

Solutions for a sustainable and developing society

Objectives and targets of the National Roadmap for Research, Development and Innovation: A new beginning for RDI cooperation between companies and research organisations

Finland's competitiveness and wellbeing are built on competence, research and innovations. Finland's rise from the emergency caused by the pandemic and success in global competition require the production of new knowledge, innovations that bring social benefits and added value, and a high level of competence.

Research and innovation activities are undergoing change. Alongside universities and research institutions, there is a narrow group of spearheading companies that invest heavily in research, development and innovation (RDI) activities. Finland needs more companies engaged in RDI activities. The research, development and innovation of companies in the SME sector must also be activated. A share of turnover larger than at present must be invested in RDI activities. It must be possible to step up and intensify public-private partnerships with new incentives for cooperation, such as a new partnership model. Risk-sharing between companies and the public sector must be predictable, simple and encouraging. Diversification of the economic structure and improvement of the productivity trend must be one of the most important long-term goals of innovation policy. Achievement of this goal requires that those doing RDI work are supported by new policy measures. Incentives for research and innovation must diversify the utilisation of research-based knowledge in society and must encompass all aspects of society's activities. Research and innovation activities can improve the

resilience of society and its operational capacity in unforeseen crises, such as the exceptional situation posed to society and the economy by the coronavirus. The starting point is to support — in addition to the business community — various societal actors in various ways and to strengthen communities, trust in Finnish society and social equity undermined by the coronavirus. At the same time, the foundation is laid for sustainable economic growth.

Competence must be taken care of and constantly renewed. High-level competence is the base on which innovation activities can be built. These activities are ambitious as to their goals, utilise the strengths of regions, sectors and organisations, are internationally competitive and support the renewal of society. RDI funding must be predictable and must develop the RDI system in a balanced way. Higher education institutions and research institutions should be widely encouraged to engage in mutual interaction and ambitious joint activities with research users. The target level must be raised clearly. The incentives for this should be effective.

The importance of research and innovation is emphasised in many of the European Union's policy priorities and programmes, in particular in support of jobs and growth, the digital single market, and energy, environment and climate measures. The intention is to exploit the outputs of research and innovation at Union, national and regional level, with a view to maximising European and national innovation potential. An increasingly greater share of international funding for research and innovation focuses on resolving broad societal challenges. Climate change is the most essential of these. Finnish actors must be well prepared to utilise European and other international RDI funding, both in Europe and more widely. Finland must gain access to effective RDI networks and support the activities that take place in them. This requires support for building networks, competence and advice on applying for funds, as well as sufficient domestic matching funds. RDI policy must be coordinated more strongly than before, both in Finland and internationally.

Increasing the intensity of RDI activities – roadmap

Finland must seize the opportunities brought by global challenges such as climate change and sustainable development and offer solutions to them. New ideas, knowledge and technologies are the most important sources of growth and productivity. The Government has set the goal of increasing Finland's expenditure-to-GDP ratio for research and development from the current 2.7 per cent to 4 per cent by 2030. To achieve this, we need a common vision and missions, more ambitious RDI activities and investments from both the public and private sectors. Without a significant increase in private sector investment, the goal will not be achieved.

The RDI roadmap has been prepared to promote the achievement of this goal and the resulting sustainable growth, as well as to create an operating environment that encourages both Finnish and foreign companies to invest in RDI activities in Finland. The aim is for Finland to remain at the forefront of both the production of new

knowledge and the development and application of technology. It is important that Finland also quickly adopts knowledge and competence produced elsewhere. Securing the availability of the required human resources is central to the roadmap. The social and economic challenges posed by the coronavirus must also be met through research and innovation activities and the introduction of new solutions and practices. The pandemic has shown that social sciences and the humanities play an important role in foreseeing future developments and in understanding the actions of individuals and population groups so that we can better understand and foresee the actions of individuals and populations.

In accordance with the Programme of Prime Minister Sanna Marin's Government, several policy preparations related to and affecting research, development and innovation are being prepared. Unnecessary duplication between the RDI roadmap and the development activities identified and agreed in other processes must be avoided (Figure 1). The vision and roadmap 2030 of the Research and Innovation Council, the vision and roadmap for higher education and research in 2030, and the speech on innovation policy by a public servant of the Ministry of Economic Affairs and Employment have served as the starting points for the preparation of the roadmap.

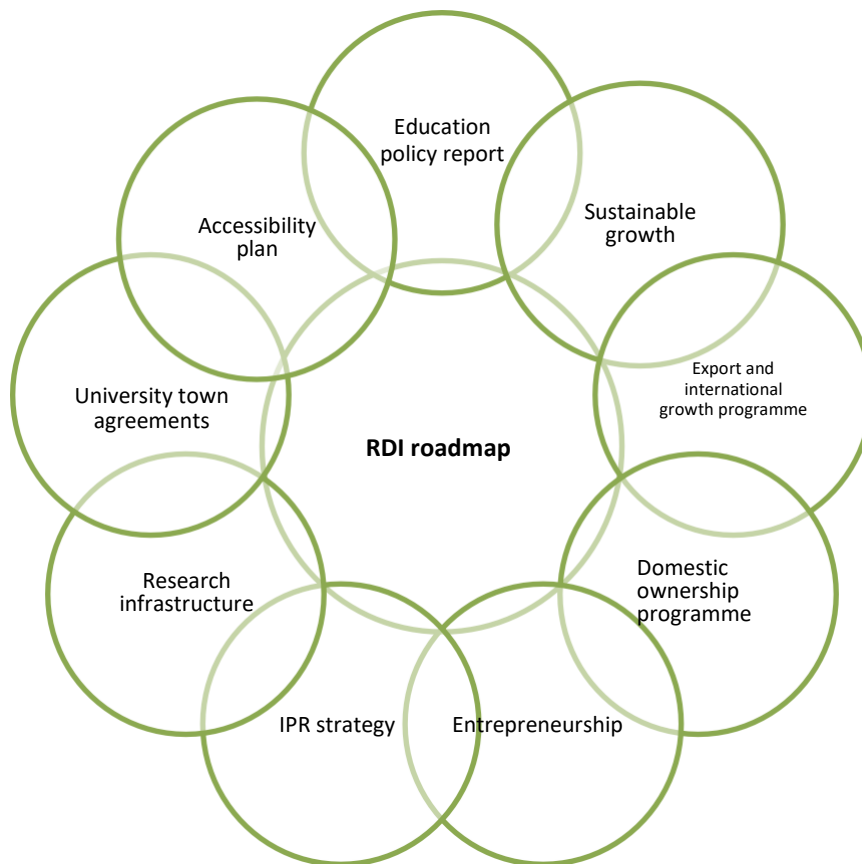


Figure 1. RDI roadmap and other current policies and processes related to research and innovation policy.

The roadmap identifies three interlinked strategic development areas: competence; a new partnership model; and an innovative public sector. They implement the goals of the Programme of Prime Minister Sanna Marin's Government to make Finland the most attractive and competent environment for experimentation and innovation in the world, producing sustainable solutions to societal challenges.

The roadmap has been prepared in cooperation by the Ministry of Education and Culture and the Ministry of Economic Affairs and Employment, in extensive consultation with the other ministries and RDI stakeholders. Measures requiring government funding for the roadmap are examined within the framework of the government's overall spending limits and are decided in the government financial planning and budget processes. The Ministerial Working Group on Competence, Education, Culture and Innovation will guide the implementation of the roadmap and decide on its updates during the term of Prime Minister Marin's Government.

The preparation and implementation of the measures identified in the roadmap require close dialogue and cooperation with the ministries, research organisations, the business community, financiers and other stakeholders in research and innovation.

Strategic development targets: Competence – a new partnership model – an innovative public sector

I Competence

The targeted growth of RDI activities also requires a significant increase in the national level of competence and education. As R&D funding doubles, there will also be a need for many more highly educated experts and other RDI professionals. This challenges the education system from early childhood education to higher education institutions. The transformation of work and the changing needs for competence in the business community require an increase in the workforce and a more competent workforce. In addition to education leading to a degree, there is a need for diverse opportunities for continuous learning for the entire population. Civics and science education deepen and increase the human resources available in the RDI environment.

Besides raising the level of competence and education domestically, Finland must be more attractive to international researchers, experts and RDI professionals. Work-based and education-based immigration and intersectoral mobility must be facilitated. Our competence and research and innovation environment must also attract international research funding and investments from outside Finland. Finland's attractiveness is also affected by services that increase the smoothness of everyday life, such as healthcare, daycare services and ease of mobility. Basic English-language services are also needed to support work-based and education-based immigration.

Wide-ranging raising of competence levels and continuous learning

1. The Ministry of Education and Culture and higher education institutions are responding to erosion of the level of competence by raising the share of young adults (25–34 years) with a degree from a higher education institution to 50 per cent by the year 2030. The intention is to achieve this by expanding admission to higher education institutions, bringing forward the start of studies and improving the completion of higher education.
2. The Ministry of Education and the Ministry of Economic Affairs and Employment will ensure that the parliamentary reform of continuous learning takes into account the competence needs of high productivity and RDI skills in working life. Education is focused, in a multidisciplinary way, on the needs of the business community and society, the development and application of new technology, and on the development of various areas of competence such as management and customer understanding. The Ministry of Education and Culture and the Academy of Finland support the profiling of higher education institutions in their strong areas of competence.
3. The mobility of people between research and the business community will be increased. The fixed-term working of researchers and experts in companies will be increased, and people with business competence will be encouraged to work in research organisations.
4. Universities are developing researcher education in cooperation with key stakeholders so that graduates' competence can be utilised more widely in the business community and elsewhere in society. The Ministry of Education and Culture is preparing a broad-based working group to be appointed in the spring of 2020, which will examine doctoral education and researchers' career opportunities for employment outside higher education institutions. The working group will also work on ways to increase mobility across different borders and on cooperation in working life during education.
5. Together with its own actors and actors from other administrative branches as well as companies, the Ministry of Education and Culture will develop practices for the joint provision of RDI services to companies and public sector organizations by vocational education, higher education institutions and research institutions. Methods will be built on existing cooperation and vocational education competence, especially in practice-based innovations.

Broad-based utilisation of society's resources and competence in RDI activities

6. The Ministry of Education and Culture, the Academy of Finland and the Federation of Finnish Learned Societies will coordinate the implementation of the Year of Research-Based Knowledge 2021. One of its priorities is the availability and comprehensibility of the research-based knowledge to all citizens. Citizens, regardless of location or level of education, must have the opportunity to be involved in understanding of the changes in society, and the knowledge base needed in resolving them and the possibility to influence it. Infrastructures for culture and cultural heritage will be utilised in this. Libraries, archives, museums and other actors in the field will organise community-based activities and activities targeted at individuals in order to make research-based knowledge available.
7. The Ministry of Education and Culture supports actors in science education and promoters of scientific competence, among others, in science centres and teacher education. The objective is to deepen and expand citizens' problem-solving abilities and understanding of the development of science, the aim being to promote learning and Finland's competence-based growth.
8. The Ministry of Education and Culture will carry out a two-stage study on the realisation of parity and equality in higher education institutions and RDI activities in 2020–2021. Further actions will be decided together with the higher education institutions on the basis of the study.

II New partnership model

Finland has good starting points to succeed as a leading country in competence and innovations. Companies are key research partners and engines of making choices for higher education institutions and research institutions. In order to strengthen, broaden and increase the effectiveness of the competence spearhead, research and the networks that utilise it must be grouped into larger competence centres and ecosystems. Cooperation between higher education institutions, research institutions, companies and other RDI actors needs to be strengthened. To support this, a new partnership model will be developed, grouping national programme funding into larger packages and linking sources of EU and other international funding more strongly to support activities.

Practices will be added to public funding instruments that will enable long-term, simultaneous development and renewal of the entire ecosystem. The new partnership model will combine the wish of companies for radical renewal, the simultaneous use of public funding instruments for the development of ecosystems (research, development and growth) and new operating models for testing, piloting and scaling innovations. Partnerships will be targeted at focused growth areas and identified ecosystems and will be selected on a competitive basis. The Research and Innovation Council plays a

key role in the strategic policies and steering of the partnership model.

Climate change is one of the most significant drivers steering global growth in the 2020s, alongside other sustainable development goals. The goal of carbon neutrality set by the Government will not be achieved without new technologies and innovative solutions based on research. Digitalisation and the data economy will be the most significant drivers of change in the coming decade. Digitalisation will enable even shorter innovation cycles and rapid product testing on the market. Owing to the impact of digitalisation and the data economy, business logics are changing and new growth opportunities will open up for companies on the global market. The transition to a data economy will require significantly more data experts as well as meeting the needs of research and business. The availability, utilisation and interoperability of data must be increased across sectoral boundaries.

High-quality research infrastructures and development environments, as well as the innovation ecosystems built on them, will attract experts to Finland, create networks and profile activities.

A new partnership model, ecosystems and infrastructures

9. The new sustainable growth will be built on competence, the balanced development of research and innovation activities, and partnerships with the support of the innovative public sector. Together with research organisations, financiers and the business community, the ministries are preparing a new, flexible public–private partnership (PPP) model to support the building of internationally competitive competence centres and billion-euro business ecosystems in Finland. The building of company-driven business ecosystems is supported by growth engine funding and the strengthening of high-level competence centres with flagship funding. Other regional, national and international financial instruments and networks are also utilised in implementing the partnership model.
10. Business Finland is piloting a contractual and challenge-based funding model with companies in order to strengthen long-term RDI activities and to leverage substantial private RDI funding in Finland. The model will be developed in 2021 on the basis of an evaluation.
11. It will be ensured that increasingly more microenterprises and SMEs have access to the RDI system by developing low-threshold RDI services and financial instruments (e.g. innovation voucher, development grant). The allocation of public R&D funding must take account of companies' possibilities to utilise R&D investments and increase business.
12. Through ecosystem agreements with university towns, the Ministry of Economic Affairs and Employment, the Ministry of Education and Culture and cities support the building of internationally attractive innovation clusters and the linking of thematic innovation networks to global value chains. Measures to promote work-based immigration and education-

based immigration will be included in ecosystem agreements.

13. Development package of research infrastructures and experimental environments.
 - 13.1. The research infrastructure funding of the Academy of Finland will be increased. The aim is to bring a larger share of national research infrastructures than at present within the scope of centralised funding in order to strengthen the openness, quality and effectiveness of research.
 - 13.2. Ministries, financiers and research organisations will develop the research and innovation environment for data management and computing (including high-performance computing) and its services to meet the RDI needs of higher education institutions, research institutions and companies. The needs of quantum computing will also be taken into account in updating the research environment.
 - 13.3. Together with RDI financiers, research organisations will develop shared and open experimental and test environments that can be utilised by domestic and foreign companies. Companies will be encouraged to open up their research infrastructures to wider use.
 - 13.4. Research organisations, in cooperation with Tulanet, Unifi and Arene, will develop joint operating models and services in order to increase the sharing and utilisation of research infrastructures and testing environments.
14. The Government is investigating the introduction of a tax incentive for R&D activities. More detailed policies will be worked out no later than in the autumn 2020 government budget session.
15. Action plans supporting the utilisation of data for selected growth sectors will be drawn up in cooperation between the business community, administration, research organisations and other stakeholders. The availability of data will be improved and the rules for the use of data will be clarified from the perspective of companies, society and users. The utilisation of data will be supported by means of legislation, agreements and self-regulation by sector.

Climate change and other societal challenges in RDI activities

16. The Academy of Finland and Business Finland are mapping research and product development related to climate change, carbon neutrality and biodiversity. On this basis, strong competence centres and blind spots important to carbon neutrality will be identified and further measures will be taken.

17. The Finnish Research Infrastructure Committee will examine the carbon footprint assessment practices of national research infrastructures and, on the basis of the information received, will decide on the harmonisation of carbon footprint assessment.
18. The ministries will ensure that Finland communicates consistently about the European Green Deal, emphasising the importance of competence and RDI activities, and about the Nordic Council of Ministers 2030 vision, and will utilise their RDI possibilities in implementation.

Effectiveness of research

19. Research organisations and financiers will strengthen competence associated with the further refinement and utilisation of research results and will develop service models and financial instruments supporting this.
 - 19.1. Through targeted and phased funding, Business Finland and the Academy of Finland will support projects that have evidence and the best possibilities for utilisation in society and/ or commercial success.
 - 19.2. The Ministry of Economic Affairs and Employment together with the Ministry of Education and Culture, in cooperation with the ministries, research organisations, financiers and the business community, will investigate the need for a national network-like operating model for the further refinement and utilisation of research results. The operating model would strengthen innovation, commercialisation and IPR competence and accelerate the transfer of research results for the benefit of society.
20. Promote open practices and the availability and utilisation of data in RDI activities in order to increase its social impact. Openness practices and access to data take into account the needs of both transparency and commercial exploitation, protection of privacy and security. Openness practices support the quality and effectiveness of research and enable the wide-ranging utilisation of research results.

International RDI cooperation

21. Taking into account the choices already made, the Ministry of Economic Affairs and Employment and the Ministry of Education and Culture, together with higher education institutions, research institutions and the business community, will identify the most important international competitive and growing competence centres relative to Finnish RDI, with which long-term cooperation will be built and the mobility of researchers and experts will be increased. Activities of the Team Finland network will be developed in order to deepen research and innovation cooperation, strengthening market knowledge and networks, as well as coordinating

local demand and Finnish supply. RDI actors will strengthen consistent country brand communications in international activities.

22. A centralised advisory service will be developed, which will bring together the services needed by all actors to support domestic and international RDI grants and financial instruments for compensation, and also to participate in international procurement. The main emphasis is especially on companies.
23. The share of EU and international funding in total R&D funding will be increased. In support of this, led by the Ministry of Economic Affairs and the Economy, a concrete action plan will be drawn up for the period 2021–2027 in order to utilise the RDI funding sources of the EU (Horizon Europe, Digital Europe, the European Defence Fund and InvestEU). The ministries encourage RDI organisations applying for funding to strengthen their capacity to apply for and utilise international RDI funding.

III Innovative public sector

Promoting RDI is a common task for all branches and levels of government. Strengthening Finland's competitiveness requires that measures promoting RDI activities in different sectors or levels of government are mutually supportive and parallel. Linking RDI activities to the development challenges of the public sector and different policy sectors, their methods and resources must be strengthened. Similarly, by using steering instruments of the public sector, such as regulation, innovative public procurement and effectiveness investments, we can develop an operating environment that encourages RDI activities and can support the renewal of public sector services. Research-based knowledge is utilised in decision-making concerning RDI activities.

Management and coordination of RDI policy

24. Cooperation in the preparation and implementation of RDI policy is strengthened by inviting Finland's most important RDI investors and RDI actors, i.e. companies, the ministries, financiers and other key RDI actors, to joint dialogue. The dialogue between private and public RDI investors will be intensified and made regular. National and international foresight information will be utilised more systematically in the preparation of RDI policy. Sustainability challenges of the public sector will be examined as part of the implementation of RDI policy.
25. In cooperation by the ministries, a review of the main title of expenditure of the budget will be carried out, the aim of which is to utilise the existing budget resources for RDI activities supporting renewal of the public sector and the business community.

26. Regular dialogue between the ministries and regional actors will ensure that regional and national RDI activities are complementary and supportive. EU cohesion policy and its financial instruments support the implementation of smart specialisation strategies and strengthen the possibilities of regions and cities to act as development platforms for RDI activities. The Ministry of Economic Affairs and Employment, the Ministry of Education and Culture, the regional councils and the Centres for Economic Development, Transport and the Environment promote linking of the regions to the best national and international clusters and networks and, through their funding, also support cross-regional RDI cooperation.
27. The State's ownership policy will give more emphasis than previously to the amount and quality of RDI activities. State-owned companies will participate in partnership models and other innovation activities from their own starting points.

Renewal of the public sector

28. In cooperation between the ministries and municipalities, a public sector innovation programme is being prepared to support the renewal of the public sector and the strengthening of innovation capacity. This link to the public administration strategy will be ensured. The aim is to solve public sector development challenges (including health and social services, transport, education) by utilising RDI activities. The programme will also support correction of the long-term effects brought on by the pandemic. At the same time, this will open up new business opportunities for companies. Cooperation between the public, private and third sectors is central in implementing the programme. (Business Finland, the Association of Finnish Local and Regional Authorities, the Ministry of Finance, the other ministries). In addition to the measures below, other measures will be defined during the preparation of the programme:
 - 28.1. The central government and municipalities will target innovative and impact-based public procurement on tackling societal challenges such as climate change and the sustainability challenges caused by demographic change. Development will be coordinated by the Competence Centre for Sustainable and Innovative Procurement KEINO.
 - 28.2. Regulation favourable to research and innovation will be utilised to promote the market access of innovations and new business models. The effects of regulation on research and innovation will be evaluated more systematically and the competence of legislation drafters in foresight, innovations and markets will be increased. In promising growth sectors (the growth portfolio project to be completed in the Ministry of Economic Affairs and Employment in the spring), experimentation concerning regulation favourable to research and innovation (so-called sandboxes, business interface

services) will be launched to support market access for new business models.

29. The Ministry of Education and Culture will conduct a study on the combined effect of regulations on research with regard to the freedom of research and RDI activities.

Assessment of and research on RDI activities

30. The Ministry of Education and Culture is launching an international assessment of the Academy of Finland. The evaluation will be carried out in 2020–2021.

IV Roadmap follow-up indicators

- R&D expenditure/GDP, % (broken down by companies and public sector expenditure), (Statistics Finland)
- Enterprise R&D expenditure by size class (Statistics Finland)
- Government funding for R&D/GDP, % (Statistics Finland)
- Foreign direct investment/GDP (Statistics Finland)
- EU Business Finance (EUTI) funding to be repatriated through Horizon Europe
- Business funding for research organisations (cooperation between companies and research organisations), (Statistics Finland)
- Internationalisation of RDI activities (residence permits issued by the Finnish Immigration Service Migri for experts and researchers) (Migri)
- Number of foreign students and researchers (Statistics Finland)
- Share of doctoral degree holders of all R&D employees, change (Statistics Finland, Vipunen)

Appendix: Other measures agreed in the Government Programme and other processes supporting the objectives of the RDI Roadmap

Strategic development targets

I Competence

Wide-ranging increase in the level of competence and continuous learning

1. In the education policy report to be submitted to Parliament in autumn 2020, the Ministry of Education and Culture will examine the functioning of the education system in order to raise the level of competence and education and the utilisation of existing talent potential in the RDI system, including the measures of the RDI roadmap. (Government Programme Action Plan Chapter 9)
2. The minimum school leaving age will be raised to 18 years. With this reform, the level of Finnish education and competence will be raised and it will be ensured that every comprehensive school leaver completes at least a secondary education. (Government Programme Action Plan Chapter 9)
3. The Ministry of Economic Affairs and Employment, the Ministry of Education and Culture, the Academy of Finland and the Finnish National Agency for Education will support the employment of international talent in Finland through Talent Boost measures. Research institutions and higher education institutions will develop an atmosphere and mechanisms that encourage international recruitment and will utilise the possibilities of key personnel taxation. As cooperation between the ministries, the entry, employment and study permit processes for foreign students and researchers will be streamlined and the integration into Finnish society of people arrive in Finland will be facilitated. (Government Programme Action Plan Chapter 2)

Broad-based utilisation of society's resources and competence in RDI activities

4. More efficient use will be made of creative competence and creative industries in innovation activities in accordance with the Creative Economy Roadmap and related measures (Creative Business Finland). The importance of creative competence lies in its influence promoting the renewal of companies and in how companies produce solutions that create better added value for the customer. (Government Programme Action Plan Chapter 9)
5. The Ministry of Education and Culture and the higher education institutions will take account of the development and innovation needs of RDI activities in the accessibility plan for higher education institutions to be compiled. The aim of the plan is to increase the share of people with a higher education degree and it examines the realisation of equality and parity in applying for higher education. (Government Programme Action Plan Chapter 9)

II New partnership model

Climate change and other societal challenges in RDI activities

6. Work in the low carbon roadmap of industry will identify the possibilities of RDI activities. (Government Programme Action Plan Chapter 3)
7. The Government will establish a climate fund that has the Finnish State Development Company Vake as its base. The fund will focus on combating climate change, promoting digitalisation and accelerating low carbon in industry. Activities of the climate fund will be specified by the government spending limits discussion of April 2020.
8. The Finnish Research Infrastructure Committee of the Academy of Finland will update the national research infrastructure roadmap in 2020. (Government Programme Action Plan Chapter 9)

Effectiveness of research

9. In the entrepreneurship strategy under preparation, the Ministry of Economic Affairs and Employment and the Ministry of Education and Culture will take account of measures that can increase the RDI intensity of startups and SMEs and bring them into closer cooperation with the higher education institute sector and vocational education actors. (Government Programme Action Plan Chapter 6)
10. The Ministry of Education and Culture will add regulations ensuring the researcher's possibility of parallel publishing to copyright law. (Vision for the Finnish higher education and research in 2030)

11. It will be ensured that the development work on open science and research coordinated by the scientific community's Federation of Finnish Learned Societies and the data infrastructure development of Ministry of Education and Culture and public research organisations are mutually supportive.
12. Competencies in the management and use of intellectual property rights, including contract and licensing competence, will be strengthened, especially in SMEs. (Government Programme objective: intellectual property strategy)

III Innovative public sector

Management and coordination of RDI policy

13. A joint project of the scientific academies coordinated by the Finnish Academy of Science and Letters and funded by the Ministry of Education and Culture will complement the scientific community's mechanisms of scientific advice. (Vision for the Finnish higher education and research in 2030)
14. In preparation of the Research and Innovation Council's affairs, wide use will be made of the various ministries' expertise.
15. In cooperation with the other ministries, Prime Minister's Office will launch an assessment of the activities and effects of the Strategic Research Council that was active in 2014–2019.