



**THE SCIENCE AND TECHNOLOGY POLICY COUNCIL  
ICELAND**

**Challenges and Objectives in Science,  
Technological Development and Innovation**

**Draft**

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**1. Introduction**

Innovation and vigorous science will make the difference between nations in competition as well as cooperation in the 21st century. The Science and Technology Policy Council (STPC) looks to the future and identifies a number of challenges facing Icelandic knowledge society.

The Council also points at a number of fields where domestic RTD and innovation is in the position to achieve competitive advantages internationally pending upon fruitful interactions between companies, universities, public institution and the social groups involved. This close cooperation may contribute greatly to a prosperous society. The Council's objective is to support and spur scientific and technological research, encourage cooperation between different actors and promote value creation and investment in research for social and economic development.

The STPC sees important opportunities in:

- Reinforcing research on education with a view to develop the educational system and make it respond more swiftly to increasing demands of knowledge, efficiency, creativity, initiative and flexibility.
- Promoting innovation as a feasible alternative for investment and to encourage domestic and foreign investors to engage in the support of innovative companies including SMES.
- Facilitating research on the national heritage its old manuscripts, literary culture, language and contemporary culture along with the present emphasis on international efforts and image of Iceland as a dynamic forward-looking nation.

- Boosting research into successful alternatives in preventive efforts against social epidemics as well as in health improvement, rehabilitation, novel approaches in health services, pharmaceuticals and safe food.
- Increasing research in support of a sustainable utilization of natural resources on land, offshore and in the ocean.
- Increasing multidisciplinary research with extensive private support into the probable and extensive impacts on the natural and social environment through global warming.
- Increasing research on the infrastructures of our society with emphasis on its characteristics and uniqueness.
- Increasing attention towards creative industries in which innovation, on-the-edge information technology, cultural activities and entertainment merge with economic activities and investment, creating new companies and job opportunities.

Icelandic research is internationally strong in an increasing number of fields. However, high quality manpower, facilities and equipment is not available across all fields of science in a community counting approx. 5 thousand FTE's in research. International cooperation and interdisciplinary efforts are important countermeasures. Short and efficient ways of communication within the public administration and within companies along with the small size of society can be turned into a competitive advantage for RTD and innovation. It is important to give priority to excellence and to identify objectives likely to contribute to future development and to encourage innovative efforts of SME's.

## **2. Challenges and changing factors/Globalization**

Globalization has a radical impact on small states. Changing division of labour between nations, increased global communication and trade are challenging opportunities that have important impact upon competition. Better understanding of the particularities of remote areas comes with globalization and offers opportunities for countries like Iceland.

### *Competition for people*

The competitive advantage of a country depends on its ability to attract the most able individuals. After completing education and acquiring post-graduate training abroad young people do follow the most attractive opportunities when they decide where to live. The living conditions and social terms have to be attractive so that highly skilled people, natives and people of foreign origin find it feasible to settle down in Iceland.

### *The key-role of education innovation in international competition*

Innovation in international outreach is based on education, research and innovation. The number of PhD students attending our own universities increases rapidly. It is necessary for the business world to cooperate with the educational system; research is closely linked with change and innovation of companies and there is a great need for companies to increase their investment in research, development and innovation.

### *The image of Iceland and a fragile competitive position*

A positive image of a country reinforces its business relationships, education and international cooperation. Reliable information explaining how things are here needs to be at hand in a number of languages. The international business climate is constantly changing and there are some indications that our competitive advantages are lacking behind that of our competitors.

### *Modern administration and economic life*

Different views on the role of the Government and modern approach to administration calls for revision of how public research-, service-, surveillance-, and administrative institutions are operated. RTD carried out by public institutions is often the source of economic or/and social benefits. Publicly founded knowledge can contribute to private economic benefits when accessible and the terms for acquiring this knowledge are reasonable.

### *Changing demographic structure and public health*

Health services, incl. geriatric and social services are defined with reference to changing age-distribution of the population, different lifestyles and multicultural impacts, and of course new developments due to the progress of medical and life-sciences. The share of the population reaching high age is increasing, higher frequency of risk behaviour, welfare diseases, addiction and related problems contribute to increasing the health budget.

### *Technological change and rapid social changes*

The most imminent environment of human beings is the subject of changes in the years to come. Information technology, automation, gene-, bio- and materials technology are increasingly penetrating greater number of social spheres. Technology is developing rapidly and so is society: The family pattern is changing, the number of immigrants is increasing, a cultural divide is emerging, parents' working days are becoming longer and along with the opening up of society, may shake stable societal values. The needs of people are changing and it is becoming necessary to address the social and cultural wellbeing with the same emphasis as economic prosperity, and through this contribute to a better quality of life.

### *Sustainable development*

Global change and the perspective of sustainable development should guide the approach to economic activities, including the development of novel industries and harnessing of natural resources on land and at sea. Decisions need to intertwine economic, social and environmental aspects. Knowledge and open access to information is basic to the public debate on the environment urban planning and natural resources and their sustainable development and utilisation.

New perspectives on safe and healthy food production and changing consumption call for more RTD downstream and in the production part.

### *Renewable energy sources and greenhouse gas emission*

With regards to its abundant energy sources, Iceland is in a unique position among nations. Increased energy prices and a global energy deficiency speed up research on new and clean energy sources and increased energy efficiency. Renewable energy sources and specialised know-how on generating geothermal and hydro energy is

strength in international cooperation and competition and is based on putting scientific knowledge and technological development into practice.

#### *The importance of creative industries*

The creative power of arts and culture is instrumental for future innovation in which information technology and multimedia integrate research, technological development and creative activities.

#### *Innovation in the services sector*

The services sector including financial and health services, care, trade and tourism, is the largest contributor to the GNP. Nevertheless only a small fraction of the total RTD effort addresses the multiple and complex needs of the services sector for new knowledge.

#### *Knowledge in the financial sector*

The global financial market has radically transformed the conditions for RTD. The market for specifically designed solutions is getting bigger and science and technologically based provisions create new opportunities for cooperation between countries. It is a worthy objective to mobilise the financial sector to provide more funds for company based RTD and innovation.

#### *Focal areas for RTD*

“Money makes the world go around” – and this applies particularly in RTD and innovation. It is essential that the legal and regulatory environment at all times is compatible with the best provisions in competition economies. Confidence in favourable social infrastructures attracts funds and companies to move their activities to Iceland. It is necessary that the business sector increases its investments in RTD. The public support for RTD consists of one hand direct institutional grants to public RTD institutes and universities, and on the other hand largely increasing contributions to competitive funding schemes which carefully select applications with reference to scientific criteria and relevance assessments. The ministry of Education, Science and Culture has drawn up contracts with the universities in order to boost academic research and teaching while increasing accountability and elaborating the acceptable quality standards. The STPC particularly encourages the financial sector to increase its investment in high-tech, research intensive SEM's. There is a great need to improve the terms for foreign investment in such companies. There is a high return on RTD and innovation investments and stronger companies provide more jobs.

The Government has decided to double its annual appropriations to the competitive funds for RTD by 2011. The program based share of this funding will be increased by a factor of four and will following a carefully and stringently designed selection procedure, particularly fund RTD and innovation plans, in the areas below:

#### *Research on education and school work*

The STPC gives priority to research into education and teaching. Modern education must transfer adequate knowledge to all citizens in order to meet increasing demands for reliable and complex know-how, creativity, flexibility, initiative and social inclusion.

New technology and knowledge, emerging new culture and a favourable attitude towards the dynamic interplay between the development of new branches of industry and culture demands continuous renewal in teachers education and life long learning. This needs to be accompanied by multifaceted research on how to configure education for all young and old within or without school in order to meet high expectations.

#### *High-tech SME's*

In many countries there is a long tradition among investors to specialise in taking risks with small, research intensive high-tech companies. This is however not the case among Icelandic investors. It is important to encourage such investments, particularly with a view to the fact that the number of economically strong companies capable of long time investments is increasing rapidly. We need to improve the terms with which foreign investors can put their money to work in this country and bring to their attention the feasibility of high-tech investment alternatives in Iceland. The public RTD funding schemes provide support for research and technological development but they do not participate in the marketing of research results or new products. That part of the whole process is intended for investors and the market. However, we are facing the fact that there is insufficient investment in innovation and investors are obviously lacking interest in high-tech, research intensive SME's until they have got sufficient wind in their sails. This is the worst market failure RTD is facing in Iceland.

There is need to introduce public mechanisms to support these SEM's and attract the interest of investors in opportunities enjoying the support available from the public side. Advice on operating a company and developing business concept need to be reinforced with particular focus on development, marketing and export.

#### *New approach in socio-cultural research*

The STPC is strongly in favour of strengthening research on our cultural heritage, the manuscripts and literary culture, the Icelandic language and contemporary culture along with the present emphasis put on outreach, informational engagement and the cultivation of a progressive image of the country.

Self-knowledge is essential for a small nation in the age of globalization: We need to understand the local and domestic characteristics and relate them to overarching global trends. We need to find more ways to strengthen our language develop language-based technologies and understand what it is to have Icelandic as a second language. The intertwining of cultural studies and the arts are growing in importance for the emerging creative knowledge-based society. Cultural information is an underutilised asset that has to be made accessible. In this field it is important to increase the cooperation between academic and technical sciences and in particular their cooperation with business and investors to make use of new opportunities, including international cooperation.

#### *Health and healthy lifestyles*

The STPC puts emphasis on more research on efficient disease prevention and improved health, progress in the provision of health service and rehabilitation for all citizens – of course based on progress within the life sciences.

We need a consistent set of legal, regulatory and financial provisions for keeping, securing, maintaining and accessing biomedical and other relevant databases. This

would imply easier registration and linking relevant information applicable for research and providing health services. Bio banks and epidemiological data, covering the nation as a whole, is obviously strength in international context. The general public interest in healthy nutrition, lifestyle and environment requires knowledge and are incitements for RTD and innovation. Creative solutions in preventive and health bringing alternatives in treatment, based on multidisciplinary RTD and incentives for new companies job creation and export. International engagement is simultaneously a prerequisite for development at the local level and the precondition for science and technology based trade and export. The co-location of academic research, technological development, high-tech and food producing companies and the University Hospital is in itself a great opportunity.

The development of new types of food is closely linked with healthy nutritional preference and environmental concern. We identify opportunities in a thorough knowledge about the chemical components and the nutritional value of our sustainable marine and agricultural products, in a good knowledge on the risk factors of life-style bases diseases, and how the interplay of genetics, environment and nutrition affects the health of people, in particular children and old people.

#### *Marine and land-based natural resources*

The STPC underlines the importance of paying due continuous attention to traditional marine and land based natural resources.

Agriculture is a rapidly emerging branch and RTD is a prerequisite for success. Research on the sea- and land based genetic resources, incl on species living under extreme conditions may find applications in biotechnology and similar fields. Further mapping of the ocean floor will provide information on natural assets, including the breeding fields of marine species, geological and geophysical properties of the ocean floor as well as areas worth protection. It is also important to do more research on existing information, fill in the gaps of knowledge and understand better the nature and processes of the ocean floor and marine life, including environmental impacts at work.

#### *Environmental change*

The STCP underlines the importance of strengthening research on probable and irreversible changes of the climate, land and oceans in an extensive cooperation of all relevant sciences with strong support from the business sector.

In the next decades it will be necessary to reduce the emission of greenhouse gases, increase carbon capture into soil and adapt to the climate changes that are envisaged. There is a need for greater efforts in energy savings, improved energy efficiency, renewable sources of energy and reduction of transport based emissions.

The climate changes might have great impact on marine based resources; fish stocks may move to different grounds, and the marine productivity in the ocean around the country may change radically. It will become more difficult to base future estimates of the sustainable size of fish stocks on past cohorts.

We also need to address in which way the present vegetation will react to climatic change, the migration of different species and plants has a lasting impact upon biodiversity.

#### *Society in rapid change*

The STPC strongly favours increased research on the infrastructures of Icelandic society – its characteristics and particular features.

The small size of our society simultaneously is a source of strength and weakness. In order to be able to react swiftly and rationally to changing conditions we need extensive knowledge of both strengths and weak spots. This knowledge will lead us by pitfalls others have run into; it will guide us towards the best solutions and goal attainment, and gives us possibility to share good practices with others. The rapid technology changes during the last few decades have greatly contributed to social change. These effects raise questions about the particular character and strength of our society that need an answer.

#### *Creative industries*

The STPC supports the development of creative industries, in which strong information technology, new approaches in presentation and production of cultural events, entertainment and investors join forces in a new type of economically important activity. This recent recognition of the economic value of art, cultural media production, design and related types of activities is often referred to as “creative industries”. The overall economic turnover is rapidly increasing and their impact on national economics becomes more evident.

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