science, technology and innovation activities is a cornerstone of Icelandic S&T policy (this is present in the policy declarations of the Science and Innovation Policy Council in 2003 and 2006).

References to European research policy and benchmarking with EU Member States (in particular Finland) are also frequent in Icelandic policy-making circles.

As with many other European countries, the discussion on ERA issues in STI policy circles is mostly related to the use of EU-level instruments: Iceland’s research community participates actively in the EU FP and sees its contribution as providing positive rewards, both in terms of funding sources (the returns are seen as positive) and in terms of networking opportunities.

Instruments for internationalisation cover a number of limited grants for preparation of international cooperative projects, as well as soft support to access international funding sources (mostly from the EU).

The European Research space is not the only focus for Icelandic S&T policy: Iceland places a high emphasis on its integration in Nordic R&D co-operation programmes, including the Nordic Research and Innovation Area. Many research linkages and large funding flows also take place with the US.

The ERA-related issues covered in this chapter are not much discussed as such in S&T policy circles, with the exception of course of the question of the modernisation of research universities (and PROs) in view of higher performance, which, as discussed at length in the previous chapters, is a main direction of Icelandic S&T policy.

4.1 Towards a European labour market for researchers

4.1.1 Policies for opening up the national labour market for researchers

Iceland is known for its tradition of sending students abroad for their higher-level education. The Graduate Students Fund provides support for such outgoing mobility.

Until recently, the labour market was relatively closed to foreign researchers, but the new plan by the University of Iceland places a premium on attracting foreign students. “Number of foreign students” is, e.g. one of the indicators in the list of indicators agreed with the Ministry in its supplementary funding agreement. Today, 20% of PhD students are of foreign origin.

Because of the small size of the domestic tertiary education and research system, PhD programmes in Iceland now tend towards the granting of joint degrees with foreign organizations. Increasing numbers of programmes are taught in English too, but some progress needs to be made in this direction, which is meeting some resistance.

Attracting foreign researchers to public research institutions in Iceland is problematic because of the specific environment, and often inherent to the nature of the country (a relatively isolated, sparsely populated cold island...). The openness of the system is however generally valued positively. It might be that a combination of virtual and short stays of “permanently mobile” researchers might be the best option to follow instead of seeking to attract people for permanent settlement in Iceland.

Until recent times, generous grants were available for researchers at the University of Iceland wishing to travel, or for sabbatical years (every 6 years) to be taken abroad. Those incentives are likely to be subject to hard cuts though given the difficult budgetary situation of the University.
There is limited information available in Iceland on the labour market for researchers. The development of a better evidence base, covering notably this important dimension of international mobility of researchers, is highlighted in recent development and analyses of STI policy in Iceland.

4.1.2 Policies enhancing the attractiveness of research careers in Europe

Salaries for researchers in HEIs in Iceland compare reasonably well with those of other developed countries, though not with US salaries. The depreciation of the Icelandic Krona is eroding the competitive position of these jobs, although the cost of living in Iceland has been reduced for those people paid in foreign currencies. The possibility to travel, mentioned above, has been a positive element of this attractiveness.

There are no comparative studies available to show how careers in the Icelandic public research sector compare to careers in other countries.

4.2 Governing research infrastructures

For the topic of research infrastructure as for the previous ones, systematic inventories and data are lacking in Iceland. A state-of-the-art of existing infrastructures is lacking, and only anecdotal evidence can be collected. The small size of the country might in part explain this situation, which assumes that specialised infrastructure is known by the restricted number of experts concerned by these infrastructures.

In early 2009, a plan was under development, based on an ongoing study of the availability of research infrastructure in Iceland, investigating possibilities for the more efficient use of, and for connections to international research infrastructures. The results will probably include new directions for opening up, or linking to foreign infrastructures.

4.3 Research organisations

New policies and strategies towards improving research quantity and quality at public research organizations, from a domestic perspective, have been discussed already in the previous chapters and presented more in detail in the annex: institutional versus performance-based funding; research prioritisation; the issue of reaching critical masses in research through mergers, reorganisations, and support to larger and targeted research centres, etc. These policies and strategies, when they will yield fruits, will contribute to improving the status of Icelandic research in the European landscape.

More specifically, initiatives to foster international openness of the universities and PROs, are part of the picture. In the agreement adopted between the University of Iceland and the Ministry of Education, Science and Culture, one of the important items among the objectives the University is committed to is: “to increase organised collaboration with first-class foreign higher education institutions and higher education departments on a worldwide level”. Of course, adapting the institution to the Bologna process is also present amongst the objectives.
4.4 Opening up national research programmes

A recent report (Nauwelaers and Wintjes 2009) pictures as follows the situation with respect to openness of national research programmes in Europe: “The most common situation across the countries is that of R&D programmes which are increasingly open to foreign participants, but with funding restricted to actors based in the country, i.e. the first stage of openness. The principle of “each agency funds its nationals” is the most widespread rule. More and more recent programmes favour international partnerships, including this as a compulsory selection criterion, but with still no or very marginal funding allocated to foreign partners, i.e. moving towards the second stage of openness. Examples of programmes at the third stage of openness are rarely found in our sample, i.e. programmes, where large amounts of money directly flow to foreign actors. This is only the case in the Netherlands and in Austria, but a number of restrictions apply. However, within this third stage, several examples are found of structural programmes in which foreign funding is sought for the establishment of excellence research centres, i.e. where incoming foreign R&D funding is part of the programme.”

Within this frame of analysis, Iceland would belong to the first stage of openness category, starting to move towards the second stage. The criterion of international cooperation is present in funding programmes. It is not given particularly high emphasis in the work of the two main competitive funds, except for the “grants of excellence” in the Research Fund. The new Centres of Excellence programme includes this criterion as compulsory. However, funding is always allocated to Icelandic organisations, and there are no cases of trans-border funding flows from national programmes.

4.5 National ERA-related policies - a summary

Iceland S&T policy places an important stance on research internationalisation. This is seen in a broader perspective than just the ERA: Icelandic research should be open to the world, where the best and most relevant competences lie, and not necessarily with EU countries. Links with the Nordic countries are particularly strong due to the strong linkages with these countries.

As for many EU countries, the approach of Icelandic policy towards ERA can be called an “implicit” one: by reinforcing its research institutions, encouraging (mostly outward) mobility of researchers, stimulating international research partnerships for researchers in PROS and universities, Iceland is reinforcing its knowledge creation structures and potential, which it brings to the Economic space. However, again similarly to most EU countries, aligning with, or opening domestic research programmes to foreign research activities, is not really on the agenda. The approach to ERA is seen as one of exploiting and contributing to EU-level instruments such as the FP.

The approach to research internationalisation is mostly an outward-oriented approach: stimulating inward investments in research and inward mobility of people to Iceland for knowledge activities, is gaining a increasing policy attention, but still represents an underdeveloped road.
### Table 9: Importance of the ERA pillars in the ERA policy mix and key characteristics

<table>
<thead>
<tr>
<th>Labour market for researchers</th>
<th>Short assessment of its importance in the ERA policy mix</th>
<th>Key characteristics of policies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Barriers for incoming mobility</td>
<td>• Policies for outwards mobility</td>
</tr>
<tr>
<td></td>
<td>• Important item to ensure renewal and diversity in human resources</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Governance of research infrastructures</th>
<th>Short assessment of its importance in the ERA policy mix</th>
<th>Key characteristics of policies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Due to small size, important opportunity for internationalisation</td>
<td>• Move towards more critical masses and research specialisation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Performance of research institutions</th>
<th>Short assessment of its importance in the ERA policy mix</th>
<th>Key characteristics of policies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• A key issue for placing Iceland on the ERA map</td>
<td>• Subject of priority policy attention</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opening up of national research programmes</th>
<th>Short assessment of its importance in the ERA policy mix</th>
<th>Key characteristics of policies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Outward opening rather than inward opening</td>
<td>• Few developments</td>
</tr>
</tbody>
</table>

### 5 Conclusions and open questions

#### 5.1 Policy mix towards national R&D investment goals

Iceland is evolving towards a knowledge-based economy and has established a complete research and innovation system, with a number of strong assets: a highly educated workforce, a range of Public Research Institutions specialized in key domains of importance for the Icelandic economy, a growing and increasingly research-oriented university sector, and an emerging segment of knowledge-intensive companies, competitive internationally in niche markets.

On the policy side, research, technology and innovation have climbed high on the policy agenda. The key policy orientations adopted during the two terms of office of the STPC (2003-2006 and 2006-2009) reflect the will to improve the quality and effectiveness of the research and innovation system, while maintaining the country’s cultural values. The main accents at the outset of the Council’s establishment in 2003 concerned a better organisation, in view of improved performance, of the public research system, PROs and universities. These ambitions are progressively implemented, even if challenges still remain for an evolution towards more performance-based funding systems for PROs and universities and to realise a more extensive switch towards competitive funding sources.

Policy attention has been so far mostly concentrated on the public R&D side. The government sees its role with respect to private R&D investment, as a facilitator: providing good framework conditions, such as a low company tax rate, is seen as an appropriate response, and opposed as a main reason for the reluctance to offer tax incentives for R&D. This points towards the need for coordinated actions in the policy domains of Education, macroeconomic policy and financial markets. This is where a broader “policy mix” view comes into play, and where coordination of policy domains become a crucial point.

The lack of appropriate funding available for New Technology-based firms emerged however as a growing concern in recent years. The government invested, without much success, in a New Business Venture Fund, and is taking new steps with the creation of a new Fund, Frumtak, in 2008.
During the very recent years, policy focus has been evolving gradually towards a more holistic view of the innovation system, trying to create linkages between R&D producers and companies, involving users’ views more into the policy design process (e.g. for the definition of targeted programmes or for the adoption of new STPC resolution), and turning attention to other bottlenecks in the innovation system than the identified challenges for public R&D funding and reforms of PROs and HEIs. More policy attention is needed to question of knowledge absorption and exploitation by companies. This function is not yet tightly linked to the other questions treated by the mainstream S&T policy: the need to bridge technology and market opportunities is not yet firmly integrated in policy orientation, though recent developments point towards evolutions in this direction.

The question of priority setting in public R&D funding is getting higher on the policy agenda. The new “Centres of Excellence and Research Clusters” programme has been launched recently: this provided for funding for a limited number of large projects, in the areas emerging from the earlier Foresight exercise, for up to seven years. Cooperation between universities, public research institutions, companies, and users is a core feature of the envisaged centers. Such an initiative represents a concrete step forward on the research prioritisation road. However, there are currently several new research prioritisation processes going on, which seem to be running largely in parallel, a situation which raises questions on the effectiveness of this prioritisation.

The above two points – a dissociation between knowledge creation and knowledge absorption in policy, and the difficulty faced by the prioritisation process – point towards the fragmentation in policy-making that Iceland is experiencing, despite progress made with the establishment of the cross-ministerial STPC. Policy development has been very well coordinated. But a number of evolutions show that the coordinating role of the Council has not yet reached high effectiveness. There is more to coordinate than R&D instruments: the example of the experiment with an employment scheme used for innovation promotion might pave the way towards the kind of policy interlinkages that could foster a synergetic use of public resources and the building of more efficient “policy mixes”.

An important direction identified for future progress in Icelandic STI policy concerns the development of strategic policy intelligence tools. R&D monitoring and evaluation are still under-developed. Evolving into this direction is a necessary ingredient for more evidence-based policy-making, for the evolution towards more efficient policy mixes, and for the identification of research priorities.

### 5.2 ERA-related policies

The objective of internationalisation of the research system is key for Iceland: international participation of Icelandic researchers in science, technology and innovation activities is a cornerstone of Icelandic S&T policy. References to European research policy and benchmarking with EU Member States (in particular Finland) are also frequent in Icelandic policy-making circles.

The European Research space is not the only focus for Icelandic S&T policy: Iceland places a high emphasis on its integration in Nordic R&D co-operation programmes, including the Nordic Research and Innovation Area. Many research linkages and large funding flows also take place with the US.
The approach of Icelandic policy towards ERA can be called an “implicit” one: by reinforcing its research institutions, encouraging (mostly outward) mobility of researchers, stimulating international research partnerships for researchers in PROs and universities, Iceland is reinforcing its knowledge creation structures and potential, which it brings to the Economic space. However, aligning with, or opening domestic research programmes to foreign research activities, is not really on the agenda. The approach to ERA is seen as one of exploiting and contributing to EU-level instruments such as the FP.

The approach to research internationalization in Iceland is mostly an outward-oriented approach: stimulating inward investments in research and inward mobility of people to Iceland for knowledge activities, is gaining an increasing policy attention, but still represents an underdeveloped road.

5.3 The way forward: the crisis as an opportunity for the knowledge-based economy

The current situation in Iceland is characterised by a very severe financial and economic crisis, caused by the complete collapse of the banking and financial sector in October 2008. But this situation provides also a rather new context for science and technology policy in the country, with impacts not only on financial and human resources mobilisation, but also on general orientations of the S&T policy.

The idea of “Iceland rebuilding through the creation of high-tech firms born on the ruins of the economy” became very popular in the public, and can provide strong support and new impetus for the policy towards a knowledge-based economy in Iceland, pursued in the recent years. The positive signals which have been sent with the fulfilment of government’s commitment for a growth in competitive funding despite budget cuts, should be acknowledged. The plans for mergers and rationalisation of PROs and universities might also get a new impulse due to the shortage of resources: untapped synergies might well be put at the forefront, notably between universities. Finally, setting up user-oriented public-private partnership experiments, such as the Centres of Excellence, which embed the idea of value creation from research, is likely to receive more support in times of economy recovery. It should be ensured that these experiments are evolving towards “co-generation” of new knowledge, making sure that research advances and technological opportunities are matched with market opportunities.

The pressing need for economic recovery and the current and expected financial shortages create a sense of urgency, and release creativity, that could speed up and encourage difficult decisions to be taken under six core future directions for S&T policy. These six opportunities are all interlinked. They are summarised in Box 4 below.
Box 4: Six core future directions for Icelandic S&T policy

1. **Value creation** from science and technology (from S&T to innovation policy): “centres of excellence” versus “competitiveness poles”?

2. **Policy alignment**, between the various Ministries, both at decision-making and at implementation stages: achieving balanced and open “policy mixes”;

3. **Research prioritisation** (concentration of funds and efforts into a targeted set of activities);

4. Shift towards **performance-based funding** for R&D (not only through the competitive funds, also addressing institutional funding);

5. **Evidence-based policy-making** fuelled by enhanced monitoring, analysis and evaluation systems;

6. **Increasing outward orientation** of the Icelandic research and innovation system.
References

Knowledge base from ERAWATCH inventory: http://cordis.europa.eu/erawatch
Knowledge base from INNO-Policy TrendChart: www.proinno-europe.eu
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<tr>
<td>AVS</td>
<td>Added Value for SeaFood</td>
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<tr>
<td>EEA/EFTA</td>
<td>European Economic Area/European Free Trade Association</td>
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<td>ERA</td>
<td>European Research Area</td>
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<td>FDI</td>
<td>Foreign Direct Investment</td>
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<td>FP</td>
<td>European Framework Programme for Research and Technology Development</td>
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<td>GBOARD</td>
<td>Governmental Budget Appropriations for R&amp;D</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>GERD</td>
<td>Gross expenditures on research and development</td>
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<td>HEI</td>
<td>Higher education institutions</td>
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<td>HES</td>
<td>Higher education sector</td>
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<td>IIIM</td>
<td>Icelandic Institute for Intelligent Machines</td>
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<td>IMPRA</td>
<td>Icelandic Centre for Entrepreneurship</td>
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<td>ISK</td>
<td>Icelandic Krona</td>
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<tr>
<td>NTBF</td>
<td>New Technology-Based Firm</td>
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<tr>
<td>OECD</td>
<td>Organisation for Economic Development Cooperation</td>
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<td>PRO</td>
<td>Public Research Organisations</td>
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<td>RANNIS</td>
<td>Icelandic Research Centre</td>
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<td>R&amp;D</td>
<td>Research and development</td>
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<td>SME</td>
<td>Small and Medium Enterprise</td>
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<td>S&amp;T</td>
<td>Science and Technology</td>
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<td>STI</td>
<td>Science, Technology and Innovation</td>
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<td>STPC</td>
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RESEARCH SYSTEM ANALYSIS REPORT

Elements on Research System Analysis relevant for the policy Mix Reports 2009 for non EU Member States

Country: Iceland
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1 - Introduction and overview of analytical framework

1.1 Scope and methodology of the report in the context of the renewed Lisbon Strategy and the European Research Area

Knowledge accumulated through investment in R&D, innovation and education is a key driver of long-term growth. Research-related policies aimed at increasing investment in knowledge and strengthening the innovation capacity of the economy are at the heart of the strategy for economic growth of many countries. The aim is to increase and improve investment in research and development (R&D), with a particular focus on the private sector. One task within ERAWATCH is to produce analytical country reports to support the mutual learning process and the monitoring of Member States’ efforts.

The main objective is to analyse the performance of national research systems and related policies in a comparable manner. The desired result is an evidence-based and horizontally comparable assessment of strength and weaknesses and policy-related opportunities and risks.

To ensure comparability across countries, a dual level analytical framework has been developed. On the first level, the analysis focuses on key processes relevant to system performance in four policy-relevant domains of the research system:

1. Resource mobilisation: the actors and institutions of the research system have to ensure and justify that adequate public and private financial and human resources are most appropriately mobilised for the operation of the system.
2. Knowledge demand: needs for knowledge have to be identified and governance mechanisms have to determine how these requirements can be met, setting priorities for the use of resources.
3. Knowledge production: the creation and development of scientific and technological knowledge is clearly the fundamental role of a research system.
4. Knowledge circulation: ensuring appropriate flows and distribution of knowledge between actors is vital for its further use in economy and society or as the basis for subsequent advances in knowledge production.

These four domains differ in terms of the scope they offer for governance and policy intervention. Governance issues are therefore treated not as a separate domain but as an integral part of each domain analysis.
On the second level, the analysis within each domain is guided by a set of generic "challenges" common to all research systems that reflect conceptions of possible bottlenecks, system failures and market failures. The way in which a specific research system responds to these generic challenges is an important guide for government action. The analytical focus on processes instead of structures is conducive to a dynamic perspective, helps to deal with the considerable institutional diversity observed, and eases the transition from analysis to assessment. Actors, institutions and the interplay between them enter the analysis in terms of how they contribute to system performance in the four domains.

Based on this framework, analysis in each domain proceeds in the following two steps. The first step is to analyse the current situation of the research system with regard to the challenges. The second step in the analysis aims at an evidence-based assessment of the strengths and weaknesses with regard to the challenges.

This report is based on a synthesis of information from the European Commission's ERAWATCH Research Inventory¹ and other important publicly available information sources. In order to enable a proper understanding of the research system, the approach taken is mainly qualitative. Quantitative information and indicators are used, where appropriate, to support the analysis.

After an introductory overview of the structure of the national research system and its governance, chapter 2 analyses resource mobilisation for R&D. Chapter 3 looks at knowledge demand. Chapter 4 focuses on knowledge production and chapter 5 deals with knowledge circulation. Each of these chapters contains two main subsections in correspondence with the two steps of the analysis.

### 1.2 Overview of the structure of the national research system and its governance

Iceland, a small country with a population of 320,000 inhabitants, nevertheless hosts a well-developed national research system. The country benefits from a complete set of R&D policies, institutions and regulations, as well as a range of public and private sector R&D performers.

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¹ ERawatch is a cooperative undertaking between DG Research and DG Joint Research Centre and is implemented by the IPTS. The ERawatch Research Inventory is accessible at [http://cordis.europa.eu/erawatch/index.cfm?fuseaction=ri.home](http://cordis.europa.eu/erawatch/index.cfm?fuseaction=ri.home). Other sources are explicitly referenced.
Over the last two decades, the country experienced a remarkable shift from a natural resources-based economy (based on exploitation of fish stocks and geo- and hydro-energy resources) in the direction of a knowledge-based economy. During this period, R&D-based activity started to grow exponentially, from a level that was very low at the beginning of the nineties. The Barcelona target of 3% of R&D expenses on GDP was reached in 2001 (the figure was 1.1% in 1990). The latest figure for GERD/GDP is 2.8% in 2005, mainly due to fierce GDP growth (R&D expenditures remained stable during the period). Total R&D expenditures rose from ISK3.6m in 1990 to ISK28.4b (€363m\(^2\)) in 2005.

Due to the structure of the economy, dominated by exports of fish and aluminium, the share of exports of high-tech products in total exports is low (8.9% in 2006). Such a figure, however, hides a range of R&D based developments in high-tech activities in specific niche activities: medical equipment, food processing machineries, and biotechnology, in which world leaders are active in Iceland.

The system is also characterised by internationalisation. Following the journeys of the fishermen, there is a strong tradition, for people and organisations, of “going abroad” and opening up to the world. R&D-intensive companies are very active overseas, and most students get their third-level education degrees in foreign countries, bringing the benefits of a large network of contacts back to the country. There is no brain-drain problem, since both individuals and organisations tend to maintain strong links with their home base and return to the country. Inward R&D investments and people flows however are less intense.

**Main actors and institutions in research governance**

Figure 1 below depicts the main actors and institutions, as well as funding flows within the Icelandic research system.

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\(^2\) 1 €=78.23 ISK, 2005 official exchange rate from European Central Bank.
Figure 1: Overview of the governance structure of the Icelandic research system

Source: ERAWATCH Research Inventory. Black solid arrows: control and structural funding; red dotted arrows: competitive funding. Number of Research Institutes is indicative.
On the policy design level, the Science and Technology Policy Council (STPC) is the key strategic body at the core of the R&D policy system in Iceland. It includes 20 members and is headed by the prime minister. The role of this body is to define the strategic orientations for science and technology policy in Iceland.

The Council is organised in two committees, the Science Committee and the Technology Committee, which prepare the decisions of the Council. There is an overlap between members of these two committees in order to foster synergies.

Each Minister with responsibilities in R&D activities takes decisions with respect to R&D institutions and funds under its own control. The main instruments for funding research in Iceland are: block grants to universities and research institutions, on the one hand, and competitive funding programmes on the other hand. There are no R&D tax incentives in Iceland.

On the operational level, the Icelandic Centre for Research, RANNIS, reporting to the Ministry of Education, Science and Culture, is an important agent for the implementation of the policy: it provides technical support to the council and its committees, to the funding bodies, and manages and follows up implementation of most research programmes.

Competitive funds active on the scientific side are: the Research Fund, closely linked to the Research Equipment Fund, and the Fund for Research and Graduate Education. These are governed by a Board appointed by the Ministry of Education, Science and Culture. The competitive fund targeting technology is the Technology Development Fund, governed by a board appointed by the Ministry of Industry and Commerce. In addition, targeted research programmes are launched for a limited duration, and focus on specific areas, such as, currently, nanotechnology and post-genomic biomedicine and a Centre of Excellence programme. The Added Value for Seafood (AVS) Programme is managed by the Ministry of Agriculture and Fisheries.

Private R&D performers receive limited government funding for research: they can access competitive funds (mainly Technology Development Fund, AVS and targeted programmes) but they do not benefit from dedicated funding sources. The government has invested in a venture capital fund, the New Business Venture Fund. The Icelandic Innovation Centre, under the control of the Ministry of Business Affairs, is in charge of technology development, technology transfer to companies and support to innovative businesses.

Public as well as private R&D performers access R&D funding from abroad (from the EU FP, Nordic funds, US funds and private sources). The share of R&D funding from abroad amounted to 11% of total R&D funding in 2005.

**Main research performer groups**

The public research side in Iceland includes universities and public research organisations. On both sides, recent mergers have been implemented to rationalise the public research landscape.

Iceland hosts one major university, the only one with a complete range of disciplines, the University of Iceland, and several smaller specialised university or university-level institutions. The universities are financed and controlled by the Ministry of Education, Science and Culture. Until recently, universities had limited research activities, but
this is currently changing, as more focus has been placed, and new instruments
developed, to enhance the research-side of universities. The major R&D performer
on the public side is the University of Iceland. The University Hospital is also an
important research actor, with extensive research co-operation with the medical
faculty of the University of Iceland.

Specialised governmental research institutes are owned by several Ministries,
according to their domain of competence. The largest research institute is the Marine
Research Institute, under the Ministry of Fisheries and Agriculture, others are Matis,
a private food research company owned by the government, the National Energy
Authority, the Iceland Geosurvey, the Icelandic Meteorological Office, the Icelandic
Institute of Natural History, and the Institute of Earth Science.

On the private side, a single company is responsible for a large share of business
R&D in Iceland: deCODE, a biopharmaceutical company, applying its discoveries in
human genetics to the development of drugs for common diseases. The country
hosts several biotech companies, a few pharmaceutical companies and medtech
companies, as well as marine biotech companies, most of them clustered in
Reykjavik around the University of Iceland and the national hospital. Other important
private R&D spenders belong to the machinery and equipment sector (for food and
medical industry) and software.

2 - Resource mobilisation

The purpose of this chapter is to analyse and assess how challenges related to the
 provision of inputs for research activities are addressed by the national research
system. Its actors have to ensure and justify that adequate financial and human
resources are most appropriately mobilised for the operation of the system. A central
issue in this domain is the long time horizon required until the effects of the
mobilisation become visible. Increasing system performance in this domain is a focal
point of the Lisbon Strategy, with the Barcelona EU overall objective of a R&D
investment of 3% of GDP and an appropriate public/private split as orientation, but
also highlighting the need for a sufficient supply of qualified researchers.

Four different challenges in the domain of resource mobilisation for research which
need to be addressed appropriately by the research system can be distinguished:

• Justifying resource provision for research activities;
• Securing long term investment in research;
• Dealing with uncertain returns and other barriers to private R&D investment; and
• Providing qualified human resources.

Establishment of the STPC with a view of ensuring mobilisation of financial
resources for research, within a long term perspective

Ensuring that sufficient resources, both financial and human, are mobilised for
research activities, is a key function to be performed by an efficient innovation
system.

This objective has been at the roots of the establishment of the STPC in 2003.
A first driving force for the launch of the STPC emerged from the difficulties faced by the previous research council, which was composed only of stakeholders: their recommendations were not followed by decision-makers, as these were seen mainly as the voice of a specific community, the science community. Establishing a Council composed of policy-makers as well as representatives of the research community and industry, would reinforce its power and ensure that the needs of the research community are endorsed at policy level (Ingthorsson 2008).

Second, the fact that each Minister holds independent decision power on research expenses under his or her jurisdiction creates a situation of fragmentation. This makes it necessary to involve and coordinate the action and budgets of several Ministries, not just the Ministry in charge of Education, Science and Culture. Therefore the membership of several Ministers in the Council, and its Chairmanship by the Prime Minister, was decided to ensure the high-level coordination and commitment needed to secure resources for R&D activities in the country. Whether this is fully achieved today is put into question by a recent peer review of Education, Research and Innovation policy in Iceland (Taxell et al. 2009).

Science and research activities have, by definition, a long-term horizon; returns to these investments are uncertain and occur over long periods of time: this makes it difficult to secure persistent policy attention over several legislatures. The existence of a stable Council, establishing multi-year strategies (the first two cover 2003-2006 and 2006-2009), facilitates the adoption of such a long-term view.

Ensuring quantity but also quality of public investments in research

The main accents at the outset of the Council’s establishment concerned a better organisation, in view of improved performance, of the public research system, focusing on three main types of action:

1. Increasing the share of competitive funding in total public R&D funding: this is seen as the best vehicle to ensure quality and excellence in research;
2. Strengthening the role of universities as research institutions, and encouraging also more internal competition in access to funds;
3. Reviewing the organisation and work methods of public research institutions, by implementing mergers and reorganisations across PROs and universities.

These objectives address chiefly the quality and mode of delivery of public funding for R&D, rather than its absolute quantity. The key idea is to evolve towards an R&D funding system that is becoming performance-based. These objectives have been maintained as key priorities throughout the two terms of the Council.

Global quantitative targets for R&D spending appear only in the Council resolution for its second term (2006-2009): there the Council considers important that total expenditures on GDP continue to grow over the 3% mark (which was reached in 2001, but not in subsequent years). However there is little discussion or consideration in practice on the mythic Barcelona 3% figure in policy debates: instead the debates and decisions relate to the above quality-related matters.

The declared governmental intentions of doubling the budget of competitive funds for R&D between 2003 and 2007 have been realised. The current deep economic and financial crisis is presenting threats to this commitment, as will be discussed in the next section on recent policy developments.
The challenge to raise private R&D expenditures: non-interventionist stance of the government

Concerning private R&D expenditures, its share of total GERD was just over 50% in 2005 (51.5%). The STPC considers in its second resolution that this share should rise until 60%, to compare with the benchmark countries (in the Barcelona goal, the share of private sector R&D is set at two-thirds of total expenses).

The relatively small share of private R&D of total Icelandic R&D expenditures can be explained partly by the still relatively small proportion of R&D-based industries in the Icelandic economic structure; by the fact that very innovative firms might thrive through “innovation-without much R&D” strategies; or through accessing R&D carried out abroad. This point, and policy-related implications, will be further discussed in the “policy mix” Chapter, Chapter 3.

Funding channels specifically dedicated to private R&D do not exist. The Technology Development Fund is one resource, the Added Value from seafood programme another one for the fisheries and fish-processing industries, but these two funds target projects which might be submitted by private and/or public actors.

Overall, the government sees its role with respect to private R&D investment, as a facilitator: providing good framework conditions, such as a low company tax rate, continuously dropping to reach a low 12%, is seen as an appropriate response, and opposed as a main reason for the reluctance to offer tax incentives for R&D. The Federation of Icelandic industries is not of this opinion however, and considers that R&D tax incentives might well address some of the barriers faced by R&D-active firms in Iceland. The debate on the relevance of establishing R&D tax incentives for private investors, is regularly re-opened in Iceland, and was again a point in the recent external report on Education, Research and Innovation policy, written as a response to the crisis situation (Taxell et al. 2009).

Policy gaps with respect to raising private R&D investments

The low number of R&D-active firms in Iceland is a concern, even more so that some of the main R&D-performers might get into trouble due to the crisis situation.

The lack of appropriate funding available for New Technology-based firms is a permanent problem in Iceland, and will be discussed more thoroughly in section 2.3 on new Policy developments and in Chapter 3 on the policy mix.

Demand-oriented policies, using innovation-oriented public procurement strategies, though mentioned in the second Council resolution, do not benefit from explicit policy attention.

Improvements to be made in the provision of human resources for the knowledge economy

Ensuring appropriately qualified human resources for R&D is the other aspect of resources mobilisation, besides the financial aspect. Since the late 90s, expenditures on education in Iceland have risen fiercely and the country now has one of the highest rates of education expenditures on GDP (OECD 2006b and Suppanz 2006). Achievements at secondary level are not in line with such investments, since the rate of people with secondary-level education is still low, and performance in generic skills as measured by the OECD PISA enquiries, is not outstanding. In contrast, the proportion of population with tertiary education reaches 30%, above the
EU-level average of 23% (2005 figures), on a par with Sweden but below that of other Nordic countries.

The number of students enrolled at universities has increased dramatically over the last decade: the growth rate from 1997 till 2005 reached 75%: this places an increasing pressure on quality of teaching and research at Icelandic universities. This is subject to important policy attention, with the adoption in 2007 of an agreement between the University of Iceland and the Ministry of Education, Science and Culture. The agreement foresees a commitment from the university to an increase in quality of teaching and research, and a supplementary government appropriation for the university, in line with performance targets set up in the agreement. Again, as discussed in the next section, the banking and financial crisis will impact on the high ambitions underpinning this agreement.

The share of science and engineering graduates is low: 10.1% in 2005 (this places Iceland at a level of 78, relative to the EU average =100, European Innovation Scoreboard 2008). This creates a shortage on the labour market, even more so due to the fact that the banking sector had absorbed a large share of qualified scientific workforce. The autumn 2008 events have changed the picture, as will be discussed in the next section.

The international dimension education is to be fostered

A large part of graduate education is traditionally acquired abroad: 57% of doctorate holders in Iceland hold a previous degree from abroad and 97% of them have lived abroad (OECD 2008). This is an asset for the research system, as it creates a wide range of networks for Icelanders at home and abroad. Things might however change with the growing supply of PhD education at home, fostered by recent changes at university level, most notably at the University of Iceland.

Attracting qualified workers to settle for a long term in Iceland is a challenge: bottlenecks exist and are linked to the small size and the relative isolation of the country, and to language barriers. However, good working conditions, high standards of living, excellent environmental conditions, partly compensate for these barriers. The recent collapse of the banking sector and its important consequences on the economy will place further strain on the attractiveness of the country for qualified workers from abroad.

3 - Knowledge demand

The purpose of this chapter is to analyse and assess how research related knowledge demand contributes to the performance of the national research system. It is concerned with the mechanisms to determine the most appropriate use of and targets for resource inputs.

The setting and implementation of priorities can lead to co-ordination problems. Monitoring processes identifying the extent to which demand requirements are met are necessary but difficult to effectively implement due to the characteristics of knowledge outputs. Main challenges in this domain are therefore:

- Identifying the drivers of knowledge demand;
- Co-ordinating and channelling knowledge demands; and
Monitoring demand fulfilment

Responses to these challenges are of key importance for the more effective and efficient public expenditure on R&D targeted country’s strategy.

The need for, and difficulty in setting priorities for research

The question of priority setting in public R&D funding is a haunting one in Iceland.

On the one hand, the very small absolute size of the economy and of the research system, the need to reach critical masses notably in fields where important research infrastructures are necessary, provide obvious justifications for concentrating funding on a limited, well-defined range of areas.

On the other hand, the need for research freedom, the high risk of governmental failure in picking up appropriate fields of research with highest potential, and the sensitivity of the matter due to the existence of vested interests on the domestic scene, all militate against such a targeting process.

At the outset of the establishment of the STPC, policy priorities have been expressed, as stated above, in terms of improvement of effectiveness of research funding approaches and reform of PROs and HEIs, but not explicitly in terms of targeting specific fields of research. Still, the need to support strong (but undefined) “knowledge clusters” was mentioned in the first STPC policy declaration, and the existence of “research programmes”, temporary programmes addressing specific scientific and/or technology areas (at that time information technology and environment), was acknowledged. The decision-making process for launching new programmes was described as follows in the first STPC strategy (2003-2006): “The research plans that public bodies wish to implement shall be sent to the Science and Technology Policy Council for evaluation”. At this stage, the situation was thus one where identification of knowledge demand was very much driven by the science community.

Methods used and evolution towards research prioritisation

Apart from ad hoc initiatives like the ones that will be described below, formal channels to bring the voice of industry in S&T decision-making circles are in practice restricted to the few members nominated by the employers and employees associations in the STPC, and the voluntary actions of the Federation of Icelandic Industries in the domain of STI policy, focusing especially on NTBFs. The formal influence of business sector on decisions taken in the STPC and its two committees is rather limited.

Things are evolving though, in the direction of opening up the policy design process to knowledge users:

- The launch of “Nanoscience and nanotechnology and postgenomic biomedicine” programme was preceded by a wide consultation process, which extended over the boundaries of the scientific community. This gave rise to many proposals, amongst which the above one was retained. Still, there are complaints that such a decision was mostly driven by the voice of the public research actors, and that the process followed until reaching the final decision on the definition of the targeted programme, was not fully transparent;

- The preparation of the policy strategy of the STPC for its second term involved a
wide and open consultation process, in which many people from outside the Council could participate. This resulted in a much more open approach in the second policy statement, with notably increased attention to the role of education and businesses and innovation, shifting the approach away from a linear view;

- The most remarkable step was taken in 2007, when a broad **Foresight exercise** was launched in Iceland under the auspices of the STPC. Its objective was to identify the drivers of change in the Icelandic society and link them to challenges for STI. This inclusive exercise, piloted by the STPC, involved a much wider constituency of the society, but excluded members of ministries. The areas chosen for the foresight were:
  1. Natural resources, environment and sustainable development;
  2. Health and wellbeing;
  3. Strengths of a small nation;
  4. Industries, trade and funding of knowledge production and innovation.

The groups formed for each topic produced their reports, which found their way into the STPC declarations, and began to be translated in 2007 and 2008 policy orientations.

In its second term strategy (2006-2009), the Council affirmed the principle of freedom of research at universities, but also opened a new, sensitive chapter of “research in the public interest”. In this chapter, the first three above areas were stated as important for Iceland, but practical consequences in terms of targeting research funds were not spelled out. After the Foresight process, the Council adopted a declaration in December 2007, in which these areas, augmented by a number of others (notably creative industries and socio-cultural research on Icelandic cultural heritage) were mentioned as presenting important opportunities. As the next section elaborates, **these priorities have finally been articulated in the form of a specific programme**, the Centres of Excellence programme.

**A relatively low importance of targeted research funding**

In budgetary terms, **targeted research programmes still account for a limited share of total public R&D funding**. Institutional funding shows prioritisation, mostly through the specialisation of governmental research institutes (see Table 1). Fisheries, social services and health are sectors which are important recipients of public R&D funds, while environment and energy (one should take some caution here with respect to accuracy of the figures) do seem to be less prioritised.

The **absence of quantitative studies of research and technology potential**, similar to the types of exercises that are carried out in other countries, is one point of attention. Also, results of sponsored research are not systematically evaluated and lessons learned brought forward into the policy cycle. This presents opportunities in terms of enhanced STI system and STI policy monitoring and evaluation, which will be discussed in section 2.4 below.
Table 2: R&D support by objectives (Mio ISK, budget 2009)

<table>
<thead>
<tr>
<th>Objective</th>
<th>R&amp;D budget adopted 2009</th>
<th>Share in total R&amp;D funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>General development</td>
<td>5929</td>
<td>37.5%</td>
</tr>
<tr>
<td>Rannis and funds</td>
<td>2219</td>
<td>14%</td>
</tr>
<tr>
<td>Fisheries</td>
<td>2163</td>
<td>13.7%</td>
</tr>
<tr>
<td>Social services</td>
<td>2070</td>
<td>13.1%</td>
</tr>
<tr>
<td>Health</td>
<td>1218</td>
<td>7.7%</td>
</tr>
<tr>
<td>Agriculture and fish farming</td>
<td>833</td>
<td>5.3%</td>
</tr>
<tr>
<td>Environment</td>
<td>349</td>
<td>2.2%</td>
</tr>
<tr>
<td>Energy</td>
<td>264</td>
<td>1.7%</td>
</tr>
<tr>
<td>Industry</td>
<td>204</td>
<td>1.3%</td>
</tr>
<tr>
<td>Others</td>
<td>539</td>
<td>3.4%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15788</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Source: Rannis

**Prospects for policy coordination**

The other question under this “knowledge demand” function relates to the capacity of the system to coordinate policies across the board. This question of policy coordination will be discussed more in-depth in Chapter 3, devoted to “policy mix” issues. The key argument will be that, while the establishment of the STPC was motivated by a desire to achieve better coordinated policies, results achieved in this respect in practical terms, still leave to desire, due to the walls that still exist between the Ministries.

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**4 - Knowledge production**

The purpose of this chapter is to analyse and assess how the research system fulfils its fundamental role to create and develop excellent and useful scientific and technological knowledge. A response to knowledge demand has to balance two main generic challenges:

- On the one hand, ensuring knowledge quality and excellence is the basis for scientific and technological advance. It requires considerable prior knowledge accumulation and specialisation as well as openness to new scientific opportunities which often emerge at the frontiers of scientific disciplines. Quality assurance processes are here mainly the task of scientific actors due to the expertise required, but subject to corresponding institutional rigidities.

- On the other hand there is a high interest in producing new knowledge which is useful for economic and other problem solving purposes. Spillovers which are non-appropriable for economic knowledge producers as well as the lack of

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3 Equivalent to €108m, at 2008 exchange rate of the European Central Bank.
possibilities and incentives for scientific actors to link to societal demands lead to a corresponding exploitability challenge.

Both challenges are addressed in the research-related Integrated Guideline and in the ERA green paper.

**Ensuring top quality in public research is a main policy goal in Iceland**

Research efforts in the public sector are split almost equally between governmental research institutions and universities (23.5% of total R&D expenditures emanate from PROs, and 22% from HEIs in 2005, while the private sector is responsible for the other half). The aim under the “knowledge production” function of the research system is to coordinate the action of these research institutions, find synergies, and enhance quality, excellence and visibility of public research.

Ensuring quality and excellence in research production in HEIs and PROs, is a main thrust of S&T policy in Iceland since the establishment of the STPC in 2003. The point that the public research system is too fragmented and is in need of rationalisation was made already in the review of STI policy in Iceland done by the OECD in 1993 (OECD 1993) and in the RITTS project in Iceland in 1997 (Nauwelaers 1997).

Uneven progress with the main instruments: reorganisations of PROs and move towards performance-based funding

Two types of actions have been decided within Icelandic S&T policy, to evolve towards these goals of quality and excellence in research:

1. **Reorganising this landscape** through a number of mergers between HEIs and governmental research institutes. This has taken place during the first and second terms of the Council, and the objectives have been reached, though not always at the expected speed. That process would have been particularly difficult in the absence of a coordinating body such as the STPC, in view of the fact that the institutes were responding to various ministries. This reorganisation process was acknowledged as one of the best achievements in S&T policy in the evaluation of the Council’s first term of office. In addition, funded R&D projects are of a larger size and involving more R&D actors (Forss and Taxell 2007);

2. **Increasing the share of performance-based funding** for these public research organisations. This should take place over the whole system but also within institutions, and in particular within the University of Iceland.

Progress has been slower on the second front than on the first one, for several reasons.

First, as mentioned already, the establishment and steady growth in budgets for Icelandic competitive funds have been achieved according to expectations. This provides a way to orient public funding towards the best performing teams and researchers. However, progress on this front should not hide the fact that the changes brought about are still relatively marginal, as they affect a proportion of 14% of total government budget appropriations for research. According to the latest budgetary figures: the adopted budget for competitive funds is ISK2255m (equivalent

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4 This assessment implicitly refers to collaboration between PROs and universities, not with private research actors. The latter point is dealt with under the “knowledge circulation” function.
to €15.4m\(^5\) in 2009. That year, total government budget appropriations for R&D amount to ISK15788m (€108m), i.e. the share of competitive funding is 14% of total public R&D funding. This share has been steadily increasing since 2003, starting from 7% and reaching its highest level, at 14.8% in 2008.

Second, with the agreement signed between the University of Iceland and the Ministry of Education, Science and Research, important steps forward have been taken to attach more performance requirements to public funding for research at the main Icelandic university. However: 1) the performance targets, even if they are monitored annually between the University and the Ministry, are not yet systematically translated into variations in funding; 2) the performance-related funding system does only apply to supplementary funding sources, not to the main block grant funding. Hence the actual impact of performance targets at the level of one institution, still appears limited.

Third, performance-based funding systems have been adopted for one other university, the University of Akureyri, and in preparation for other universities, but not yet developed for the PROs.

Because of budgetary cuts necessary in view of the economic crisis situation, the Ministry might lose the means it had developed to implement such performance-oriented funding mechanisms.

**Deficient monitoring and evaluation systems act as barriers for more efficient policy-making**

Another important point here relates once again to R&D monitoring and evaluation: the depth and frequency of data collected on R&D and R&D policy are insufficient to properly assess evolutions and achievements in terms of research quality and excellence. This point was put forward in the STPC resolution for 2006-2009: “the collection and analysis of statistical data pertinent to research, development and innovation (need to be) strengthened”. At the time of the evaluation of the first term of the STPC, this deficiency became obvious, as stated in the internal evaluation report “the main problem encountered in data gathering for this evaluation was that data is scattered and a coordinated frame of presentation is lacking… it was not possible to obtain data on the actual distribution of competitive funds between different types of participants… there was very little information available on the impact of public support” (Ingthorsson 2007). This makes it difficult, e.g. to assess the relevance of the claims, mostly made by governmental research institutes, of a gap between the Research Fund which would favour academia, and Technology Development Fund, which favours businesses, leaving too little room for funding for the type of applied R&D projects presented by these R&D organisations\(^6\).

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\(^5\) 1 €=146.25 ISK, 2008 exchange rate European Central Bank.

\(^6\) This problem with monitoring and evaluations systems, actually has effects on all four functions of the research system.
Evaluation of impacts of R&D programmes are not common practice either. So far, the ongoing targeted programme on nanotechnology and postgenomic biomedicine has not been evaluated: the impacts of such a prioritisation effort on stabilising stronger teams are not known, while the Centres of Excellence programme is already launched.

Increased internationalisation as a vehicle for enhancing research quality

To be complete, a relevant point to be added here concerns internationalisation of research: **excellence in research today means internationalisation.** International connections and partnerships are intrinsic aspects of the quality of research at universities and PROs. Chapter 4 examines the need for more “inward” openness of the Icelandic research system.

Growing attention to research exploitability

Ensuring exploitability of knowledge in S&T policy is sought through two mechanisms:

1. applying a **combination of scientific and socio-economic benefits criteria** for project selection in competitive funding procedures. The difficulty of combining those two types of criteria is not particular to programmes in Iceland. The internal evaluation of the first term of the Council concludes that “there has been a difficulty to balance scientific and other criteria in the selection process (of the two main funds). This may reflect a tension between academic perspective and the more applied approach and the message of ensuring continuous funding may not have been fully appreciated by the evaluation panels” (Ingthorsson 2007).

2. adding “third mission” **types of indicators** in the list of target indicators included in the agreement adopted by the University of Iceland and the Ministry. Such indicators are present but it is hard to judge about the weight given, in practice, to these types of performance indicators over the more conventional ones such as publications and citations.

In addition, a new **law on Intellectual Property Rights** has been adopted in 2004, which describes the rights and duties of employees in the public and private sectors who are at the origin of an invention. Through this law, public institutions can claim exploitation rights of inventions of their employees. The University of Iceland has set up an IP Committee and takes the position of joint ownership of inventions between the university and its employees.

5 - Knowledge circulation

The purpose of this chapter is to analyse and assess how the research system ensures appropriate flows and sharing of the knowledge produced. This is vital for its further use in economy and society or as the basis for subsequent advances in knowledge production. Knowledge circulation is expected to happen naturally to some extent, due to the mobility of knowledge holders, e.g. university graduates who continue working in industry, and the comparatively low cost of the reproduction of knowledge once it is codified. However, there remain three challenges related to specific barriers to this circulation which need to be addressed by the research system in this domain:
Facilitating knowledge circulation between university, PRO and business sectors to overcome institutional barriers;

Profiting from access to international knowledge by reducing barriers and increasing openness; and

Enhancing absorptive capacity of knowledge users to mediate limited firm expertise and learning capabilities.

**A growing policy accent on knowledge circulation between the public and private sectors: yet to be implemented in policy instruments**

**Increasing research conducted in collaboration between public and private actors** is an explicit priority objective of S&T policy in Iceland, stated as follows:

- In the first Council resolution: “increase the cooperation between research institutes, universities, and business enterprises in forming knowledge clusters capable of attaining a strong position in international competition”;
- In the second Council resolution: “to encourage private firms and the public sector institutions to join efforts in strengthening research and development in order to boost successful and profitable innovation and thus international competitiveness based on knowledge”.

The evolution in wording between the resolutions of the first and second terms of the Council indicates a growing accent placed on economic exploitation of knowledge over time.

In the new agreement between the University of Iceland and the Ministry, collaboration with companies is part of the objectives, and of the targets. However, as mentioned above, the translation of such “third mission”- oriented targets into important elements for the career paths of researchers, is not (yet) clear. According to the external evaluation of the STPC, the criteria are still purely academic (Forss and Taxell 2007).

In practice, the **criterion of public-private partnerships in research is not compulsory** in the operation of the various national funds, and there are no specific mechanisms in place to encourage this cooperation. A new programme, the Centre of Excellence Programme, is the first programme to put this dimension of public-private cooperation at its core. While acknowledging that the small size of the country and of its research community is an asset to facilitate contacts and cooperation between research actors on the public and private sides, the OECD policy mix review still recommended that more consideration could be given to specific industry-science partnership programmes in Iceland (OECD 2006).

As mentioned already above, the monitoring system for public R&D is still under-developed. Nevertheless, partial evidence collected during the evaluation of the Council’s first term of operation, seems to suggest that projects funded under the competitive funds managed by Rannis include a growing share of projects carried out in cooperation by the public and private sectors (Ingthorsson 2007). However **not much is known about the nature and extent of, and barriers towards these cooperative R&D ventures**. Not much is known either about untapped potential for public-private research collaboration.

Cross-sector mobility is hampered by barriers due to the different working conditions
in the two sectors as in all countries, but the abolition of lifelong tenure in public institutions is one positive factor facilitating this mobility. Here again, there is no evidence available to assess the extent of this phenomenon.

Unbalanced circulation of knowledge across borders

The question of international openness of the system is discussed in Chapter 4, dealing with the ERA. At this point, the open character of the Icelandic research system should be re-stated, even if there is some imbalance between its outward-orientation and its capacity to attract R&D investments and people from abroad.

Uncertainty about the barriers for knowledge absorption

Finally, it is not sufficient for knowledge to circulate freely across sectors and borders, it should also be absorbed and exploited by the users, mostly the companies. The Icelandic Innovation Centre and its service centre for entrepreneurs and SMEs, IMPRA, have, as mission, to facilitate access to knowledge by companies. These bodies have a broad support mission, focusing not only on technology transfer but also on support for business development, management, export, financing innovation, etc. They are also active around the country in more remote and rural areas. While these bodies are close to the beneficiaries due to the nature of their activity, independent feedback from beneficiaries on the visibility, relevance, completeness, usefulness and impact of their action is currently unavailable.

The notion of “knowledge absorption” used in this series of ERAWATCH country reports places emphasis on the "production" of knowledge in the public R&D sector and its subsequent "application" in the business sector. Other possible trajectories for innovation are also at play, with very different policy consequences, as elaborated below in Chapter 3. A key challenge is the need to bridge technology and market opportunities.
References

Knowledge base from ERAWATCH inventory: http://cordis.europa.eu/erawatch
Knowledge base from INNO-Policy TrendChart: www.proinno-europe.eu


List of Abbreviations

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<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AVS</td>
<td>Added Value for SeaFood</td>
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<tr>
<td>EEA/EFTA</td>
<td>European Economic Area/European Free Trade Association</td>
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<td>ERA</td>
<td>European Research Area</td>
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<tr>
<td>FDI</td>
<td>Foreign Direct Investment</td>
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<tr>
<td>FP</td>
<td>European Framework Programme for Research and Technology Development</td>
</tr>
<tr>
<td>GBOARD</td>
<td>Governmental Budget Appropriations for R&amp;D</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<tr>
<td>GERD</td>
<td>Gross expenditures on research and development</td>
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<td>HEI</td>
<td>Higher education institutions</td>
</tr>
<tr>
<td>HES</td>
<td>Higher education sector</td>
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<tr>
<td>IIIM</td>
<td>Icelandic Institute for Intelligent Machines</td>
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<tr>
<td>IMPRA</td>
<td>Icelandic Centre for Entrepreneurship</td>
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<td>ISK</td>
<td>Icelandic Krona</td>
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<tr>
<td>NTBF</td>
<td>New Technology-Based Firm</td>
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<tr>
<td>OECD</td>
<td>Organisation for Economic Development Cooperation</td>
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<td>PRO</td>
<td>Public Research Organisations</td>
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<td>RANNIS</td>
<td>Icelandic Research Centre</td>
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<tr>
<td>R&amp;D</td>
<td>Research and development</td>
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<tr>
<td>SME</td>
<td>Small and Medium Enterprise</td>
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<tr>
<td>S&amp;T</td>
<td>Science and Technology</td>
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<tr>
<td>STI</td>
<td>Science, Technology and Innovation</td>
</tr>
<tr>
<td>STPC</td>
<td>Science and Technology Policy Council</td>
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</tbody>
</table>
Abstract

The main objective of the ERAWATCH Policy Mix Country reports 2009 is to characterise and assess in a structured manner the evolution of the national policy mixes in the perspective of the Lisbon goals, with a particular focus on the national R&D investments targets and on the realisation and better governance of the European Research Area. The reports were produced for all EU Member State and six Associated States to support the mutual learning process and the monitoring of Member and Associated States’ efforts by DG-RTD in the context of the Lisbon Strategy and the European Research Area. The country reports 2009 build and extend on the analysis provided by analytical country reports 2008 and on a synthesis of information from the ERAWATCH Research Inventory and other important available information sources.

This report encompasses an analysis of the research system and policies in Iceland.
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