

Policy and action plan 2017–2019

The Science and Technology Policy Council



Address by the Minister of Education, Science and Culture

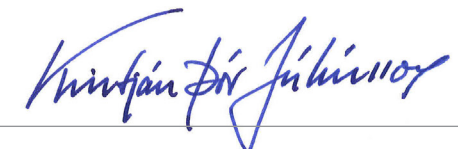
Research and innovation are an integral part of Icelandic society. Together with education, they propel economic growth, enhance quality of life and play a key role in creating a diverse employment sector. A coordinated approach towards scientific research and innovation developments supports a better cooperation between government, institutions and companies, and underpins Iceland's unique position and progress in all areas of life.

The overarching goals of the policy presented in this document are quality and impact. Iceland enjoys a robust research environment in various research fields, dynamic entrepreneurs and ingenuity. The government can contribute to establishing and maintaining conditions where knowledge activities can develop and prosper. The actions of this policy are designed to enhance the performance of the research and innovation system through effective decision-making and sound financial management.


Earlier this year, the Ministry of Education, Science and Culture took over the chairmanship of the Science and Technology Policy Council from the Office of the Prime Minister. This change provides opportunities for closer cooperation on policy matters between the relevant Ministries and Council's working committees. The policy of the Science and Technology Policy Council is in accordance with the Icelandic government's Fiscal Plan for 2018–2022. Cooperation between the Ministry of Education, Science and Culture and the Council's Working Committees has been substantial and effective where the institutional expertise within the committees has been imperative to success. Furthermore, the cooperation between the Ministry of Education, Science and Culture and the Ministry of Industries and Innovation on developing the policy has been outstanding as well as the cooperation with other relevant ministries.

It is essential that both women and men face a level playing field in research and innovation, specifically as they relate to access to research funding. Emphasis should be placed on encouraging women to study science, technology, engineering and mathematics and they should have equal opportunities to obtain senior positions in research institutions and knowledge enterprises.

The Science and Technology Council was established fourteen years ago. It is time to assess what impact and progress the Council has made since then and review the current legislation. I intend to launch such a revision where notice will be taken of best practices in our neighbouring countries. Our aim is that the legislative framework provides for conditions that support the work of Iceland's research and innovation community even further both in Iceland and in the international arena.



Kristján Þór Júlíusson, Minister of Education, Science and Culture



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Introduction

Research and innovation are an integral part of most aspects of modern society and they have a fundamental impact on our daily lives. In recent years, technological innovations have had an enormous impact on how people connect and communicate with each other. Yet there are signs that an upcoming wave of technological advancements will bring about greater impact on daily life than ever before in human history, specifically with the development of artificial intelligence and of genetic science. This wave of developments has come to be referred to as “the fourth industrial revolution.” Simultaneously we face new challenges: extensive environmental changes across the world, an ageing society, public health and global migration, to name a few. Research, innovation and civic participation in the knowledge society, will play key roles in meeting these challenges as well as promoting sustainable development and inclusive societies. New challenges also call for new solutions based on increased inter- disciplinary collaboration, encouraging greater participation by the humanities, social sciences and arts and on greater involvement of citizens in design, innovation and research.

Research and innovation are key factors in economic development. Knowledge creation and new technology has enabled us to significantly boost the worth and proceeds derived from the utilisation of our natural resources. This has resulted in widespread benefits in Icelandic society today and is the foundation for modern Icelandic prosperity. Although research and innovation has provided substantial benefits to Iceland’s three major economic sectors (fisheries, tourism and energy) further growth is subject to natural limitations. To ensure future economic growth we need find ways to diversify the economy through knowledge and innovation. Investment in the intellectual property and knowledge industry will spawn new opportunities with increased research and development activities.

This calls for a robust education system since it is a prerequisite for having a permanent pool of highly skilled people who can create, develop and apply research and technology for the benefit of society. A society supported by dynamic higher education institutions and knowledge-based enterprises will be better prepared to meet future challenges. Education increases productivity, which in our case is lower than in our neighbouring countries. Securing a higher standard of living in Iceland rests on a foundation of

increased productivity. To maintain our quality of life we must advance in research and innovation, cooperate across academic disciplines and industries and take note of best practice in other countries.

The importance of evidence-based policy-making

Statistical analyses, assessments and evaluations are imperative for measuring the impact of research and innovation and they serve as the basis for evidence-based policy-making. Policy and decision making should be founded on research, statistics and assessment studies and be supported by reasoned arguments grounded in factual evidence. State funding must be based on quality and impact assessments Progress has been made in recent years by extending data and information collection. For example, Statistics Iceland has expanded its analyses in the field of research and innovation and the Ministry of Education, Science and Culture is preparing an investment in an information system for all research conducted by Icelandic universities and research institutions (CRIS). Nevertheless, more work is needed to ensure improved collection of information and statistics to improve our understanding of the research and innovation system and strengthen the bases for decision making in the government, universities, research institutions, and companies.

It is important that a vigorous scientific system is a part of the Icelandic government's vision for the future and that research and innovation benefit society in diverse ways. can benefit the wider community. Dissemination of scientific knowledge and innovation must be reinforced e.g. through open access to publications and data, through websites and through press coverage. Outreach to both the public and to the policymakers about research and innovation should be supported, to enable public participation in general discussions and debates related to research and innovation as well as to ensure wide support for future development of the R&I system.

Public expenditure on research and development in Iceland

Many states have set themselves a target to increase the percentage of GDP for such R&D expenditures (commonly called R&D intensity), with the intention to strengthening economic growth and creating new jobs in the intellectual property and knowledge industry. In 2015, R&D intensity in Iceland was 2.19% which is a significant increase

from previous years (was 1.76% in 2013). Total expenditure on research and innovation in 2015 was approximately ISK 48.5 billion, of which 65% came from private companies and 36% from universities and government institutions.

In the Science and Technology Policy and Action Plan 2014–2016, the objective was set for an increase in corporate investment in research and development of ISK 5 billion from 2014 to 2016. In return, government investment in research- and innovation funds was increased by ISK 2.8 billion for the period. Although Statistics Iceland has not yet published figures for 2016, it is already clear that the policy objective was met as corporate expenditure on research and development increased from ISK 24.7 billion in 2014 to ISK 31.4 billion in 2015, just under ISK 6.7 billion. Furthermore, the Council's objective to increase corporate and foreign capital as a share of the total investment in research and development from 54% to 57% was not only met but exceeded to a total of 64% in 2015.¹

Despite these promising results, the objective in the last Council policy statement for investment in research and development to amount to 3% of GDP in 2016 was not met. This can be attributed to the reference figures employed being too high. When Statistics Iceland took over data collection and statistical analysis on research and development it adopted a new numbering order. This means that figures from before 2013 are not comparable with later figures.

In 2015, investment in research and development in Iceland as a proportion of GDP (R&D intensity) exceeded the 2.04% EU average. The increase in R&D intensity in Iceland between the years 2014 and 2015 was also significantly higher than in our neighbouring countries.² As in Iceland two thirds of the total expenditures in the Nordic countries came from enterprises. Among the Nordics Iceland ranks the second lowest with regards to R&D intensity. Only Norway spends less on research and development with an R&D intensity of 1.93% In 2015, Sweden spent 3.26% of GDP on research and development, while Denmark spent 3.03% and Finland 2.9%.³



The overarching aim of the Science and Technology Council Policy is that investment in research and development will reach 3% of GDP by the year 2024.



Research and development in an ever-changing world

- **Action 1:** Through regular and wide consultations Iceland's major societal challenges will be defined and dealt with in a consistent manner.

Active participation in the knowledge society

- **Action 2:** A three-year strategic programme will be promoted to enhance the status of the Icelandic language in computers and technology.
- **Action 3:** A strategy for dissemination of research and technology from universities and research institutions to the public, all school levels and government will be implemented.

Quality education and key skills

- **Action 4:** The quality and performance of universities will be strengthened, among other things through increased funding with the aim to achieve OECD's average in 2020 and the average of the Nordic countries in 2025.
- **Action 5:** The funding model for universities will be reviewed with the aim of providing better support for quality.
- **Action 6:** The Science and Technology Council will evaluate the conclusions of the expert group on human resources and skills projection for the Icelandic labour market.

Progressive companies and innovation

- **Action 7:** The tax environment for research and innovation in Iceland will be revised. An impact assessment on the recent legislative amendments will be made and proposals submitted on how the tax environment should be further developed towards the best examples in our neighbouring countries.
- **Action 8:** The innovation support system and its institutional structure will be reviewed in order to improve progress and competitiveness of economic activities equivalent to what is best in neighbouring countries.

Strategic development of research infrastructure

- **Action 9:** A roadmap for research infrastructures will be developed and international participation in research infrastructure will be strengthened.
- **Action 10:** A policy will be developed on open access to data.

Research and development in an ever-changing world

Today's communities face complex, global challenges in areas including the environment, climate, health, energy, food, migration and security. It is important that investment in the creation of knowledge will lead to a better understanding of societal challenges and effective solutions. Such solutions often demand wide-reaching cooperation across disciplines as well as cooperation between universities, institutions and companies. If new knowledge is to benefit the society it must generate change, e.g. in government policy, with legislation, with changed practices in companies and institutions or with changes in people's behaviour. Societal challenges entail a high level of uncertainty as it is difficult to foresee their impact and how best to respond to them. Clear objectives and targeted investment in knowledge increases the prospect of positive outcomes and successful adjustments to changed circumstances.

Research and technology is developing at such a pace that it is commonly referred to as the "fourth industrial revolution". This concept refers, among other things, to developments in genetics, artificial intelligence, robotics, nanotechnology and biotechnology. The changes are likely to impact people's lives, work, leisure in a fundamental way as well as their means of communications and interconnectivity. Societal challenges and technological changes in the coming years will require active involvement and participation of the whole society: of public bodies, the education system, the employment sector, scientists and the public. These challenges will require a change in education at all levels to enable young people to benefit from their education in a world of accelerated change and increased cross-discipline collaboration in research, including participation of the humanities and social science in research on technology and its applications.

At the international level, it is important that Iceland will be able to contribute to new solutions to societal challenges. In this context reference can be made to the United Nations Sustainable Development Goals which largely concern the amelioration of human rights, sustainable development, food security, the eradication of poverty, improved education and improved health across the world.

In 2007, before the priorities of the Strategic Programme for Science, Technology and Innovation were set for the years 2009–2015, the Science and Technology Council organised a consultation on the future bringing together people from various

backgrounds to discuss challenges facing the Icelandic society. The Science and Technology Council has ambitions to reiterate such a consultation focussing on 'societal challenges' which would serve as part of preparation for the Strategic Programme for the coming years.

The Science and Technology Council's aspiration is that research and innovation will help defining, understanding and tackling the societal challenges which Iceland faces.

Action 1: Through regular and wide consultations Iceland's major societal challenges will be defined and dealt with in a consistent manner.

It is recommended that Iceland's major societal challenges will be defined by applying methods that have proven to be effective in our neighbouring countries e.g. by initiating dialogue and consultation on priorities. Based on the outcome of this work, 3-5 priority areas will be defined where cross-disciplinary research and innovation collaboration will be initiated with participation of universities, research institutions and enterprises. Examples of defined priority fields in our neighbouring countries are the ocean, climate change, social participation and democracy, environmentally friendly cities and new technology. The aim is to reinforce prioritisation on investment in research and innovation, among other things through the Strategic Programme and Infrastructure Fund, and to coordinate more effectively international government cooperation on research and innovation at European and Nordic levels. In addition, emphasis will be given on strengthening the status of the Icelandic language in computers and technology (see Action 2).

An important part of the Action is to involve the public and other stakeholders in consultation on which challenges Iceland will be facing in the next decades, and how best to invest in research and innovation to enhance society's ability to meet them. The benefits of such a consultation are stronger links between research and development and society and better public awareness and understanding of science, technology and innovation and its role in society

However, the prioritised areas of science and innovation do not replace or set aside open competitive funding which is first and foremost based on peer review (i.e. without prioritisation) such as funding from the Icelandic Research Fund. On the contrary, it is important that these different types of funding cooperate to enhance the research and innovation community. It is the intention that societal challenges will be defined periodically every three to five years.

Responsibility: Science and Technology Council.

Time plan: Priorities for 2018-2021 will be defined in the autumn of 2017. Conclusions will be available by end of 2017.

Costs: ISK 2 million in 2017. The costs will be shared by the Ministry of Education, Science and Culture and the Ministry of Industries and Innovation.



Active participation in the knowledge society

In the knowledge society, scientific knowledge and technology are an integral part of most aspects of daily life. Research and technical development are a dominant factor in everything from communications to food production and transport. Understanding the greatest challenges, we face today such as global environmental change, energy and immigration is to a large extent based on research and scientific knowledge. At the same time, there is a growing public distrust towards science and technology, such as towards genetically modified food and vaccinations. Scientific outcomes are increasingly politicalised, the attribution of human activity towards climate change being a case in point.

There are various reasons for public distrust of science and technology, such as increased market participation in research, a greater level of uncertainty and changed expectations of science. There are indications that informing the public better is not sufficient to gain public trust as people's perception of research and technology outcomes are influenced by factor such as beliefs, interests and the social status of the individual. Modern society is far more diversified than ever before and, in many cases people's position on scientific matters is somewhat defined by their background. Improved understanding of different social groups and enhanced public involvement in knowledge building, decision-making and democracy can ease possible frictions in society. At the same time, there are increased demands for practical applications of research findings, quality statistics, and well-established knowledge in public policy-making and in the development of public services such as in the education system and the health service. There are no simple solutions to the challenges stemming from the increased integration of society, science and technology. However, it does call for an education system which strengthens and nurtures critical, analytical and creative thinking, thus constantly developing skills to tackle the complex and diverse challenges of the future.

It is the Science and Technology Council **vision** that all citizens will be able to apply the benefits of research in daily life, for decision-making and for innovation.



Action 2: A three-year strategic programme will be promoted to enhance the status of the Icelandic language in computers and technology.


It is important to foster the Icelandic cultural heritage, and opportunities for citizens to participate in a society where technology plays a major role. The Icelandic linguistic area is small, which makes it necessary to consider the position of the Icelandic language in a world where communications with and through devices and computers is becoming a significant part of daily life. During the last few years computers are increasingly voice controlled, using speech synthesis and voice recognition, and accelerated developments are anticipated in this technology in the coming years. It is important for the development of the language, for the language competence of new generations and for equal access for people to technology, to ensure that Icelandic will be a living language in communication through devices.

To assure the status of the Icelandic language in the digital era, an investment is needed in research on language acquisition and Icelandic, on the link between the technological advances and the language, on language technology and related issues. It is necessary to work consistently on developing measures that make communication in Icelandic possible and effortless with the new technology, which includes enabling future technology to "understand" and "communicate" in Icelandic. It is important to consider the impact of technology on children's language acquisition and language competence, the development of teaching material in Icelandic and impact of technology on the language. The Action requires that part of the Strategic Programme 2018–2021 prioritises language and technology.

Responsibility: Science and Technology Council in cooperation with the Ministry of Education, Science and Culture.

Time plan: Strategic Programme grants for language and technology launched by mid-2017.

Costs: The costs of the Action are within the funding to the Strategic Programme for science and technology.



Action 3: A strategy for dissemination of research and technology from universities and research institutions to the public, all school levels and government will be implemented.

It is important that findings and outcomes stemming from science and innovation benefit the Icelandic society and that a robust science community be part of the Icelandic government's vision for the future.

Promoting research, technology and innovation is therefore the main prerequisite for support for enhanced knowledge activities in universities and industries. Science and technology must be transmitted through diverse means (e.g. in publications, on websites, in social media and in the mass media) to increase understanding of research and innovation and their importance for society, both by the public and the policy-makers.

This action requires the Science and Technology Council, universities, research institutions, ministries and industry to work together on a plan on how to improve understanding of research and innovation activities and of technological development in society. The plan, which will include timeline and cost estimates, will be carried out during the years 2018–2020 with extensive involvement from government, universities, research institutions and companies.

- Responsibility:** The Science and Technology Council in cooperation with the universities and with the Ministry.
- Time plan:** Plan ready in June 2018 for implementation 2018–2020.
- Costs:** The main costs of this action consist of work efforts. Further implementations costs will be determined once the action plan has been submitted.

Quality education and key skills

Today, substantial part of young people complete university degree which by now has become a prerequisite for employment in more sectors than before. The Icelandic university system has in recent years advanced and grown and now has close similarities with the European higher education system. This is reflected among other things in increased selection of programmes at all education levels, enhanced research activities and active international collaboration. However, funding for implementation has not followed these changes. It is important for the employment sector, the education and health system and for society at large that a quality university education is guaranteed, both with respect to teaching and services to students. Therefore, if we want to ensure that our students receive education comparable to what is best in our neighbouring countries, strengthening the universities must be continued to support high quality activities and internal development.

Strong universities are essential for Iceland's competitiveness in the future, to foster inventive enterprises that compete on the international market and to ensure that young people are willing to live and work here. The opportunity to conduct independent research and establish start-up companies generates prosperity which benefits the whole society. It has been demonstrated that cooperation between universities, research institutions and the industry sector often create new employment opportunities and innovative companies which are thus more likely to invest in further innovation and development, to create new opportunities and an attractive environment for highly skilled individuals.

The innovation industry requires continuous update of knowledge and skills and it is important to meet these demands through dedicated, coordinated efforts and to increase the variety of available education and training. Young people must be encouraged to stay in education, supported to make good progress in their studies and drop-out rates must be lowered. Comparison made by the Organisation for Economic Co-operation and Development (OECD) shows that although the proportion of people in the age range 25–64 in Iceland have completed tertiary education is above OECD's average (39% in Iceland compared to 35% in OECD), we are still lagging when it comes to educating young people. In Iceland around 40% of people aged 25–34 years old have completed tertiary education while the average is 42% in the OECD states.⁴

The Science and Technology Council's **vision** for the future is that Iceland will enjoy strong universities participating in building a modern knowledge society.

Action 4: The quality and performance of universities will be strengthened, among other things through increased funding with the aim to achieve OECD's average in 2020 and the average of the Nordic countries in 2025.

Strong universities underpin knowledge activities across society, educate and train professionals, endorse culture and democratic deliberation and support innovation. Universities furthermore import new knowledge, technology and methods through international cooperation.

This Action is a continued effort to achieve funding equal to OECD's and subsequently the Nordic countries' average funding for each university student within a given period. At the same time, and as part of this effort, a working group representing the Ministry of Education, Science and Culture and Science Committee will review the university system with the aim of submitting proposals to the Minister on how the quality, competence and efficiency of universities can be furthered. Developments abroad and studies done in Iceland in recent years will be taken in consideration.

Responsibility: Ministry of Education, Science and Culture

Time plan: A working group will be established in the autumn of 2017 which will submit proposals in the spring of 2018. Funding will be increased in stages until the objectives are achieved in 2020 and 2025.

Costs: Costs entail provision of work and required funding increase for the system, as revised, to achieve OECD's average funding in 2020 and Nordic countries average funding 2025.

Action 5: The funding model for universities will be reviewed with the aim of providing better support for quality.

An important factor to improve quality of university activities is to review the universities' funding model to be able to provide better support to quality and excellence. It will be determined to what extent current prize categories reflect actual teaching costs given the quality requirements made in those countries we compare ourselves to. The current model has an incentive to increase the number of students rather than to

focus on quality. Teaching costs are not in linear proportion to the number of students but rather depend on the size of the study programmes, the facility and equipment required, the need for variety of courses, the need for teaching staff etc. The current funding model creates an incentive for universities to reduce the number and variety of courses, to simplify and enlarge them, rather than to increase the quality and variety of the education being offered to students.

The new funding model must assure more emphasis on the quality of studies rather than on maximising the number of students at minimum cost. The review needs to look at how vocational and on-site studies can be strengthened, including those at vocational universities. The Action requires that the working group will be formed in 2017. Due to the extended scope of the project the implementation will be executed in stages. It is expected that the changes will be fully implemented in the 2022 budget.

Responsibility: Ministry of Education, Science and Culture

Time plan: The working group will be formed in 2017. Changes to the cost model will be implemented in stages for the budget years 2019–2022.

Costs: Provision of work.

Action 6: The Science and Technology Council will evaluate the conclusions of the expert group on human resources and skills projection for the Icelandic labour market.

Most European states regularly analyse the needs for skills and human resources for the future labour market. Though it is impossible to predict the future with any certainty, evaluation of different scenarios enable society to prepare and take measures with a greater level of certainty. The acceleration of technological development and societal changes requires states to be better prepared and aware of possible different scenarios to enable improved standards of living, to increase competitiveness and to create opportunities for society. For this reason, it is important that students, institutions, companies and society have relevant information available for policy-making and decision-making, whether it is for a selection of a course of study, for development in the educational system or for the labour market. The expert group working on behalf of the Ministry of Welfare is currently conducting a study of the skills projections in our neighbouring countries and will submit conclusions by the end of 2017. The Science and Technology Council supports the work and will assess the group's conclusions.

Responsibility: Science and Technology Council
Time plan: The Science and Technology Council reacts to the conclusions of the expert group at the first Science and Technology Council meeting after receipt of the report.
Costs: No costs are foreseen for this Action.


Progressive companies and innovation

Entrepreneurship and innovation are prerequisites for economic welfare. In the government's agreement, emphasis is placed on innovation in all economic sectors and on increasing diversity in economic activity, through investment or some other form of incentives in creative industries, green industries such as environmentally friendly technical development and production, intellectual property and knowledge industries and in increased research and development activities. Furthermore, the government's agreement pledges to support means to improve access to venture capital for companies based on innovation and ingenuity, to foreign markets and to necessary foreign expert knowledge. This will underpin dynamic research and development and enhance Iceland's competitiveness.

The state creates a framework for economic activity and structures the determining circumstances, of which tax legislation is a clear example. In 2009 Iceland passed a legislation which authorises a deduction from income tax or a direct repayment of research and development costs to innovative companies. For the past few years industry's share of research and development has increased rapidly, and now innovative companies face new challenges which among other things, relate to extensive development in technology and knowledge. The provisions on repayment for research and development costs are temporary and, unless otherwise decided will be terminated by end of 2019.

To strengthen Iceland's international status, the state's support system must strengthen the competitiveness of its economic activity. The purpose of the support system is to provide assistance and guidance to entrepreneurs and start-up companies to enable them to establish themselves and develop. Increasing diversity of economic activities should be supported, the competence to take on societal challenges and to attract well-educated people.

The Science and Technology Council **vision** for the future is that Icelandic companies in the intellectual property and knowledge industry can be successful on the international competition market.




Action 7: The tax environment for research and innovation in Iceland will be revised. An impact assessment on the recent legislative amendments will be made and proposals submitted on how the tax environment should be further developed towards the best examples in our neighbouring countries.

Significant amendments were made to several laws in June 2016 to support funding and operation of innovation companies and SMEs, most of which came into force on 1 January 2017. The results of these changes remain to be seen. They are; a) a special tax discount for foreign experts; b) a tax discount for investments in shares in SMEs; and c) the upper limit for support to innovation companies for research and development costs was significantly heightened. It is constructive to evaluate the consequences of these changes once some experience has been gained of their implementation and then to submit proposals for improvements if needed.

A working group on behalf of the Ministry of Finance and Economy will be appointed with the participation of representatives from the Ministry of Industries and Innovation, the Ministry of Education, Science and Culture and of representatives from Science and Technology Council committees. The objective of the group is to examine the tax environment of research and innovation in Iceland and to evaluate the impact of the law's provisions on special support for innovation companies. The group shall furthermore apprise itself with the state of play in Iceland's neighbouring countries and, if necessary, submit proposals on how the conditions in Iceland can be strengthened. The work will commence in the autumn of 2018 and results will be published when taxation of legal entities for the operational year 2017 are available.

Responsibility: Ministry of Finance and the Economy
Time plan: Work commences autumn 2018. The working group submits proposals to the Minister of Finance and the Economy by 1 June 2019.
Costs: Provision of work.



Action 8: The innovation support system and its institutional structure will be reviewed in order to improve progress and competitiveness of economic activities equivalent to what is best in neighbouring countries.

Conditions for entrepreneurs, start-up companies and innovation in Iceland must be secured and its competitiveness enhanced. It is important that support for entrepreneurs and start-up companies is strategic and productive. Such services are provided by Innovation Centre Iceland, Rannís, business development agencies and by Promote Iceland. A close and comprehensive cooperation between the institutions and funds that provide support for entrepreneurs and innovation should be emphasised. These support activities need to be better coordinated and constructive.

The environment and conditions for entrepreneurs and innovative companies needs to be simplified; outstanding innovation companies need a better access to foreign markets and support to expand internationally. The Icelandic support system for entrepreneurs and innovation needs to be improved to be comparable with the conditions in the Nordic countries.

The Action entails the establishment of a working group, under the auspices of the Ministry of Industries and Innovation, with the participation of the Ministry of Education, Science and Culture, Ministry of the Interior and the Science and Technology Council, which will lead the review of the support system for entrepreneurs and start-up companies and will submit proposals for improvements.

Responsibility: Ministry of Industries and Innovation
Time plan: The work is to be completed by 1 March 2018 and conclusions to be presented to the Council at its spring meeting in 2018.
Costs: Provision of work.



Strategic development of research infrastructure

One of the key pillars of outstanding success in science, innovation and technology is access to quality research infrastructure. Research infrastructures are facilities, resources and services used by science community to conduct research and foster innovation in their scientific fields. Research infrastructure includes: specialised and expensive technical equipment (or sets of equipment), document and data libraries, electronic infrastructure such as data and computing systems, and communications networks and other items considered to be indispensable and necessary to achieve results in research and innovation. High-quality research infrastructure supports quality in research activities, research cooperation and utilization of knowledge for the benefits of society and the employment sector. Quality infrastructure attracts competent and well-educated staff and connects research institutions and scientists, often across academic disciplines. International cooperation on developing research of infrastructure can furthermore facilitate international cooperation in science and innovation.

In recent years strong emphasis has been put on the development of research infrastructure in Iceland's neighbouring countries. Most states in Europe have defined a policy on development and increased investment in research infrastructure. Such policies are perceived a significant measure to strengthen knowledge activities both in public institutions, universities and in innovation companies. The development of research infrastructure can contribute to strengthening services for institutions and companies, create jobs in the knowledge industry and attract highly educated and competent staff. Furthermore, these developments can improve skills to meet societal challenges such as in the fields of environment and public health. Part of the research infrastructure strategy is to increase international participation in such infrastructures. A small country like Iceland can only ensure access of its scientist to first class infrastructure in all fields through collaboration with other countries.

It is the Science and Technology Council's **vision** for the future that Icelandic scientists and academics should have unhindered access to modern and high-quality research infrastructure, both at home and abroad.



Action 9: A roadmap for research infrastructures will be developed and international participation in research infrastructure will be strengthened.

In April 2017 the Ministry of Education, Science and Culture published the report *Development of infrastructure in Iceland for the future*⁵, based on the outcomes of a working group on research infrastructure and monitoring appointed by the Science and Technology Council working group. The report contains a proposal to form a research infrastructure strategy and consequently to develop a roadmap based on it. Iceland is one of the few countries in Europe, which are yet to develop a roadmap. A roadmap may be described as a strategic plan for establishing research infrastructure which has been prepared in close collaboration between the authorities and the scientific community to strengthen policy-making and improve decision-making on infrastructures. The roadmap would serve to further support decision-making based on quality information to strengthen cooperation on infrastructure and to utilize funds in an efficient manner.

The Action requires the Ministry of Education, Science and Culture to form a working committee for the preparation of a national roadmap on research infrastructure in Iceland. The above-mentioned report includes proposals for the process of making the roadmap. According to the proposal research infrastructure in Iceland will be mapped and the science community will be encouraged to provide input. Subsequently, the board of the Infrastructure Fund will submit a proposal for prioritisation based on general predefined criteria and on government policy. Furthermore, the report recalls the importance of increasing Iceland's participation in international research infrastructures.

Responsibility: Ministry of Industries and Innovation
Time plan: The work is to be completed by 1 March 2018 and conclusions to be presented to the Council at its spring meeting in 2018.
Costs: Provision of work.



Action 10: A policy will be developed on open access to data.

In recent years, the amount of data generated by research has increased significantly. In number of research fields, strategic utilisation of data and interconnections between databases have become an important source of new knowledge and innovation. An example of this is climatology where knowledge of changes in nature are first and foremost based on data generated by regular measurements over a long period. There is an increased understanding of the value of databases and chronological data, not only to increase knowledge per se but also the quality of knowledge on nature, health and society and to design new products and services.

To respond to this development, authorities in our neighbouring countries have increasingly focused on ways to ensure that data generated with public funding contributes to the betterment whole of society. The assumption that databases should be in the public domain has gained momentum and subsequently calls for governments to secure open access to the extent possible. NordForsk recently published a report on open access to data in the Nordic countries⁶. The report finds the discussion on open access and policy developments in the Nordic countries at very different levels. Finland is good example of how significant progress has been made in a short time. The Action requires that the Ministry of Education, Science and Culture to form a working committee which will submit a proposal on policy for open access to research data in Iceland.

Responsibility: Ministry of Education, Science and Culture.
Time plan: The working group will start work in January 2018. Proposals are to be submitted to the Minister by the autumn of 2018.
Costs: Provision of work.

¹ Statistics Iceland: Research and development data: <https://www.statice.is/statistics/business-sectors/science-and-technology/rd/>

² Statistics Iceland. 2016. Iceland's R&D expenditure is higher than the neighbour countries: <https://www.hagstofa.is/utgafur/frettasafn/visindi-og-taekni/utgjold-til-rannsokna-og-throunar-i-evropu-20132015/>

³ Eurostat. 2016, 30. nóvember. R&D expenditure in the EU remained nearly stable in 2015 at just over 2% of GDP. See: <http://ec.europa.eu/eurostat/documents/2995521/7752010/9-30112016-BP-EN.pdf/62892517-8c7a-4f23-8380-ce33df016818>

⁴ See table A1.3 page 43 in OECD. 2016. Education at a Glance: OECD indicators. Paris: OECD Publishing.

⁵ Ministry of Education, Science and Culture: 2017. Report on the Future of Research Infrastructure in Iceland (report in Icelandic).

⁶ NordForsk. 2016. Open Access to Research Data: Status, Issues and Outlook. Oslo: NordForsk.

