

**TOWARDS A NEW STAGE
IN NORWAY'S SCIENCE,
TECHNOLOGY AND
INNOVATION SYSTEM**
IMPROVING THE LONG-TERM
PLAN FOR RESEARCH AND
HIGHER EDUCATION

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Towards a new stage in Norway's science, technology and innovation system: improving the Long-term plan for research and higher education

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This study assesses the implementation of the recommendations from the OECD Innovation Policy Review of Norway 2017 along four major themes: (1) Developing research communities of outstanding quality; (2) Enhancing competitiveness and innovation capacity; (3) Tackling major social challenges; and (4) Improving the governance of the science, technology and innovation system. The results of this assessment are then used to identify new opportunities for reforms in the Norwegian Long-term plan for Research and Higher Education 2023-2032. While focused on Norway, the report also provides lessons on key issues, such as the sustainable transition of advanced economies, that can be useful in other national contexts.

Keywords: Science and technology, Innovation, Societal challenges

JEL codes: O14, O25, O35, O38, Q55

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Table of contents

OECD Science, Technology and Innovation Policy Papers	2
Towards a new stage in Norway's science, technology and innovation system: improving the Long-term plan for research and higher education	3
Acknowledgements	4
Glossary	8
Executive Summary	9
Chapter 1. Introduction.....	11
1.1. The objectives of the study.....	11
1.2. Gradual evolution and step changes of the Norwegian STI system since 2017.....	11
Chapter 2. Methodology.....	13
2.1. Online survey	14
2.2. Semi-structured interviews.....	15
2.3. Data collection template.....	16
2.4. Workshops and conferences.....	16
2.5. Consultations.....	17
2.6. Caveats.....	17
Chapter 3. Developing excellent academic communities.....	19
3.1. Is the diagnostic established in 2017 still relevant in 2021/22?	19
3.2. Have the 2017 recommendations been implemented and how?.....	19
3.3. What changes to the context have occurred or what issues have arisen from 2017 to now?	24
3.4. What specific options for change should a revision of the LTP consider?	30
Chapter 4. Enhancing competitiveness and innovation – business innovation	34
4.1. Is the diagnostic established in 2017 still relevant in 2021/22?	34
4.2. Have the 2017 recommendations been implemented and how?.....	35
4.3. What changes to the context have occurred or what issues have arisen from 2017 to now?	41
4.4. What specific options for change should a revision of the LTP consider?	48
Chapter 5. Tackling major societal challenges.....	53
5.1. Is the diagnostic established in 2017 still relevant in 2021/22?	53
5.2. Have the 2017 recommendations been implemented and how?.....	53
5.3. What changes to the context have occurred or what issues have arisen from 2017 to now?	57
5.4. What specific options for change should a revision of the LTP consider?	61
Chapter 6. Improving the governance of the STI system.....	67
6.1. Is the diagnostic established in 2017 still relevant in 2021/22?	67
6.2. Have the 2017 recommendations been implemented and how?.....	68
6.3. What changes to the context have occurred or what issues have arisen from 2017 to now?	71
6.4. What specific options for change should a revision of the LTP consider?	74

References	76
Annex A. Organisations of survey respondents	79
Annex B. Interview participants	80
Annex C. Detailed results of the SWOT relevance assessment	81
Annex D. Synthetic results of the survey	86
Annex E. Summary of the options for change	89
Endnotes	91

FIGURES

Figure 2.1. Overview of the fieldwork and corresponding core questions	13
Figure 3.1. Assessment of the level of implementation of ‘Developing excellent academic communities’ recommendations produced in the 2017 Norway Review	20
Figure 3.2. Respondents’ suggestions prioritises or de-Prioritise ‘Developing excellent academic communities’ recommendations	23
Figure 3-3. Share of publications in the 10% top cited world publications, 2006-2020	24
Figure 3-4. Number of ERC grants, 2012-2020	25
Figure 3-5. HERD financed from General University Funds (GUF) as a percentage of GDP, 2012-2019	26
Figure 3-6. Higher Education Expenditure on Research and Development (HERD) as a percentage of total Gross Domestic Expenditure on Research and Experimental Development (GERD), 2012-2019	27
Figure 3-7. Allocation of RCN funds by sector, project funding only, 2016–2020	28
Figure 4.1. Assessment of the level of implementation of ‘Enhancing competitiveness and innovation’ recommendations produced in the 2017 Norway Review	36
Figure 4.2. Respondents’ suggestions to Prioritise or de-Prioritise ‘Enhancing competitiveness and innovation’ recommendations	41
Figure 4-3. R&D expenditure in Norway by sector of execution 1970–2019.	43
Figure 4-4. R&D expenditure in Norway by sector of execution 1970–2019.	43
Figure 4-5. Allocation of RCN project and basic funding to research institutes 2016–2020	44
Figure 4-6. R&D expenditures by type of activity, universities and research institutes	45
Figure 4-7. Various government funding mechanisms for innovation and collaborative research	48
Figure 5.1. Assessment of the level of implementation of ‘Tackling major societal challenges’ recommendations produced in the 2017 Norway Review	54
Figure 5.2. Respondents’ suggestions to Prioritise or de-Prioritise ‘Tackling major societal challenges’ recommendations	57
Figure 5.3. Allocation of RCN funding per area of the LTP, 2015 and 2020	58
Figure 5-4. Indicative illustration of a possible LTP mission governance structure	64
Figure 6.1. Assessment of the level of implementation of ‘Improving the governance of the Norwegian national system of innovation’ recommendations produced in the 2017 Norway Review	68
Figure 6.2. Respondents’ suggestions to Prioritise or de-Prioritise ‘Improving the governance of the Norwegian national system of innovation’ recommendations	71
Figure 22. Key options for change to develop excellent academic communities	89
Figure 23. Key options for change to enhance competitiveness and innovation	89
Figure 24. Key options for change to tackle major social challenges	90
Figure 25. Key options for change to improve the governance of the system	90

TABLES

Table 2.1. Key questions for the OECD study for each of the four 2017 Review objectives	13
Table 2.2. Number of survey respondents by type of organisation	14
Table 2.3. Workshop issues/ tensions by objectives in the 2017 Review	17
Table 3.1. Relevance assessment of SWOTs related to ‘Developing excellent academic communities’	19
Table 3.2. Actions taken to implement ‘Developing excellent academic communities’ recommendations	21

Table 3.3. Researcher project calls' success rates at the Research Council of Norway and Agence Nationale de la Recherche, 2016-2021	28
Table 4.1. Relevance assessment of SWOTs related to 'Enhancing competitiveness and innovation – business innovation'	34
Table 4.2. Actions taken to implement 'Enhancing competitiveness and innovation' recommendations	37
Table 4.3. Share of basic funding of Norwegian RTOs, by arena (2020)	45
Table 4.4. Share of basic funding of European RTOs, by size category (2020)	45
Table 5.1. Relevance assessment of SWOTs related to 'Tackling major societal challenges'	53
Table 5.2. Actions taken to implement 'Tackling major societal challenges' recommendations	55
Table 5.3. The four types of mission-oriented innovation policy	60
Table 6.1. Relevance assessment of SWOTs related to 'Improving the governance of the STI system'	67
Table 6.2. Actions taken to implement 'Improving the governance of the Norwegian national system of innovation' recommendations	69

BOXES

Box 3.1. Major enablers and barriers to implementation of actions related to 'Developing excellent academic communities'	22
Box 4.1. Major enablers and barriers to implementation of actions related to 'Enhancing competitiveness and innovation'	40
Box 5.1. Major enablers and barriers to implementation of actions related to 'Tackling major societal challenges'	56
Box 6.1. Major enablers and barriers to implementation of actions related to 'Improving the governance of the STI system'	70

Glossary

Acronym	Explanation
DARPA	Defence Advanced Research Projects Agency
ERC	European Research Council
EU	European Union
FFA	The Association of Norwegian Research Institutes (Forskningssinstituttene fellesarena)
FME	Centres for Environment-friendly Energy Research (Forskningssentre for miljøvennlig energi)
GERD	Gross Domestic Expenditure on Research and Experimental Development
GUF	General University Funds
HE	Higher Education
HEIs	Higher Education Institutions
HERD	Higher Education Expenditure on Research and Development
IN	Innovation Norway (Innovasjon Norge)
KPI	Key Performance Indicator
KPN	Competence project for the business community (Kompetanseprosjekt for næringslivet)
KSP	Competence and collaboration project (Kompetanse- og samarbeidsprosjekt)
LTP	The Norwegian Long-term plan for higher education and research (Langtidsplan for forskning og høyere utdanning)
MER	Ministry of Education and Research (Kunnskapsdepartementet)
MTIF	Ministry of Trade, Industry and Fisheries (Nærings- og fiskeridepartementet)
NIFU	Nordic Institute for Studies of Innovation, Research, and Education (Nordisk institutt for studier av innovasjon, forskning og utdanning)
NORCE	Norwegian Research Centre
OECD	Organisation for Economic Cooperation and Development
R&D	Research and Development
RCN	Research Council Norway (Forskingsrådet)
RIs	Research Institutes
SFF	Centre of Excellence (Sentrene for fremragende forskning)
SFI	Centre for Research-based Innovation (Sentrene for forskningsdrevet innovasjon)
SINTEF	The Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology (Stiftelsen for industriell og teknisk forskning)
SSH	Social Science and Humanities
STI	Science Technology and Innovation
S&T	Science and Technology
TRLs	Technology Readiness Levels
TTO	Technology Transfer Offices
TVET	Technical and Vocational Education and Training
UHR	Universities Norway/Universitets- og høyskolerådet

Executive Summary

First introduced in 2015, the Long-term plan for Research and Higher Education (LTP) establishes ten-year objectives and priorities to set the course for policy development and investment in research and higher education, while still specifying goals and priority areas for the more immediate four-year horizon. The LTP is subject to revision every four years.

In 2017, the Innovation Policy Review of Norway supported the first LTP revision that took place in 2018, by providing an assessment and recommendations to help strengthen the Norwegian Science, Technology, and Innovation (STI) system. In 2021, the OECD was once again called upon to provide inputs to the third edition of the LTP (covering the period 2023-2032) by monitoring and following-up on the outcomes of the last Review.

To do this, the OECD devised a mixed-methods study, using an online survey administered to STI stakeholders, a template to collect information specifically from agencies, semi-structured interviews with select actors in the STI system, and a workshop open to STI stakeholders.

This study has several findings, organised along the four previously mentioned objectives. Ultimately, by using the 2017 OECD Review as a baseline, this study was able to produce useful inputs for Norway's LTP revisions cycle. It derived valuable lessons on the implementation of the Review's recommendations; investigated their ongoing relevance and prioritisation; and identified new opportunities for changes and reforms that the LTP could support. It also focused stakeholders' conversation on key transversal issues, such as the sustainable transition of the Norwegian economy and the key role systemic policymaking plays in enabling it.

Developing research communities of outstanding quality

The main thrust of the options for change in this area is to balance and link the two imperatives of excellence and relevance to maximise the economic and societal impact from high quality research. The recommendations of the 2017 Review related to excellence have been well implemented, reinforcing the trends that were ongoing at the time. The priority should now be on building upon this level of excellence to deliver more innovation and economic and societal impacts. Stakeholders affirmed that the excellence and relevance imperatives, which still drive most modern STI systems, do not go hand in hand in Norway, leading to a dual system.

To achieve this, Norway could review the selection and evaluation criteria of SFFs to collectively find the adequate 'excellence and impact profiles' of each centre; Establish collaborative research platforms, to bring together, and allow exchange of information among, various types of centres and research-oriented clusters and; Continue to experiment, learn from and improve research-funding processes.

Enhancing competitiveness and innovation capacity

A first series of proposed options aims to institutionalise and systematise innovation in universities to strengthen capabilities at all levels. The 'third mission' in universities is increasingly acknowledged in Norway but the required innovation capabilities and incentives at all levels required to instantiate it, are not sufficiently developed. Flexibility and differentiation in university profiles has proved effective in several countries to enhance the contribution of universities to innovation performance in line

with their specific collective aspirations, competencies, and surrounding communities. To achieve this, Norway could improve and strengthen ongoing initiatives to support university strategic profiling; enhance the flexibility of careers to accommodate different profiles of faculty and; revise the structure of incentives in universities at all levels in order to better balance innovation and excellence.

The study also proposes to find effective ways to go beyond the traditional division of the research landscape between universities and RIs and reinforce the cooperation between them. The traditional division of labour based on the level of Technology Readiness Levels (TRLs) has become largely obsolete in many areas due to the natural evolution of the missions of these institutions and to the complexity of the scientific, technological, and societal challenges with which they contend. Norway could for instance systematically review the various incentives and instruments supporting cooperation between universities, RIs, and industry; and experiment with ecosystem-based initiatives in which different actors in priority areas are incentivised and supported to collectively develop and implement common strategic agendas to strengthen competitiveness and/or address societal challenges.

Norway also needs to leverage the full potential of its research institute sector to tackle economic and societal challenges, not least by increasing their level of basic funding.

Finally, Norway could improve its various types of thematic innovation centres, starting from the review of the SFI selection and evaluation criteria to increase their innovation performance.

Tackling major social challenges

Norway has implemented novel and ambitious mission-oriented policies as joint initiatives between agencies, covering in a coordinated way the different types of support across the innovation cycle. The 'next stage' in this policy approach is to build on these initiatives to collectively design and implement wider scope and more transformative national missions with high-level legitimacy and strong interministerial cooperation. To do this, Norway need to anchor strategically and institutionally national mission(s) in the Norwegian system and ensure a stable and effective funding of these national missions, potentially with an integrated budget. Norwegian missions should be linked to EU missions, while keeping their national specificities.

While Norway strives to implement high-level national missions, it should also keep on developing and improving the existing challenge-led mission-oriented schemes run jointly by agencies.

Improving the governance of the system, especially supporting STI policy coordination.

After seven years of operation, the LTP still plays a useful role to structure the annual budget negotiations but its concrete impact on the orientation of funding remains limited, in particular, outside RCN. Furthermore, its role to formally strengthen interministerial coordination has diminished. Against this backdrop, Norway could take the opportunity of the LTP revision to improve its content and process in order to increase its impact on STI priority-setting and holistic coordination. To do this, Norway need to include clearer and sharper priorities in the revised LTP and use it to collectively discuss, commit to, and present some key reforms of the STI system. It is also important to establish formal processes for coordinating the implementation of the revised LTP.

Chapter 1. Introduction

1.1. The objectives of the study

The main objective of this OECD study is to inform the 2022 revision of the Norwegian Long-term plan for Research and Higher Education (LTP), like the results of the 2017 OECD Innovation Policy Review (OECD, 2017^[1]) informed the first revision of the LTP in 2018, leading to the second plan covering the period 2019-2028. It uses the 2017 Review as a baseline and interrogates its relevance and necessary changes through multiple interactions with key actors of the Norwegian Science, Technology and Innovation (STI) system. Following the structure of the 2017 Review, the study scans the status of implementation of the recommendations and identifies current and future needs for improvement and transformation of the Norwegian research and innovation system to propose policy options in order to:

1. Develop excellent academic communities;
2. Enhance competitiveness and innovation;
3. Tackle major societal challenges;
4. Improve the governance of the Norwegian national system of innovation.¹

The study also provides useful insights into the Norwegian STI system's strengths, weaknesses and change options that could also serve as the basis for policymaking beside the immediate need of informing the revision of the LTP.

1.2. Gradual evolution and step changes of the Norwegian STI system since 2017

More than five years elapsed since the Review was launched in 2017, and even more since the end of the investigations that sustained its diagnostic, conclusions, and recommendations. While five years is a meaningful time in political and social terms, it is a short term when it comes to the evolution of an STI system. To effect meaningful change in such systems, multiple and interrelated non-linear changes in laws, strategies, plans, corresponding budgets, institutions, industry structures must occur alongside shifts in mind-sets and behaviours (which always evolve slowly). Against this backdrop, a complete new OECD Innovation Policy Review, that would involve numerous interviews, country visits, data analysis, and workshops, is not justified in terms of effort or impost. Instead, MER asked that the OECD perform a 'light monitoring' of the diagnostic and the recommendations and to focus on possible implications for the LTP second revision.

Although five years is a short time period and system evolution is gradual, some periods are characterised by step changes when long-term dynamics coalesce and materialise. This is certainly true in the case of Norway during the period covered by this study. This study shows that some important trends manifested, which makes this exercise of light monitoring more meaningful than a mere update. Two overarching contextual changes stood out in the course of interactions with actors of the Norwegian STI system:

- **The impact of the COVID-19 crisis:** Like in many countries, the outbreak of the COVID crisis created a sense of emergency that led to new initiatives outside the frame of usual routines and procedures. One characteristic of these initiatives was that they involved a higher degree of coordination and cooperation between

a broad range of organisations. The wide mobilisation to find rapid solutions and the fact that there was an influx of funding were conducive conditions for these new practices.

- **Increased urgency around environmental issues, in particular climate change:** While climate change is not a new challenge, the level of awareness of the climate urgency has increased significantly since 2017. The prominence of the debates around sustainable transitions during the last parliamentary election in 2021 was an evidence of these phenomena. Before this, key milestones were the enactment of the 2017 Norway Climate Act that sets the target of reducing emissions by 45 percent from 2005 levels, then several overarching and sectoral strategies and plans to fulfil these targets. Other environmental issues such as the loss of biodiversity have also become prominent

The fieldwork investigations carried out in this study do not allow the production of 'OECD recommendations', in the same way a fully-fledged Review would. Instead, this study provides 'options for change'. Norway can use these options to inform the LTP revision process, in the immediate term, as well as use them as fodder for broader debates relevant to the constitution and operation of Norway's STI system, in the medium term. They are especially pertinent to ongoing discussions about the utility and practice of mission-oriented innovation.

Chapter 2. Methodology

The OECD study pursued a mixed methods approach to its fieldwork, comprising a survey, semi-structured interviews, data collection via a template, and a workshop. Cumulatively, these methods sought to address the set of questions for each of the four 2017 Review objectives (see Table 2.1):

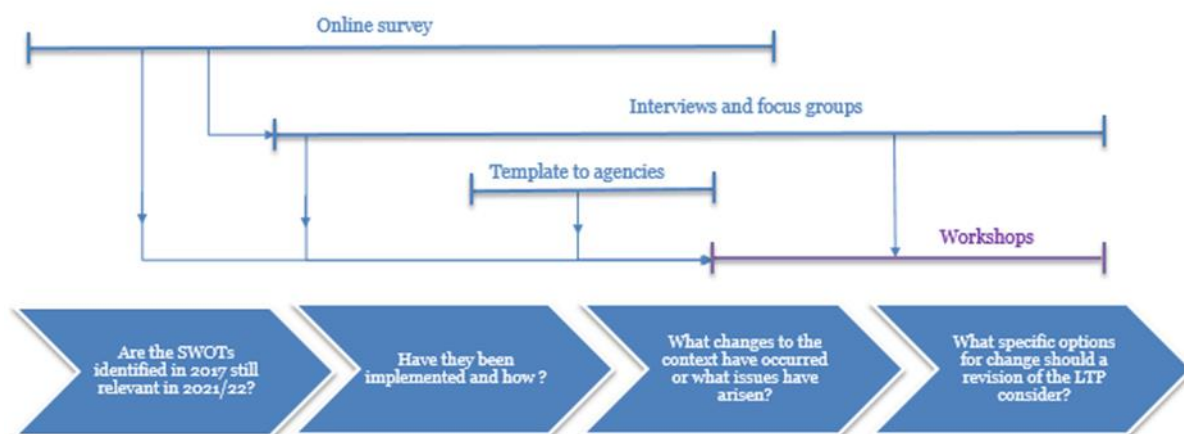
- Developing excellent academic communities
- Enhancing competitiveness and innovation – business innovation
- Tackling major societal challenges
- Improving the governance of the STI system

Table 2.1. Key questions for the OECD study for each of the four 2017 Review objectives

Key questions the study addressed	
1.	Are the SWOTs identified in 2017 still relevant in 2021/22?
1.	Have the 2017 recommendations been implemented and how?
2.	What changes to the context have occurred or what issues have arisen from 2017 to now?
3.	What specific options for change should a revision of the LTP consider?

As outlined in 2.1, the OECD used these methods in concert to solicit differing but complimentary, forms of information in order to shape robust input into the revision of the LTP. An overview of the rollout of these combined methods is outlined in Figure 2.2.

Figure 2.1. Overview of the fieldwork and corresponding core questions



A full overview of each individual method is described below.

2.1. Online survey

In interaction with MER, the OECD developed a survey to collect information on:

- The relevance of the strengths, weaknesses, opportunities and threats identified in 2017;
- The main actions undertaken or planned, in relation to the conclusions and recommendations of the 2017 Review;
- The main challenges and benefits, or reasons for not implementing the recommendations could also be included in the template.

2.1.1. Survey respondents

A database of 128 potential respondents from across the Norwegian STI system was developed for the purpose of this study. The survey was sent on the 14 of September and administered by OECD until the 30 of September. The OECD received 89 responses, achieving a response rate of approximately 70%.

Almost half of the respondents (44) belong to research organisations (Higher Education Institutions, HEIs or Research Institutes, RIs). There were 26 respondents belong to a public body (ministry or agency). Only 8 respondents work in a business company.² The number of survey respondents by organisation type is outlined in Table 2.2 and a more comprehensive list can be found in Annex A.

Table 2.2. Number of survey respondents by type of organisation

Type of organisation	Number of respondents
RI	25
University	19
Ministry	13
Agency	13
Industry	8
Intermediary	5
Stakeholder	4
Local authority	2
TOTAL	89

The respondents are well versed in the issues addressed in the survey: 60 out of 89 respondents considered themselves as 'Very familiar', 'Familiar' or 'Moderately cognisant' of the OECD 2017 Review. Out of these 11 were very familiar with 2017 Review and took an active role in implementing some of its recommendations. Only six respondents declared they had no prior knowledge of the Review.

2.1.2. Content of the survey

The survey consisted of four main sections:

- **Section 1: Identification of respondents.** Respondents were invited to declare what type of organisation they worked for and the degree of their familiarity with the previous OECD Review process.
- **Section 2: Relevance of the 2017 Review SWOT diagnostic.** Respondents were asked to rate the current relevance of 12 strengths, 11 weaknesses, 5 opportunities and 5 threats identified in 2017. They were also invited to provide additional information on the strengths/weaknesses/opportunities/threats that they had assessed as the most and least relevant.
- **Section 3: Implementation of the 2017 recommendations.** Respondents were asked to rate the level of implementation of 25 recommendations. They were also invited to provide additional information on the actions taken as well as the main enablers of and barriers to the implementation of recommendations.
- **Section 4: Suggestions for the revision of the Long-term plan.** Respondents were asked to provide any general comments to aid the 2022 revision of the Long-term plan.

2.2. Semi-structured interviews

2.2.1. Interviewees

The OECD undertook semi-structured group interviews with a diverse set of stakeholders from across the Norwegian STI system, using two different formats:³

- Interviews with representatives of the main ‘communities’ within the Norwegian STI system (universities, research institutes, companies).
- Interviews with key public administrations (ministries and agencies in charge of significant research and innovation activities) were invited to interviews.

A few additional interviews were undertaken with organisations that could not participate in the group interviews, on demand.

The interviewees were preferably chosen among the survey respondents and were supplied their own personal survey answers, to aid their preparation for the interview. Stakeholders also participated in interviews based on their individual expertise on the subject matter (rather than as ‘official spokespeople’ of the organisation). All interviews were performed under Chatham House rules.

2.2.2. Content of interviews

The interview consisted of four main sections:

1. **Orientation.** Stakeholders introduced themselves, noted their position in their organisation and more broadly within the Norwegian research and innovation system, and any Prior involvement in the 2017 OECD Review and/or the LTP
2. **Major contextual changes:** Stakeholders offered insights into any major shifts or changes in the broader political, social, technological contexts that they believe may be shaping thinking or operations.
3. **Recommendation validation and/or update:** Stakeholders were given the opportunity to react to aggregated survey results (ratings and comments) and offer their insights on

which of the 2017 OECD Review recommendations remain the most important in strengthening economic growth and tackling societal challenges. Stakeholders also had the opportunity to supply any missing recommendations.

4. **Recommendation implementation:** Stakeholders were invited to discuss which recommendations had been successfully implemented, what the main enablers and barriers to effective implementation exist, what further support is required to bolster implementation efficacy, and in what ways the LTP could be revised to promote what has worked well and what requires further improvement.

2.3. Data collection template

The OECD used a template to collect information on the policy actions that have been implemented since 2017 in areas of relevance to the OECD Review recommendations (regardless of whether these actions were motivated by the Review or not). This kind of data intake was useful to show either the breadth or types of tangible actions taken since the 2017 OECD Review, to bring recommendations to life, or other forms of action that form relevant context. It was also useful in revealing where actions tended to be concentrated or missing, to show the extent to which implementation/ action had occurred or not occurred.

2.4. Workshops and conferences

The OECD hosted an online workshop on the 14 December 2021, to which over 80 people from across the Norwegian innovation system were registered. The purpose of the workshop was to present findings to date, to convene an interactive discussion on the key issues or tensions the study had yielded so far, and to solicit specific suggestions for the revision of the LTP through discussion using Mural (an interactive online collaboration space) where people could post their suggestions and interact with those of others. It also provided the broader community of people directly engaged or otherwise interested in the LTP in Norway the opportunity to ask questions about the state of the revision and its possible future directions. An overview of the key issues or tensions (as they relate to each thematic area) that the OECD used as discussion prompts is outlined below in Table 2.3. Beyond just prompting discussion in the workshop, these tensions or issues are useful to keep in mind when considering the 'options for change' this document later outlines, as they can serve as the basis for further consideration of the implications of incorporating such proposed options for change in the revised LTP.

Table 2.3. Workshop issues/ tensions by objectives in the 2017 Review

Thematic area	Key issue/ tension
Developing excellent academic communities	<ul style="list-style-type: none"> • How to reconcile excellence and directionality (relevance)? • What funding instruments beside CoEs? • How to change the incentive system to promote innovation in HEIs (and still not compromise excellence)?
Enhancing competitiveness and innovation – business innovation	<ul style="list-style-type: none"> • How to change the incentive system to promote innovation in HEIs (without compromising excellence) • How to use an increase of RI basic funding for impact? • What new types of relationships between RIs and HEIs could be explored?
Tackling major societal challenges	<ul style="list-style-type: none"> • What is the most appropriate level of ambition and scope? • Through what political/ administrative vehicle to drive these changes (is it the LTP or something else)?

The OECD also presented preliminary results at the UHR annual conference in December 2021 and the Association of Norwegian Research Institutes (Forskningssinstituttene fellesarena or FFA) - Universities Norway (Universitets- og høyskolerådet or UHR) conference (Samarbeidskonferansen FFA-UHR) in February 2022.

2.5. Consultations

The OECD circulated drafts of this document to stakeholders from across the Norwegian STI system in March 2022 as well as key actors within MER in May 2022. These consultations yielded over 130 individual comments, the majority of which were substantive, that helped to refine the analysis and proposed options for change.

2.6. Caveats

When considering the results of the survey, in particular, it is important to keep in mind that the results obtained through the survey do not always allow for a clear distinction between respondents' changing perception of the relevance of an element versus disagreement with the inclusion of an element in 2017. Hence, a low relevance rating for a particular strength, for example, might indicate that respondents believe that the situation has changed in relation to that strength *or* that they disagree that this has ever been a strength.

The structure of the database of respondents (i.e. the number of respondents in universities, RIs, business companies, etc.) is an important determinant of the type of responses this survey garnered, regarding matters such as the perception of the SWOTs and the actions undertaken within the Norwegian system. The database of respondents is constituted predominantly by members of the Norwegian research community,

indicating a bias. As such, these kinds of actors may be over-represented in the survey: 9 respondents are from the Research Council Norway (RCN), 8 from The Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology (SINTEF), and 6 from the Ministry of Education and Research (MER).

Chapter 3. Developing excellent academic communities

3.1. Is the diagnostic established in 2017 still relevant in 2021/22?

Survey respondents had the opportunity to rate the SWOTs related to ‘Developing excellent academic communities’ with regard to their enduring relevance. Those that were rated ‘relevant’ or ‘very relevant’ are outlined in Table 3.1.⁴

Table 3.1. Relevance assessment of SWOTs related to ‘Developing excellent academic communities’

Strengths	Weaknesses	Opportunities	Threats
2. Several academic strongholds in specialised economic areas, such as fisheries, aquaculture and O&G* (2/10)	6. Low outward mobility in research: young researchers with little international mobility* (1/11)		
3. A well-equipped higher education institution (HEI) system that allows for planning and building of scientific capacity* (3/10)	3. Limited fully-fledged tenure track and strategic recruitment; high average age of university professors*(2/11)		
	4. Persistent deficiencies in higher education in the STEM fields despite progress*(7/11)		

Source: OECD Survey

Notes: *>75% of Very relevant and Relevant;

The figure between brackets indicate the rank of this item out of the SWOTs the respondents were asked to assess. For instance, a strength with the rank (2/10) is the second most relevant strengths out of the 10 strengths that were proposed to respondents.

3.2. Have the 2017 recommendations been implemented and how?

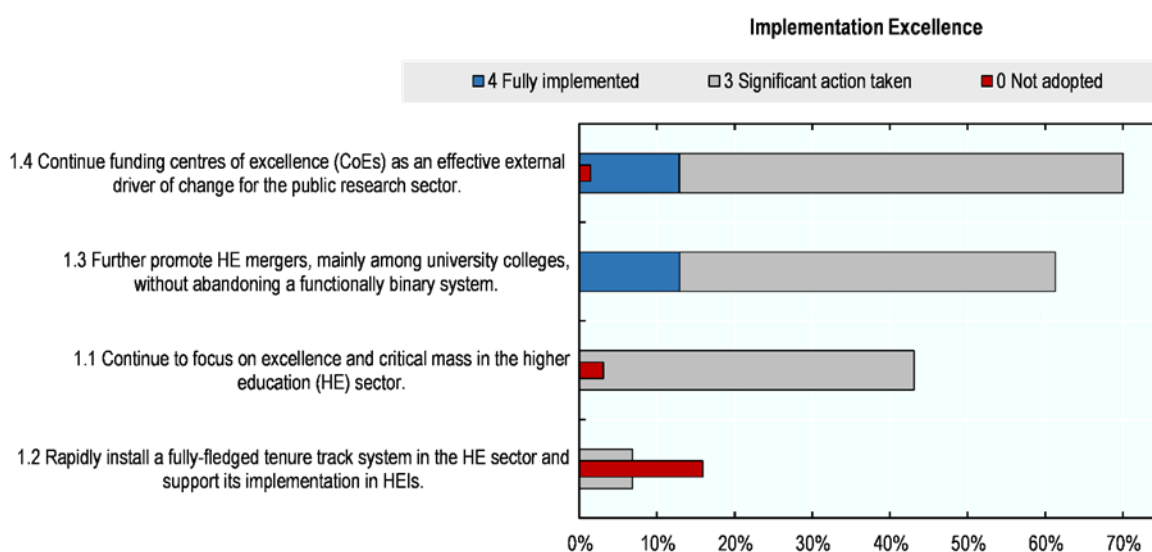
3.2.1. The extent of implementation

There is a strong consensus that recommendations regarding ‘Developing excellent academic communities’ have been implemented and that Norwegian research is of consistent high quality and more integrated in the European and international scientific community than in 2017. The structural reforms that have allowed stronger critical mass and performance in the past have continued and the centres of excellence have played a key role to increase this performance of the research system.

The two recommendations in this area that are considered most fully implemented are (see Figure 3.1):

- 1.3* Further promote HE mergers, mainly among university colleges, without abandoning a functionally binary system.⁵
- 1.4* Continue funding centres of excellence (CoEs) as an effective external driver of change for the public research sector.⁶

Figure 3.1. Assessment of the level of implementation of 'Developing excellent academic communities' recommendations produced in the 2017 Norway Review



Source: OECD Survey

The recommendation that is considered least implemented concerns the setting of a fully-fledged tenure track system in the higher education sector (recommendation #1.2, 16% of respondents rated it 'not adopted at all').

3.2.2. Implementation actions

The OECD collected information on what implementation/ or contextually relevant actions were undertaken via the survey to the broader innovation community as well as through a data intake via a template sent to agencies. These actions have been synthesised in Table 3.2.

Table 3.2. Actions taken to implement 'Developing excellent academic communities' recommendations

Recommendation	Actions
1.1 Continue to focus on excellence and critical mass in the higher education (HE) sector.	<ul style="list-style-type: none"> • Funding for interdisciplinary research proposals: RCN initiated a funding collaboration with the HEIs (Fellesløftet IV), launching a call for large-scale interdisciplinary research proposals with the aim to fund 40 projects (32 within the HE sector) and to split costs between RCN and the institutions obtaining the projects. • Ongoing and increased funding for SFF: The 2020 evaluation of the SFF scheme concluded that it was a success, having already funded 44 centers. It is expected that eleven more centers will be funded with the fifth and ongoing call. The SFF budget has increased from 322 mill NOK in 2016 to 341 mill NOK in 2020. • Increase in funding for research of high scientific quality and international exposure: The budget for RCN's FRIHUMSAM, FRIMEDBIO and FRINATTEK schemes increased from 832 mill NOK in 2018 to approx. 1 billion NOK annually 2017-2019. The budget for FORINFRA increased from 1.44 billion NOK 2010-2015 to 3.63 billion NOK 2016-2020. • Increase in Higher Education Expenditure on Research and Development HERD funding: HERD increased from 18.7 billion NOK in 2015 to 26.3 billion NOK in 2019, and the share of General University Funds (GUF) has remained at approximately 70% throughout the period. • Creation of research groups and 'development dialogues': There has been stronger attention on facilitating and building research groups that conducts research of high quality in the HE sector with a greater degree of cooperation, practice sharing, and mutual learning. • Specific strategic focus on research quality: Institutions have put 'research quality' as an objective in their strategies and/or as a measure in their development agreements with the Ministry of Education and Research. MER has introduced a 'development dialogue' with HEIs, focusing on areas where the different HEIs wish to improve. • RCN has introduced a portfolio approach in order to ensure that the best applications are funded across calls.
1.2 Rapidly install a fully-fledged tenure track system in the HE sector and support its implementation in HEIs.	<ul style="list-style-type: none"> • Tenure track uptake: The tenure track was formally introduced in 2015. Post OECD Review, it has been used to a small extent (with around 90 people employed in tenure track-positions in 2019). An evaluation of the tenure track system is planned.
1.3 Further promote HE mergers, mainly among university colleges, without abandoning a functionally binary system.	<ul style="list-style-type: none"> • Mergers and merger consolidation: In 2017, the HE mergers had resulted in ten universities, six state scientific colleges and five state colleges, in addition to 17 Private colleges receiving governmental funding. The focus has been on consolidating the mergers, although further mergers of smaller Private colleges took place in 2017 and 2018 (Høgskolen Kristiania and VID). • System evaluation: Nordic Institute for Studies of Innovation, Research, and Education (NIFU), with funding from RCN, is conducting an evaluation of the reform (Strukturreformen), examining the effects of higher education system re-design on system performance.
1.4 Continue funding centres of excellence (CoEs) as an effective external driver of change for the public research sector.	<ul style="list-style-type: none"> • Ongoing and increased funding for SFF (see 1.1 above)

Source: OECD data collection template

The online survey and interviews offered respondents and participants the opportunity to reflect on the major enablers and barriers to implementation of actions related to the 'Developing excellent academic communities' recommendations, covering issues such as the usefulness of political and financial support as well as the problems that accompany a lack of collaboration and absorptive capacity. Their reflections were synthesised and outlined in Box 3.1.

Box 3.1. Major enablers and barriers to implementation of actions related to 'Developing excellent academic communities'

Main enablers

1. **Political support:** Political endorsement and support, clear directives, and more top-down enforcing has made change both possible and relatively quick, especially when it comes to recommendations such as 1.3 'Further promote HE mergers'. Steering from the Ministry and extensive systemic action, such as the kind agencies like RCN have undertaken, were seen as especially welcome to ensuring recommendations were implemented.
2. **Financial support and incentives:** Ongoing and increased funding is perceived as crucial to effective implementation of recommendations such as 1.4 'Continue funding Centres of Excellence'. However, respondents noted that a broader conversation about how SFF funding is evaluated and what SFF operation could look like in a 'post-funding' era would be necessary in the medium term, given that SFF centres can only receive funding support for up to ten years.
3. **Increased international engagement and outlook:** Increased internationalisation, in the form of international recruitment and co-publication, is perceived as useful to implementing 1.1 'Continue to focus on excellence and critical mass in the higher education sector'. Participation in European Union (EU) programs (notably Horizon 2020 and Horizon Europe) is also perceived as useful to furthering the excellence agenda. This participation prompted a reshaping of the system so that it was better mobilised to compete for (and win) EU funding.

Main barriers

1. **Lack of collaboration of HEIs:** There is the ongoing perception that the Norwegian higher educations are not cooperating enough, resulting from both a lack of strong willingness from universities to work together and with other partners as well as a lack of institutional mechanisms to do so. They also insufficiently collaborate with relevant universities in Europe.
2. **Lack of innovation capacity in some industries:** The unevenness of the performance of Centres of Excellence (SFFs) and SFIs may be due to the fact that some industries have more established traditions of working closely with academia than others or that some industries are more mature than others and, thus, can more readily use their outputs. To a lesser extent, this also holds true in the health area, regarding interactions between hospitals and universities.

Source: OECD Survey

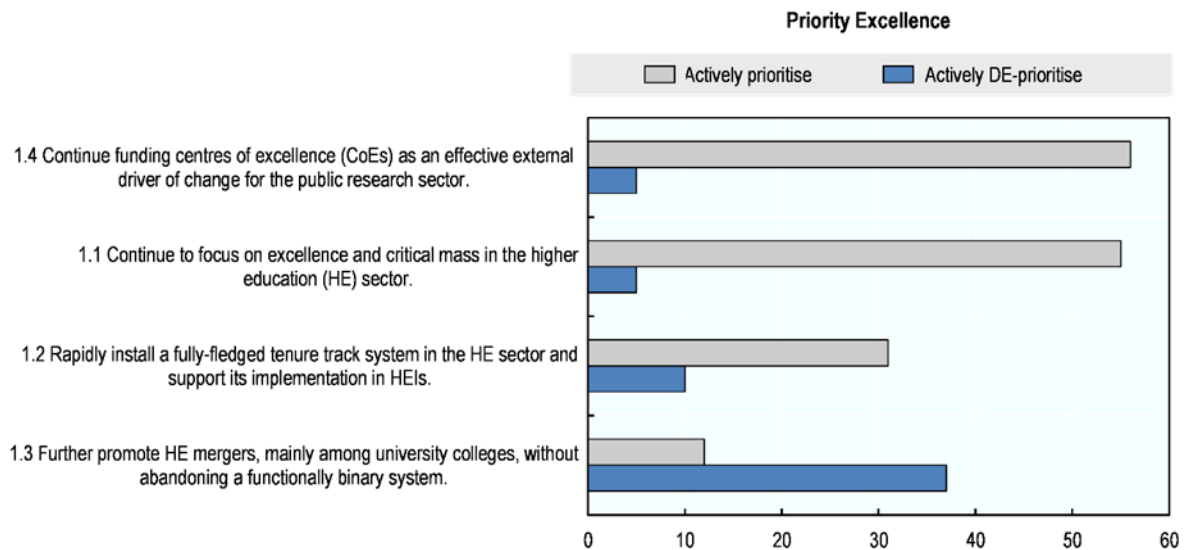
3.2.3. Priority actions

The respondents clearly affirmed that they want the government to keep supporting the strengthening of research excellence, in general and via the funding of SFFs. The two recommendations that more than 45 respondents considered high priority are:

- 1.1 Continue to focus on excellence and critical mass in the higher education (HE) sector.
- 1.4 Continue funding centres of excellence (SFF) as an effective external driver of change for the public research sector.

A majority of respondents indicated that they want to deprioritise the universities mergers since this recommendation is considered well implemented.

Figure 3.2. Respondents' suggestions prioritises or de-Prioritise 'Developing excellent academic communities' recommendations



Source: OECD Survey

3.3. What changes to the context have occurred or what issues have arisen from 2017 to now?

'Excellence was a key priority throughout several recommendations of the 2017 Review, requiring changes of structures to obtain the needed critical mass to compete on an international scale as well as change in processes.

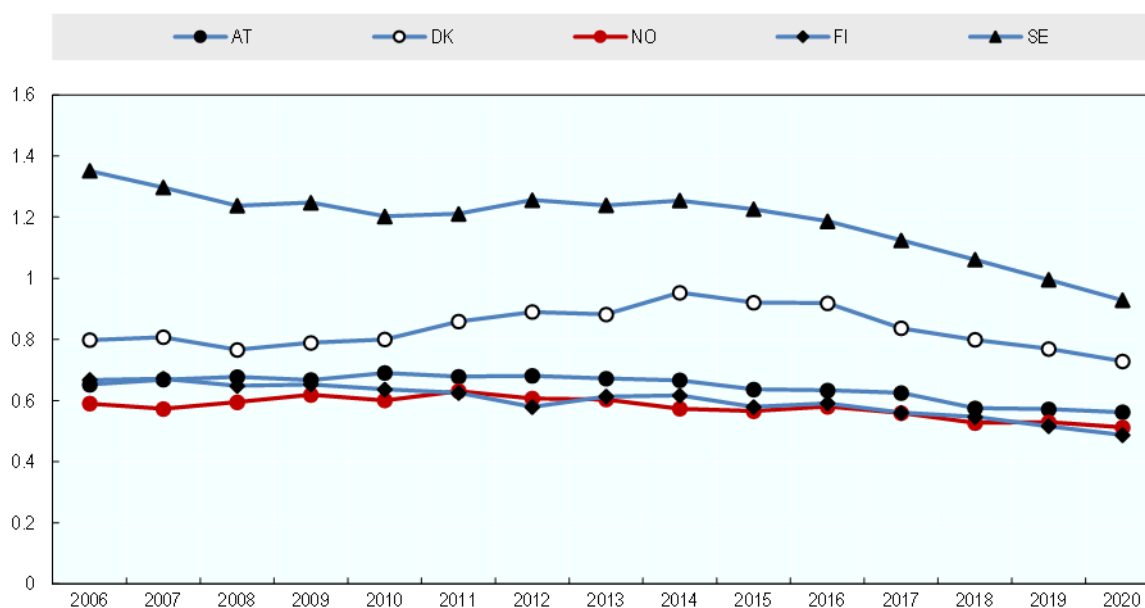
3.3.1. Evolution of research performance

There is strong consensus among the researchers who were interviewed that the level of excellence of research in Norway has improved during the period. Although not an indicator of excellence, it is interesting to note that Norway is one of the OECD countries (with Spain and Italy) where the increase in the number of publications has been the highest between 2016 and 2020 (increase of 12%; RCN, 2021). While it is beyond its scope to perform bibliometric analysis, two easily accessible indicators of excellence are mobilised in this study:

- The share of Norwegian publications in the 10% top cited world publications does not show any marked improvement and Norway's is still lagging some its peers using these metrics. The decrease in performance has been less pronounced than in Sweden, Denmark and to lesser extent; Austria and Finland (see Figure 4.3).⁷
- The number of European Research Council (ERC) grants per year increased rapidly between 2015 and 2018 and decreased markedly since then (Figure 4.4). RCN's indicator report 2021 indicates that this is also true in the Marie Skłodowska-Curie activities (MSCA) programme (RCN, 2021).

These two indicators are obviously imperfect and partial, and should be complemented with more in-depth bibliometric analysis.⁸ One can only say at this stage that there has not been any significant improvement.

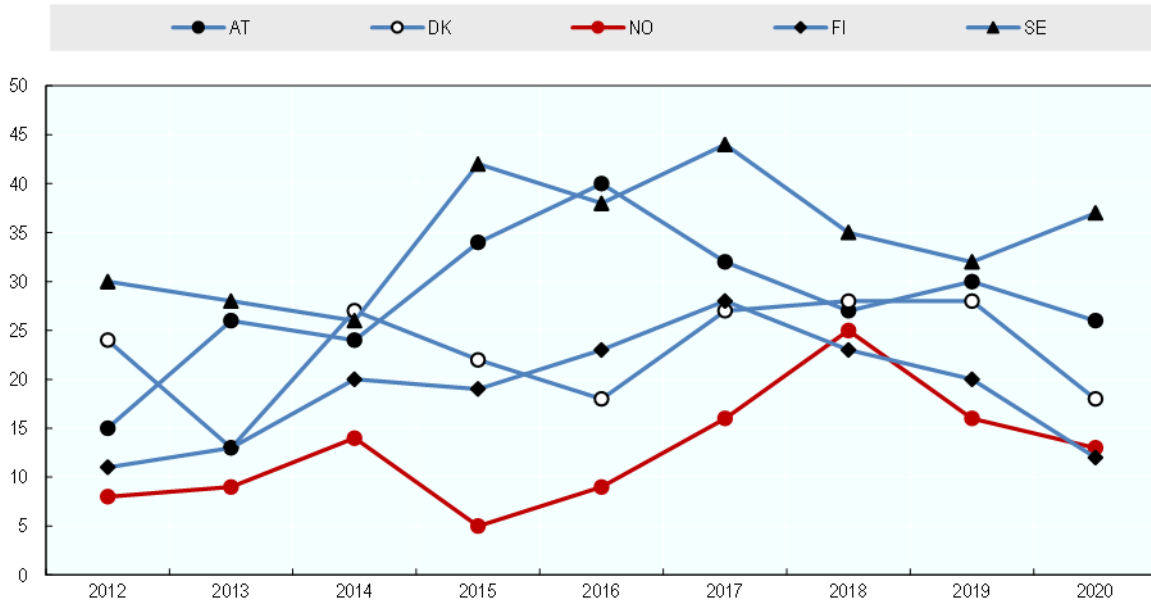
Figure 3-3. Share of publications in the 10% top cited world publications, 2006-2020



Source: (OECD, 2022_[2]) STI Scoreboard, last accessed on 17 February 2022

Note: AT: Austria; DK: Denmark; NO: Norway; FI: Finland; SE: Sweden.

Figure 3-4. Number of ERC grants, 2012-2020



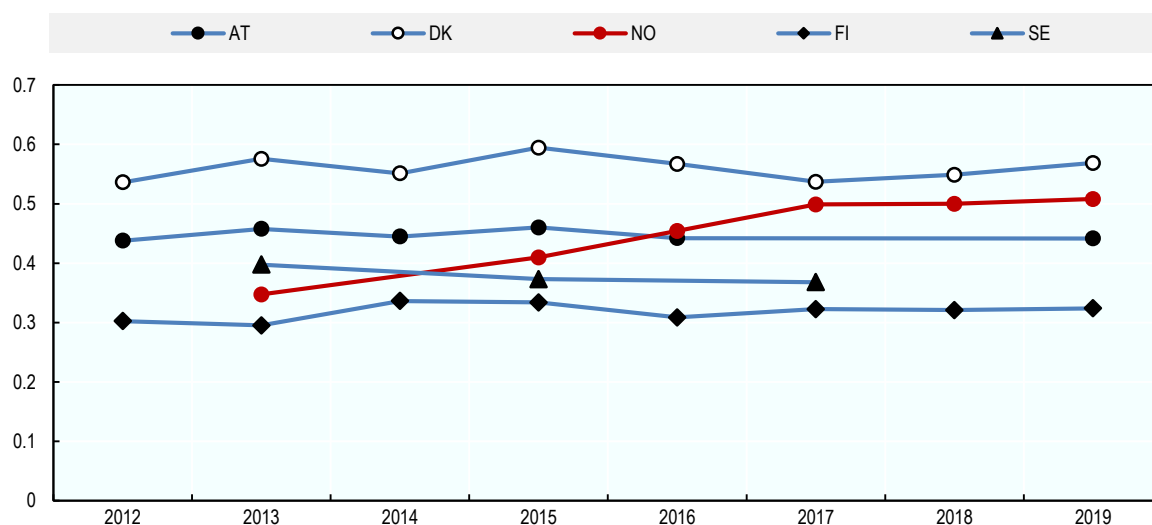
Source: (European Research Council, 2022^[31]) last accessed on 17 February 2022

Interestingly, these indicators of excellence should not be considered as measuring excellence in universities only. Some research institutes such as the National Institute of Public Health, SINTEF, Norwegian Research Centre (NORCE) or the Institute of Marine Research are among the national institutions with the highest share of publications in the 10% most cited world publications, all types of institutions considered.

3.3.2. Evolution of research funding

Another trend that was asserted many times during interviews and workshops relates to the significant increase of the basic funding allocated to Norwegian universities during the period. The research expenditures of universities financed from the basic funding increased from 0.35% of GDP in 2013 to 0.50% of GDP in 2017 and has been rather stable since then (Figure 3-5). In 2019, basic funding and competitive funding represented respectively 69% and 15% of total university revenues (RCN, 2021).

Figure 3-5. HERD financed from General University Funds (GUF) as a percentage of GDP, 2012-2019

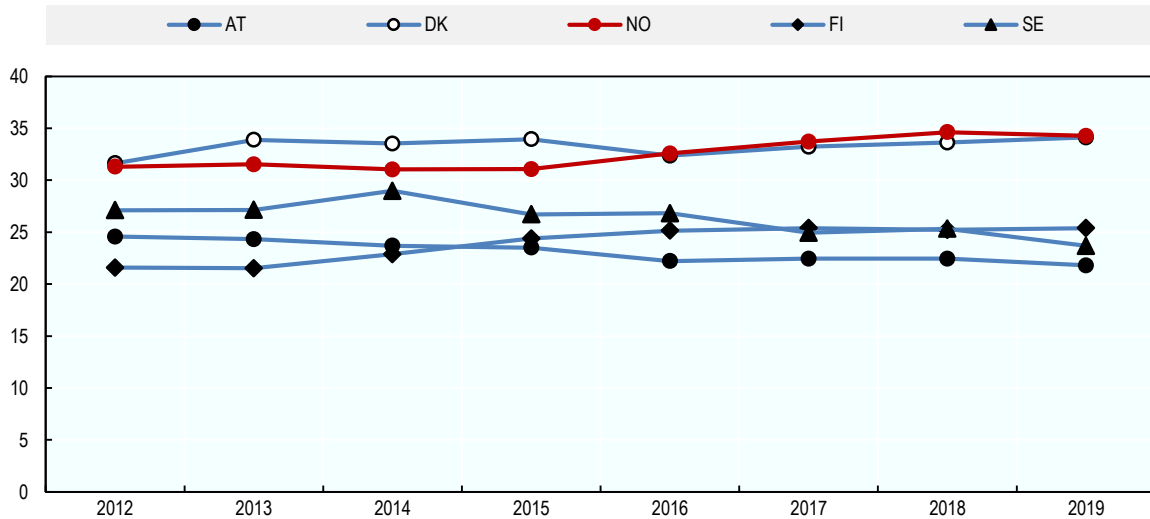


Source: (OECD, 2022^[21]) last accessed on 17 February 2022

The growth in basic funding has been significant between 2015 and 2019 in five large universities⁹ (+42%) and even more so in other, smaller and originally less research-oriented, universities (+76%). In total, the amount of basic funding for higher education institutions has increased by 47% during the period (NIFU statistics).¹⁰ A document by RCN presents lower growth rates, but still significant: a 25% growth of basic funding for the big 4 universities¹¹ and 33% for the whole HE sector (RCN, 2021b). Basic funding grew at a high rate than the number of registered students during the same period (about 6%). It also exceeded the increase of RCN project funding allocated to universities (25%).

Partly based on this increase in basic funding,¹² universities have increased their research activities more rapidly than other research performing sectors (mainly companies and research institutes¹³). This increase of universities' share of total Research and Development (R&D) expenditures since 2015 was also more rapid than in comparator countries, where it was rather stable (Figure 3-6).

Figure 3-6. Higher Education Expenditure on Research and Development (HERD) as a percentage of total Gross Domestic Expenditure on Research and Experimental Development (GERD), 2012-2019



Source: (OECD, 2021^[4]) last accessed on 17 February 2022

While the number of researchers in the five large universities has also risen between 2015 and 2019 (+24%), the increase in recent years is reported to have been particularly high in other universities (+69%), in line with the basic funding increase (Research Council Norway, 2021^[5]). The number of doctoral degrees completed has also increased significantly in HEIs other than the big universities between the periods 2011-2015 and 2016-2020 (Research Council Norway, 2021^[6]). This trend is also related to the change of status of several state university colleges that received the university status and increased their R&D activities. This trend could to some extent counterbalance the increase of concentration of measures aimed to increase excellence and critical mass. A typical debate, raised by a few interviewees, concerns the choice between strengthening the top universities to help them compete with the globally leading institutions and trying to improve the average excellence by supporting all institutions and, in particular, those lagging behind in terms of research quality.¹⁴

As it is often the case, the increase in basic funding of universities has not reduced the competitive pressure, neither among them not between them and other RCN call applicants (research institutes in the first place). The increase of government funding translates into new appointed staff in universities, whose wages are most often fully covered by the institutions basic funding but not additional cost and essential PhDs. Therefore, the institutions have to supplement its budget with external funding.¹⁵ In the end the share of GUF in the revenues of universities remains unchanged at approximately 70% throughout the period while the HERD increased (Table 3.2). According to interviewees, this situation has resulted in more competition for research competitive funding and, since the budget of RCN project funding did not increase accordingly in recent years (see Figure 3-7), a decrease in the success rate. This is confirmed by RCN data. Success rates have fluctuated since 2016 between 12% and 15%, with a peak in 2018 and a fall since then.¹⁶ In recent years RCN success rates appear significantly below those of the French Agence Nationale de la Recherche (ANR) (Table 2.1) and are lower than most national research agencies, which tend to be

situated in the 10% to 20% range, as it was documented in a report from the OECD Global Science Forum) (OECD, 2018^[7]).¹⁷

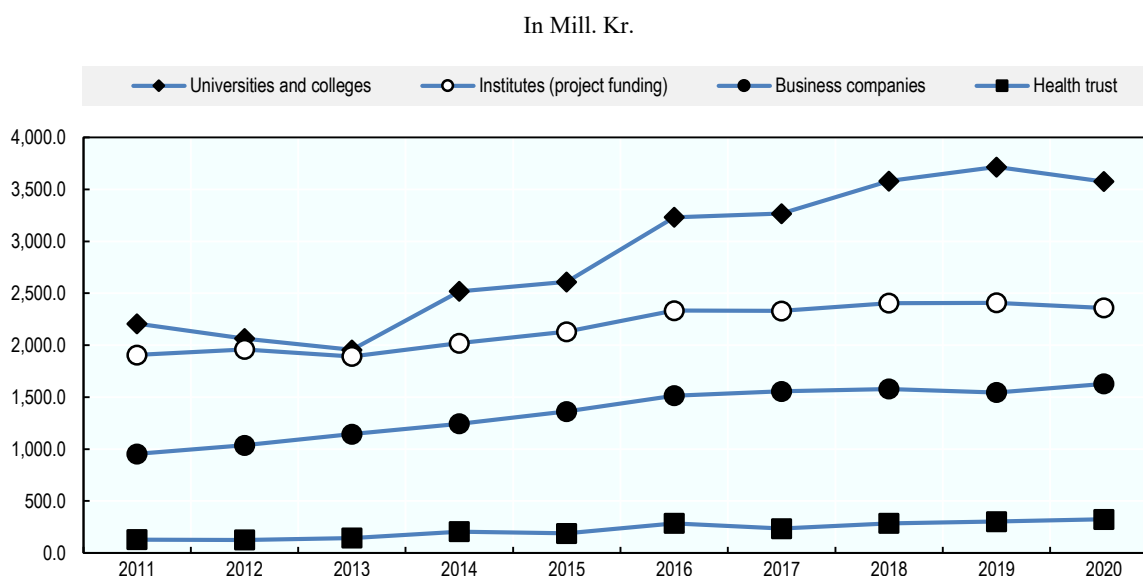
Table 3.3. Researcher project calls' success rates at the Research Council of Norway and Agence Nationale de la Recherche, 2016-2021

	2016	2017	2018	2019*	2020	2021
Applications	2065	2285	2070	2371	2427	2468
Granted	279	307	311	344	295	290
Success rates – RCN	13,5 %	13,4 %	15,0 %	14,5 %	12,2 %	11,8 %

Success rates - Agence Nationale de la Recherche (ANR - France)	12.9 %	13.3 %	15.0 %	16.0 %	17.0 %	
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Sources: Data provided by RCN; Annual reports of the Agence Nationale de la Recherche (<https://anr.fr/fr/lanr/nous-connaître/documents-stratégiques/>)

Figure 3-7. Allocation of RCN funds by sector, project funding only, 2016–2020



Source: (NIFU, 2020^[8])

Some interviewees also expressed concern regarding the unavoidable concentration resulting from the measures to promote excellence and critical mass. Another option, favoured by some of them, would be aim for an increase of the average level of research quality throughout the HE system, rather than trying to strengthen some pockets of excellence.

Another noticeable evolution about research funding (and research performance for that matter) is the increase of Norwegian institutions' participation in EU Framework Programmes (FP), which represent an important addition to the national funding instruments. Norwegian return from program funding improved from 1.7 percent in FP7 to 2, 2 percent in Horizon 2020. This is found to have increased the quality of Norwegian research and innovation and Norwegian participants' competitiveness. It also enables Norway to deal with major societal challenges (Technopolis, 2020^[9]). Interviewees emphasised the importance of maintaining the national STIM-EU scheme (now called

RES-EU) to support the participation of research institutes in EU Framework Programmes.

3.3.3. Reforms of RCN funding

In the face of the acceleration of research and innovation development and the increase in global research competition, the ability of a research system to react quickly to opportunities has become a key overall performance factor. Against this backdrop, research performers have insisted on the need to improve the research funding and management processes to make them faster (from proposal to funding decision and actual funding allocation) and more ‘agile’ (i.e. able to adapt the project content swiftly and without accessible bureaucratic burden).

RCN has in the past experimented with new processes,¹⁸ with mixed results, as it is often the case for experimentation. An important reform has been to streamline all funding processes, reduce the different application types, limit variations in selection criteria, and reduce the number of application deadlines. Some concerns have been expressed as to whether this growing uniformity allows sufficient flexibility to convey the different objectives of different programmes and funding instruments.

It has also recently changed its call for proposal procedures in all research areas to increase their consistence with EU Framework Programmes’ selection criteria and overall intervention logic. This has the benefit of preparing potential Norwegian applicants to participate in EU calls. It also makes it easier to coordinate national calls with EU calls.

IKTPLUSS has experimented with continuous calls with short turnarounds for applicants. The results are encouraging with fewer weak applications and more efficient evaluation process

RCN has launched some calls where several application types are included in the same call so that research topics can be covered either by researcher projects or by collaboration projects.

In order to move toward higher level strategic steering and strengthen interdisciplinary and intersectoral cooperation, RCN has consolidated its programmes and other activities into 15 cross-functional portfolios. The revision of the portfolio plans in 2021-22 was subject to open consultations, which was appreciated by research and innovation communities.¹⁹ Some margins for improvement, for instance in terms of clarity and transparency of associated processes were also mentioned during consultations undertaken in the context of this study.

3.3.4. Policy support to excellence

Beside the increase of universities’ basic funding, the Norwegian Centres of Excellence (SFF) scheme managed by RCN is one of the Principal instrument to increase the level of research quality, often in platforms gathering several partner institutions (mainly universities – including abroad – but also hospitals and some research institutes). Since the 2017 Review, ten new SFF centres have been selected to be supported for as long as ten years (2017-2027) as part of the SFF-IV call.

The SFFs have been praised for their excellence in areas of high national and international relevance. The evaluation of the scheme by an independent committee concluded that it has been a “*tremendous success for Norway*”, notably due to excellent scientific quality of research performed in the SFF centres. They have “*changed the mindset of researchers, introduced the concept of excellence and allowed the best*

researchers to come together to design and conduct ground-breaking research and projects” (Research Council Norway, 2020_[10]). The SFIs and Centres for Environment-friendly Energy Research (Forskningssentre for miljøvennlig energi or FMEs) are also CoEs that develop scientific excellence, in addition to promote cooperation between HEIs, RIs and industry

The added value of these centres lies notably in the long-term platform for cooperation they provide, including with top international research partners. Some interviewees emphasised that the outputs of these centres are superior to what any of the individual groups participating together in each of the centres could produce by themselves. This is particularly important in areas that require interdisciplinary and transdisciplinary research, including social science. For instance, the Centre for Autonomous Marine Operations and Systems (NTNU AMOS) gathers researchers from different departments of NTNU, SINTEF and some companies such as Equinor to contribute with fundamental research combining different disciplines marine hydrodynamics, robotics, ocean structures, marine biology and marine archaeology. Innovation is central to the strategy of the Center and has been anchored in the management of the center and its daily practices (detailed consortium agreements, training of staff, early involvement of the Technology Transfer Offices [TTOs], etc.) from the beginning.

While focusing on upstream research, several of them perform research in areas of high relevance, for instance contributing to sustainable transitions. Some interviewees highlighted examples that echo the cases of scientific but also societal impact of centres of excellence collected as part of the evaluation of the SFF scheme published in 2020 (Research Council Norway, 2020_[10]).

However, discussions focused on how Norway could build on this strong investment in research excellence to deliver more innovation results. Several stakeholders stressed that, despite some successful examples, SFFs are not sufficiently focused on delivering impact. They called for a change of incentives and funding systems in order to trigger the necessary cultural change within SFFs, as also proposed in the survey's open text comments. They also emphasised that the needed reform should take into account the different contexts in which these centres operate, in relation in particular to the level of maturity of their potential 'client base'. However, even when the sectors that could participate in, and benefit from, the production of new knowledge are weak or sometimes even non-existent, there are options to create some markets (some successful centres have created new companies that became their clients).

Beside changes within SFFs, improving the impact of centres also depends on their relationships with other schemes. In that sense, the clear-cut divide between the SFFs and the SFIs for research-based innovation was questioned during interviews.

3.4. What specific options for change should a revision of the LTP consider?

3.4.1. Options for change 1.1: Balancing and linking excellence and relevance to maximise the economic and societal impact from high quality research

The recommendations of the 2017 Review related to excellence have been well implemented, continuing the trends that were ongoing at the time. A majority of the actors of the STI system in HEIs, RIs, and companies the OECD study consulted believed that the priority should now be on building upon this level of excellence to deliver more innovation and economic and societal impacts. Stakeholders affirmed that the excellence and relevance imperatives, which still drive most modern STI systems,

do not go hand in hand in Norway, leading to a dual system. This lack of alignment has led researchers to accommodate different – at times hard to conciliate – injunctions. This proves difficult since the system does not offer them flexibility to choose their profile. This challenge of maintaining the level of achieved excellence and raising research-based innovation capabilities is of course not specific to Norway. It can be found in many countries that, at some point in their specific national trajectories, have invested significant resources in building a large and performing basic research system. Several options can be envisaged.

Rather than having institutions dedicated to excellence and others more innovation-intensive activities, one option is to strengthen ‘hybrid’ institutions, *i.e.* institutions that perform cutting-edge research in areas of high relevance. Various types of centres of excellence (positioned differently in the excellence-relevance spectrum) belong to this type of institutions. They have been evaluated positively in recent years. These centres coexist with and valorise the results obtained from fundamental research supported through various bottom-up funding schemes such as FRIPRO.

Norway could review the selection and evaluation criteria of SFFs to collectively find the adequate ‘excellence and impact profiles’ of each centre

In line with the very positive conclusions and recommendations of the 2020 SFF evaluation committee, Norway should continue supporting the creation of new COEs and ensuring the good functioning and evaluation of existing ones.

However, the broad thematic targeting of CoEs is not in itself a guarantee that the excellent research that is produced will result in innovation outcomes and impacts if the selection and evaluation criteria are uniquely focused on academic excellence. This critique was raised in several occasions during interactions with public and private research performers, including universities.

This initiative could ensure that knowledge exchange and innovation criteria are also influencing the SFFs’ strategies and researchers’ behaviours. One option would be to accompany the development of SFFs, making innovation/impact criteria more prominent after the first cycle of five years, in order to strengthen incentives for generating innovation results based on some of the results during the first five years. SFFs should remain excellence-driven, but would be incentivised to dedicate more attention to knowledge exchange (in a broad sense, *i.e.* not limited to patents) and innovation.

It is important to note that this option for change goes against the recommendation of the 2020 SFF evaluation committee, which stated that “*the criteria for selection of the SFF scheme has, through the first four generations, been solely on scientific excellence*” and that “*it is crucial for the SFF scheme that the selection criteria continue to do so going forward*”). (Research Council Norway, 2020_[10]). Any change in the selection and evaluation criteria, and more generally any steering mechanism, should be negotiated with each centre to find the adequate ‘excellence and innovation profile’.

The intent of this option for change is not to substitute relevance to excellence, but to build on the high level of research quality to derive economic, policy, and societal impacts. During consultations, several researchers also expressed their concerns that this type of change might come to the detriment of curiosity driven, researcher-led, fundamental research where the future usages of the knowledge produced are still to be unveiled or are uncertain. The recent COVID crisis has demonstrated once more the importance of long-term research: the rapid development of vaccines was made possible through decades of patient, long term scientific development and experimentation. Basic

research should be preserved in Norway and the right balance between basic research, user-inspired basic research (especially important in SFFs), and applied research can only result from national debates. More generally, a debate on excellence, its definition and what selection criteria and indicators to use to review proposals and measure performance, is needed, taking into account the growing literature on this topic.²⁰ Against this backdrop, this option for change aims to ensure that i/ this debate takes place, in the society at large, at MER and RCN, and in the context of each centre; ii) flexible mechanisms, incentives and institutions are in place to promote the interactions between the different types of research and are adapted to the specific situation of each centre.

Norway could provide stronger support for collaboration between different types of research provider

Effective exploitation of research results most often occurs when there is good cooperation between high quality research institutions and other organisations with strong innovation capabilities. Norway can learn from other countries, which have experimented with the best ways to create and configure collaboration spaces and platforms between research institutions.

Such platforms could bring together, and allow exchange of information among, the various types of centres (SFFs, SFIs, FMEs) and research-oriented clusters in common priority areas (possibly in line with LTP Priorities) or in relation to crosscutting challenges. These platforms should be light mechanisms that create collaboration opportunities, not increase the administrative and coordination burden of the participating institutions. For example, they could make efficient use of digital tools to exchange information on past and ongoing projects, undertake some monitoring of activities by Science and Technology (S&T) and societal challenges, and hold a few meetings per year. They could also manage some dedicated meetings to take stock and increase the level of research relevant to any national missions Norway could launch. In effect, this approach could kick-start better cooperation as well as ensure that the relevant research groups, including those in excellence schemes, are connected to missions (even if only indirectly).

More generally, without compromising basic research freedom, it is essential to establish different channels between the different schemes supporting research and innovation, including RCN programmes for free and bold research, such as FriPro.

Norway could continue to experiment and improve research funding processes

It is essential to reconcile the excellence imperative and the necessary flexibility of research funding. This is necessary in order to be able to reap both the benefits of excellent research in the scientific community as well in terms of innovation in a timely fashion, given the pace of change and unabating competition between international research teams.

This could make the 'excellence imperative', which calls for a thorough and international selection process, become less heavy and more rapid. RCN has experimented in the past, for instance IDELAB and more recently in pilots and new schemes like Pilot-E and the Green Platform (two-step calls for proposals, stage gate funding, for instance). Such experimentations should continue and when successful, adapted and mainstreamed to all relevant research programs.

A recent significant change is the shift of RCN towards a portfolio approach to move beyond individual programmes and develop synergies between different support

activities. It will be important in coming years to analyse and evaluate the implementation and effect of this approach on various types of research (from fundamental long-term research to applied research) and – even more importantly – on the linkages between these types of research.

Chapter 4. Enhancing competitiveness and innovation – business innovation

4.1. Is the diagnostic established in 2017 still relevant in 2021/22?

The SWOTs related to ‘Enhancing competitiveness and innovation–business innovation’ that respondents rated ‘relevant’ or ‘very relevant’ are outlined in Table 4.1.

Table 4.1. Relevance assessment of SWOTs related to ‘Enhancing competitiveness and innovation – business innovation’

Strengths	Weaknesses	Opportunities	Threats
2. Several academic strongholds in specialised economic areas, such as fisheries, aquaculture and O&G (2/10)	7. Industrial specialisation in sectors with low research and development (R&D) intensity (3/11)	3. Public procurement for innovation to support diversification (4/5)	3. Weak strategic basis of many public research institutes (PRIs), small institutes, low basic funding (1/5)
10. Strong capacity to develop consensual sectoral innovation strategies in dedicated platforms and networks (e.g. the ‘21 Forums’) (5/10)	8. Limited research-industry relationships, except in O&G and aquaculture (8/11)	-	-

Source: OECD Survey

Notes: *>75% of Very relevant and Relevant; the figure between brackets indicate the rank of this item out of the all the weaknesses the respondents were asked to assess.

The figure between brackets indicate the rank of this item out of the SWOTs the respondents were asked to assess. For instance, a strength with the rank (2/10) is the second most relevant strengths out of the 10 strengths that were proposed to respondents.

4.2. Have the 2017 recommendations been implemented and how?

4.2.1. The extent of implementation

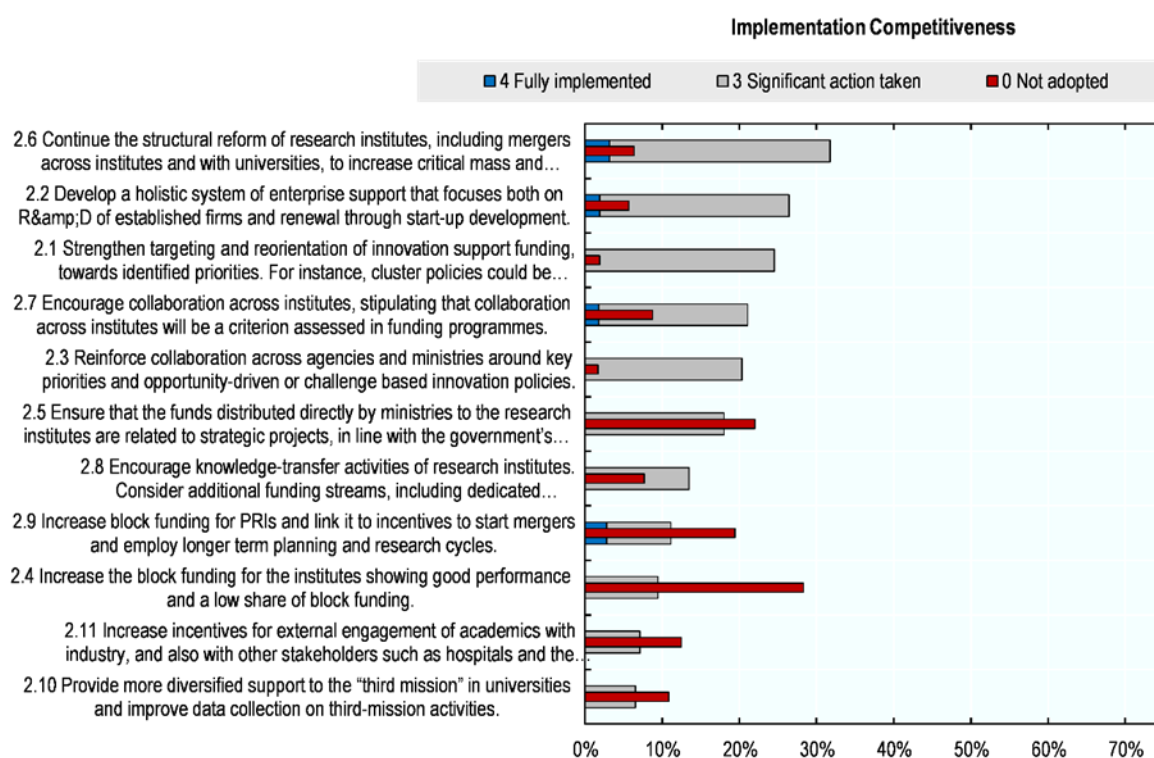
According to the survey, the five recommendations in this area that are considered to be implemented to the greatest extent are:

- 2.6* Continue the structural reform of research institutes, including mergers across institutes and with universities, to increase critical mass and international competitiveness.
- 2.2* Develop a holistic system of enterprise support that focuses both on R&D of established firms and renewal through start-up development.
- 2.1 Strengthen targeting and reorientation of innovation support funding, towards identified Priorities. For instance, cluster policies could be amended to increase their selectivity.
- 2.7* Encourage collaboration across institutes, stipulating that collaboration across institutes will be a criterion assessed in funding programs.
- 2.3 Reinforce collaboration across agencies and ministries around key Priorities and opportunity-driven or challenge based innovation policies.

A significant proportion of respondents consider that no actions have been taken in response to several recommendations, all related to the funding of RIs:

- 2.4 Increase the block funding for the institutes showing good performance and a low share of block funding (28%)
- 2.5 Ensure that the funds distributed directly by ministries to the research institutes are related to strategic projects, in line with the government's defined priorities (22%)
- 2.9 Increase block funding for RIs and link it to incentives to start mergers and employ longer term planning and research cycles (19%).

Figure 4.1. Assessment of the level of implementation of 'Enhancing competitiveness and innovation' recommendations produced in the 2017 Norway Review



Source: OECD Survey

4.2.2. Implementation actions

As with the recommendations related to 'excellent academic communities', the OECD similarly collected information what on what implementation/ or contextually relevant actions were undertaken via the survey to the broader innovation community as well as through a data intake via a template, synthesised below in Table 4.2.

Table 4.2. Actions taken to implement 'Enhancing competitiveness and innovation' recommendations

Recommendation	Actions
2.1 Strengthen targeting and reorientation of innovation support funding	<ul style="list-style-type: none"> The LTP priority on climate and environment has increased its funding share between 2015 (14%) and 2020 (20%) (see Figure 3-7)
2.2 Develop a holistic system of enterprise support that focuses both on R&D of established firms and renewal through start-up development.	<ul style="list-style-type: none"> Integrated instruments: RCN has further developed its collaboration with Investinor, Innovation Norway, SIVA and EU programs to enable more integrated instruments, spanning from start-ups to enterprise support to bolster research based innovation. Industry specific innovation accelerators: SIVA, in partnership with Innovation Norway and RCN, launched seven New Norwegian Catapult centres (norskkatapult) to upgrade the innovative capability of small and medium sized enterprises in specific industry areas. The centres support companies in developing prototypes, offer expertise and equipment for testing, visualisation and simulation. Increase in SFI funding: The number SFIs has been increased substantially from 24 in 2016 to 39 in 2021. The funding of the SFI program has increased accordingly, in particular in the context of the COVID crisis in order to support R&D addressing challenges relevant to industry.
2.3 Reinforce collaboration across agencies and ministries around key Priorities and opportunity-driven innovation policies.	<ul style="list-style-type: none"> Cross-agency initiatives: There are a number of collaborative initiatives across agencies such as Pilot-E, Health Pilot-H, Pilot-T, Bio-economy, and Green Platform. Furthermore, there is close collaboration between actors in specific sectors such as aquaculture, agriculture, CCS. A large-scale review of business innovation support has been commissioned to a consultancy company to propose a new configuration of agencies that reduce overlaps.
2.4 Increase the block funding for the institutes showing good performance and a low share of block funding.	<ul style="list-style-type: none"> Marginal increase in block funding: Block funding has been marginally increased, from 7 % to 7, 5 %, in the period 2015-2019. During the same period the growth of the Technical-Industrial institutes has levelled off to only 0, 5% in the period (2015-2019). So, while some action has been taken it, this is not necessarily a complete fulfilment of the specific goals for block funding for these institutes as outlined in the LTP. Competitive funding around collaborative research is still the major type of public funding for most of the institutes, especially the industrial oriented institutes. The risks associated, as pointed out in the report, are still valid.
2.5 Ensure that the funds distributed directly by ministries to the research institutes are related to strategic projects, in line with the government's defined Priorities.	<ul style="list-style-type: none"> Streamlining enterprise support for R&D: The RCN has streamlined its funding, calls and processes, for enterprise support for R&D, making it a more holistic system. Through this, more balance (in terms of strategic goals related to size, age, and geography of companies) is being achieved. The strategic component in the basic funding of research institutes has been suppressed. Government's Strategy for a Comprehensive Institute Policy (February 2020) Formalisation of a policy for 12 research institutions outside the basic funding system (June 2020). Recommendation to create a 'tier-two' research institute arena
2.6 Continue the structural reform of research institutes	<ul style="list-style-type: none"> Reduction of the number of research institutes in block funding schemes: The number of RIs included in the block-funding scheme is significantly reduced from 44 to, at present, 32 (2016-2021). Reduction in TI-institutes in contract research: The number of TI-institutes that undertake more than 70% of the contract research from industry to the block funded institutes, has been reduced from 14 to 6 in the same period.
2.7 Encourage collaboration across institutes, stipulating that collaboration across institutes will be a criterion assessed in funding programs.	<ul style="list-style-type: none"> New agency led collaboration efforts: RCN removed obstacles for collaboration between industry and research institutes and explicitly encouraged it when it results in added value. However, such collaboration is not mandated through any specific criterion in assessments. There is a requirement in RCN calls to show how knowledge will be disseminated and usually this is met through collaboration with a research institution. However, there may be other means to achieve this requirement e.g. through industrial networks.
2.8 Encourage knowledge-transfer activities of research institutes.	<ul style="list-style-type: none"> Institutionalised commercialisation support: RCN has developed dedicated commercialisation instruments and increased funds for commercialisation. Activities targeted at alignment, opening, and broadening to make funding more accessible and streamlined: Alignment of assessment criteria with that of the EU, broader target audience, calls open to TTOs, research institutions, and spin-outs, removed application deadlines, continuous reception, assessment, and decision of applications, staging, and dedicated grants for students. Knowledge transfer Key Performance Indicator (KPI) indicator: RCN developed this indicator for the block funding system, to complement the four existing indicators (related to contract R&D, scientific publication, funding from international resources and number of doctoral degrees completed).

2.9. Increase block funding for RIs and link it to incentives to start mergers and employ longer term planning and research cycles.	<ul style="list-style-type: none"> • Marginal increase in block funding: (see 2.4).
2.10 Provide more diversified support to the "third mission" in universities, in addition to increasing the budget of the FORNY program, as suggested by the LTP.	<ul style="list-style-type: none"> • Commercialisation schemes: RCN introduced schemes supporting commercialisation of research (like verification projects, TTO support, student entrepreneurship, pilot and demonstration projects, and various direct and indirect (tax incentives) schemes for business sector). On-going evaluation of the TTO scheme and NIFU report on TTOS. • Collaboration and knowledge transfer: RCN introduced schemes on excellent research and innovation, thematically oriented programs, programs on user-driven research-based innovation and research-based regional innovation and industrial and public-sector PHD. • Mobility schemes: Continued support for industrial and public sector PHD. By the end of 2021, 289 candidates had completed their doctoral project and just over 70 per cent of the candidates stay in the business sector after completing their degree, which indicates that the scheme is effective in increasing R&D efforts in the business sector.
2.11 Increase incentives for external engagement of academics with industry, and also broader stakeholders such as hospitals and the public and voluntary sector. Improve data collection on third-mission activities.	<ul style="list-style-type: none"> • Creation of a 'third mission' innovation unit: Universities Norway (UHR) established a third mission strategic unit targeting innovation activities, UHR-Innovasjon (in addition to research and education) to further collaboration between universities on third mission issues, sharing best practices and improve data collection on third-mission activities and how best to contribute to associated activities.

Source: OECD data collection template

From feedback solicited through the online survey and interviews, the major enablers and barriers to implementation of actions related to the 'Enhancing competitiveness and innovation' recommendations are synthesised, covering enablers such as effective cooperation and collaboration and the value of dedicated strategies, as well as the barriers of lack of meaningful support for 'third mission activities' and the flow on effects of low basic funding. These are outlined in Box 4.1.

Box 4.1. Major enablers and barriers to implementation of actions related to 'Enhancing competitiveness and innovation'

Main enablers

1. **Cooperation and collaboration mechanisms:** New/emboldened collaboration mechanisms and platforms, as well as criteria that explicitly encouraged collaboration (for example, those found in RCN and Horizon Europe funding schemes) as well as increased cooperation among institutes.
2. **Dedicated strategies, technology areas, and infrastructure:** The independent strategic advisory bodies, such as Energi21 and its strategies, is useful to the realisation of collaboration around key Priorities involving industry, institutes, and universities.
3. Establishment of a dedicate unit for innovation and commercialisation in HEIs and research performing organisations

Main barriers

1. **Lack of comprehensive support for third mission activities:** While some efforts have been made to implement 2.11 'Increase incentives for external engagement', the lack of other forms of practical support for third mission activities (such as merit system in academia that adequately recognises and rewards innovation activity, relevant KPIs incentivising innovation, time to pursue it, stability within a research career to pursue it, or tailored funding for transition activities) hinders the full realisation of this recommendation.
2. **Less basic funding has led to short-termism in the research agenda:** Low basic funding has conditioned RIs to make 'safer bets' in terms of selecting R&D activities only in areas they feel more assured industry will be interested in, in the short term, unless there is alternate forms of funding (such as EU funding). These kinds of situations mean that RIs do not feel encouraged to invest in emerging areas in and undertake more risky research (including in applied research).
3. Low R&D intensity research industry and limited risk capital available. Institutions like Investinor could be set-up as a political and strategic instrument in facilitating this.

Source: OECD Survey

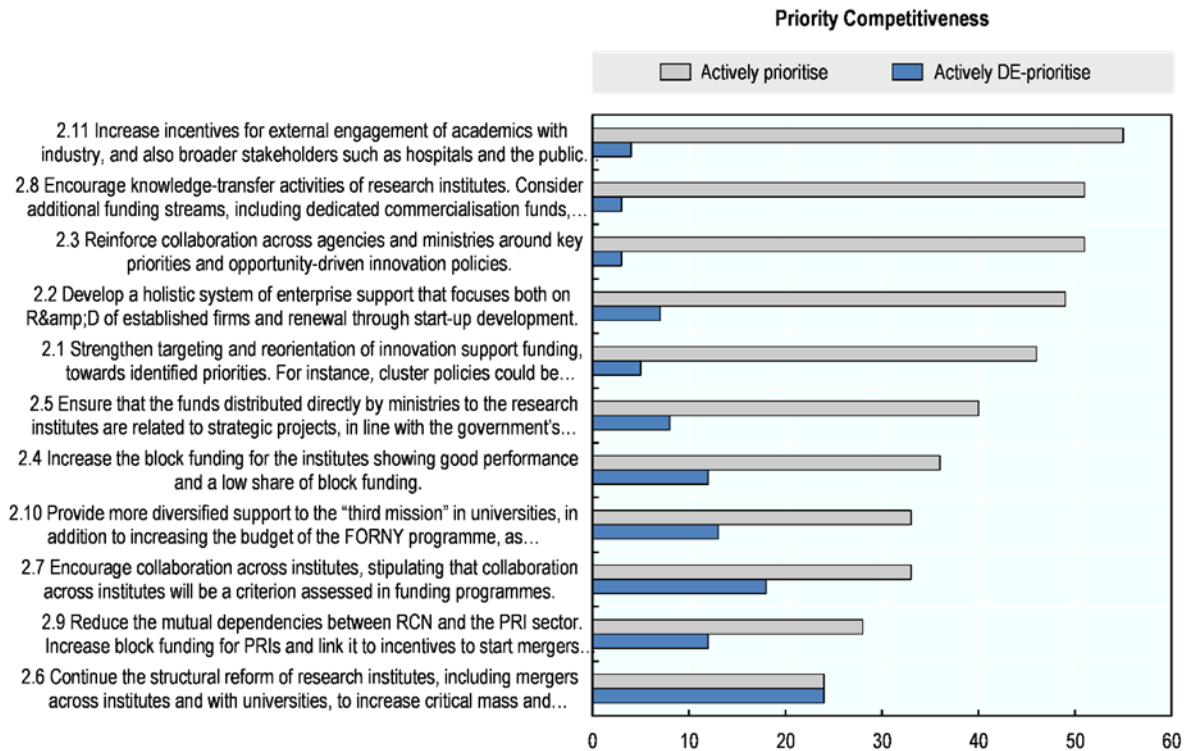
4.2.3. Priority actions

More than 45 respondents prioritised the following recommendations:

- 2.11 Increase incentives for external engagement of academics with industry, and also broader stakeholders such as hospitals and the public and voluntary sector. Improve data collection on third-mission activities.
- 2.8 Encourage knowledge-transfer activities of research institutes. Consider additional funding streams, including dedicated commercialisation funds, and/or the inclusion of knowledge-transfer indicators, in the performance-based funding system (including, but not limited to, commercialisation).
- 2.3 Reinforce collaboration across agencies and ministries around key priorities and opportunity-driven innovation policies.
- 2.2 Develop a holistic system of enterprise support that focuses both on R&D of established firms and renewal through start-up development.
- 2.1 Strengthen targeting and reorientation of innovation support funding, towards identified Priorities. For instance, cluster policies could be amended to increase their selectivity.

There is no strong call for deprioritisation in this area. Consistently with other results on the SWOTs and recommendations, the policy action that 24 respondents indicate should be deprioritised is the support to structural reforms of RIs (inc. mergers). As shown above this is the recommendation that is considered most fully implemented.

Figure 4.2. Respondents' suggestions to Prioritise or de-Prioritise 'Enhancing competitiveness and innovation' recommendations



Source: OECD Survey

4.3. What changes to the context have occurred or what issues have arisen from 2017 to now?

4.3.1. Third mission in universities

During interviews and workshops, there was a consensus on the stronger acknowledgement of the importance of third mission (which includes innovation activities)²¹ within universities. Higher education institutions no longer lack strategic overview and innovation is mentioned more explicitly in strategic and reporting documents. Furthermore, it is now reflected in senior management teams of some universities, for instance via a vice rector position with innovation responsibilities. There are also many examples of significant contribution of HEIs to innovative activities and public engagement in the private and public sector, in strong connection with their provision of higher education. Universities also provide the knowledge basis for many public policies, through their direct or indirect involvement in white papers, expert groups, public committees etc.

However, this change is a long-term process and many interlocutors (including in survey open text comments – see Box 4.1) underlined that there is still significant margin for

improvement. The third mission would need to be more firmly institutionalised within universities, under strong leadership from universities' management. Considering innovation specifically, these remain in many universities often performed on a voluntary basis and seen as a side activity relatively to education. One can find in the HE sector many good practices and success cases disseminated in different parts of various universities, but innovation is not yet systematised. An indicator of this is the low amount of research contract with industry. Innovation activities and performance are not rewarded institutionally via an adequate incentive structure. It is for instance not part of career progression criteria. There is also little flexibility in time allocation between education, research and innovation activities (in a broad sense, hence also including community engagement, different types of cooperation with industry and public administrations). The only existing mechanisms are limited in time.

At the level of institutions or parts of them (departments etc.), the KPIs that are used for the allocation of the basic funding within the university are still based mainly education related indicators. Research indicators account only for a small share of the funding allocated, and are limited to publications and research income. The third mission is largely absent from the overall institutional funding incentive structure. Recent discussions, both in Europe and in Norway, about the need of reforming the system of recognition and rewards for academic careers, is suggesting ways of rewarding also innovation-competence, in addition to the research indicators (Universities Norway, 2021^[11]).

The situation in that regard of course differs between universities and research areas. This would therefore require some process to adapt the reforms to be implemented to the different contexts. Interviewees pointed to the lack of process and incentives to aid differentiation of strategic profiles among universities. They also more generally emphasised the limited innovation capabilities in HEIs, hence requiring specific training at all level of universities, including at top level.

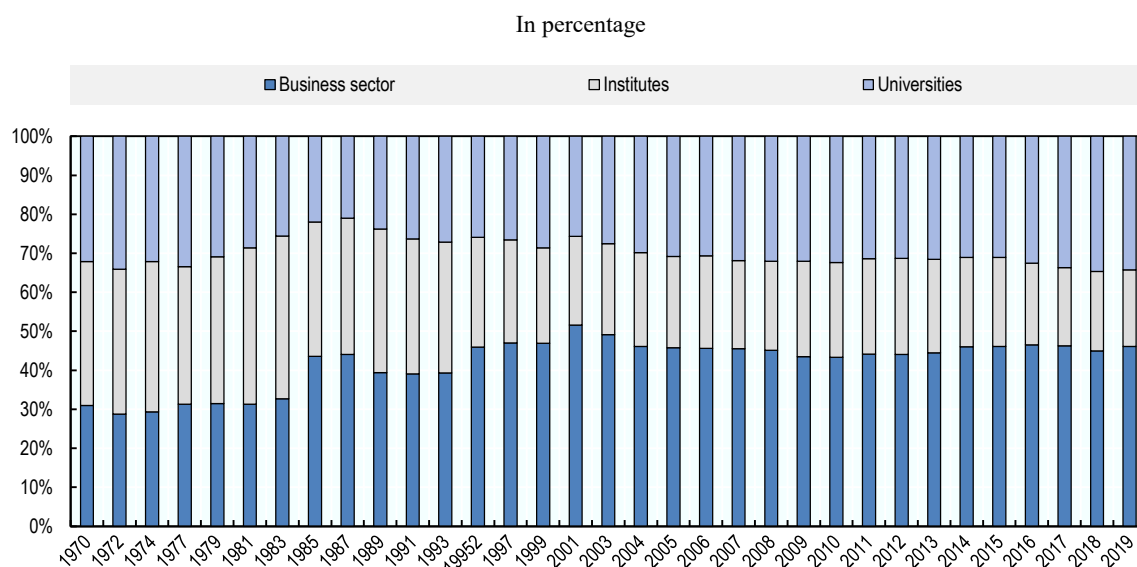
The mutual mobility of researchers between academia and industry, one important channel for knowledge exchange and innovation, is also considered too infrequent and, according to some, has even decreased in recent years. The recent evaluations of SFIs and FMEs commissioned by RCN also point to severe weaknesses in that regards.

While the TTO system was barely mentioned during interviews and consultations, it has continue to be a matter of debates and has experienced reforms during the period. This indicates a willingness from several institutions to improve and better integrate in its activities the objective of commercialisation.²²

4.3.2. Research institutes' funding

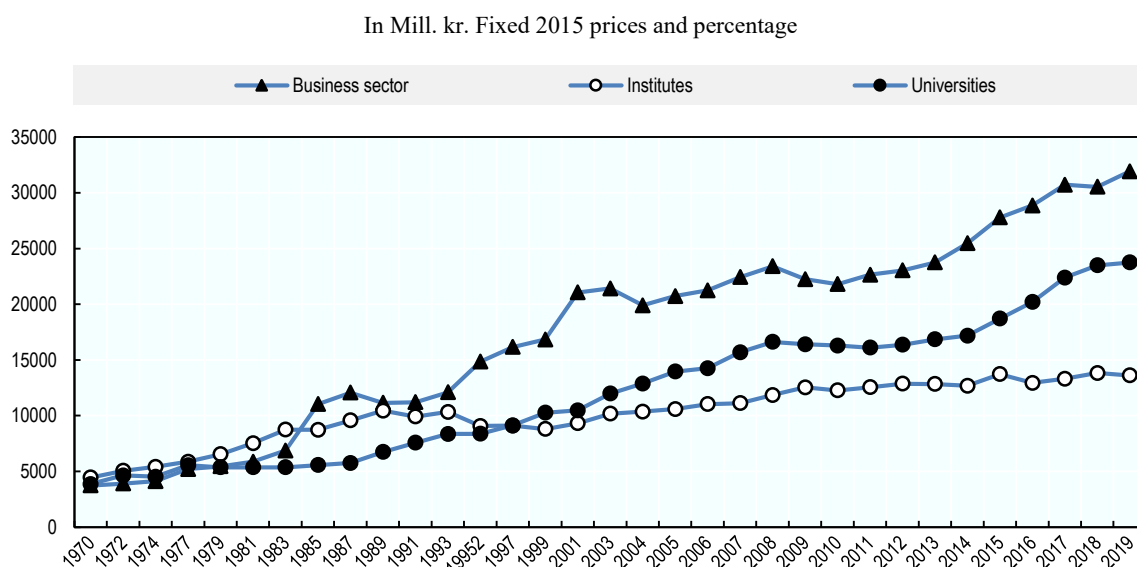
Figure 4-3 shows that the share of RIs in the total research expenditure has decreased in the long run. While this trend has to do also with structural changes (some institutes have changed sector from RI to HE), it demonstrates that the research activities in this sector are almost not growing anymore, including in volume (Figure 4-4). The latest data available showed that while the HE sector experienced a growth in real terms of 1 per cent, the institute sector had a small decline of almost 2 per cent (Research Council Norway, 2021^[6]).

Figure 4-3. R&D expenditure in Norway by sector of execution 1970–2019.



Source: (Research Council Norway, 2021^[6])

Figure 4-4. R&D expenditure in Norway by sector of execution 1970–2019.

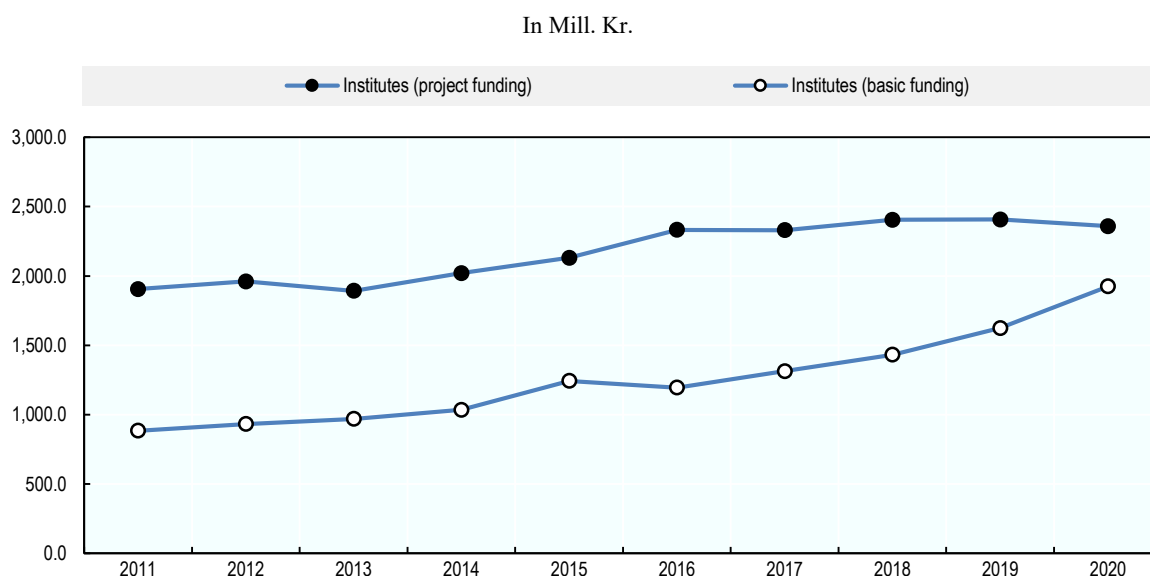


Source: (Research Council Norway, 2021^[6])

The RI sector has been subject to significant structural change during the period, in line with recommendation 2.6, and the survey results and interviews clearly show that there is no need for additional reforms in this direction.²³ This contrasts with the lack of follow-up of the recommendations calling for an increase of the basic funding of RIs. Most actors consulted during this study claimed that these recommendations have not been implemented. According to figures provided by RCN research, institutes' basic funding has been only marginally increased from about 7% in the period 2015-2019. During the same period, Technical-Industrial institutes have experienced almost no growth (see Table 4.2). However, these statements and data are difficult to reconcile

with NIFU statistics which show an opposite trend since 2016 (Figure 4-5). This is partly related to two main factors: i) in 2020, RIs received an extraordinary basic funding in connection to help them cope with the negative consequences of the COVID-19 crisis on their activities. This was a one-off action and cannot be considered a shift in policy; ii) the STIM-EU funding is a results-based funding instrument integrated in their basis funding that provide institutes a compensation based on success in EU calls. This measure has to some extent reduced the negative effects of the low levels of basic funding.

Figure 4-5. Allocation of RCN project and basic funding to research institutes 2016–2020



Source: (NIFU, 2020_[8])

Numerous OECD reports stress the importance of sufficient basic funding to support the development of research institutes and their ability to deliver impacts. Basic funding is not just some additional funding channel for RIs, it allows them to build and strengthen their capabilities and knowledge to secure future collaborative and contractual funding. It is also increasingly crucial to perform the type of long term and complex research (including using cutting-edge technological infrastructure) that is needed to tackle societal challenges.

The share of basic funding allocated to Norwegian research institutes ranges between 5% to 25% according to a recent RCN study (Research Council Norway, 2020_[12]). The rate of basic funding varies notably between institutes serving different research areas ('arenas'), from 10% for industrial technology institute to 16% for social science institutes (Table 4.3). Despite the increase of basic funding in recent years, this is significantly below the average of European Research and Technology Organisations' share of basic funding according to a recent OECD study commissioned by EARTO (Larrue and Strauka, 2022_[13]). In average, the basic funding represents about 40% of the revenues of European RTOs. This average is somewhat misleading since a few very large RTOs have the highest share of basic funding.²⁴ The medium and large RTOs are in the 30% to 35% range.

Table 4.3. Share of basic funding of Norwegian RTOs, by arena (2020)

	Share of basic funding in total income	Share of basic funding (including STI-EU) in total income
Social Science Institutes	15 %	16 %
Environmental institutes	11 %	14 %
Primary business institutes	13 %	14 %
Technical-industrial institutes	7 %	10 %

Source: (Research Council Norway, 2020^[14])

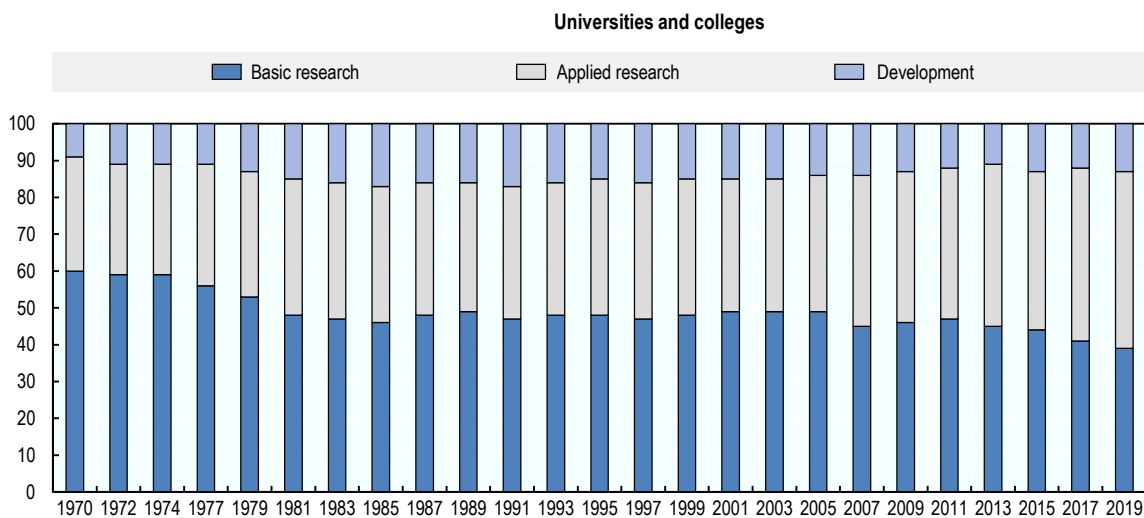
Table 4.4. Share of basic funding of European RTOs, by size category (2020)

	Share of basic funding in total income
Very small	18%
Small	22%
Medium	30%
Large	35%
Very large	45%

Source: (Research Council Norway, 2020^[12])

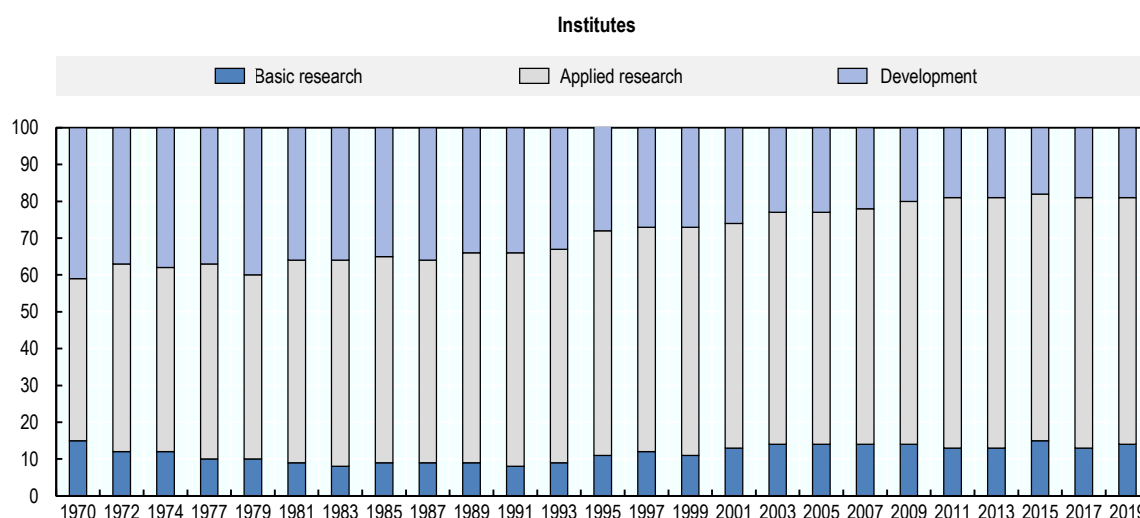
4.3.3. The division of role and relationships between research institutes and universities

As previously noted, the competition for research funding has increased. Universities are increasingly active on applied research and development and the domain of overlaps between institutes and universities has expanded. Figure 4-6 shows that the universities and colleges have increased their share of applied research activities (from 43% in 2015 to 48% in 2019). Not surprisingly, applied research is the main R&D activity of research institutes but it has remained rather stable, which means that the share of basic research has not increased (as can be observed in other countries). This might be related to the low level of basic funding that does not allow research institutes to increase their upstream research activities.

Figure 4-6. R&D expenditures by type of activity - universities

Source: (OECD, 2021^[4])

Figure 4-7. R&D expenditures by type of activity - research institutes

Source: (OECD, 2021^[4])

While the two types of institutions still have their specific profiles, the traditional division of roles between universities and RIs, whereby universities do basic research and education-based applied research with companies, and institutes support industrial R&D, is increasingly subject to questions. The end of the linear model had already undermined the relevance of this model. More recently, the focus on societal challenges has questioned this model even more as it requires more and closer collaboration between the different research and innovation partners. New forms of finer-grained complementarities need to be found between these universities and RIs, with interlinkages between the various activities conducted at different stages of the innovation chain. In many cases, complementarities are to be found within a specific collaborative activity, rather than ex ante based on a broad division of labour in terms of TRL levels.

International experience shows that this type of cooperation needs to be supported via different funding mechanisms and incentives. In Norway, the funding allocated through RCN project schemes that promote building of competence and cooperation (like the Competence projects for the business community [KPN] and Competence and collaboration projects [KSP]) have levelled off in recent years. Some countries have also used their R&D tax incentive system with specific modalities for companies' research expenditures performed in partnership with research institutes. This could indirectly support cooperation between universities and research institutes.

4.3.4. The centres for innovation and competence

Norway supports the creation and operation of several types of centres geared toward innovation in a broad sense: the Centres for Research-based Innovation (SFIs), Centres for Environment-friendly Energy Research (FME) (Technology-oriented or Social science-oriented) and the Centres for Clinical Treatment Research scheme (FKB).

The number SFIs, which are particularly aiming for innovation and technology transfer based on high quality research, has been increased substantially from 24 in 2016 to 39 in 2021 and their funding has been increased accordingly.

However, several stakeholders claimed that not only SFF but also SFI were also overly geared toward academic quality criteria. This is consistent with the results of the 2018 evaluation of the SFI scheme that revealed some significant weaknesses regarding the contribution of SFIs to innovation (technological as well as service innovation and public-sector innovation), commercialisation, and internationalisation). (DAMVAD, 2018^[15]).

4.3.5. Skills

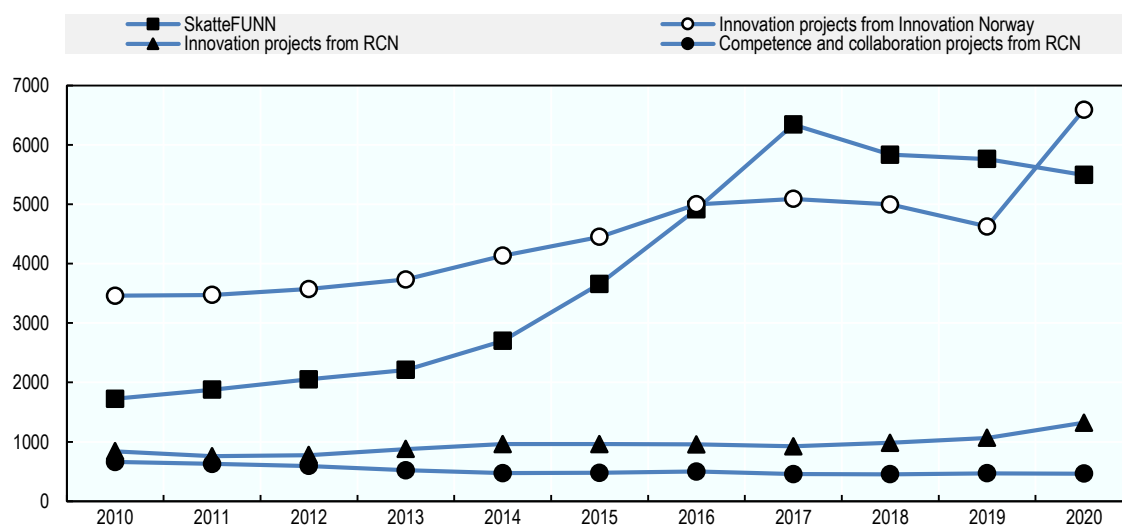
The linkages between research, innovation, competence and employment is essential. Although this was not the focus of this study, some interviewees raised the issue of the lack of voluntarist and planned approach to the provision of education and life-long learning in present and future priority areas. There is already a fierce battle for talents in digital skills and batteries, for instance. More generally, there is little funding incentives or regulatory measures to educate and train people to help the green transition and some stakeholders called for more directional higher education, Technical, Vocational Education, and Training (TVET) policy. This is in line with survey results regarding the low level of implementation of the recommendation 3.2 on technical, vocational, and educational training to address societal challenges.

4.3.6. Funding for innovation

R&D and innovation in general is supported in Norway through various funding instruments. In terms of amounts allocated, the Norwegian R&D tax credit Skattefun R&D funding is the main one, increasing from NOK 1.5 bill. in 2013 to above NOK 6.0 bill in 2017, followed by a slow decrease since then. This latest trend during the period is a significant change in the government support to business R&D, as evidenced for instance by the decision in 2020 to reduce the cap on the maximum amount of eligible expenditure from NOK 50 million to NOK 25 million.

The funds distributed by Innovation Norway have also increased until 2017, and slightly decreased afterward, with a strong increase in 2020 due to the government support to industry in the context of the COVID crisis. The RCN instruments for innovation have increased in recent years while those dedicated to collaborative research have decreased regularly since 2010 (Figure 4-8). In 2019, R&D tax incentives accounted for 50% of total government support for BERD in Norway

Figure 4-8. Various government funding mechanisms for innovation and collaborative research



Source: Statistics Norway

Note: Innovation projects from RCN include Innovation projects in business (IPN), User-driven Innovation projects, and Innovation project in the public sector. Competence and collaboration projects include Competence projects for business and industry (KPN) and Collaboration projects (KSP).

4.4. What specific options for change should a revision of the LTP consider?

4.4.1. Options for change 2.1: Strengthen strategic profiling in higher education for more differentiated and performing universities

The ‘third mission’ in universities is increasingly acknowledged but the required innovation capabilities and incentives at all levels required to instantiate it, are not sufficiently developed. Flexibility and differentiation in university profiles has proved effective in several countries to enhance the contribution of universities to innovation performance in line with their specific collective aspirations, competencies, and surrounding communities. In line with survey results and interviews that call for a prioritisation of recommendations related to the third mission of universities and knowledge exchange in general, there is a need to institutionalise and systematise innovation in universities to strengthen capabilities at all levels, including the strategic leadership of the universities so that heads of Department and Deans have ownership of innovation.

Norway could improve and strengthen ongoing initiatives to support university strategic profiling

Performance agreements, which started as a pilot with about 10 universities in 2016-17 seem to remain rather marginal, have limited effect on funding and are not always well implemented. They therefore do not have a strong influence on the differentiation of universities. This should have concrete implications on the institutional funding of universities, a portion of which being conditioned to the development and realisation of the contract. These contracts, tightly connected to each university’s strategy, should not be considered as simple administrative tools with neutral KPIs but as strategic tools to serve regional or national priorities (including missions when relevant). Depending on university organisations, this might also necessitate changes in university governance, such as a move from collegiate governance to executive governance with societal

representation (while academic aspects of governance are left to the academics). This shift in strategic power away from individual departments and colleges allows for a “smarter” orientation and profiling of universities. This is crucial to allow universities to act strategically, as integrated entities. The Netherlands, where ambitious reforms of the governance of universities have been implemented since the early 1970s, could provide valuable lessons as to how to conduct this process of university profiling.²⁵

Norway could enhance the flexibility of careers to accommodate different profiles of faculty

Some mechanisms currently exist to allow the ‘buyout’ of sometime (out of project funding) to focus on innovation activities, but they remain limited in time and not incorporated into the typical faculty career structure. It could be possible, under some future, well-defined conditions, to develop career plans for faculty members who want to work more on innovation related activities.

This also relates to the tenure track system, which will be evaluated, and more generally to the need to make research carrier more attractive, not least for young scientists.

Norway could revise the structure of incentives in universities at all levels in order to better balance innovation and excellence, in line with their specific profiles

Performance-based funding mechanisms as well as institutional evaluation processes should better reflect the technological and social innovation variables in a wide sense (i.e. including also engagement with local companies, hospitals and public administration). Universities will then be able to reflect these changes in the KPIs used for their internal allocation their basic funding.²⁶

Norway could make the LTP more clearly highlight the expected contributions of universities and RIs to the goals and thematic Priorities (and national missions, if relevant)

More generally, it should be made clear that priorities are not ‘earmarked’ for specific categories of actors. There are needs for cooperation between different types of actors in each LTP overarching goal and thematic priorities.

4.4.2. Options for change 2.2: Going beyond the traditional division of the research landscape between universities and RIs

There was a strong consensus among stakeholders on the need to reinforce the cooperation between universities and RIs. The traditional division of labour based on TRLs has become largely obsolete in many areas due to the natural evolution of the missions of these institutions and to the complexity of the scientific, technological, and societal challenges with which they contend.

Norway could systematically review the various incentives and instruments supporting cooperation between universities, RIs, and industry

These incentives include for instance shared positions between HEIs and RIs, different types of alliances and partnerships, industry PhD programs, regional innovation platforms,²⁷ ecosystem-based support (which include support to networking and possibly strategic plan co-creation), shared infrastructure, joint projects, joint labs, dedicated funding to strengthen knowledge exchange in HEIs and RIs, and faculty positions to industry, etc. Also important are the individual staff evaluation and

promotion criteria, particularly for early career researchers in HEIs, which often do not value cooperation outside other HEIs and focus on narrowly defined scientific excellence.

It is also necessary to analyse how the existing instruments could be modified to promote cooperation between universities, RIs, and industry. For instance, the Green Platform is only accessible to enterprises and research institutes, not HEIs.²⁸ While this might be a way to preserve funding for business innovation, this exclusion of one type of actor is a missed opportunity in terms of support to cooperation.

Norway could experiment with ecosystem-based initiatives in which different actors in priority areas are incentivised and supported to collectively develop and implement common strategic agendas

Such schemes have been used for several years in Finland (Business Finland Growth Engines and Flagship Projects), Sweden (Strategic innovation Programs and Vision-Driven Health) and more recently in Denmark (Green Missions) to strengthen competitiveness and/or address societal challenges. They prove effective in the progressive development of new partnerships between universities, RIs, and industry to collaborate to develop strategic agendas and roadmaps in which they have strong ownership. Once selected, the partnerships are empowered to implement their agendas with public financial support. These agendas are most often systemic, covering not only research and innovation but also skills, regulations, public acceptance, and market creation. Rather than being stipulated ex ante in rules and laws, the distinct roles of universities and RIs emerge from within the partnerships and are adapted to each specific institutions and strategic agendas.

The 21-strategies could be instrumental in contributing to these initiatives, which would cut across many of them and would create linkages between them. Ecosystem-based initiatives would be complementary to 21-strategies, not alternatives.²⁹

4.4.3. Options for change 2.3: Leveraging the full potential of RIs to tackle economic and societal challenges

While they perform well – as shown in their evaluation – RIs are not used to their full potential. Their low basic funding in European and international comparison (in particular the technical-industrial institutes which average share of basic funding is 7%) have some important implications on the type of research they can perform and therefore the type of contribution they can make to economic and societal challenges. The fact that RIs in Norway not only survive with low basic funding and are successful in European Programs should not be taken as evidence that the system is functioning well. These performance statistics do not show the change in the nature of activities that result from this low basic funding and the invisible, ‘counterfactual’, costs in terms of lost opportunities.

Norway could progressively increase the level of basic funding of research institutes

The 2017 Review recommendations to increase the basic funding of research institutes has not been implemented and is even more relevant in 2022 than 5 years ago. A recent OECD study has shown the importance of maintaining the adequate balance between the three main types of activities performed by research institutes: (i) in the short term, routine exploitation of the knowledge, including via consulting and the provision of various services to industry and public administration; (ii) in the long term, exploratory

research and development to develop an area of capability or a technology platform; and (iii), in between, they refine and exploit their knowledge base, often in collaborative projects with industry. These activities broadly correspond to their three sources of funding (i.e. privately commissioned projects, basic funding, competitive funding) (Larrue and Strauka, 2022^[13]). The study shows that the mid- to long-term activities have become increasingly important for these institutions to deliver on their mission, which has become increasingly directed towards more complex and ambitious societal challenges. This evolution calls for a significant share of stable and predictable funding that allows them to build long-term areas of expertise (through the accumulation of knowledge and skills, the acquisition and maintenance of technology infrastructures, etc.).

Furthermore, the COVID crisis has revealed in many countries the role that RTOs – a category of research organisations to which most Norwegian RIs belong – can play beyond the support to industry. Their role as ‘policy tools’ to contribute to addressing complex and systemic challenges is increasingly acknowledged by policy makers in many different national settings. Furthermore, if Norway engages in national missions, there will be a need for RIs that not only understand industry needs and market logic in their areas but that can also perform research with a mid to long-term horizon, manage cutting edge technological infrastructure and equipment, and are able to serve as intermediaries between many actors of different disciplines and sectors in these ambitious joint endeavours.

The increase of basic funding of research institutes should be progressive, spread over several years, but planned ahead with sufficient visibility and credibility. One way to do this is to enshrine the basic funding increase in the next LTP’s investment (‘escalation’) plan.

The question of whether this increase of basic funding should be subject to conditions or be ‘earmarked’ remains open and should be discussed with institutes. The Association of Norwegian Research Institutes (FFA) mentioned that there could be ways to make the basic funding more targeted, notably in the LTP priority area.³⁰ Some strategic plans, which would include LTP priorities and missions, negotiated between ministries and institutes are an interesting option. It is however important not to limit the autonomy of RIs and increase their bureaucratic burden in return of additional funding. Other means exist to steer research institutes toward national priorities and missions.

STIM-EU has been evaluated positively (Technopolis, 2020^[9]) and should be part of the reflection on increasing the level of basic funding of research institutes.

4.4.4. Options for change 2.4: Improving the various thematic innovation centres

Norway could review the SFI selection and evaluation criteria to increase their innovation performance

Several stakeholders claimed that SFI Centres for Research-based Innovation were also overly geared toward academic quality criteria. This is consistent with the results of the 2018 evaluation of the SFI scheme that revealed some significant weaknesses regarding the contribution of SFIs to innovation (technological as well as service innovation and public-sector innovation), commercialisation and internationalisation (DAMVAD, 2018^[15]).

A review of the SFI selection and evaluation criteria is consistent with the results of the evaluation of SFIs (that calls for changes in performance metrics) to ensure that the

balance between research quality and research relevance is adequate for achieving the original mission of these institutions. This original mission aims to enhance the ability of the relevant business sectors in specific strategic areas to innovate and create value through a greater focus on long-term research.

The evaluation of FMEs in 2021 was positive but also identified weaknesses when it comes to innovation and technology transfer. It recommended that more emphasis be put on innovation and commercialisation during the second four-year funding phase of the centres.

Chapter 5. Tackling major societal challenges

5.1. Is the diagnostic established in 2017 still relevant in 2021/22?

The SWOTs related to ‘Tackling major societal challenges’ that respondents rated ‘relevant’ or ‘very relevant’ are outlined in Table 6.1.

Table 5.1. Relevance assessment of SWOTs related to ‘Tackling major societal challenges’

Strengths	Weaknesses	Opportunities	Threats
	10. Lack of a dedicated actor for renewal in the public sector (4/12)	1. Evidence that diversification from O&G is already under way and industrial upgrading (1/5)	4. Reluctance to embrace structural change (72%) (2/5)
	12. Limited capacity of the government sector to support strong STI Priorities (5/12)	2. Putting in place an environment conducive to the emergence of new activities/sectors (2/5)	2. Strong reliance on past performance, limited ability to invest in new areas (70%) (3/5)

Notes: *>75% of Very relevant and Relevant; the figure between brackets indicate the rank of this item out of the SWOTs the respondents were asked to assess. For instance, a strength with the rank (2/10) is the second most relevant strengths out of the 10 strengths that were proposed to respondents.

5.2. Have the 2017 recommendations been implemented and how?

5.2.1. The extent of implementation

Respondents do not report much implementation activity associated with the recommendations in this area. The recommendation that is considered most fully implemented is:

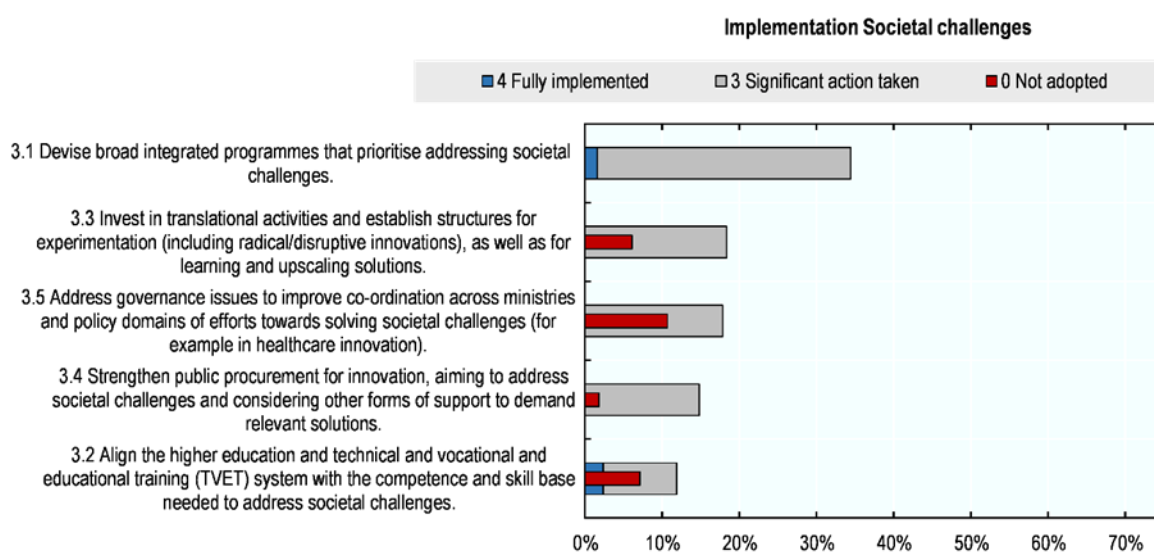
- ‘3.1* Devise broad integrated programs that Prioritise addressing societal challenges’ It received however only 34% of ratings ‘Significant action taken’ and ‘Fully implemented’.

It is followed (with almost halved percentages) by:

- 3.5 Address governance issues to improve co-ordination across ministries and policy domains of efforts towards solving societal challenges (for example in healthcare innovation).
- 3.3 Invest in translational activities and establish structures for experimentation (including radical/disruptive innovations), as well as for learning and upscaling solutions.

The recommendation 3.5 is also considered as ‘not adopted’ at all by more than 10% of the respondents.

Figure 5.1. Assessment of the level of implementation of 'Tackling major societal challenges' recommendations produced in the 2017 Norway Review



Source: OECD Survey

5.2.2. Implementation actions

Again, the OECD collected information on what implementation/ or contextually relevant actions were undertaken in relation to OECD 2017 Review recommendations related to 'Tackling major societal challenges' via the survey to the broader innovation community as well as through a data intake via a template sent to agencies. These actions have been synthesised in Table 5.2.

Table 5.2. Actions taken to implement 'Tackling major societal challenges' recommendations

Recommendation	Actions
3.1 Devise broad integrated programs that prioritise addressing societal challenges.	<ul style="list-style-type: none"> • Funding reorientation: The Green Platform program has reoriented funding towards identified Priorities. • Portfolio management approach: RCN has introduced portfolio management, in lieu of programs, to better understand and, thus, allocate funding for the range of projects related to particular strategic objectives, enabling more coherent work toward societal challenges. • Jointly administered programs: The new "Green Platform" (jointly administered by RCN, Siva, and Innovation Norway) and a continuation, and modest strengthening of the FME program administered by RCN aims to support large-scale R&D and innovation projects that coordinate joint actions along the whole innovation chain from upstream research to business development, commercialisation and scaling of green transition processes, products and services. Five ministries participate in it and three agencies complement each other and coordinate their funding instruments towards the common goals. • National action plans and the use of high-level strategic frameworks: The development of the national action plans, such as the 21 programs, engage the entire value chain in addressing identified challenges. Additionally, the use of Horizon 2020 strategic frameworks in RCN activity has helped to coalesce commitment and funding around particular objectives.
3.2 Align the higher education and technical, vocational, and educational training (TVET) system with the competence and skill base needed to address societal challenges.	In the figure there is partly full adoption, partly not adopted at all and partly significant action taken. Why there is no entry here?
3.3 Invest in translational activities and establish structures for experimentation (including radical/disruptive innovations), as well as for learning and upscaling solutions.	<ul style="list-style-type: none"> • Building agencies' experimentation practice: RCN and Innovation Norway are developing structures and working practices for more experimentation (including radical/disruptive innovations), as well as for learning and upscaling solutions to foster radical innovation and cross and trans-disciplinary research.
3.4 Strengthen public procurement for innovation, aiming to address societal challenges and considering other forms of support to demand relevant solutions.	<ul style="list-style-type: none"> • New procurement schemes: RCN introduced a new funding scheme for pre-commercial procurement in 2019 to better support demand relevant innovation within a wide range of challenges. Additionally, Innovation Norway's continues to develop its Public-Private Innovation Partnership Procurement program (PPIP), which has been evaluated positively in 2019. Furthermore, the PPIP calls for proposal was coordinated with RCN's Pre-Commercial Procurement Program in 2019. • New partnership schemes: Innovation Norway introduced in 2017 the Innovation Partnerships ('Innovasjonspartnerskap') to use innovative public procurement as a tool for systemic innovation in the public sector, as well as market creation and closer cooperation between innovative companies and the public sector.
3.5 Address governance issues to improve co-ordination across ministries and policy domains of efforts towards solving societal challenges (for example in healthcare innovation).	<ul style="list-style-type: none"> • Increased cooperation within existing governance structures: Agencies have made efforts to increase cooperation within the existing structures by using common objectives and forms of coordination in specific areas. • New institute strategies: In 2020, the Government developed the Strategi for en helhetlig instituttpolitikk (Strategy for an holistic institute policy) a strategy for the institute sector to integrate historically fragmented institute policies, including a common follow-up arena to cohere reporting of key numbers and figures, research, establishment of meeting places and long-term follow up of scientific quality.

Source: OECD data collection template

The major enablers and barriers to implementation of actions related to the 'Tackling major societal challenges' recommendations survey respondents and interview participants reflected upon are outlined in Box 5.1. Again, there is a clear emphasis on the usefulness of effective collaboration, the positive effect of research

internationalisation as well as the issues Norway faces when it comes to procurement, narrow research remits, and lack of incentive structures.

Box 5.1. Major enablers and barriers to implementation of actions related to 'Tackling major societal challenges'

Main enablers

1. **Shared focus:** The ability of national frameworks or strategies to focus attention on key issues in research and innovation was welcomed.
2. **New collaboration structures:** Beyond funding mechanisms, initiatives that explicitly draw together different actors (such as university-municipality collaborations, like those in Trondheim and Oslo) was appreciated as useful to cross-border innovation.
3. **Increased participation in EU framework programmes:** Increased participation in these programmes has invigorated discourse about the potential of a mission-oriented approach in the Norwegian context.

Main barriers

1. **Unsystematic use of new procurement approaches:** While new procurement approaches have been welcomed, the full and effective implementation of 3.4 'Strengthen public procurement for innovation,' relies on changing the practices around how procurement is used. Some consternation has been expressed regarding the unevenness of the use of new approaches.
2. **Narrow focus:** With regard to the implementation of 3.5 'Address governance issues to improve co-ordination', concerns were expressed about how some sectors retain a narrow focus, continuing to focus on their specialisation and basic research rather than broader societal challenges, suggesting that strategic intent is not sufficiently backed with incentives.
3. **Lack of effective incentive structure to sustain critical mass:** The development of certain competencies and critical mass in areas such as the green transition requires the right kind of incentives to induce people to seek the relevant forms of education and find employment after. There is the perception that these goals are not adequately supported with an effective incentive structure, making them hard to fully realise.

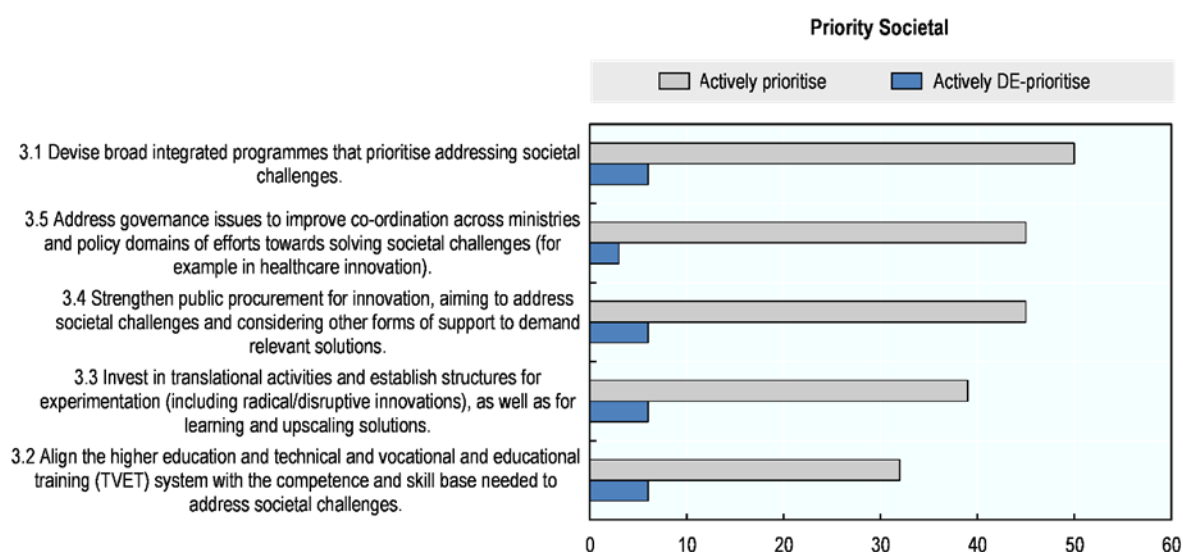
Source: OECD Survey

5.2.3. Priority actions

Two of the recommendations that receive the highest number of 'priority votes' are related to mission-oriented policies (broad integrated challenge-led programs; challenge-led collaboration across policy silos). The three recommendations that are considered high priority by more than 45 respondents are:

- 3.1 Devise broad integrated programs that prioritise addressing societal challenges;
- 3.5 Address governance issues to improve co-ordination across ministries and policy domains of efforts towards solving societal challenges (for example in healthcare innovation);
- 3.4 Strengthen public procurement for innovation, aiming to address societal challenges and considering other forms of support to demand relevant solutions.

Figure 5.2. Respondents' suggestions to Prioritise or de-Prioritise 'Tackling major societal challenges' recommendations



Source: OECD Survey

5.3. What changes to the context have occurred or what issues have arisen from 2017 to now?

5.3.1. A growing strategic emphasis on societal challenges

As noted in introduction, all actors the OECD met during this study agree that the increase of the level of priorities of societal challenges has been the most significant change since 2017 and that system transformation is needed to address them. This evolution is clearly reflected in new regulations and strategies, overall and in specific areas. An important milestone in Norway's effort to support sustainable transitions was the 2017 Climate Change Act, which sets by law the national emission reduction targets for 2030 and 2050. In 2021, the Climate Action Plan was launched to coordinate the policy measures to fulfil these objectives.

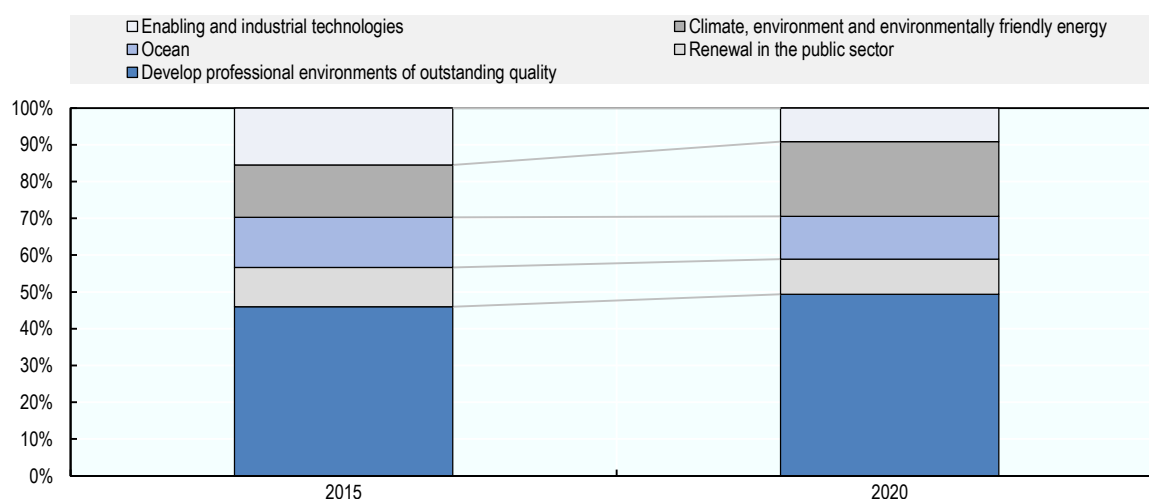
Specifically in the energy area, the White Paper 'Putting Energy for work—long-term value creation from Norwegian energy resources' (Report. St. 36 - 2020–2021) is an important document to present the main transition pathway: renewable energy and new grid technologies are expected to play an essential role to respond to the increasing demand for electrification and the phasing out of fossil energy. On the business and stakeholder side, the climate imperative is increasingly acknowledged by 21 platforms, as evidenced by the OG21 Strategy presented at the OG21 forum in November 2021. Although the platform, for reasons that can be easily understood, does not call for moving away from oil and gas, its new strategy, aims not only at strengthening the Norwegian competitive position but also puts a lot of emphasis on how the Norwegian petroleum industry can participate in the energy transition by decarbonising the whole O&G value chain (hence not only the extraction but also the upstream and downstream activities) and developing new skills that are important for the petroleum industry and other low carbon energy industries. Similarly, the New Energi 21 Strategy in 2018

focuses on the ‘research, development, demonstration and commercialisation of new climate-friendly energy technology’.

5.3.2. A shift in research and innovation funding

This strategic change has translated into new or repurposed programmes and, more generally, a shift in research and innovation funding towards these challenges. The LTP priority on climate and environment is the only priority that has increased its funding share between 2015 (14%) and 2020 (20%) (See Figure 5.3). R&D in this area has increased more rapidly than the total Norwegian R&D in the period 2015–19. In particular, climate research and energy efficiency have experienced high growth, while petroleum-oriented and maritime research, on the other hand, has experienced a real decline (NIFU, 2021_[16]). This echoes the statement heard during the interviews and confirmed in the survey that ‘the transition has already started’.

Figure 5.3. Allocation of RCN funding per area of the LTP, 2015 and 2020



Source: RCN data, last accessed on 25 February 2022

<https://www.forskingsradet.no/contentassets/cf81b3616f9d450a932ddc28c676db38/tall-for-2020.xlsx>
and <https://www.forskingsradet.no/contentassets/cf81b3616f9d450a932ddc28c676db38/forskingsradet-i-tall-2015---tabeller-og-figurer.xlsx>

Note: the figure does not include the new LTP priorities introduced after the first revision of the plan.

Although it is more difficult to measure, other agencies are also allocating more funding to research and innovation activities that aim to address societal challenges. Innovation policy in Norway has traditionally been neutral (SØA, 2019_[17]), and its official mission is still formulated in generic terms.³¹ However, interviews suggest that this policy area as well is now increasingly open to more ‘directional’ and challenge-oriented interventions, in particular to provide solutions for the green transformation of the economy. Given the weight of MTIF in terms of business innovation support, this important trend can open new opportunities for more pro-active strategic, if not mission-oriented, policies addressing the challenge of greenhouse gas reduction. This change was already underway in 2017 but is said to have increased during the period. In 2015, MTIF and Innovation Norway had led the launch of the ‘Dream Commitment’, a wide-range collective brainstorming initiative, where one of the recommendations was to build national teams in areas where Norway has an international comparative advantage.

Innovation Norway had identified six ‘opportunity areas’ for Norway, several of them being related to broad societal challenges (Clean Energy, Ocean Space, Bio-economy etc.).

Innovation Norway reports that 51% of the grants it awarded in 2019 went to projects that have a defined environmental effect of an increase of 2% compared to the previous year.³² It has also launched innovative initiatives such as the Explorer (a showcase for green solutions) and Innovation Partnerships (public-private collaborations to develop new solutions to major social challenges, using public procurement for innovation).³³

This trend is even clearer in the case of ENOVA. While this agency was still in 2017 aiming to support energy efficiency, its mission is now focused on supporting climate technology. As for SIVA, it has released in 2021 its strategy on green industry and sustainability and these issues have gained more importance in the provision of support to companies and clusters.

However, some concerns were also expressed. In particular, some interlocutors stressed that while the reorientation toward societal challenges is indeed occurring, the underpinning system remains unchanged for the most part. They notably pointed to the governance structure (still fragmented among policy areas) and the incentive and evaluation structure (too focused on scientific excellence). Notably, the current governance and incentive structures (at various levels of the system, including universities’ disciplinary structures) do not promote transdisciplinary research, which is essential to contribute to societal challenges (OECD, 2020^[18]).

5.3.3. Mission-oriented policy

The OECD study on mission-oriented innovation policy in Norway released in 2021 identified some novel initiatives that adopted a mission-oriented policy approach (Larrue, 2021^[19]). More precisely, the study showed that Norway has implemented one of the four types of mission-oriented, namely the ‘Challenge-led research and innovation schemes’ (Table 5.3). Pilot-E was the first one and has been evaluated positively. It funds larger consortia (including academia, industry and potential users) throughout the different stages of the innovation chain, drawing upon policy instruments of RCN, IN and ENOVA, including public procurements. This type of focused mission-oriented innovation policy, led by agencies, proves particularly effective to ‘accelerate’ the development of environmentally friendly transport and energy solutions from idea to market.

Other types of mission-oriented policies, such as the ‘Overarching mission-oriented strategic frameworks’ implemented in the Netherlands, Germany, or Japan, are led by central policy bodies and/or ministries. This higher level of governance enables them to tackle broader systemic, and therefore possibly more transformative, challenges. They engage a wider portion of the national innovation system relevant to a given, collectively chosen, mission.

Table 5.3. The four types of mission-oriented innovation policy

Type	Basic Principles	Examples
Overarching mission-oriented strategic frameworks	Broad missions set up at the highest level of policymaking (ministries or center of government). They coordinate actions among a wide array of public and private actors toward missions with concrete and ambitious targets.	<ul style="list-style-type: none"> • Horizon Europe's missions (EU) • Mission-driven Top sector and Innovation Policy (NL) • High Tech Strategy 2025's missions (DE) • Moonshot R&D Program (JP)
Challenge-led research and innovation schemes and agencies	Competitive schemes focused on specific and ambitious problems. One or several agencies bring together their instrument portfolio to cover in an 'as integrated as possible' way commonly selected consortia throughout the different stages of the innovation chain. Often inspired by Defense Advanced Research Projects Agency (DARPA) practices (strong Project Manager; portfolio management, use of public procurement; stage-gate approach, etc.). Some newly created 'breakthrough agencies' also come close to this model.	<ul style="list-style-type: none"> • Pilot-E and Green Platform (NO) • Industrial Strategy Challenge Funds (UK) • ARPA-E (US) • Science Foundation Ireland's Innovative Prize (IE)
Thematic mission-oriented programs	Traditional strategic R&D programs reformed to improve their orientation and coordination to conduct interdisciplinary and intersectoral research and innovation activities in priority or 'challenge' areas	<ul style="list-style-type: none"> • Mobility of the Future (AT) • Building of Tomorrow/Cities of the Future (AT) • Programme Prioritaire de Recherche (FR)
Ecosystem-based mission programs	Programs intend to allow stronger directionality and legitimacy by delegating responsibilities related to strategic orientation to relevant community (or ecosystems) of stakeholders in priority or emerging areas. Usually function in two stages: i) support to the structuration of ecosystems and development of strategic agendas; ii) support to the implementation of the strategic agendas of the selected ecosystems	<ul style="list-style-type: none"> • Strategic Innovation Programs (SE) • Growth Engines (FI)^o • Green Missions (DK)

Source: (Larrue, 2021^[20])

At this still early stage of development of this new policy approach, most countries have preferably set up one type of mission-oriented innovation policy, the one that is better suited to the specificities of their national institutional setting. In Norway for instance, given the strong role of agencies in the national STI system, the absence of a high-level coordination body and the need to overcome the 'sector principle', the option of a cross-agency scheme seemed the most relevant and effective option.

However, this should not be taken as an evidence that these different types are mutually exclusive. They can be complementary insofar as they address different types of challenges (in particular, more or less focused and technological, or systemic and transformative) and can benefit each other's (for example, well-structured ecosystems with clear agendas can better contribute to national missions or submit projects to challenge-led schemes). Several countries that started with one type are now reflecting on the possibility of experimenting with other types.

Against this backdrop, there are discussions in Norway regarding the opportunity of setting-up overarching national missions, in addition to the challenge-led schemes already in place at agency level. Both the 2021 OECD study on MOIP in Norway as well as a RCN International Advisory Board (IAB) note recommended that Norway experiment with a pilot national mission. This 'mission-01' could be, according to the IAB, related to climate change, targeting decarbonisation of industrial activities and/or transport, such as carbon capture, utilization and storage, low-emission maritime transport, or offshore wind power (Research Council Norway, 2020^[21]).

More generally, national missions could be a first a national experiment regarding a wider and more intense STI coordination in priority areas, with more stakeholder

engagement, stronger political backing and dedicated holistic structures of governance covering a large portion of the STI system in order to address more transformative and long-term challenges. This approach could therefore possibly pave the way towards a stronger governance in LTP priority areas or even towards a high-level coordinating committee to coordinate the entire STI system. As discussions become more precise in the context of the LTP revision, key questions arise as to where to anchor national missions, both strategically and institutionally, how to finance them, what should be their scope, and how to connect them to EU Horizon Europe missions. These questions need to be addressed as part of a discussion involving different public and private actors who each take an equal role in a systematic review of different options. Some options for consideration for such a proposed discussion are presented below.

5.4. What specific options for change should a revision of the LTP consider?

5.4.1. Options for change 4.1: Collectively design and implement national missions

Norway could consider the different ways of anchoring strategically the national mission(s).

Norway could set up national missions in complement to its current challenge-led mission oriented schemes such as Pilot-E. These national missions would be located at a higher level in the STI system and would encompass not only the technological and industrial dimensions but also, in a more systemic way, other dimensions such as the associated skill development, regulatory changes and the demand. This is consistent with the latest OECD Environmental Performance Review of Norway that stresses that although Norway invests heavily in the development of new technologies to support its green transition, technical solutions alone will not be sufficient to deal with climate change issues. It calls on Norway to consider for its green transition also behavioural changes and adjustment to consumption patterns (OECD, 2022^[22]).

One option is to 'host' the national mission within the LTP thematic priorities, with dedicated funding enshrined in the escalation plan. This option would present some advantages for both the mission initiative and the LTP Priorities. It would provide:

- A strong orientation to a wide set of research and research-based innovation activities and would provide them clearer prospects for markets and usage.
- Missions with a strong multiannual funding framework and high-level political backing
- An 'integrative device' that would tie together the escalation plan and a large portion of the LTP goals and Priorities

This option would also face some challenges. First, there could be a mismatch between scope of the mission and that of the LTP. Despite the initial intentions and especially when considering not just the document itself but its sphere of policy influence, the scope of the LTP is still limited for the most part to research and research-based innovation. The best option would be a national mission, program in a wide scoping LTP, covering research, research-based innovation, and business innovation (and the linkages between all these and higher education and lifelong learning). However, this would require significant changes regarding the leadership and coordination of the LTP. Against this backdrop, two main risks of having a national mission in the LTP emerge: (i) misalignment between scope and budgetary envelope; and (ii) limit the scope of the mission.

Missions might be broader than the LTP 'area of budgetary influence', which might result in reduction of the budget available for research and research-based innovation since some LTP related research funding would be dedicated to non-research activities. Similar concerns have been raised by the scientific community regarding the inclusion of the five EU missions within the Framework program. To avoid this, other ministries concerned by the mission would need to contribute to the mission as part of the LTP.

Hosting a "mission" within a LTP could narrow the scope of the mission to the science and technology dimension, hence dramatically reducing the range and chance of success of potential solutions. A 'research mission' on climate change, for instance, would not address the market and behavioural dimensions that are key to the necessary socio-technical transition toward 'Net Zero'.

Other options, more exploratory at this stage, would be to use the 21-strategies (such as Energy21). Some of them could gather around a common challenge to develop a national mission, with support from public authorities that would be described in a 'super-21 strategy' document, with a dedicated roadmap. One strong point of this option is the stronger buy-in of industrial actors. Finally, the national mission could also be presented in a dedicated whole-of-government white paper.

The overall principles of mission-orientation are now well established in the literature (Larrue, 2021; (Lindner et al., 2021_[23]). Let us just stress that it will be particularly important to ensure that these missions are truly intersectoral and interdisciplinary, addressing complex societal challenges that cannot be tackled through simpler interventions. This is a key condition of the 'additionality' of this policy approach, which also involve additional transaction and management costs. It is also important in order to minimise the risks of capture by specific sectors. To that effect, the identification of topics on which missions should focus should be open to a transparent process with broad representation.

Norway could consider the different ways of anchoring institutionally the national mission(s)

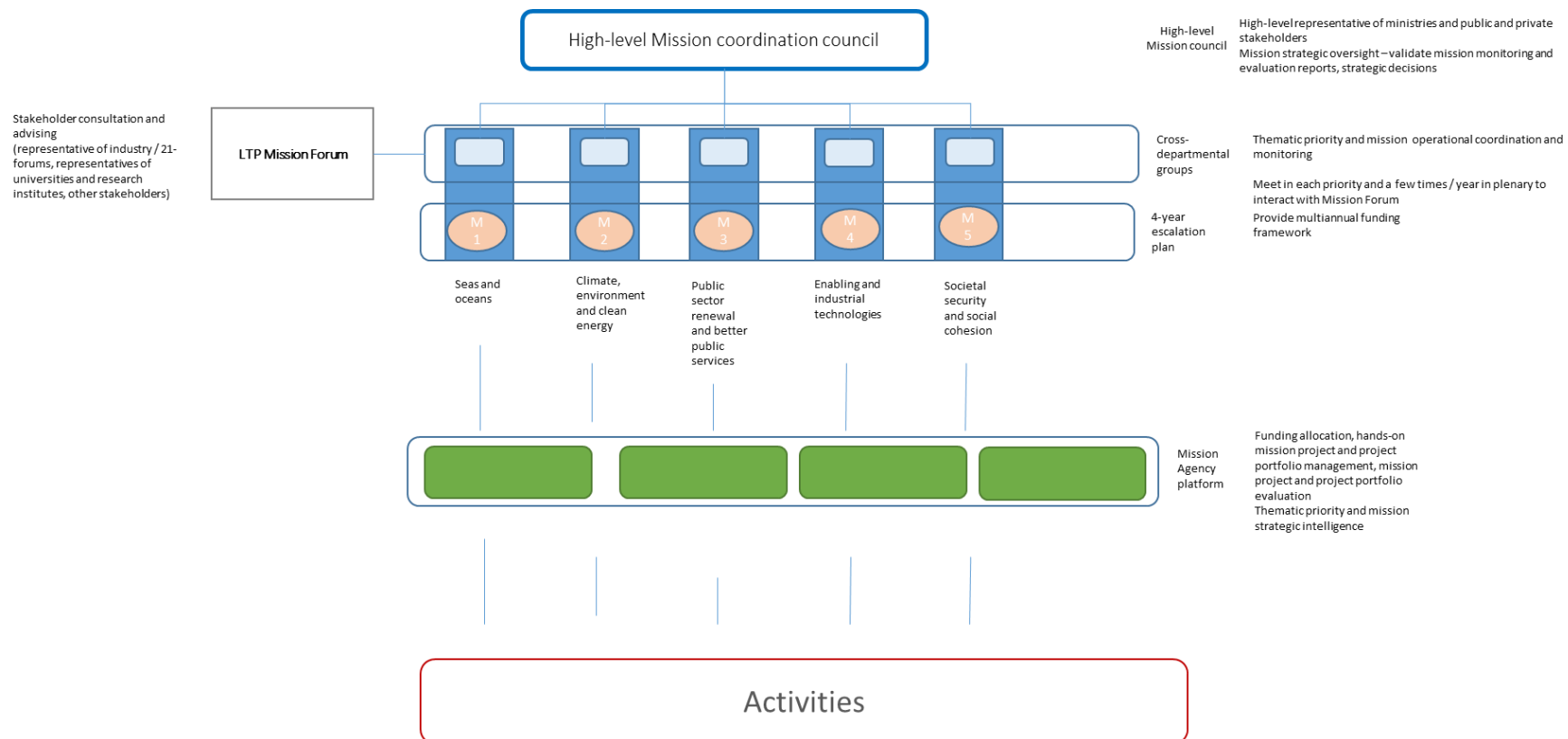
Drawing on international examples several options can be envisaged. The mission could be led by:

- **A centre-of-government body.** For instance, the Prime Minister's office directly, the Cabinet Office, and could be attached to a high-level committee (like the Moon-shot Program in Japan, led by the CSTI, headed by the Prime Minister, and supported by a powerful Cabinet Office). However, this option appears unlikely in Norway, since the Prime Minister office is limited in size and capacity and ministers have a strong decision-making power.
- **MER with a stronger coordination role.** This is the case in Korea where the powerful Innovation Office within MSIT is tasked with coordination of all STI plans that are submitted every year for its review and approval. While MER also has a soft coordination role, this role is limited to research and higher education. Its convening and convincing power would be far more limited beyond this scope.
- **MTIF** could also be an option. One advantage is that the 'sector principle' is less strong in innovation policy than in research policy and that MTIF controls many of the policy and regulatory instruments that would be key to the achievement of the mission.

- **A large mission-oriented cross-ministerial program.** To some extent, RCN strategic R&D programs are a form of these. They are derived from the grouping of consistent demands from different ministries and funded by these ministries. However, although these programs require some discussions between ministries to align their demands and agree on common objectives, the coordination remains mainly indirect, via RCN. A program directly supervised by ministries in a dedicated governance body and delegated to agencies could be an option, but will partly depend on political issues related to the nature of the on-going coalition.
- **A dedicated agency** with staff originating from different agencies, but this is a costly option in resources and time. It is also less relevant with the current priority to streamline the agency landscape. Furthermore, these mission-oriented agencies are usually more suited to focus technological missions, replicating some of the DARPA-like agency success stories.
- **A virtual cross-agency platform** with some dedicated management and governance bodies that would rely on the staff from the different participating agencies. It is unclear that such an option (which would basically consist of applying a structure close to the one of Pilot-E to a national mission) could work. It might lack the necessary high-level legitimacy, political backing, and visibility. The participation of different ministries and high-level stakeholders in a dedicated supervision committee to govern the platform and mission might alleviate some of these issues.
- **Some large public private partnerships/consortia** could be interesting to launch and manage some industry led missions, possibly drawing here also on the relevant 21-platforms. This would ensure strong ownership and involvement of industry, which can be problematic in Norway due to the national industry structure. This option would depend on the possibilities regarding the legal status of such an entity, and how it could be linked to (and partly funded by) public authorities.

For the sake of clarity and analysis, different options have been systematically presented above. The reality will be a mix of these different options since different levels of governance (high-level council, ministries, agencies) and components of the system (universities, research institutes, clusters, public administrations, other stakeholders, etc.) will be involved in the missions, in different capacities and serving various functions. Figure 5-4 provides an illustration of one possible overall structure of governance of the LTP missions. This should not be taken as a recommended structure but rather as a departure point for more debate on the elaboration of missions.

Figure 5-4. Indicative illustration of a possible LTP mission governance structure



Norway could ensure a stable and effective funding of the national mission(s)

Most of the options presented above would work better with an integrated budget, rather than different funding streams stemming from different ministries, which often results in the fragmentation of the mission's projects and activities. This runs the risk of replicating the ministerial siloes inside the mission, which then become (as can be seen in other countries) a large 'umbrella program' rather than an integrated mission initiative. As previously mentioned, the escalation plan could be used to earmark the budget for the first four years (renewable, subject to positive evaluation). This would present the advantage of providing an integrated binding multiannual funding and would ensure some transversal connections between the escalation plan and the thematic priorities.

Norway could carefully determine the adequate scope of the national mission(s)

This issue is one of the most difficult ones and can only be addressed through consultation and negotiations between the different actors potentially involved. A very broad mission, such as 'achieving Net Zero by 2050' allows (and requires) a more systemic approach that links together different components of a system transition. In practice, it runs the risks of dilution of the mission (confronted to the various interests of the numerous involved parties' interest), disintegration (reproduction of the vertical siloes due to the size of the initiative) and excessive transaction costs (in elaborated governance structure, with significant political and administrative turf). A narrow mission can be effective at delivering a 'local' solution to a technological issue, which has little chance of achieving significant impact and might remain 'unnoticed'. An intermediary scope – for instance some missions within the thematic priorities – might be more suited to the current Norwegian situation: a STI system that is well performing but is limited in size; experience with more focused missions until today. Such intermediary scope missions would also strengthen the ties within each priority and provide a more tangible initiative to lead and monitor for the cross-departmental groups (see below) in each priorities.

Norway could link Norwegian missions to EU mission, while keeping their national specificities

The EU missions and national missions should benefit each other, while remaining distinct so that they best correspond to the national comparative advantages and aspirations. Although the EU Mission Implementation Plans have been released, there is still significant uncertainty on what these missions will actually consist of and how they will be implemented. Committing strong efforts in these conditions is therefore difficult and risky. At the same time, it is clear that a 'wait-and-see' strategy would certainly prove highly detrimental to later participation in EU missions. This typical dilemma of 'missing the boat – sinking the boat' deserves careful attention and a gradual strategy. It is essential to strike a sound balance of engagement and flexibility. Several countries have started more or less formal initiatives to create or mobilise networks in relevant areas. Austria is an example of a country that has chosen a voluntary approach to participate in the EU mission co-creation, building on enhanced coordination among national institutions and with EU missions. In Norway, teams of ministries and agencies (and for some of them some stakeholders also) have been established for each EU mission. They are under the umbrella of a dedicated EU mission task force. Based on the international examples, necessary actions should be taken in three complementary dimensions:

- Policy coordination – sharing information and aligning plans of the different policy bodies when relevant to the EU missions;
- Network building in relevant areas – raising awareness-raising, creating channels of interaction for exchanging information on EU missions and relevant national initiatives, mobilising actors around common initiatives; and
- Strategic intelligence – collecting, integrating and analysing dispersed information on missions.

5.4.2. Options for change 4.2: Keep on developing and improving challenge-led mission-oriented schemes

Challenge-led mission-oriented schemes have been implemented in Norway since the launch of Pilot-E in 2016. The lessons learned from this first cross-agency initiative have been leveraged in other ‘Pilot X schemes’ (Pilot-T, Health Pilot, the Bio-economy Initiative) and recently in a wider endeavour (the Green Platform).

Norway could continue to mainstream challenge-led mission-oriented schemes where relevant and improve them as necessary

In particular, efforts to improve these initiatives should aim to:

- Make them function more seamlessly. How could the respective processes (in particular the reporting) and information systems of the three agencies be made more consistent and, where possible, integrated? This might require the development of a dedicated new instrument, rather than relying on the instruments of the participating agencies, as it is currently the case. The disparities in processes and information systems of the partner agencies create significant transaction costs.
- Better integrate their instrument portfolio, in particular the supply-side instruments and the initiatives to support the adoption and commercialisation (regulation and public procurement). While such integration is occurring in Pilot-E for instance (with the use of public procurement for innovation), there is stillroom for improvement. This seems particularly true for the Green Platform Initiative, given its broader scope, which makes its connection with any of the potential markets more difficult than in the case of a narrower challenge or area-based scheme. In any case, the linkages to scale up support instruments are essential to ensure that the developed solution does not remain an isolated venture.

Chapter 6. Improving the governance of the STI system

6.1. Is the diagnostic established in 2017 still relevant in 2021/22?

6.1.1. Relevance of the 2017 SWOT

The SWOTs related to 'Improving the governance of the STI system' that respondents rated relevant or very relevant are outlined in Table 6.1.

Table 6.1. Relevance assessment of SWOTs related to 'Improving the governance of the STI system'

Strengths	Weaknesses	Opportunities	Threats
5. A rather simple institutional landscape, with strong funding actors, Research Council of Norway (RCN) as a central actor (4/10)	12. Limited capacity of the government sector to support strong STI Priorities (5/11)	4. Revision of the Long-Term Plan (wider scope integrating higher education; more precise investment and action plans) (3/5)	-
-	-	5. Improved cross-ministry and cross-agency co-ordination in new 'mission-oriented' policy mechanisms (5/5)	-

Source: OECD Survey

Notes: *>75% of Very relevant and Relevant; the figure between brackets indicate the rank of this item out of the SWOTs the respondents were asked to assess. For instance, a strength with the rank (2/10) is the second most relevant strengths out of the 10 strengths that were proposed to respondents.

6.2. Have the 2017 recommendations been implemented and how?

6.2.1. The extent of implementation

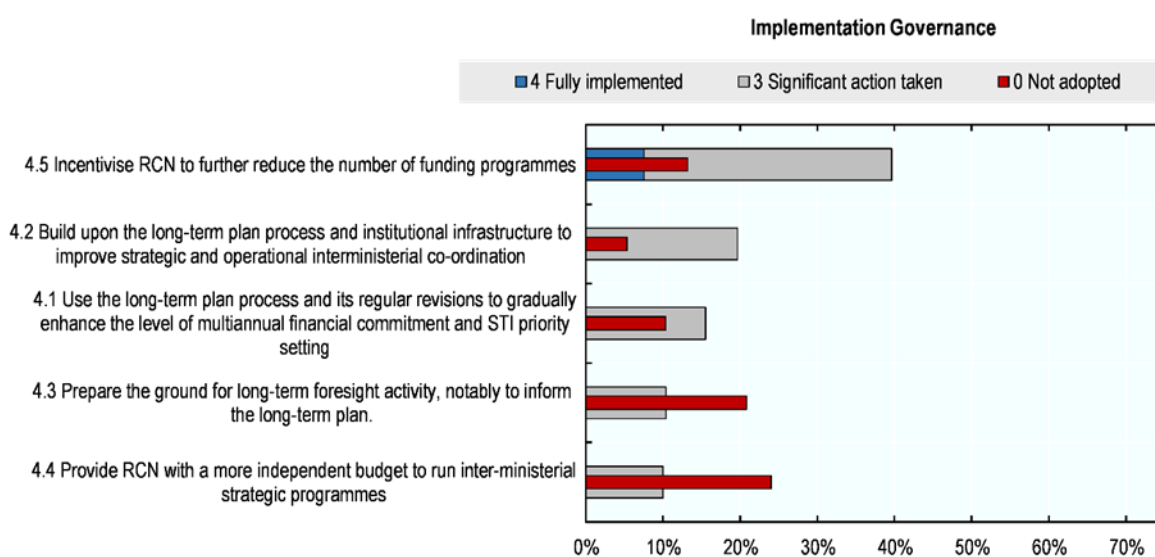
The level of implementation of recommendations in this area is also considered rather low. The only recommendations that 40% of respondents rate as having had '3 significant action taken' or '4 fully implemented' are:

- 4.5* Incentivise RCN to further reduce the number of funding programs
- 4.2 Build upon the long-term plan process and institutional infrastructure to improve strategic and operational inter-ministerial co-ordination

Two recommendations are considered as not adopted at all by more than 20% of the respondents:

- 4.4 Provide RCN with a more independent budget to run inter-ministerial strategic programs
- 4.3 Prepare the ground for long-term foresight activity, notably to inform the long-term plan.

Figure 6.1. Assessment of the level of implementation of 'Improving the governance of the Norwegian national system of innovation' recommendations produced in the 2017 Norway Review



Source: OECD Survey

6.2.2. Implementation actions

Finally, are the implementation/ or contextually relevant actions that respondents and participants shared via the survey to the broader innovation community as well as through a data intake via a template sent to agencies. These actions have been synthesised in Table 6.2.

Table 6.2. Actions taken to implement 'Improving the governance of the Norwegian national system of innovation' recommendations

Recommendation	Actions
4.1 Use the LTP process and its regular revisions to gradually enhance the level of multiannual financial commitment and STI priority setting	
4.2 Build upon the LTP process and institutional infrastructure to improve strategic and operational interministerial co-ordination	<ul style="list-style-type: none"> • Requisite ministerial interaction: The LTP process has compelled ministries to interact during the production and implementation phases in ways they historically had not and to create (at least temporary) structures to do so. • Ad hoc multi-actor meetings: In addition to new inter-ministerial interaction, as mentioned above, there are also meetings both ministries and agencies attend (such as MER and NFD meeting RCN and other actors to discuss innovation and commercialisation).
4.3 Prepare the ground for long-term foresight activity	<ul style="list-style-type: none"> • Introduction of targeted foresight projects: RCN has performed targeted foresight projects in connection with revisions of the LTP, resulting in ad hoc reports. • Incorporation of foresight into strategy setting: Roadmaps associated with the various 21-strategies draw upon foresight.
4.4 Provide RCN with a more independent budget to run inter-ministerial strategic programs	
4.5 Incentivise RCN to further reduce the number of funding programs	<ul style="list-style-type: none"> • Portfolio management approach: As previously stated elsewhere in this document, RCN has introduced portfolio management, in lieu of programs. In effect, this has meant the creation of 15 portfolio boards to replace more than 50 program boards and other allocating bodies, thus setting in motion changes to organisational structure as well as changes to the conducting of calls for proposals and assessment arenas and changes. This has achieved cost reduction through simplification, standardisation, and digitalisation. Applicants now have fewer packages to address and, in effect, this has resulted in a de-facto de-coupling of funding from ministries, in that ministries no longer have their 'own' separate programs.

Respondents and interviewees reflected on the major enablers and barriers to implementation of actions related to the 'Improving the governance of the STI system' recommendations, canvassing themes such as stakeholder willingness on the enabling side and lack of ongoing structures and processes on the barrier side. Their reflections were synthesised and outlined in Box 6.1.

Box 6.1. Major enablers and barriers to implementation of actions related to 'Improving the governance of the STI system'

Main enablers

1. **Stakeholder dialogue:** There is goodwill and a willingness on the part of disparate actors to engage in the LTP development process; momentum and goodwill can be better leveraged to build more dynamism into strategic and operational interministerial co-ordination processes and practices.

Main barriers

1. **Lack of ongoing structures to sustain multi-actor planning:** While an ad-hoc interdepartmental group has been created to develop the LTP, and monitor its first implementation, it has not met after these phases and has little incentive given the sense of sectoral competition for funding that exists for ministries after.
2. **Lack of a concomitant budgeting process to support new portfolio approach:** While the new portfolio approach of RCN does indeed implement the recommendation to reduce the number of programs, the full and effective implementation of this recommendation would require a concomitant budgeting process to support the coordination of budgeting across multiple portfolio boards, encompassing a greater number of dimensions than today's programs and activities. Such an approach could provide greater flexibility in the dialogue with ministries.

Source: OECD Survey

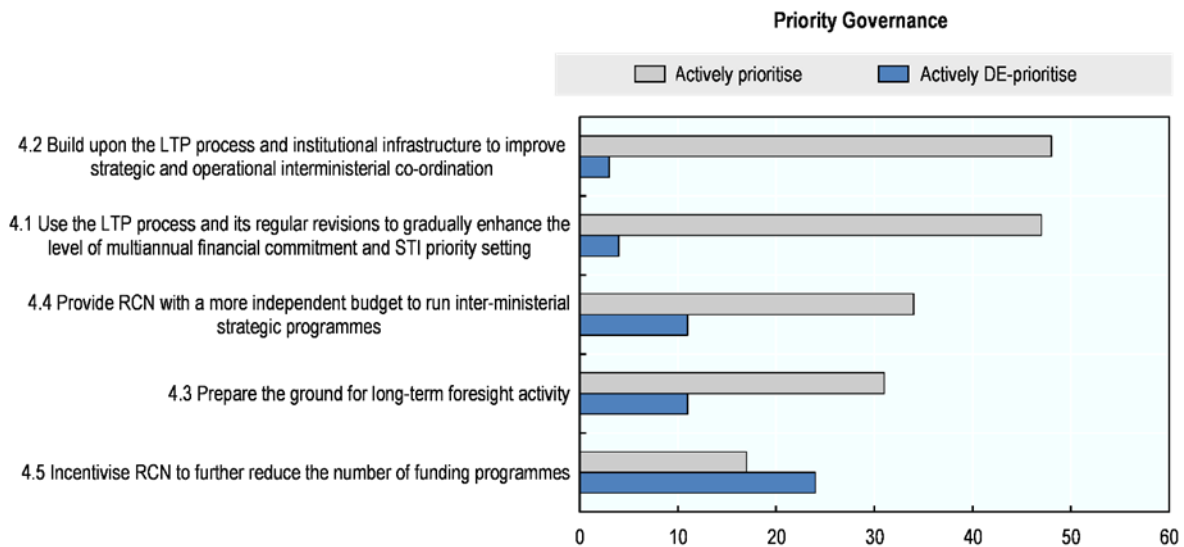
6.2.3. Priority actions

More than 50 respondents consider the use of the LTP to improve the governance of the STI system (for its both orientation and coordination). The increase of funding with a longer-term horizon should be linked to the LTP and its regular revisions. The two recommendations that are considered high priority by more than 45 respondents are:

- 4.2 Build upon the LTP process and institutional infrastructure to improve strategic and operational inter-ministerial co-ordination
- 4.1 Use the LTP process and its regular revisions to gradually enhance the level of multiannual financial commitment and STI priority setting

The structural reforms – here the reduction of RCN programs – are again among the policy actions that respondents think should be deprioritised.

Figure 6.2. Respondents' suggestions to Prioritise or de-Prioritise 'Improving the governance of the Norwegian national system of innovation' recommendations



Source: OECD Survey

6.3. What changes to the context have occurred or what issues have arisen from 2017 to now?

6.3.1. An increase of interministerial coordination

The rising pressure of societal challenges, which systemic nature calls for interventions that cut across policy siloes, has resulted in more holistic policymaking. These trends have been reinforced after the outbreak of the COVID crisis which, in Norway like in many other countries, have been compelled to work together in emergency mode (OECD, 2020^[24]). The mission-oriented 'Pilot X' schemes are specific examples of this new approach to policy making. Building on these cross-agency endeavours, the Green Platform Initiative is financed by MTIF (NOK 1 billion for the period 2020–2022) but involves 5 ministries and 4 agencies. It is a broad and open call for large, coordinated R&D and innovation projects that aim to contribute to research and innovation activities that can contribute to Norway's 'green transformation'.

Interministerial coordination is now more pervasive in government action and other less visible initiatives rely on this approach. HEILO for instance is a partnership between RCN and ENOVA to support hydrogen solutions. These initiatives offer quasi one-stop-shop to stakeholders that seek the right public support for their specific needs. There are also several examples of joint calls between agencies. Finally there also a range of cooperation efforts between agencies that do not involve joint funding. For instance, IN and ENOVA share capacity in some instances (for strategic intelligence, information sharing, expertise in project selection and evaluation) but without joint funding. A new cooperation between IN and RCN is being discussed around the concept of 'zero emission coastlines', with involvement of local authorities.

Finally, although it needs to be confirmed in the years to come, this trend seems to extend beyond formal programs and schemes. A more holistic perspective is progressively embedded in some institutions' structures and actors' routines. This manifests itself in the use of portfolio strategies (at RCN especially, but also at

Innovation Norway), more interdisciplinary (including Social Science and Humanities, SSH) and intersectoral practices (for instance within and in between 21-platforms). Other examples abound in areas such as health area, where relevant authorities and stakeholders work to establish a one-stop-shop to access health data from Norwegian public sector, or in climate change to develop common strategic policy intelligence (classification, statistics, etc.) to be able to better monitor progress and gaps.

While these initiatives have seen some growth, they are not without significant resistance and barriers. A main example of which is the highly sectorised policy structure. The OECD did not conduct an interview or a workshop free from reference to the 'sector principle', enshrined in the Constitution and in policy makers' minds. This principle that enables Norway to embed and anchor public support to research and innovation in currently 15 ministries becomes an hindrance when it comes to addressing complex and systemic societal challenges, like issues related to climate change, health, or welfare. The intent is not to suppress or even weaken this principle but to work with it, establishing mechanisms and institutions to 'connect the dots' beyond the disciplines, sectors, and administrative siloes.

6.3.2. The respective role and capabilities of RCN and ministries

As it was first described in the 2012 evaluation of RCN by Technopolis, and then further developed in the 2017 OECD Review, RCN plays a very important coordination role for research and research-based innovation. It strives to integrate the demands of about 15 ministries formulated annually into a limited number of programmes that respond to all ministries' knowledge needs while remaining consistent. Furthermore, RCN plays the role of strategic adviser and supporter to the ministries (first of all MER) for research-related strategic intelligence.^{xxxiv}

Interestingly, several interviewees claimed that this may have caused a certain loss of competencies in ministries and an over reliance on the RCN. If confirmed, this is important to bear in mind when launching national missions. These initiatives require strong resources and capabilities in ministries (and possibly in central administrations), as discussed in the relevant literature.^{xxxv}

6.3.3. The Long-term plan priorities

The first revision of the LTP brought some changes to the structure and content of this strategic document. In line with a proposal included in the OECD 2017 Review, two former thematic priorities ('Innovative and adaptable industry' and 'World-leading academic groups') that overlapped with the overall objectives 'Enhanced competitiveness and innovation capacity' and 'Developing academic communities of outstanding quality' have been incorporated in the latter. This has increased the clarity of the LTP priorities.

Furthermore, a new priority has been added 'Societal security and social cohesion in a globalised world' and the priority 'Enabling technologies' has been renamed 'Enabling and industrial technologies' for the sake of clarity.

Last but not least, the provision of higher education, which was largely absent in the first edition, was more prominent in the second edition. One of the three main initiatives in the escalation plan related to 'enhanced quality in higher education'.

However, one key matter of debate remains the scope of the LTP. Like the first edition, the LTP is still mainly covering research and research-based innovation, which broadly corresponds to RCN's remit. This does not mean that business and social innovation is not covered in the LTP – they are notably in the thematic Priorities – but that its

influence on activities beyond that scope decreases significantly. The title of the LTP (the long-term plan of higher education and research) clearly reflects 'cadastral' issues of responsibilities between ministries. The LTP is still considered as the MER/RCN strategy. As it was clearly put in one of the input provided to MER in the context of the LTP electronic consultation, the *'LTP is perceived as the Ministry of Education's tool. The plan must, to a far greater extent, become a tool for all ministries and the hub for the political discussion about priorities in competence, education and research policy'*.

MTIF and sectoral ministries cooperate actively in the revision of the LTP, but the latter remains the strategic plan of the MER. Innovation policy is, as it has been traditionally the case in Norway, primarily attached to industrial policy, not to research policy. It should be noted however that this is the case in most countries and often to a larger extent since very few countries have a research agency with such a large scope, which somewhat alleviates the ministerial siloes.

6.3.4. The effect of the LTP on funding

The effect of the LTP was also discussed during interviews. Some interviewees claimed that the plan still hesitates between setting priorities and making sure that everything that is important is covered. While the intent not to leave anyone behind is laudable, it falls short of the very essence of priority setting.

In a report to RCN, NIFU data analysis showed that the LTP priorities have not had significant effects on funding beside RCN (i.e. on Innovation Norway, Enova and SIVA interventions) (NIFU, 2021^[16]). Furthermore, the plan appears to meet its budget objectives included in the second 'escalation' plan (for renewal and restructuring in the business sector, quality in higher education and technology support), but it lacks budgets and mechanisms to follow up on the other parts of the plan, especially when related to research aimed at tackling societal challenges.

The plan is still, as discussed in the 2017 Review, assessed by policy makers as instrumental, in particular to support interministerial consensus (and take stock of divergences, which is equally important as it was put by an interlocutor) to structure the yearly budgetary negotiations and support alignment of the different positions ahead of the two budget conferences of March and October.

Another limitation of the LTP is that there is still no annual action plan (as it is for instance the case in Japan where there is a dedicated process to link the Basic S&T Plan to agency funding). Even more worrying is the fact demonstrated by NIFU that the LTP is not even mentioned in the letter of assignment of ministries (other than MER) to RCN, and its anchoring in institutions' strategy is limited.

Finally, the inter-departmental groups that were praised in the 2017 Review have faded out and are no longer active, as it is often the case for groups and committees with unclear mandate and status. These grouped had proved instrumental to coordinate and monitor ministries and agencies' interventions in each priority area. These types of coordination efforts in Norway have to face the pervasive and convincing argument that *'Norway is a small country and everybody in the STI governance system knows each other so there is no need for formal mechanisms'*. Currently, such groups are formed for the revision of the plans every four years and are disbanded when the plan is launched.

6.4. What specific options for change should a revision of the LTP consider?

6.4.1. Options for change 4.1: Improving the LTP content and process to increase its impact on STI priority-setting and holistic coordination

The 2017 Review was in no way an evaluation of the LTP content and impact. Still, this new strategic initiative was seen very positively for its influence on STI priority-setting and holistic coordination and, even more, for the opportunities it offered to continuously improve, given that its review cycle is every four years. It was also a tool to increase financial predictability during four years and provide high-level commitment to some key initiatives included in the escalation plan. After seven years of operation and as the second revision is ongoing, the LTP is still present and its priorities play a useful role to structure the annual budget negotiations but its concrete impact on the orientation of funding remains limited, in particular, outside RCN. Furthermore, its role to strengthen interministerial coordination has diminished.

In the absence of a strong Centre-of-Government STI policy bodies or a high-level strategic and/or coordination committee, it was the initial ambition of the LTP to be a whole-of-government plan that could support holistic policy making. While this report echoes the 2017 Review in arguing that this scenario is not yet the case, its second revision is a new chance to realise the initial intent.

Norway could include clearer and sharper priorities in the revised LTP

Part of the problem might find its origin in the way the Priorities are presented. The thematic priorities are in fact priority areas, which create confusion. The priorities are within each of the three overarching goals and five areas and are more clearly apparent in the second plan than in the first one. However, even these priorities remain too broad to orientate and structure action according to a vast majority of the stakeholders engaged in this OECD study. As argued by NIFU in its report to RCN, the complex priority structure of the LTP as it currently stands in its first two versions make it ill suited to be used as a governance tool.

Some key actions related to the thematic priorities could also be reflected in the escalation plan. This would make these thematic priorities less 'intentional', more tangible.

Norway could take the opportunity of the LTP revision to collectively discuss, commit to, and present some key reforms of the STI system

The LTP would not only provide orientations and priorities but would also be the place to co-design (i.e. in cooperation with various relevant public bodies and other stakeholders), legitimise, and officially announce new STI initiatives (launch of new policy instruments, experimentations, legal reforms, etc.) to be implemented in the four years to come. This is the case for instance of the Swedish four-year R&I Bill.

Some of the resulting reforms could then be formalised and programmed as part of LTP escalation plans, which according to NIFU have had real effect on funding and policies (NIFU, 2021^[16]).

Norway could discuss collectively the processes for coordinating the implementation of the revised LTP, in parallel to discussion of its content

The interdepartmental groups that were active during the two first years of the plan have not met after 2018. Reactivating and formalising these groups would be instrumental to

strengthen the influence of the LTP in different ministries and maintain systematic information exchange across administrative siloes. These processes (together with any implementation and monitoring mechanisms) could be presented in a specific section of the LTP dedicated to the governance and implementation of the plan.

Norway could set up a light process for monitoring the efforts to implement the LTP, the resulting achievements and, when possible, some of its effects as well as gaps

This could take the form of an interim report after two years of implementation. This would increase its visibility and impact on actors' behaviours, in particular at a moment when the dynamics tend to fade out (the enthusiasm of the revision is over and the next revision is still far). This is all the more important since, beside the 'escalation' plan, none of the priorities' actions presented in the LTP has earmarked funds. The monitoring of these actions would strengthen them and make them more concrete. Knowing that these priorities will be monitored would also be an incentive to make them clearer and sharper. The monitoring could also involve research and innovation performers through some dedicated consultations since many of the actions taken can have significant impact on them. Finally, it would also be useful when starting the next revision the year after. Monitoring the LTP would therefore require some efforts to align part of the STI information system to the LTP structure (thematic areas, priorities, transversal actions, and indicators/targets) as well as require different ministries and agencies to accept a reporting structure along those lines.

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Annex A. Organisations of survey respondents

Organisation	Type of organisation	Number of respondents
Akademikerne	Industry	1
Akvaplan-niva	Research institute	1
CICERO Center for International Climate Research	Research institute	1
Digdir, Norwegian digitalisation agency	Agency	1
Equinor	Industry	1
Herøya Industripark AS (HIP)	Intermediary	1
Innovation Norway	Agency	1
Institutt for samfunnsforskning, ISF	Research institute	1
Inven2 AS	Industry	1
Kommunesektorens organisasjon (KS)	Local authority	1
Kristiania University College	University	1
Ministry of Education and Research (MER)	Ministry	9
Ministry of Health and Care Services (HOD)	Ministry	3
Ministry of Industry, Trade and Fisheries (MTIF)	Ministry	1
Ministry of Petroleum and Energy (MPE)	Ministry	1
Norwegian Geotechnical Institute (NGI)	Research institute	1
Norinnova AS	Intermediary	1
Norsk institutt for studier av innovasjon, forskning og utdanning (NIFU)	Research institute	1
Norsk Regnesentral (NR)	Research institute	1
Norwegian University of Life Sciences (NMBU)	University	2
Norwegian Agency for Quality Assurance in Education (NOKUT)	Agency	1
Norwegian Confederation of Trade Unions	Stakeholder	1
Norwegian Institute for Air Research (NILU)	Research institute	2
Norwegian Institute for Nature Research (NINA)	Research institute	3
Norwegian Oil and Gas Association	Industry	1
Norwegian Polar Institute	Research institute	2
Norwegian University of Science and Technology (NTNU)	University	5
Oil and Gas for the 21st Century (OG21)	Industry	1
Research Council of Norway (RCN)	Agency	9
Rock Physics technology AS	Industry	1
SINTEF	Research institute	8
Siva SF	Research institute	1
Statistisk sentralbyrå (Statistics Norway); SSB	Agency	1
Telenor ASA	Industry	1
The Confederation of Norwegian Enterprise (NHO)	Stakeholder	1
The Employers Association Spekter	Stakeholder	1
Transportøkonomisk Institutt	Research institute	1
Trøndelag fylkeskommune	Local authority	1
TrønderEnergi AS	Industry	1
Trondheim Municipality (Trondheim kommune)	Stakeholder	1
UiT Arctic University of Norway	University	1
Universities Norway (UHR)	University	2
University of Bergen (UiB)	University	3
University of Oslo (UiO)	University	4
University of Stavanger (UiS)	University	1
Vestlandets innovasjonsselskap AS (VIS)	Intermediary	3

Annex B. Interview participants

Type of organisation	Organisations included
Agency	Research Council Norway (RCN) Innovation Norway Statistics Norway ENOVA Industrial Development Corporation of Norway (SIVA)
Research Institute	SINTEF NIFU Norsk Regnesentral Association of Norwegian Research ISF NILU NINA Norwegian Polar Institute
Ministry	Ministry of Health and Care Ministry of Petroleum and Energy Ministry of Education and Research Ministry of Climate and Environment MTIF
University	University of Stavanger Kristiania University College Norwegian University of Science and Technology UiT Arctic University of Norway University of Oslo VIS University of Bergen Universities Norway Norwegian University of Life Sciences Young Academy Norway
Industry	Equinor Iven2 AS ABELIA OG21 The Confederation of Norwegian Enterprise Telenor ASA Norwegian Confederation of Trade Unions

Annex C. Detailed results of the SWOT relevance assessment

Strengths

The strengths identified in 2017 are still considered very relevant. All of them are considered relevant or very relevant by at least 81%,^{xxxvi} and five of them receive this positive assessment by more than 90% of respondents:

- 1.*^{xxxvii} Abundant and prudently managed natural resources
- 3.* A well-equipped higher education institution (HEI) system that allows for planning and building of scientific
- 2.* Several academic strongholds in specialised economic areas, such as fisheries, aquaculture and O&G
- 5.* A rather simple institutional landscape, with strong funding actors, including the Research Council of Norway (RCN) as a central actor (but with numerous roles and instruments)
- 6. A diversified public research institutes (RI) sector with good technological performance, well-connected to industry

It is unsurprising that the first listed strength of 'Abundant and prudently managed natural resources' continued to be validated as a top strength, given that this is a structural endowment of which Norway has proved itself highly capable of sharing the benefits.

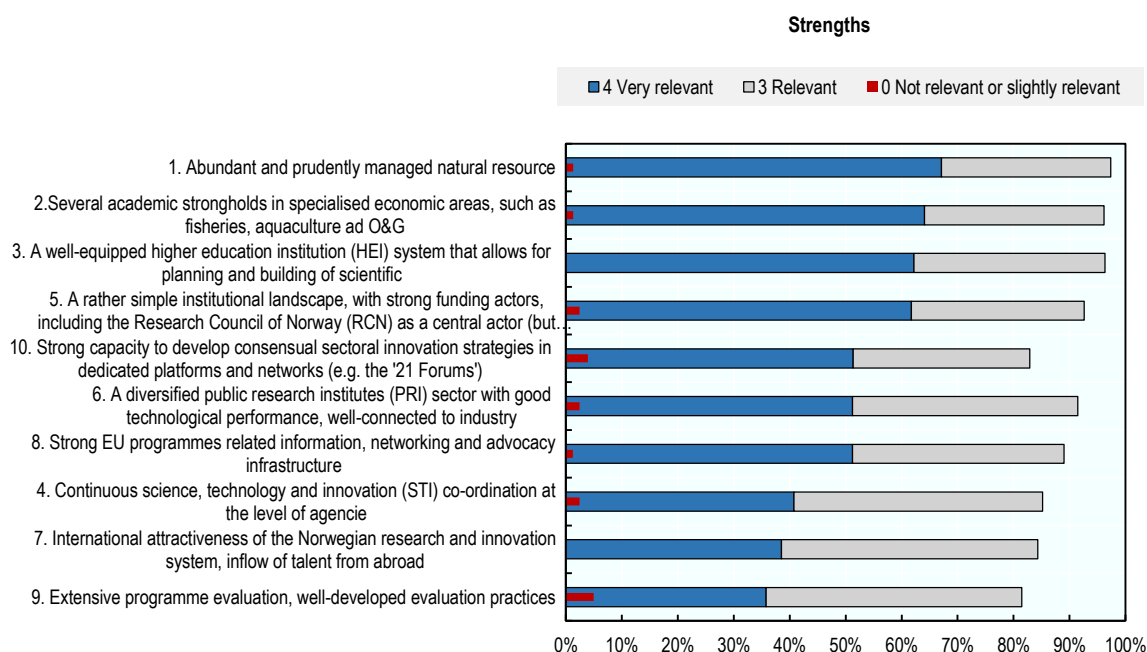
Three of the most relevant strengths relate to the Norwegian research system, HEIs and RIs, notably in areas where Norway take advantage of abundant natural resources (fisheries, aquaculture, and O&G).

Despite the high level of consensus, the comparison with the low ratings, i.e. those strengths that were considered by some respondents as not relevant at all or only slightly relevant provide interesting insights and whether a small portion of the population strongly disagrees with the general opinion. The two strengths that received the highest proportion of low ratings are

- 9. Extensive programme evaluation, well-developed evaluation practices;
- 10. Strong capacity to develop consensual sectoral innovation strategies in dedicated platforms and networks (e.g. the '21 Forums').

These two strengths are also those that received the lowest relevant rankings (however, respectively 81% and 83% of respondents rate them as 'relevant' or 'very relevant').

Figure C.1. Assessment of the relevance of strengths identified in the 2017 Norway Review



Weaknesses

The weaknesses appear less consensual, with greater differences between the most and least relevant ones. The five weaknesses that respondents still consider the most relevant are:

- 6.* Low outward mobility in research: young researchers with little international mobility
- 3. Limited fully-fledged tenure track and strategic recruitment; high average age of university professors
- 7* Industrial specialisation in sectors with low research and development (R&D) intensity
- 10.* Lack of a dedicated actor for renewal in the public sector (including upscaling successful solutions and approaches)
- 12. Limited capacity of the government sector to support strong STI Priorities

Two weaknesses received a lower proportion 'of 'relevant' or 'very relevant' ratings (but still around 65% of respondents):

- 13. Fragmentation and lack of critical mass in higher education institutions
- 11. Insufficient strategic focus on key fields like health

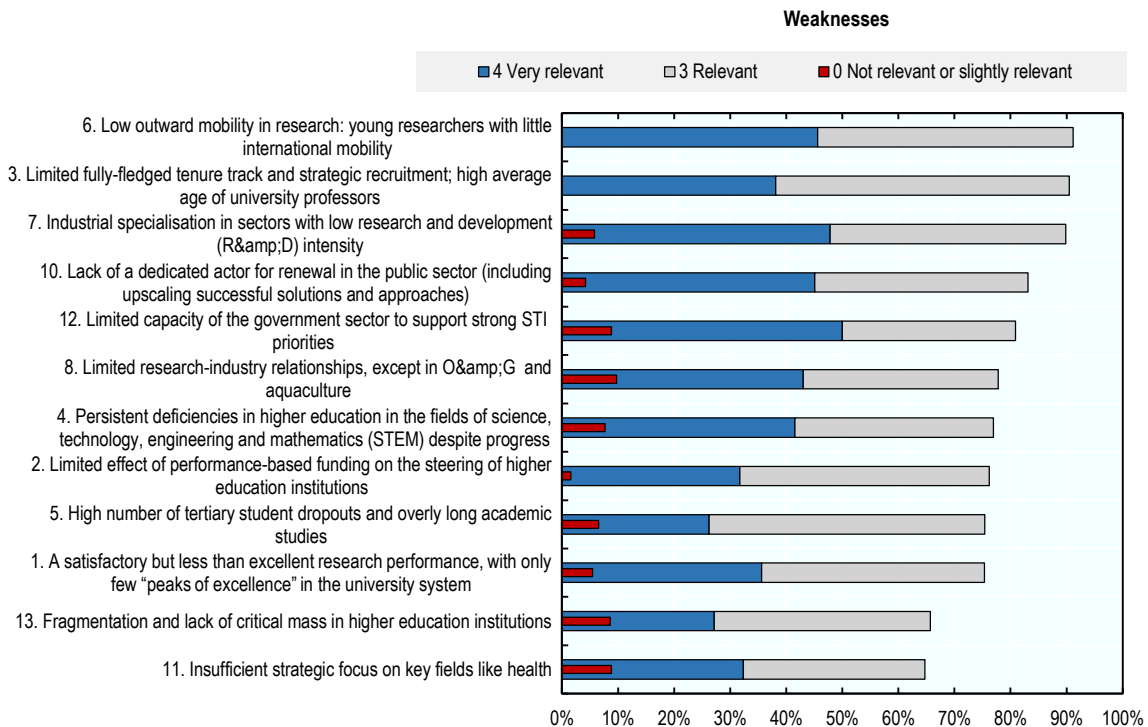
Furthermore, four weaknesses were considered as not relevant anymore by approximately 10% of respondents:

- 8. Limited research-industry relationships, except in O&G and aquaculture
- 13. Fragmentation and lack of critical mass in higher education institutions

- 11. Insufficient strategic focus on key fields like health
- 12. Limited capacity of the government sector to support strong STI Priorities

The weaknesses 11 and 13 therefore seem to be considered as less relevant than in 2017 by the respondents.

Figure C.2. Assessment of the relevance of weaknesses identified in the 2017 Norway Review



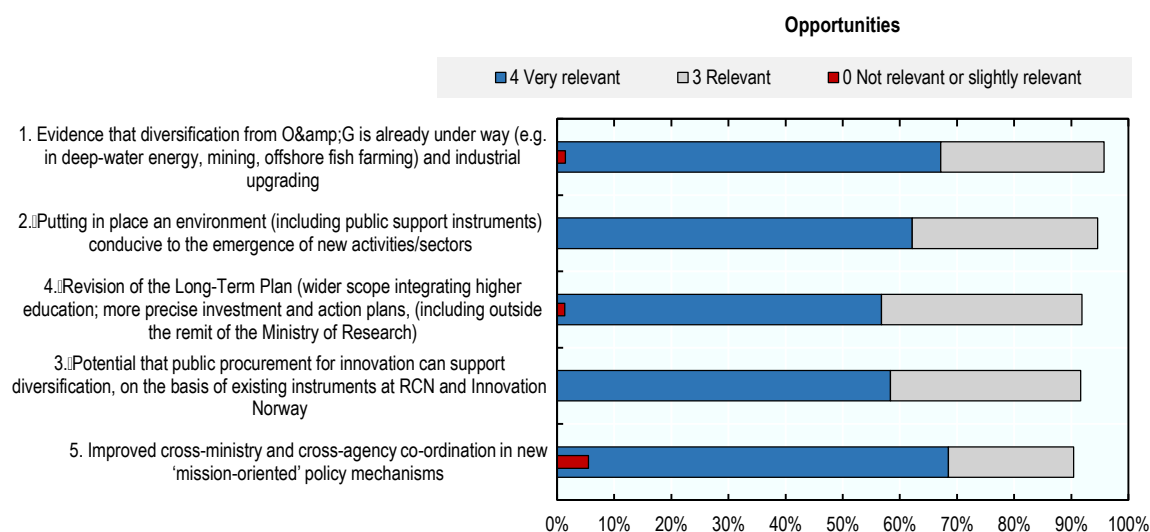
Opportunities

Like the strengths, a majority of respondents consider all opportunities as relevant or very relevant. No opportunity receives less than 90% of relevant or very relevant ratings. Furthermore, half of the respondents consider all of them still very relevant. The two most highly rated opportunities are:

- 1.* Evidence that diversification from O&G is already under way (e.g. in deep-water energy, mining, offshore fish farming) and industrial upgrading
- 2. Putting in place an environment (including public support instruments) conducive to the emergence of new activities/sectors

The opportunity that receives the highest proportion of low relevance ranking is the opportunity '5: Improved cross-ministry and cross-agency co-ordination in new 'mission-oriented' policy mechanisms' (however, remaining at only 5%). It is also however the opportunity that has the highest percentage of 'very relevant' ratings (68%), hence not diminishing the importance of the issue of how a mission-oriented policy approach can improve holistic coordination.

Figure C.3. Assessment of the relevance of opportunities identified in the 2017 Norway Review



Threats

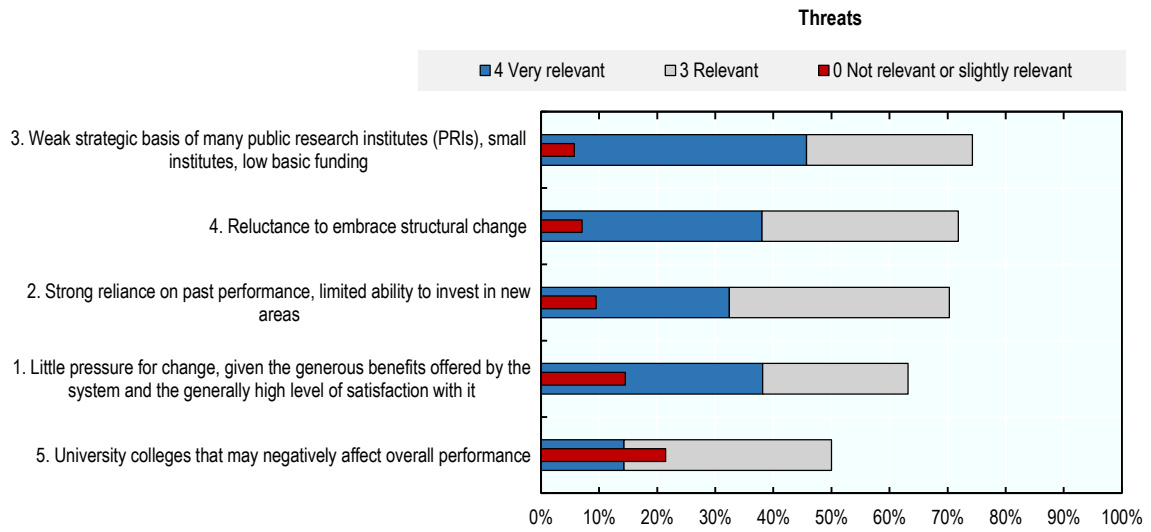
Respondents consider the threats identified in 2017 as significantly less relevant today than it is the case for the strengths, weaknesses and opportunities. The two most highly rated threats are:

- 3.* Weak strategic basis of many public research institutes (RIs), small institutes, low basic funding
- 4.* Reluctance to embrace structural change

A significant proportion of respondents clearly disagrees with the OECD diagnostic of 2017 regarding two threats:

- 5. University colleges that may negatively affect overall performance (21% of not relevant anymore)
- 1. Little pressure for change, given the generous benefits offered by the system and the generally high level of satisfaction with it (14% of not relevant anymore)

Figure C.4. Assessment of the relevance of threats identified in the 2017 Norway Review



Annex D. Synthetic results of the survey

The table D.1 provides an analysis of the responses cutting across the different survey components (relevance of SWOTs; implementation of recommendations in different areas; Prioritisation of recommendations). These insights are broken down by overarching goals and sub-topics.

Six main results can be derived from this overall analysis of the survey results:

1. Norway has a strong research capacity in HEIs and RIs. The structural reforms that have allowed stronger critical mass and performance in the past are no longer needed. However, the government should keep on investing in research excellence. The centres of excellence have played a key role in this respect and the government should keep on supporting them in the future. There are still some issues related to human resources in HEIs (no fully-fledged tenure-track and limited international mobility of young researchers). Although it is not seen as a major issue relative to others, the government should increase its support to the third mission in HEIs and knowledge-transfer in RIs (although research-industry relationships seem to have improved, even national key sectors). Regarding RIs specifically, the institutional funding they receive from the government is considered too low, and insufficiently connected to their past performance and/or to future strategic projects.
2. Business innovation is still hindered by a specialisation in sectors with low R&D intensity. However, a comprehensive policy portfolio that benefits established and new firms supports it. This support system should be maintained and even improved, notably by making it more strategic (linked to national Priorities) and demand/opportunity-led.
3. While the LTP has been instrumental to improving the orientation and coordination of the system, the capacity of the governance system as a whole to implement strong STI Priorities and put more focus on some key areas requires further improvement. A majority of respondents still consider that the LTP should provide the strategic framework to tackle these issues. The LTP itself should be improved, notably by the use of activities such as foresight to inform its Priorities.
4. Some mission-oriented and challenge-led initiatives have been implemented but they remain insufficient to overcome some of the long-standing silos among public bodies pertaining to different policy fields. This policy approach should be prioritised according to a majority of respondents, for example through the potential launch of broad integrated programmes addressing societal challenges.
5. Norway's progress in diversifying beyond oil and gas is something that survey respondents have acknowledged, echoing broader sentiment found in Norwegian society as a whole. Although these natural resources have undoubtedly led to high standards of living in the country, there is general social acceptance that a transition is necessary. However, this broad social acceptance and notional support for energy transition does not always translate to tangible support for public policies aimed at the necessary structural change.
6. There is still some reluctance to embrace structural change. RCN is (and will continue to be) a key player in supporting this transition. It has streamlined its programme structure but an increase in its financial independence would prove crucial to its ability to run inter-ministerial strategic programmes effectively.

Table D.1. Synthetic table of survey results

	Positive assessment (<i>increased relevance of strengths and opportunities / decrease relevance of weaknesses and threats / recommendations implemented</i>)	Negative assessment (<i>increased relevance of weaknesses and threats / decrease relevance of strengths and opportunities / recommendations not implemented</i>)	In green: Recommendations to be Prioritised In red: Recommendations to be de-Prioritised
Develop excellent academic community			
HEIs	<p>S: The higher education institution (HEI) is well-equipped, providing a good basis for robust research</p> <p>W: The fragmentation and lack of critical mass in universities is not a major issue</p> <p>R: The restructuring of the university landscape (inc. mergers) has been implemented.</p> <p>R: The centres of excellence (CoEs) are well funded and strengthen research; support to these structures should be continued.</p> <p>R: The government should keep on investing in research excellence and search to achieve critical mass (but not through mergers)</p>	<p>W: Low international mobility of researchers, in particular the youngest ones</p> <p>W: The career track in university is still not performing well (regarding both the recruitment and retention of the best researchers)</p> <p>R: A fully-fledged tenure track system is still not implemented in universities</p>	<ul style="list-style-type: none"> • Funding of centres of excellence • Focus on excellence and critical mass in HEIs • Incentives for engagement of universities with industry • University mergers
Enhance competitiveness and innovation			
Business innovation	<p>W: Research-industry relationships have improved, even beyond areas related to Norwegian strong sectors</p> <p>R: There is comprehensive policy portfolio to support innovation in established and new firms</p>	<p>W: Industrial specialisation in sectors with low R&D intensity</p>	<ul style="list-style-type: none"> • Support system for innovation in large established firms and start up • priority-led innovation support • Public procurement and other demand-driven support for innovation to address societal challenges
RIs	<p>S: RIs have good technological performance and are well-connected to industry</p> <p>R: The restructuring of the RI landscape (inc. mergers) has been implemented and is effective. Collaboration between institutes has also improved, partly encouraged by the funding system</p>	<p>T: RIs remain too small in general, and receive too little basic funding</p> <p>R: Block funding of RIs has not been increased in relation to their performance</p> <p>R: The funding of RIs is not related to government's strategic projects</p>	<ul style="list-style-type: none"> • Support to knowledge-transfer in research institutes • Structural reforms of RIs (inc. mergers)
Tackle major societal challenges			
Transformational / structural change	<p>O: The diversification from O&G has started and is making strands</p> <p>O: There are policy instruments to support the emergence of new activities/sectors</p>	<p>W: Renewal in the public sector is still limited</p> <p>T: There is still some reluctance to embrace structural change</p>	<ul style="list-style-type: none"> • Broad integrated challenge-led programmes

	<p>T: There is no tendency of Norwegian actors to remain in their comfort zone due to favourable lifestyles, there is a real motivation for change</p> <p>O: The policy system to support the emergence of new activities is still an opportunity</p> <p>R: Norway has implemented broad integrated programmes to address societal challenges</p>		
Improve the governance of the Norwegian national system of innovation			
Strategic orientation and priority setting	<p>R: The LTP has been used to improve strategy and governance</p>	<p>W: Limited capacity to implement strong STI Priorities</p> <p>There is still insufficient strategic focus in some key areas</p> <p>The dedicated thematic platforms and networks might need to improve their capacity to develop consensus on strong innovation strategies</p> <p>R: The LTP is not supported by foresight</p>	<ul style="list-style-type: none"> • Use the LTP to further improve strategy and governance • Use the LTP to guide increased STI funding
Interministerial coordination	<p>S: There has been collaboration across policy silos in challenge-based/mission oriented schemes</p> <p>S: RCN is a central and strong funding body</p> <p>R: RCN has streamlined its funding programme structure</p>	<p>O: Mission-oriented innovation initiatives remain too limited to overcome the policy silos</p> <p>R: RCN has not been made more financially independent to run inter-ministerial strategic programmes</p>	<ul style="list-style-type: none"> • Collaboration across agencies and ministries around key Priorities • Challenge-led collaboration across policy silos • Reduction of the number of RCN programmes

Note: S: Strength; W: Weakness; O: Opportunity; T: Threat; R: Recommendation

Annex E. Summary of the options for change

Figure 3. Key options for change to develop excellent academic communities

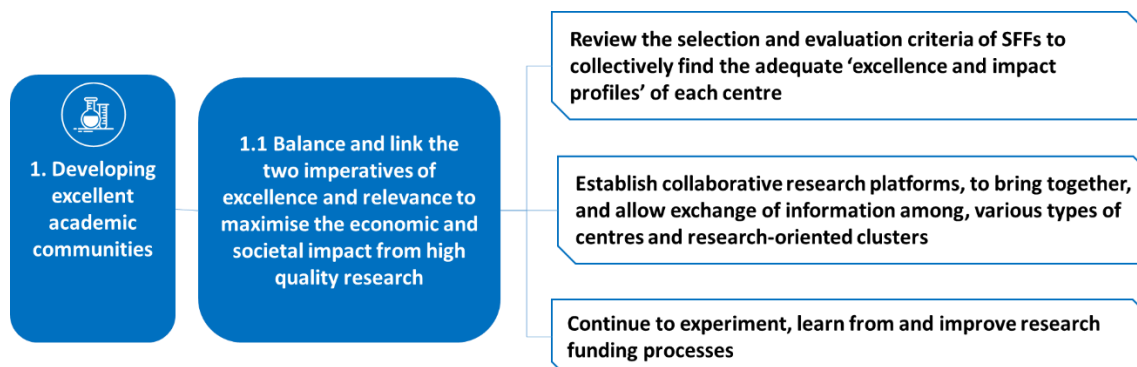


Figure 4. Key options for change to enhance competitiveness and innovation

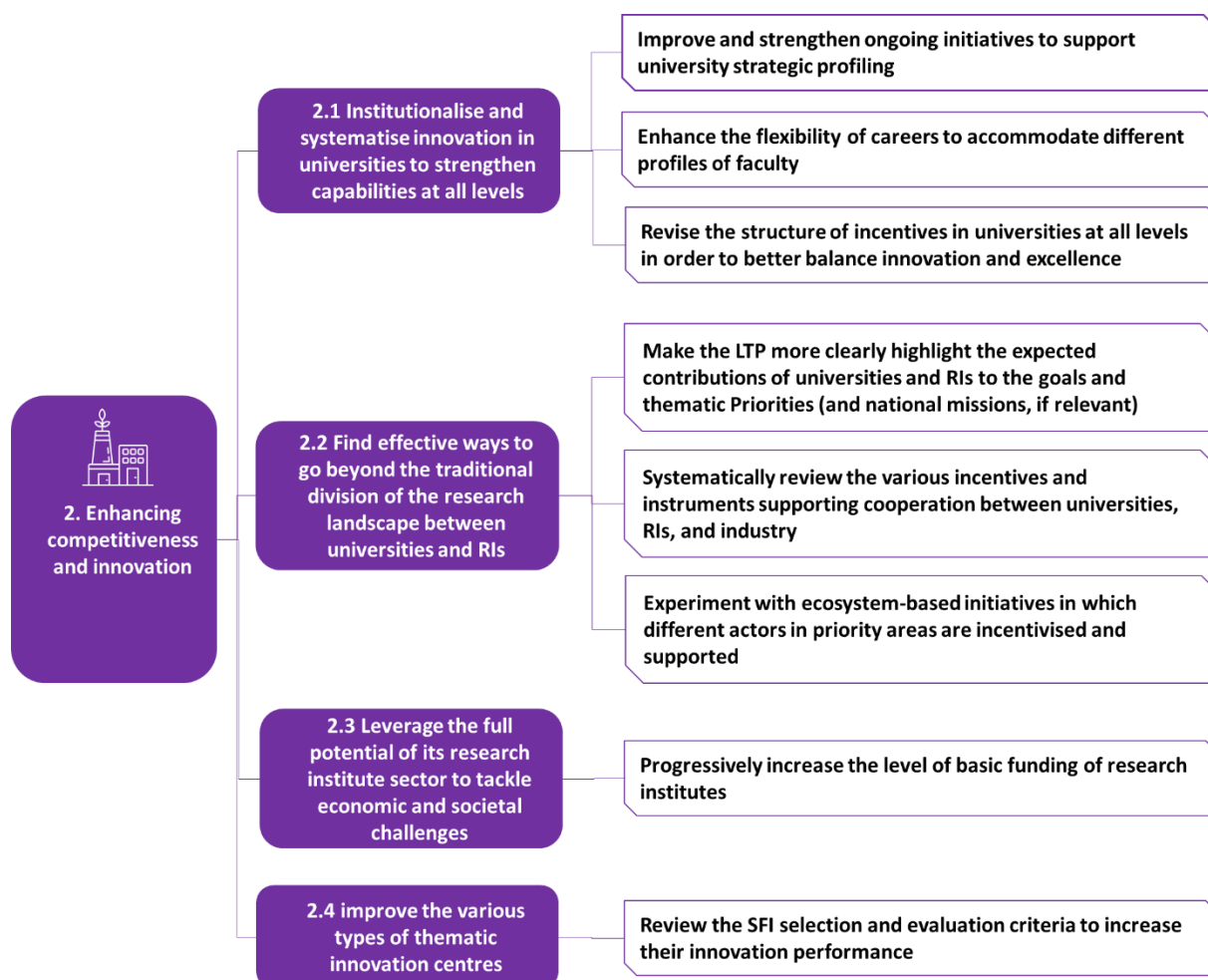


Figure 5. Key options for change to tackle major social challenges

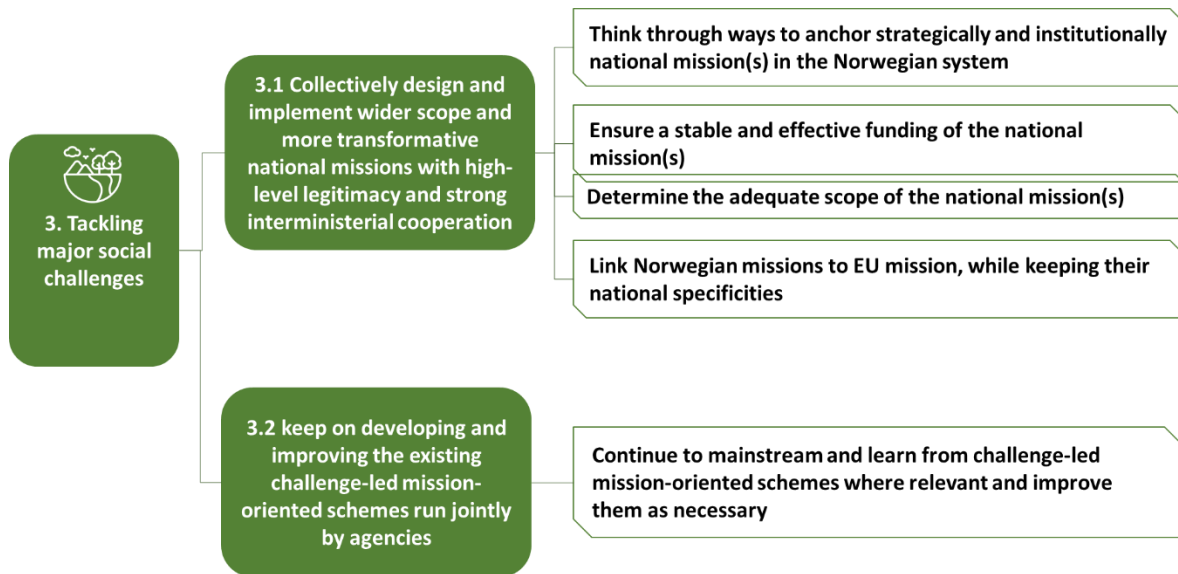
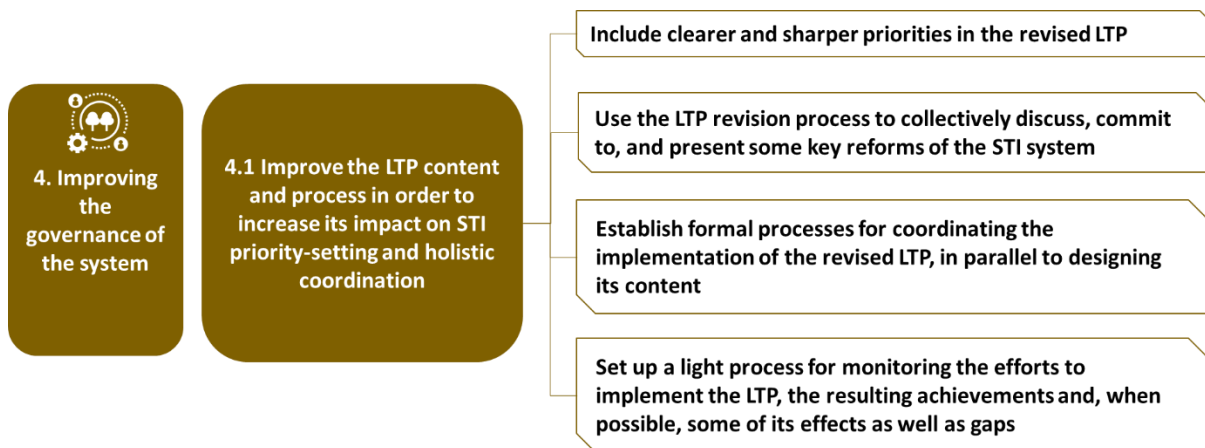


Figure 6. Key options for change to improve the governance of the system



Endnotes

¹ These four objectives were used to structure the 2017 Review. These objectives consist of the three overarching goals of the LTP, to which OECD added one objective to take into account the governance of the overall STI system.

² The list of organisations to which respondents belong is provided in Annex A.

³ The list of organisations included in the interviews can be found in Annex B.

⁴ The detailed results of the Relevance assessment of SWOTs are presented in Annex C.

⁵ In the rest of this section the ‘*’ indicates that the modality is among the 50% most relevant modalities regardless of whether the criteria used is ‘Significant action taken’ and ‘Fully implemented’ together, or only ‘Fully implemented’.

⁶ In the rest of this section, the recommendation in italics are those that about half respondents (45) consider should be prioritised.

⁷ The 2020 SFF evaluation stressed that the SFFs have produced more than 25% of Norway’s top 10 cited articles and the centres have produced more than 30% of the top 1% of cited papers in Norway. They have also been awarded a significant share of ERC Norwegian projects (NIFU, 2020^[8]).

⁸ These aggregated indicators also hide significant institutional and interdisciplinary differences. Some universities have increased markedly on these two indicators during the period. This pleads for some mechanisms that allow (and support) flexibility in the strategic profiling and funding of different institutions (see Option for change 2.1).

⁹ Aka the ‘U5’: UiO, UiB, NTNU, UiTø, UMB.

¹⁰ NIFU R&D Statistics databank, <http://www.foustatistikkbanken.no/nifu/?language=no>.

¹¹ UiO, UiB, NMBU, UiTø.

¹² Since the universities’ basic funding also funds teaching and administration, the effect is not easy to capture.

¹³ See also Figure 4-4.

¹⁴ Related to this is the crucial issue, in Norway and many other countries, of the effect of the quest for excellence and critical mass on the geographical concentration of research activities, which has important consequences in terms of not only equity but also innovation performance. Currently, public R&D is concentrated mainly in two cities in Norway.

¹⁵ Such a pattern was observed also for instance in Sweden (OECD, 2016^[31]).

¹⁶ Here also it is important to bear in mind that the success rates differ significantly depending on the kind of project. ‘Research projects’ have a lower success rate (10.9% in 2020) than other projects (14.8% for all projects). Within Research projects themselves, FRIPRO (longer-term bottom-up research) has a lower success rate than thematic research programmes.

¹⁷ This comparison does not take into account other important parameters, for instance the fact that the funding from the business sector is lower in Norway.

¹⁸ For instance, the programme IKTPLUSS has experimented with continuous calls with short turnarounds for applicants. The results were encouraging with fewer weak applications and more efficient evaluation process. RCN has also adapted its selection criteria to be in line with EU criteria in order to prepare potential Norwegian applicants to participate in EU calls and simplify the coordination of national calls with EU calls. Finally, RCN has launched some calls where several application types are included in the same call so that research topics can be covered by either researcher projects or collaboration projects.

¹⁹ A total of 519 actors and stakeholders (329 in the public sector and 190 in the private sector) provided inputs to the portfolio plans. All inputs are openly available see (Research Council Norway, 2022^[28]).

²⁰ See for instance (Ferretti F., 2018^[30]).

²¹ This term refers to the social and economic mission of Universities. It includes different activities performed by HEIs which seek to transfer and use academic knowledge, technologies and innovations, as

well as to promote entrepreneurial skills, innovation, social welfare and the formation of human capital, to the benefit of the social and economic development (Compagnucci L., 2020^[29])

²² See the recent study (NIFU, 2022^[32])

²³ This statement holds true also for structural changes in the HE sector. The recommendations on structural changes in the HE and RI sectors are among those that are considered most fully implemented between 2017 and 2021 and that should be deprioritised in the coming LTP period (see Figure 3.1 and Figure 4.1, Figure 3.2 and Figure 4.2).

²⁴ These are often the historical 'national RTOs', also having significant basic research activities, public service delegated missions (e.g. safety and environmental metrology, government advising role) and/or activities in national strategic areas (e.g. defence, nuclear). In Norway, the largest RTO, SINTEF, is among those RTOs with a share of basic funding that is lower than the national average.

²⁵ Austria is also an interesting case in that regard.

²⁶ During consultations, the need to better integrate TTOs within the core structure of universities including their strategies, associated with predictable and long-term funding plans) has also been raised.

²⁷ Such as Catapult centres where researchers and industry can collaborate to test, pilot and verify new technologies, systems and equipment across multiple sectors (See Table 5.2).

²⁸ Universities can be partners but not project leaders.

²⁹ However, it is important to note the difference between the ecosystem initiatives and 21-Strategies. The latter provide a strategy that is used by the government to design their programmes and interventions but are not directly a roadmap to be implemented by the actors who developed it. Furthermore, the 21-strategies are mainly related to specific industries.

³⁰ It is important to note that the institute strategic initiatives, which formed one targeted channel to provide non-competitive and multiannual funding to institutes, have been almost entirely abandoned. This goes against the proposal to make the basic funding more directional.

³¹ As can be seen on IN's 2019 annual report (the latest available on the agency's website): '*Innovation Norway's objective is to be the policy instrument of the state and the county authorities for achieving value-creating business development throughout the country. Innovation Norway's main purpose is to trigger business development that is profitable from both a commercial and a socio-economic perspective, and to help different regions realise their potential for business development. This goal is to be achieved through the sub-goals of more successful entrepreneurs, more companies with growth potential and more innovative business clusters.*' (Innovation Norway, 2019^[27]). However, it should be noted that this is especially true for MTIF and IN's interventions. Sectoral ministries (e.g. energy, fisheries, agriculture and health) have always had some more directed innovation support measures in their respective sectors.

³² IN's 2019 annual report, https://arsrapport.innovasjon Norge.no/en/arsrapport-2019-eng/#side=en_514205.

³³ The first 3 years of operation of the scheme have been evaluated positively (INOBA, 2020^[26]).

^{xxxiv} Innovation Norway also has a formal role of policy adviser.

^{xxxv} See for instance (Kattel and Mazzucato, 2018^[25])

^{xxxvi} In the rest of this document, the percentages represent the share of respondents that provided a rating, *i.e.* not including those who responded they did not know or left this specific question blank.

^{xxxvii} In the rest of the document the '*' indicates that the modality is among the 50% most relevant modalities regardless of whether the criteria used is the 'relevant' and 'very relevant' ratings together, or only the 'very relevant' ratings. It should be noted that whether the analysis uses the 'relevant' and 'very relevant' ratings together, or only the 'very relevant ratings', can provide slightly different rankings of modalities.