

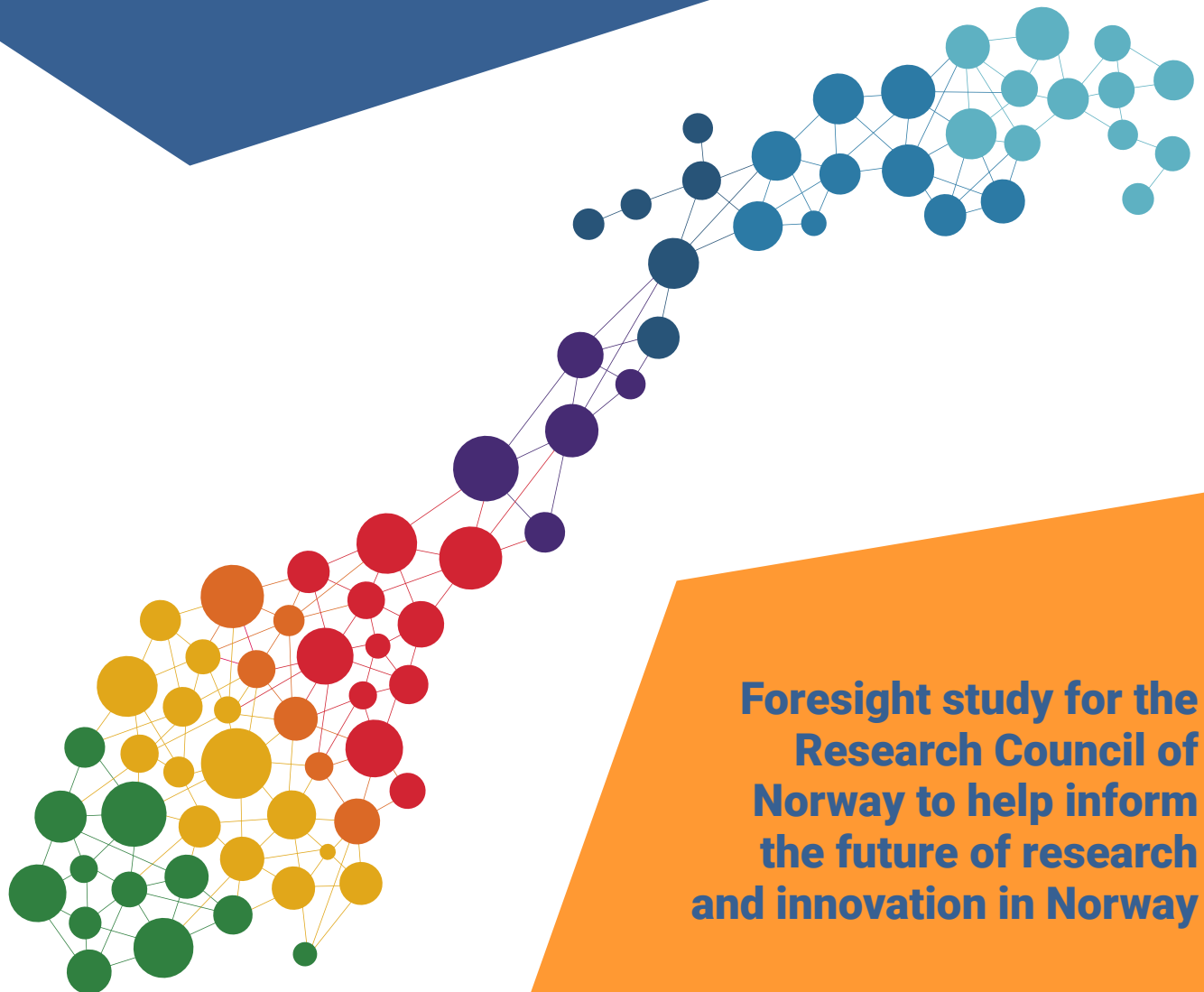


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Structural measures to develop a resilient research and innovation environment in Norway

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**Foresight study for the
Research Council of
Norway to help inform
the future of research
and innovation in Norway**

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Preface

As part of its current strategy (2020–2024), the Research Council of Norway (RCN) has three primary objectives: ground-breaking research and radical innovation, sustainable development, and restructuring of the business and public sectors. Against this backdrop, the RCN commissioned RAND Europe and DAMVAD Analytics to carry out a foresight study to help inform the future of research and innovation (R&I) in Norway. The work will contribute to the development of a robust evidence base for the RCN’s input to the revision of the Norwegian government’s Long-Term Plan for Research and Higher Education 2019–2028 (hereafter, LTP). The study will also help inform the RCN’s internal decision making, strategies and organisational activities.

The study focuses on the five strategic areas identified in the RCN’s current strategy: (i) oceans; (ii) green transition; (iii) health and welfare; (iv) cohesion and globalisation; and (v) technology and digitalisation. The specific aims of the study were to:

- Identify a set of potential priority missions or targeted, challenge-based policy actions within and across (or outside) the five strategic areas that the RCN, together with other stakeholders, could consider implementing in the future to help address societal challenges; and
- Identify system-level structural measures to potentially facilitate the development of a resilient R&I environment in Norway.

We adopted a mixed-methods, participatory approach to the research, involving a variety of methodologies, such as trend analyses, literature reviews, stakeholder interviews, focus groups, an online survey of the public, crowdsourcing ideas and information from experts, future scenario analyses and workshops. All of these methods are covered in this report.

We envisage that the research will be of interest to funders and academia, national and local government policymakers, innovators and practitioners, and industry, and, more broadly, to anyone – including the public – interested in R&I and wider societal challenges.

This report on structural measures is one in a series of nine reports presenting the findings of the study. The other reports are as follows:

- Health and welfare: An analysis of trends, future directions and potential missions to address societal challenges in Norway
- Technology and digitalisation: An analysis of trends, future directions and potential missions to address societal challenges in Norway
- Oceans: An analysis of trends, future directions and potential missions to address societal challenges in Norway
- Green transition: An analysis of trends, future directions and potential missions to address societal challenges in Norway
- Cohesion and globalisation: An analysis of trends, future directions and potential missions to address societal challenges in Norway

- A summary of potential cross-cutting missions to address future societal challenges in Norway
- Addressing future societal challenges in Norway: Detailed methodology report
- Addressing societal challenges in Norway: Key trends, future scenarios, missions and structural measures

We have been able to conduct this study because of the contributions of many individuals. We would like to thank the project team at the Research Council of Norway for their excellent guidance, support and advice over the course of the study. In particular, we would like to thank Stig Slipersæter and Philip Lorentzen. We are also grateful to the executive board of the RCN for constructively engaging with us at various points in the study. We would like to thank Andrew Curry (School of International Futures) for helping organise and run the stakeholder foresight workshops. We are grateful for the valuable inputs from the members of our advisory panel of experts, namely, Dr Sonja Marjanovic (RAND Europe, health and welfare expert), Stijn Hoorens (RAND Europe, cohesion and globalisation expert), Prof. Paula Kankaanpää (Marine Research Centre, the Finnish Environment Institute (Suomen ympäristökeskus, SYKE), oceans expert), Prof. Eeva Primmer (SYKE, green transition expert), Dr Jonathan Cave (University of Warwick, technology and digitalisation expert), Prof. Hakan Sicakkan (University of Bergen, cohesion and globalisation expert), and Mona Skaret (Bouvet ASA, research and innovation expert). We are also very grateful to the many stakeholders – across academia, industry, government, the third sector and the public – who kindly agreed to engage with the study at various stages. Finally, we would like to thank to our quality assurance reviewers, Dr Susan Guthrie (RAND Europe) and Asbjørn Boye Knudsen (DAMVAD Analytics), for their valuable advice and critical review of the research.

RAND Europe is a not-for-profit research organisation that aims to improve policy and decision making in the public interest, through research and analysis. RAND Europe’s clients include European governments, institutions, non-governmental organisations and firms with a need for rigorous, independent, multidisciplinary analysis. DAMVAD Analytics is a Nordic, research-based consultancy with offices in Copenhagen and Stockholm. DAMVAD’s consultants have strong analytical and evaluation skills and specialised knowledge regarding research and innovation policy throughout the Nordic region, including Norway.

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Abbreviations

AI	Artificial intelligence
COMET	Competence Centres for Intelligent Technologies
DigDir	Digitaliseringsdirektoratet [Norwegian Digitalisation Agency]
EU	European Union
EDIH	European Digital Innovation Hubs
FCA	Financial Conduct Authority
FinTech	Financial technology
HEI	Higher education institution
JRC	Joint Research Centre
NGO	Non-governmental organisation
NTNU	Norges teknisk-naturvitenskaplige universitet [Norwegian University of Science and Technology]
RCN	Research Council of Norway
R&I	Research and innovation
R&D	Research and development
SFI	Sentre for forskningsdrevet innovasjon [Centres for Research-based Innovation]
SIVA	Selskapet for industrivekst [Industrial Development Cooperation of Norway]
SME	Small to medium-size enterprise

1. Introduction

As part of the current strategy (2020–2024), the Research Council of Norway (RCN) has articulated the following three primary objectives with an overarching view towards achieving a ‘well-functioning research and innovation system’ (Research Council of Norway 2020):

- Sustainable development;
- Ground-breaking research and radical innovation; and
- Restructuring of the business and public sectors.

The RCN commissioned RAND Europe and DAMVAD Analytics to carry out a foresight study to contribute to the development of a robust evidence base for the RCN’s input to the 2022 revision of the Long-Term Plan for Research and Higher Education 2019–2028 (Ministry of Education and Research 2019). The study will also help inform the RCN’s internal decision making, strategies and organisational activities. The study focuses on the five main strategic areas identified in the RCN’s current strategy for the next ten years (Research Council of Norway 2020), and is intended to help frame thinking about the future of research and innovation (R&I) in relation to these strategic areas in Norway. The five strategic areas covered by this study are: (i) oceans; (ii) green transition; (iii) health and welfare; (iv) technology and digitalisation; and (v) globalisation and cohesion.

In particular, the study aims to:

- Identify a set of potential priority missions or targeted, challenge-based policy actions within, across or outside the five strategic areas for the next ten years that the RCN together with other stakeholders could consider implementing in the future to help address societal challenges¹; and
- Identify a series of system-level structural measures to facilitate the development of a resilient research and innovation environment in Norway (the topic of this report).

This report is one in a series of nine reports.² The report presents an analysis of structural measures to address the challenges associated with maintaining a robust and well-functioning Norwegian R&I ecosystem. Structural measures or support measures can be considered to be foundational, system-level instruments, policies, or tools in the R&I landscape that contribute to the translation of R&I into wider societal benefits. They broadly address the performance of the Norwegian R&I system in terms of the three

¹ For the wider study, we regard missions as targeted, timebound, concrete priority actions to help solve one or more societal challenges that the RCN and other stakeholders could consider developing and implementing in the future. In the long term, the missions will help the RCN achieve its primary overarching objectives (over a roughly ten-year time frame) and eventually contribute to enriching lives locally, nationally and internationally. Further details regarding missions and our approach to developing missions are provided in the companion report (RAND Europe and DAMVAD Analytics, 2021h).

² The other reports are as follows: Health and welfare: An analysis of trends, future directions and potential missions to address societal challenges in Norway (Gloinson et al. 2021a); Oceans: An analysis of trends, future directions and potential missions to address societal challenges in Norway (Skjoldager et al. 2021b); Green transition: An analysis of trends, future directions and potential missions to address societal challenges in Norway (Skjoldager et al. 2021a); Technology and digitalisation: An analysis of trends, future directions and potential missions to address societal challenges in Norway (d’Angelo et al. 2021); Cohesion and globalisation: An analysis of trends, future directions and potential missions to address societal challenges in Norway (Gloinson et al. 2021b); A summary of potential cross-cutting missions to address future societal challenges in Norway (Gunashekar et al. 2021a); Addressing societal challenges in Norway: Key trends, future scenarios, missions, and structural measures (Gunashekar et al. 2021b); and Addressing future societal challenges in Norway: Detailed methodology report (Gunashekar et al. 2021c).

primary objectives of the RCN (i.e. sustainable development; ground-breaking research and radical innovation; and restructuring of the business and public sectors). Mission-oriented policies require multiple actors and different sectors to innovate (Mazzucato 2018). The translation of R&I into wider societal benefits depends on coordinated and structural policy measures that defy quick solutions (OECD 2018). Funds cannot just be ‘thrown’ at different projects; they need to have a direction. The findings clearly support this view, where involved stakeholders emphasised a stronger push towards a centrally coordinated strategy that provides a unified approach across funding and other support measures. Even though the RCN is a unifying agency, an even more coupled spending across sectors is called for, which in many ways suggests support for the mission-oriented approach. This provides the backdrop moving into the presentation of identified structural measures, with measures involving a diverse set of stakeholders that could help address various challenges within the R&I policy landscape.

We have characterised five overarching structural needs within the Norwegian R&I system, highlighting the challenges in the current R&I system that potentially require further attention (see Table 1 at the end of this chapter for a summary). To help respond to the overarching needs, we have identified ten associated potential structural measures which provide direction and inspiration on how to respond to the needs (see Table 1)

Summary of the methodology

The structural measures were identified using a mixed-methods approach that involved interviews with Norwegian and international experts, two foresight workshops, a crowdsourcing exercise which included experts within and outside each strategic area (oceans, green transition, technology and digitalisation, health and welfare, and cohesion and globalisation), as well as desk research. Over the course of the study, we engaged with a broad range of stakeholders across academia, government, industry, the not-for-profit sector, the RCN and the public. The methodology for the study is described in detail in the associated methodology report (Gunashekar et al. 2021c).

The final list of proposed structural measures was selected following a staged approach. A long-list of the structural measures were derived from a trend analysis of the five strategic areas, a crowdsourcing exercise with experts, and expert interviews. The structural measures were examined and validated at stakeholder workshops and further updated based on feedback received at the workshops, from the RCN, and through interviewees with international and Norwegian R&I experts. The long-list of structural measures was then narrowed down based on such factors as: potential relevance of the measures to the Norwegian R&I context; measures that were suggested by several stakeholders we consulted; measures that spanned multiple strategic areas; and measures that are potentially innovative or novel in the Norwegian R&I system (or existing measures that could potentially be improved to address policy challenges).

Caveats of the analysis

When reading and interpreting the analyses presented in this report, there are some caveats that need to be considered. The proposed structural measures are not intended to be definitive or exhaustive. They represent a broad range of ideas for further examination by the RCN and other stakeholders that might be involved in implementing any potential structural measures in the future. We have suggested a mix of structural measures, each of which include examples of similar measures that have been implemented in Norway

and/or internationally. Some of the examples are relatively new and their success has not been measured yet, while others have been successfully adopted and evaluated.³

Structural measures are cross-sectoral and cross-cutting in their nature. The suggested structural measures also differ in their level of specificity and their relevance to each of the five strategic areas.⁴ Where possible, we have focused on including structural measures that are relevant to several strategic areas, while being relevant to R&I needs in the Norwegian context. For the structural measures to be successfully adopted, they must therefore be conceptualised and understood in the Norwegian R&I context. A few structural measures are new to Norway, but some of the structural measures are already employed within the wider Norwegian R&I system. Based on our analysis, we suggest either scaling up or adjusting certain initiatives to ensure potentially greater impact in the Norwegian R&I system.

Finally, to reflect the cross-sectoral and cross-cutting nature of structural measures, the structural measures are based on a synthesis of findings from the analysis over the course of the study. Potential structural measures were examined and validated at stakeholder workshops and then updated based on feedback received at the workshops and from the RCN. Each of the structural measures are therefore based on triangulated evidence, rather than single suggestions made by an individual expert or stakeholder.

Alignment with the RCN's three primary objectives for the strategy period

All the structural measures that are described in the report are to varying degrees intertwined with each other and aimed at delivering responses to the three overarching goals of the RCN (i.e. ground-breaking research and radical innovation; sustainable development; and restructuring of business and public sectors). The three objectives serve as the backbone for a well-functioning and dynamic R&I system in Norway. To guide the reader, in the table below, we summarise the needs and corresponding structural measures identified.

³ An example is the regulatory sandbox developed by the Financial Conduct Authority, which was found to create a supportive regulatory environment in the United Kingdom and provided inspiration for regulatory sandboxes in other country contexts (Deloitte and Innovate Finance 2018).

⁴ For instance, structural measures that can be applied within the health and welfare strategic area include the creation of a systemic and holistic framework based on research knowledge to foster innovation (OECD 2017). Digital technologies can also be used to promote inclusiveness across all sectors of the population and be more actively embedded within the healthcare sector (Directorate of eHealth Norway 2019). Other structural measures that could be implemented in the health sectors are enhancing knowledge sharing and health data accessibility, prioritising health and care in industrial policy, promoting evidence-based approaches for health, and initiatives to ensure the internationalisation of research (Ministry of Health and Care Services 2017).

Table 1: Overview of needs and proposed structural measures

Need 1: Increase access to and sharing of R&I data and knowledge
Structural measure 1: Establish a central knowledge and data repository.
Structural measure 2: Explore new data-sharing policies
Need 2: Support the development of a future-proof Norwegian workforce
Structural measure 3: Establish a future skills research centre
Structural measure 4: Make the education system more flexible and incorporate more entrepreneurial and innovation skills in the education system
Need 3: Support and promote collaborative, research-based and interdisciplinary innovation
Structural measure 5: Promote interdisciplinarity, collaborations and partnerships through funding requirements and specialised calls
Structural measure 6: Strengthen the Centres for Research-based Innovation (SFI) scheme ⁵
Need 4: Support new industry development beyond the oil and gas sector
Structural measure 7: Promote fewer but stronger national industry clusters
Need 5: Experiment with new types of regulatory practices and approaches
Structural measure 8: Use policy labs to promote collaboration
Structural measure 9: Make increasing use of regulatory sandboxes that promote innovation in different sectors and areas
Structural measure 10: Create a new high-risk research funding body or funding scheme

Source: Study team analysis

Outline of the report

The remainder of the report is structured as followed:

- In Chapter 2, we present five overarching structural needs. The five overarching structural needs highlight areas that require further attention. We also give a brief introduction to the measure ‘archetypes’.⁶
- In Chapter 3, we present the proposed structural measures. We include a brief introduction to each measure, followed by an example for reference and inspiration.

⁵ Research centres under the scheme are characterised as a ‘dedicated, long-term initiative designed to strengthen and further develop elite, creative research and innovation groups or to build up research groups in strategically important areas’ (Research Council of Norway 2019). The overarching aim of the scheme is to ‘enhance the ability of the business sector to innovate and create value through a greater focus on long-term research (Research Council of Norway 2019).

⁶ We have categorised the proposed structural measures into six high-level archetypes of the basic mechanisms that could be used as tools to implement the measures.

2. The five overarching structural needs

In this chapter, we present an overview of the five overarching structural needs. These needs have been identified by analysing the findings from the desk research, interviews, literature and crowdsourcing.⁷ All of the overarching needs require that R&I efforts across Norway be aligned and unified. This chapter also gives a brief summary of what we mean by 'archetypes'. The needs are summarised below:



No. 1: Increase access to and sharing of R&I data and knowledge

If Norway is to deliver solutions for societal challenges such as the green transition and develop new sustainable businesses and societies at pace, there is a need to increase the access to and sharing of data between public and private actors and across sectors in Norway. This includes stronger obligations for the actors to share R&I data and to further strengthen wider Open Science initiatives that are already in place in Norway.



No. 2: Support the development of a future-proof Norwegian workforce

Many Norwegians are currently employed in occupations that are likely to change radically or even disappear entirely over the next decades (Manyika et al. 2017; Næringslivets Hovedorganisasjon (NHO) 2018). To work more constructively on solving this challenge, there is a growing need for targeted research as well as innovative practical ideas that can support the development of a future-proof Norwegian workforce



No. 3: Promote collaborative, research-based and interdisciplinary innovation

Many of the significant future challenges identified across the five strategic areas (oceans, green transition, technology and digitalisation, health and welfare, and cohesion and globalisation) can only be solved through collaborative, research-based and interdisciplinary innovation. The Norwegian R&I system needs to experiment with new ways of supporting and promoting collaboration across different levels, sectors and disciplines.



No. 4: Support new industry development beyond the oil and gas sector

Over several decades, Norway has grown more dependent on the high revenues and returns from its strong oil and gas sector. However, with the long-term trend of production pointing downwards, uncertainty around oil prices and climate concerns, Norway could diversify its economy to non-oil activities (OECD 2019b). New industry development in other areas is needed to contribute to a more diversified and sustainable national economy. Hence, there is a need to strengthen the support for new industry development in the Norwegian R&I system (including but not limited to small to medium-size enterprises (SMEs) and start-ups) (OECD 2019b). To succeed, the initiatives have to be larger and more focused.

⁷ As noted previously, individual references to interviews and the crowdsourcing exercise are not included in this report, as the findings presented here reflect the summarised findings from the analysis rather than suggestions made by individual experts or stakeholders.



No. 5: Experiment with new types of regulatory practices and approaches

To keep up with the pace of change in technology while also fostering innovation and mitigating against potential risks, there is a need to experiment with new types of regulatory practices and approaches. This need has been articulated by many actors in the Norwegian R&I system over time, but it has not been straightforward to achieve. The Norwegian R&I system is competing with that of other countries on providing the best conditions for R&I. One competitive parameter is to provide ‘lighter’ regulatory spaces, within which research-based innovation can better thrive in delineated periods.

Different archetypes of structural measures

We have categorised the proposed structural measures into six high-level archetypes, or models, of the basic mechanisms that could be used as tools to implement the measures. These archetypes have been identified by grouping the structural measures in the long-list of structural measures we identified through the trend analysis, expert crowdsourcing exercise, interviews and expert foresight workshops. The archetypes are presented in the table below, providing an overview of possibilities and directions when working with and developing new structural measures and/or strengthening existing measures. Using a mix of different archetypes is important in order to achieve desired outcomes in terms of a balanced system, thus ensuring different mechanisms to support the future of R&I. Moreover, most structural measures will have to be cross-cutting in terms of their scope and applicability to different areas of R&I.

Table 2. Overview of structural measure high-level archetypes

Financial instruments	Governance and regulation	Cooperation and networks
<ul style="list-style-type: none"> Measures that include a monetary element addressing funding calls, funding schemes, funding programmes or the structure of the funding system, or that include other monetary incentives to realise an objective, such as tax incentives. 	<ul style="list-style-type: none"> Structural measures that address the governance system and structures, policies, and rule of law. 	<ul style="list-style-type: none"> Measures that encompass facilitation of collaborations, partnerships, networks, interaction capabilities across sectors and bilateral and multilateral agreements.
Knowledge	Education, training and skills	Data and infrastructure
<ul style="list-style-type: none"> Measures that are aimed at using existing knowledge and generating new knowledge. 	<ul style="list-style-type: none"> Measures that are aimed at generating particular abilities, competences and expertise for the job market, as well as general life skills. 	<ul style="list-style-type: none"> Measures that address the collection, use and sharing of data.

Source: Study team analysis

3. Potential structural measures

As noted previously, a set of policy levers or actions, together with underlying structural measures will be required by the RCN. The policy levers or actions and the structural measures can help steer the R&I system towards its main outcomes of interest (i.e. achieving a ‘well-functioning R&I system’) and its three overarching objectives for the current strategy period (i.e. ground-breaking research and radical innovation; sustainable development; and restructuring of the business and public sectors) (Research Council of Norway 2020). Developing a series of strategically selected priority missions, cutting across the RCN’s five strategic areas, could help contribute to this. If missions are implemented successfully, and in parallel with the establishment or improvement of key structural measures at a systemic level, this could help the RCN meet its current objectives and ultimately contribute to enriching lives locally, nationally and internationally.

In the sections below, we outline a series of indicative structural measures identified for each high-level R&I-related need that was presented in Chapter 2. For each structural measure, we provide information on: (i) the need(s) the structural measure addresses; (ii) the strategic area(s) the measure is specifically relevant to; (iii) the RCN strategic objective that the structural measure can help address in the future; (iv) the archetype it falls within (a list of the archetypes are provided in Table 2); and (v) an indicative list of potential actors that can be involved in implementing the structural measure. For each structural measure, we provide a brief introduction to the measure, followed by examples from existing Norwegian measures, as well as examples mentioned by interviewees and participants in the foresight workshops.

A few structural measures are cross-cutting and will correspond to more than one need. There are also different levels of specificity in each structural measure. The structural measures are not definitive; rather, we suggest measures that the RCN – together with other stakeholders – can explore in the future. Furthermore, to facilitate innovation and contribute to key policy goals, it is important to get the mix of policy measures right. Structural measures do not operate in isolation, and they will need to interact with other structural measures to address various challenges in the R&I policy landscape.

The approach enables the inclusion of a wide set of R&I activities. Solving grand challenges demands a systems perspective, which includes a broader involvement of actors and stakeholders, who need to coordinate and collaborate strategically to create change, both within and outside the R&I system. Potential key actors that may be involved in the realisation of the measure are a mix of public and private bodies with measures and instruments that cut across the policy apparatus. Public sector actors include the Research Council of Norway, Innovation Norway, the Industrial Development Corporation of Norway (SIVA) and educational institutions, as well as the regional health authorities and the research institutes. The third and private sectors encompass non-governmental organisations (NGOs) and industry, the latter spanning larger firms and clusters to smaller start-ups. Mobilising citizen participation where possible is also central to contributing to key R&I policy goals in Norway.



Need 1: Increase access to and sharing of R&I data and knowledge

Structural measure 1: Establish a central knowledge and data repository	
Other needs supported by this measure: No. 3: Promote collaborative research-based and interdisciplinary innovation	RCN objective: Restructuring of the business and public sectors
	Archetype: Data and infrastructure
RCN strategic area(s) with special relevance: Relevant to all strategic areas	Potential actors: Responsible ministries, the RCN, Innovation Norway, Norwegian Digitalisation Agency (Digitaliseringsdirektoratet, or DigDir), Norwegian Centre for Research Data
Description	
<p>Norway, like many other countries, has invested in infrastructure to promote Open Science, including online repositories, databases, archives and digital platforms containing information on research and development (R&D) projects and researchers. However, there is still a lot of potential in making data and knowledge available through a central data and knowledge repository. This repository could act as a central platform for extraction of relevant data from previous publicly funded research projects and national registries.</p> <p>The repository could also serve as a hub for knowledge and research results. This will help ensure that projects build onto each other and serve as a source of partnering initiatives for new projects.</p> <p>When establishing the repository, focus should be on Norwegian strengths, since there is a lot of innovation in some Norwegian sectors. These sectors include, but are not limited to, carbon capture and storage, energy, maritime, aquaculture and petroleum. The results and innovation from these areas can then diffuse more easily into other sectors as well.</p>	
Examples and inspiration	
<p>The UK Biobank and Finland’s Open Data Bank</p> <p>The UK Biobank, in the United Kingdom, is a large-scale biomedical database and research resource that provides researchers access to health data, fostering collaboration among experts from academia, industry, charities and government (UK Biobank 2021). Finland has collected all of its open data sources in a central repository that is open to all actors (Avoindata 2021). The Finnish Digital and Population Data Services Agency serves as the authority that promotes the use of open data and innovation in Finland (Digital and Population Data Services Agency 2021).</p> <p>RE3DATA.org, funded by the German Research Foundation</p> <p>RE3DATA.org is an online search engine and registry to find data repositories across countries and research fields. This makes data sharing easier and allows researchers to quickly search for appropriate repositories to share their own data in. Currently, the registry indexes and provides information on more than 2450 repositories (Cousijn & Fenner 2020). The German Research Foundation has funded a project to make it easier to connect the RE3 data with other data sources and research infrastructure. This will make the reuse and combination of data easier, by means of core repository descriptions that are persistently identifiable and can be referred to and cited in an appropriate manner (Cousijn & Fenner 2020).</p>	

Structural measure 2: Explore new data-sharing policies	
Other needs supported by this measure: No. 3: Promoting collaborative research-based and interdisciplinary innovation	RCN objective: Restructuring of the business and public sectors
	Archetype: Data and infrastructure
RCN strategic area(s) with special relevance: Health and welfare; Technology and digitalisation	Potential actors: Government, relevant ministries, DigDir
Description	
<p>Although Norway, like many other countries, has implemented initiatives that foster and enhance access to and sharing of public research data, it does not have many initiatives and principles that target the access and sharing of data between the public and private sectors. Likewise, policies around the use of specific new technologies are still lacking (in 2020, a new strategy on artificial intelligence (AI) was introduced – this can serve as a form of inspiration (Ministry of Local Government and Modernisation 2020)).</p> <p>Norway can develop more ambitious data-sharing and tech policies and principles that encourage new practices for both public and private R&I data. This is especially important in the health sector, where large datasets play a vital role in most innovation and the data typically involves sensitive information.</p> <p>Regulation can help facilitate data sharing. Policies that facilitate anonymisation and safe data sharing allow for more collaboration and reuse of data across different projects. For instance, the National Strategy on Access to and Sharing of Research Data in Norway aims to improve research quality and increase value creation that is knowledge intensive, by creating basic principles to manage and develop publicly funded research data (Ministry of Education and Research 2018). It aims to clarify the expectations of research institutions, develop measures that can create a better basis for building on previous research, and compile research data in innovative ways (Ministry of Education and Research 2018).</p>	
Examples and inspiration	
<p>The European Union’s (EU) common data sharing</p> <p>The development of a common European data economy is at the core of the EU’s new digital strategy. The ambition is to establish an internal market for data as a commodity, in line with other commodities. Three main goals are formulated for this ambition (European Commission 2020):</p> <ul style="list-style-type: none"> • Make better use of publicly held data for research for the common good; • Support voluntary data sharing by individuals; and • Set up structures to enable key organisations to share data. <p>Although the open data market size was worth €184.45 billion in 2019, it is forecasted to range between €199.51 and €334.20 by 2025 (European Data Portal 2020).</p> <p>Initiative on Rare and Undiagnosed Diseases (IRUD) in Japan</p> <p>IRUD is an initiative led by the Japan Agency for Medical Research and Development that aims to construct a comprehensive medical network and data-sharing framework for patients who have rare and undiagnosed diseases (Allagnat et al. 2019). The framework aims to be internationally compatible and was initiated in 2015, to accelerate the efforts that have been made by international counterparts. The initiative has been used in a Lithuanian context, with Japanese and Lithuanian researchers successfully diagnosing patients via active data sharing (Allagnat et al. 2019).</p>	



Need 2: Support the development of a future-proof Norwegian workforce

Structural measure 3: Establish a future skills research centre	
Other needs supported by this measure: None identified	RCN objective: Sustainable development Archetype: Education, training and skills
RCN strategic area(s) with special relevance: Relevant to all strategic areas	Potential actors: Relevant ministries, the RCN, other relevant institutes
Description	
<p>To help build capacity and to address the challenges and demands of a changing labour market, Norway could establish a research centre on future skills, potentially inspired in part by the Future Skills Centre in Canada, with the aim to help its population better understand future skills priorities, knowledge gaps and leading practices (Future Skills Centre • Centre des Compétences Futures 2021). The impact of the Canadian Future Skills Centre on the workforce has not been measured.</p> <p>The centre could be responsible for delivering timely data and knowledge on future skills needs by, for example, providing a platform potentially along the lines of the UK skills taxonomy (Djumalieva and Sleeman 2018), described below. The platform could also help both workers and students to learn more about which skills are needed and the value of those skills. Furthermore, the platform could help inform education providers and policy makers on how skills are changing, so that relevant policy measures could be implemented in the future.</p> <p>The centre could also provide ambitious practical ideas to deliver solutions for a changing labour market, to promote technology readiness and broader digital skills (for example, by providing courses free to the public to keep their skills up to date with the demands of digitalisation). Another focus of the centre could be the specific value of the humanities and social sciences areas as a part of the innovation value chain.</p>	
Examples and inspiration	
<p>The Future Skills Centre in Canada/Centre des Compétences Futures</p> <p>The Future Skills Centre is a forward-thinking centre for research and collaboration, which aims to respond to the need for a more agile, adaptable workforce in Canada and ensure that Canada's skills development policies and programmes are 'future fit'. The centre shares insights into the needs of the labour market today and in the future and supports skills development and employment training. It seeks to ensure an inclusive approach, having a strong focus on supporting underserved groups. It also funds and partners with different groups to lead innovation projects across Canada (Future Skills Centre • Centre des Compétences Futures 2021).</p> <p>The UK skills taxonomy:</p> <p>The UK skills taxonomy is not a centre but, rather, a framework that a centre could potentially draw on to identify emerging skills that are in demand now and in the future. The data-driven skills taxonomy was developed by researchers in the United Kingdom (UK) to address skills shortages in the UK. The taxonomy was created through a large collection of skills that were mentioned in UK job adverts between 2012 and 2017. Machine learning was then been used to hierarchically cluster the skills and to capture which skills are needed for which jobs (Djumalieva and Sleeman 2018). The taxonomy provides a way to measure the demand for certain skills by employers and the current supply of those skills from workers, and maps the different supply-based courses that are provided by educational institutions and employers.</p>	

The course Elements of AI

A centre could also be responsible for different training platforms and solutions that could help citizens develop resilience around, for example, technological change. Elements of AI is an example of an online training course that has seen great success in the Nordic countries and that could inspire future training platforms. The online educational platform, launched in 2018, is a collaboration between the University of Helsinki and the IT company Reactor. The course has currently reached 0.5m participants in Finland (Karlsson 2020). The course inspired a similar course in Sweden, as AI Sweden, Vinnova and Linköping University have now launched a Swedish version. The course in Sweden aims to educate 1 per cent of the Swedish population on the basics of new technology (Karlsson 2020). The course is also provided by the Norwegian University of Science and Technology (NTNU), in Norway. This is an example of an initiative that could potentially be scaled up and promoted nationwide by a future skills centre.

Structural measure 4: Make the education system more flexible and incorporate more entrepreneurial and innovation skills	
Other needs supported by this measure: No. 3: Support and promote research-based and interdisciplinary innovation in different sectors	RCN objective: Sustainable development
	Archetype: Education, training and skills, knowledge
RCN strategic area(s) with special relevance: Technology and digitalisation; Cohesion and globalisation	Potential actors: Educational institutions, government and ministries, industry
Description	
<p>Several stakeholders we engaged with over the course of the study highlighted the fast pace of change in society and the evolving workforce demands, which require competencies from several subject areas. They also noted that more interdisciplinarity and entrepreneurial skills would be needed to try to solve the larger global challenges. Work life will also require rapid shifts between professional perspectives, so being able to ‘translate’ competencies from one knowledge area to another will be imperative for using Norway’s strengths to build new industries.</p> <p>A move away from traditional education programmes has been suggested. It has been noted that it is important to not discard disciplinary approaches, but, rather, to provide more flexibility in education (Wernli et al. 2017). It is also important to open up the education system to more interdisciplinarity. Interdisciplinarity can be an important facilitator for new ideas and innovation adaptation in education and vocational training (Wernli et al. 2017). More emphasis on interdisciplinarity and innovation in education could also help support the development of an agile workforce that can adapt quickly to a rapidly changing society and lay the ground for a holistic approach to solving problems (Harris 2019).</p> <p>Integrating the humanities and social science perspective in innovation has also been frequently mentioned as important (Kaloudis et al. 2019). This integration would help spur a more rounded understanding of global challenges and the social framework in which innovation takes place, and thus also contextualise and give direction for innovation to meet these challenges.</p>	
Examples and inspiration	
<p>Future development plans at NTNU</p> <p>One example from Norway is NTNU’s two development projects within NTNU’s future development plan – Fremtidens HUMSAM-studier (Future humanitarian and social science studies) and Fremtidens teknologi studier (Future technology studies) – which will investigate the opportunities and challenges of the current study portfolio and recommend changes to meet the needs of the future (Norwegian University of Science and Technology (NTNU) 2021). Looking to expand opportunities for more interdisciplinarity is an important part of the investigation, as is bringing a greater focus on innovation, digitalisation and sustainability into the university’s study programmes.</p>	



Need 3: Promote collaborative research-based and interdisciplinary innovation

Structural measure 5: Promote interdisciplinarity, collaborations and partnerships through funding requirements and specialised calls	
Other needs supported by this measure: N/A	RCN objective: Ground-breaking research and radical innovation
	Archetype: Cooperation and networks, financial instruments
RCN strategic area(s) with special relevance: Relevant to all strategic areas	Potential actors: Ministries, the RCN, industry, research institutes, higher education institutions (HEIs)
Description	
<p>Several stakeholders we consulted over the course of the study mentioned that there should be a greater focus on interdisciplinarity in calls, as well as on calls that would to a larger degree trigger private sector interest. Combining methods, concepts, perspectives and theories from different disciplines is vital for producing new, valuable knowledge (NordForsk 2020).</p> <p>Norway already has collaborative support measures and programmes in place, such as the Large-Scale Interdisciplinary Researcher Project (Research Council of Norway 2021a). However, Norway could further refine the collaborative support programmes within a broader supporting and complementary set of policies, which may improve their outcomes in terms of scientific novelty and innovation.</p> <p>Funders, including the RCN, could further promote interdisciplinarity by having a mechanism in place to identify calls where interdisciplinarity is an advantage and by putting emphasis on collaboration between two or more academic disciplines when evaluating applications. This would potentially incentivise researchers to seek out interdisciplinary teams when pursuing funding.</p> <p>Incentivising public–private collaborations could also be promoted with specialised funding calls. This could, for example, be in relation to calls where public and government organisations set out specific issues or problems in calls that, they believe, can be solved or pushed forward by R&D or research. The public/government agency can commit its own funding in collaboration with an external third-party fund that funds the private sector component. However, as is the case with interdisciplinarity, it is worth noting that there are wider cultural and structural barriers to promoting effective collaboration.</p> <p>Managing to implement processes, calls and initiatives that trigger private sector interest, with a certain level of competition, can help individual companies that are supporting specific individual projects, as well as larger clusters that can contribute to developing their respective sector. Inspiration can be taken from Vinnova, the Swedish Energy Agency, and its strategic innovation programme (Vinnova 2021), and from the UK’s industrial strategy with its sector (Department for Business, Energy & Industrial Strategy 2019).</p>	
Examples and inspiration	
<p>Vinnova’s strategic innovation programmes</p> <p>As of 2014, Vinnova, the Swedish Energy Agency, and Formas, the Swedish Research Council for Sustainable Development, finance a total of 17 strategic innovation programmes. Aiming to create sustainable products and services for the future, the programmes require businesses, academia and organisations to join forces (Vinnova 2021).</p>	

UK industrial strategy with its sector deals

The industrial strategy is no longer active, but its sector deals have been put forward by study participants as an example of how to potentially facilitate partnerships with government and industry on sector-specific issues. For example, the UK government and the life sciences sector agreed to a multi-billion-pound deal ensuring that the UK remained at the forefront of innovation in this sector (Department for Business, Energy & Industrial Strategy 2019). The UK's business and economic environment changed during the strategy. This caused a shift of focus in government towards creating and supporting jobs. Helping to drive growth in existing, new and emerging industries is, however, still a priority. The industrial strategy has now transitioned into the Plan for Growth (GOV.UK 2021).

Structural measure 6: Strengthen the Centres for Research-based Innovation (SFI) scheme	
Other needs supported by this measure: N/A	RCN objective: Ground-breaking research and radical innovation
	Archetype: Cooperation and networks; Governance and regulation
RCN strategic areas with special relevance: Relevant for all strategic areas	Potential actors: Industry, the RCN, HEIs
Description	
<p>The SFI scheme is a larger and longer-term research programme, with a duration of eight years (Research Council of Norway 2021b). Research centres under the scheme are characterised as a ‘dedicated, long-term initiative designed to strengthen and further develop elite, creative R&I groups or to build up research groups in strategically important areas’ (Research Council of Norway 2019). The overarching aim of the scheme is to ‘enhance the ability of the business sector to innovate and create value through a greater focus on long-term research’ (Research Council of Norway 2019). The scheme has been noted as largely successful in promoting innovation, by supporting long-term research through close cooperation between R&D-intensive companies and prominent research institutions (Damvad Analytics 2018). However, further developments related to the scheme that could potentially increase innovation output have also been identified (Damvad Analytics 2018). These adjustments include:</p> <ul style="list-style-type: none"> • Have more committed, competent and active industry partners • Contribute to setting the agenda for the next industrial (digital and disruptive) revolution • Have a stronger focus on commercialising research results • Give much higher priority to internationalisation • Support public innovation and services innovation more • Make SFI centres swifter in terms of starting up and being operationalised 	
Examples and inspiration	
<p>COMET Scheme in Austria</p> <p>The Austrian, research-based innovation centres programme Competence Centres for Intelligent Technologies (COMET), was founded in 2006 (Koschatzky et al. 2015). The main success factors of the programme relate to are: 1) the high levels of trust between science and industry and the long-term commitment from both sides; 2) the research managers at the centres; 3) the legal form of centres as GmbHs [Gesellschaft mit beschränkter Haftung, company with limited liability] and physical entities; 4) the openness to the international environment; 5) the research program functioning as a ‘living’ construct (e.g. the ability to adapt); 6) the fact that competitive components form the regular calls; and 7) selection is not done on pre-determined topics, but there is thematic openness (Koschatzky et al. 2015).</p> <p>Catapult network in the UK</p> <p>The funding model of the Catapults is noted as a unique characteristic of the programme, a characteristic that was found to be a critical part of the UK innovation ecosystem by a recent review (Department for Business, Energy & Industrial Strategy 2021c). The three-way funding model (one third from business-funded R&D contracts, won competitively; one third from collaborative applied R&D projects, won competitively; and one third from core public funding) ensures a balance between science and industry, strengthens public-private collaborations, and enables the Catapults to operate at a high level (including attracting skilled employees and providing state-of-the-art facilities and equipment). Further strengths of the Catapults are their legal form, as ‘companies limited by guarantee’ (shortened to CLGs), and their independent status, in the</p>	

sense that they are neither part of a governmental body or research organisation nor part of a company (Department for Business, Energy & Industrial Strategy 2021c). A review of the catapult network has shown that Catapults play an important role in the wider R&D system (Department for Business, Energy & Industrial Strategy 2021c).



Need 4: Support new industry development beyond the oil and gas sector

Structural measure 7: Promote fewer but stronger national industry clusters	
Other needs supported by this measure: N/A	RCN objective: Restructuring of the business and public sectors
	Archetype: Cooperation and networks
RCN strategic areas with special relevance: Relevant for all strategic areas	Potential actors: Industry, the RCN, Innovation Norway, SIVA
Description	
<p>Norway currently has about 40 Norwegian Innovation clusters (Innovation Norway 2021).⁸ Promoting fewer but stronger national industry clusters could give other industries the size, professionalism and know-how needed to attract R&I funds to compete with the oil and gas sector. Coupling forces can gather overlapping efforts from several actors, create unified knowledge within areas to strengthen innovation through increased cooperation, and increase international competitiveness of Norwegian firms in the industry.</p>	
Examples and inspiration	
<p>Looking to Denmark's cluster approach</p> <p>Denmark has taken a similar cluster approach, which aims to produce industry-relevant research of high quality, with the establishment of the Danish Board of Business Development (as a central authority (Danmarks Erhvervsfremmebestyrelse 2021).</p> <p>The Strategy Business Promotion in 2020–2023 identifies a number of economic areas of business and technology as the future focus of the publicly funded cluster organisations (Danmarks Erhvervsfremmebestyrelse 2021). With this strategy, there will be only one funded cluster within each selected sector. This will gather efforts across the country and enable a simpler, more efficient and more understandable cluster structure. This new approach was developed based on an evaluation of the old system, which had more clusters (Forenkling af erhvervsfremmesystemet 2018). The new approach focuses on supporting: (1) one professional and nationwide cluster organisation should be the leading force for innovation within its area; (2) cluster initiatives must be rooted in an independent, private cluster organisation, which strengthens innovation in the companies through cooperation across their ecosystem; (3) cluster organisations must be neutral cooperation platforms, which are open and available to all types of relevant businesses and entrepreneurs all over the country; and (4) cluster initiatives must consist of activities which motivate the companies to take joint responsibility for the development within their area, e.g. through private co-financing (Danmarks Erhvervsfremmebestyrelse 2020).</p>	

⁸ The Norwegian Innovation Clusters are a publicly funded cluster program that aims to contribute to value creation through sustainable innovation. To achieve value creation, the aim is to catalyse and strengthen collaboration-based development activities in the clusters, to ensure that the clusters are dynamic and attractive, and to increase the innovation capacity of individual companies in the clusters (Innovation Norway 2021).

Structural measure 8: Use policy labs to promote collaboration	
Other needs supported by this measure: None identified	RCN objective: Ground-breaking research and radical innovation
	Archetype: Cooperation and networks, governance and regulation
RCN strategic area(s) with special relevance: Health and welfare; Technology and digitalisation; Oceans; Green transition	Potential actors: Industry, the RCN, HEIs, research institutes, NGOs, government
Description	
<p>The European Commission’s science and knowledge service, the Joint Research Centre (JRC), defines policy labs as ‘emerging structures that construct public policies in an innovative, design-oriented fashion, in particular by engaging citizens and companies working within the public’ (Fuller and Lochard 2016, 2).</p> <p>To further strengthen R&I policy coherence and alignment, policy labs have been noted as an instrument to potentially help mitigate conflicts of interest, but also inform institutional innovation – innovation that is novel, useful and legitimate (Raffaelli and Glynn 2015). Policy labs create a platform for multiple partners from the public, private and civic sectors to meet, bringing together different disciplines, approaches and viewpoints in order to develop new solutions. Policy labs provide several benefits: (1) they address the need for systems thinking, interconnecting different actors; (2) they involve design thinking, making something more actionable and concrete; and (3) they are more user oriented (Christiansen 2016).</p> <p>The opportunity for this structure is potentially easier to leverage in smaller countries, ones that are not as ‘locked in’ to historical and embedded processes. In Norway, the Norwegian Policy Lab, connected to the FIT4FOOD2030 project, is an example of a policy lab that has involved a broad range of actors from the food system, breaking silos within the sector and creating a vision for the entire system (fit4food2030 2020).</p> <p>There are many types of policy labs. A policy lab can, for example, be used to address policy that can facilitate innovation in specific subsectors, but also to discuss regulatory challenges of and barriers to innovation, for example, by identifying certain technologies, services and products where it can be useful to develop a regulatory ‘sandbox’ to spur innovation. Sandboxes have also been highlighted by study participants as a means to facilitate innovation. This is discussed under structural measure 9.</p>	
Examples and inspiration	
<p>Policy labs in the EU</p> <p>Norway could draw inspiration from public policy labs in the EU. The European Commission’s science and knowledge service has created a map (Public Policy Labs in the European Member States) of public policy labs for the purpose of inspiring others. The map provides an overview on ‘who works on what’ at the local, regional and national levels (Fuller and Lochard 2016).</p>	



Need 5: Experiment with new types of regulatory practices and approaches

Structural measure 9: Make increasing use of regulatory sandboxes that promote innovation in different sectors and areas	
Other needs supported by this measure: No. 4: Support new industry development beyond the oil and gas sector	RCN objective: Restructuring of the business and public sectors
	Archetype: Knowledge, governance and regulation
RCN strategic areas with special relevance: Technology and digitalisation	Potential actors: Government, relevant ministries, industry
Description	
<p>A regulatory sandbox is a controlled environment where, for a predetermined period of time and for defined use cases, close collaborations between firms and regulators take place to enable firms to test new data uses, technologies and applications while receiving regulatory guidance (OECD 2020).</p> <p>There are many forms of innovation facilitators, but the use of regulatory sandboxes has been put forward as a potentially viable instrument for two reasons (Ministry of Finance 2018): (1) they allow innovators to test new products, technologies and services and create clarity on which laws and regulations would apply to these innovations; and (2) regulators get to learn about new innovations within the sector. This creates collaboration and mutual learning between government and businesses, while decreasing risk. Norway has used regulatory sandboxes in a few sectors, for example in Fintech and in AI (Datatilsynet 2021; Ministry of Finance 2018). The tool could also be considered in other heavily regulated industries.</p> <p>Technology is outpacing the regulatory environment in some areas of technology that are developing relatively quickly in Norway (e.g. drones). Thus, there is a specific need for frameworks, regulations and incentives to support the different types of technology development. Regulatory sandboxes should be closely monitored and evaluated to see whether regulations are prohibiting innovations to develop without any upside, potentially taking down barriers and decreasing time-to-market for new innovations with faster approval.</p> <p>Interaction capabilities are important, and experiences from one sandbox environment should be shared and discussed throughout sectors. Coordination of knowledge between regulators and awareness of regulations and of which sectors are affected could, for example, be addressed through policy labs and public bodies.</p>	
Example measures from other contexts	
<p>The Association of Southeast Asian Nations (ASEAN) and Global System for Mobile Communications (GSMA) pilot space for cross-border data flows</p> <p>ASEAN and GSMA created a regulatory pilot space for companies to test the impact of policy solutions on cross-border data flows. The initiative explores digital economy aspects across the region (OECD 2019a). The space has two main aims:</p> <ul style="list-style-type: none"> • Allowing companies to demonstrate to policymakers and themselves that cross-border data flows can happen between countries that usually do not allow it; and • Enabling ASEAN member states, independently of the data privacy and cybersecurity laws they already have in place, to test the impact of different policy solutions on cross-border data flows in a controlled environment, for a predetermined amount of time (OECD 2019a). 	

Financial Conduct Authority (FCA) in the UK – regulatory sandbox

The FCA launched its regulatory sandbox in 2016. The sandbox aims to allow firms to ‘test innovative products, services and business models in a live market environment, while ensuring that appropriate safeguards are in place’ (Financial Conduct Authority 2019). The objectives of the sandbox are (Financial Conduct Authority 2019):

- Reducing the cost and time of getting innovative ideas to market;
- Reducing regulatory uncertainty to enable greater access to finance for innovators;
- Enabling a greater number of products to be tested and potentially introduced to the market; and
- Enabling the FCA to work with innovators to ensure that consumer protection safeguards are built into new services and products in an appropriate way.

Even though it is difficult to measure the direct impact, it has been previously noted that several positive indicators suggest that the sandbox contributes to a supportive regulatory environment in the UK (Financial Conduct Authority 2019). It has inspired similar schemes among regulators across the world and has, in part, contributed to a strong policy environment and regulatory regime (Financial Conduct Authority 2019).

European Digital Innovation Hubs (EDIH)

The European Commission will launch the EDIH calls in September 2021, to enable selected EDIHs to start operating in 2022 (European Commission 2021). The aim of the hubs is to create ‘one-stop shops’ that can help companies respond in a dynamic way to digital challenges and to become more competitive (European Commission 2021).

The EDIHs will provide access to technical expertise and experimentation and the option to test before investing, by helping companies improve their business or production processes, products or services that use digital technologies (European Commission 2021). The hubs will also provide innovation services, including financing advice, training and skills development, that are necessary for digital transformation to be successful (European Commission 2021). The hubs will also aim to take into account environmental issues related to energy consumption and low carbon emissions (European Commission 2021)

Structural measure 10: Create a new high-risk funding body or funding scheme	
Other needs supported by this measure: None identified	RCN objective: Ground-breaking research and radical innovation
	Archetype: Funding, governance and regulation
	Potential actors: Industry, the RCN, pioneering researchers and institutes, educational institutions
RCN strategic area(s) with special relevance: Relevant for all strategic areas	
Description	
<p>Several study participants mentioned that the pace of technological development is increasing, and the current set-up in terms of funding calls is perceived as being relatively slow. The COVID-19 pandemic has also illustrated the importance of agility in funding and decision making (Gunasekar and Gloinson 2020). Throughout the study, stakeholders also highlighted the need to supporting SMEs and pioneering entrepreneurs to a larger degree (pointing especially to those that might fall outside the demand in the current set-up). A funding body or scheme that is particularly dedicated to high-risk research, and that could follow and keep up with the pace of development and also fund inspiring inventors, could mitigate against possible market failures that might occur in the current set-up.</p> <p>In order to spur more high-risk research focus, several countries have created bodies inspired by the Defense Advanced Research Projects Agency (DARPA) in the United States (Department for Business, Energy & Industrial Strategy 2021b). Other examples include Moonshot R&D in Japan and the SPRIN-D in Germany (Department for Business, Energy & Industrial Strategy 2021a).</p>	
Examples and inspiration	
<p>Defense Advanced Research Projects Agency</p> <p>DARPA (formerly known as Advanced Research Projects Agency, or ARPA) is a research funding agency that has achieved breakthrough innovations over the past 50 years both inside and outside defence applications. The mission of the agency is to 'make pivotal investments in breakthrough technologies for national security' (DARPA 2021) The DARPA/ARPA model is centred around three main elements: ambitious goals, temporary project teams, and independence (Dugan and Gabriel 2013; DARPA 2021). The agency aims for transformational change rather than advances that are incremental (DARPA 2021). Its ability to identify which research goals to pursue has been highlighted as one of its strengths. DARPA/ARPA has focused on two main aspects when identifying the goals: (i) recognising and focusing on scientific fields that are able to solve, often in innovative ways, a practical problem of importance; and (ii) uncovering emerging user needs that existing technologies are unable to address (Dugan and Gabriel 2013). ARPA played a key role in the development of transformational technologies, such as geographical positioning systems and the Internet (Department for Business, Energy & Industrial Strategy 2021b).</p> <p>The UK's new Advanced Research & Invention Agency (ARIA) is based on the principles of ARPA/DARPA (Department for Business, Energy & Industrial Strategy 2021b). ARIA is an independent research funding body that will fund high-risk and high-reward scientific research. The agency will be led by scientists who have the freedom to identify and fund transformational science and technology at a speed (Department for Business, Energy & Industrial Strategy 2021b). The aim of ARIA is to strengthen the UK's role as a global science superpower while strengthening the UK's work to build better through innovation (Department for Business, Energy & Industrial Strategy 2021b).</p>	

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