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Health and welfare

An analysis of trends, future directions and potential missions to address societal challenges in Norway

Emily Ryen Gloinson, Carolina Feijao, Fay Dunkerley, Mann Virdee, Camilla d'Angelo, Gemma-Claire Ali, Mikkel Skjoldager, Andrea Skjold Frøshaug, Torben Bundgaard Vad and Salil Gunashekar

A photograph of a man in a plaid shirt standing on a rocky outcrop, holding a young child in the air. They are positioned in the foreground, looking out over a vast, calm body of water. In the background, there are large, rugged mountains with patches of snow under a clear sky. The image is partially overlaid by a large orange shape at the top and a dark blue shape at the bottom right.

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

RAND Europe team: Salil Gunashekar, Emily Ryen Gloinson, Fay Dunkerley, Mann Virdee, Camilla d'Angelo, Carolina Feijao and Gemma-Claire Ali

DAMVAD Analytics team: Mikkel Skjoldager, Andrea Skjold Frøshaug and Torben Bundgaard Vad

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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 health and welfare is one in a series of nine reports presenting the findings of the study. The other reports are as follows:

- 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
- Structural measures to develop a resilient research and innovation environment 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 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.

For more information about this document, please contact:

Dr Salil Gunashekar (Research Leader in Science and Emerging Technology)	Torben Bundgaard Vad (VD, Partner, Ph.D.)
RAND Europe Westbrook Centre, Milton Road	DAMVAD Analytics
Cambridge CB4 1YG, United Kingdom	Overgaden Oven Vandet 58A
Tel. +44 (1223) 353 2562	1415 Copenhagen K, Denmark
Email: sgunashe@randeurope.org	Tel. +45 2444 7554
	Email: tva@damvad.com

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Abbreviations

AI	Artificial intelligence
ESBL	Extended-spectrum beta-lactamase
EU	European Union
LTP	The Long-Term Plan for Research and Higher Education 2019–2028 – Meld. St. 4 (2018–2019) Report to the Storting (white paper)
MSIS	Meldingssystem for smittsomme sykdommer (Norwegian Surveillance System for Communicable Diseases)
NAV	Arbeids og velferdsforvaltning (Norwegian Labour and Welfare Organisation)
NCD	Non-communicable disease
NOK	Norwegian kroner
NORM	Norsk overvåkningssystem for antibiotikaresistens hos mikrober (Norwegian Surveillance System for Antimicrobial Drug Resistance)
NORM-VET	Norsk overvåkningssystem for antibiotikaresistens hos mikrober fra fôr, dyr og næringsmidler (Norwegian Surveillance System for Antimicrobial Drug Resistance – Veterinary Medicine)
HOD	Helse og Omsorgsdepartementet (Ministry of Health and Care Services)
ICT	Information and communications technology
OECD	Organisation for Economic Co-operation and Development
PESTLE	Political, economic, societal, technological, legal and environmental
PISA	Programme for International Student Assessment
RCN	Research Council of Norway
R&I	Research and innovation
SDGs	[United Nations] Sustainable development goals
UN	United Nations
VRE	Vancomycin-resistant enterococci

1. Introduction

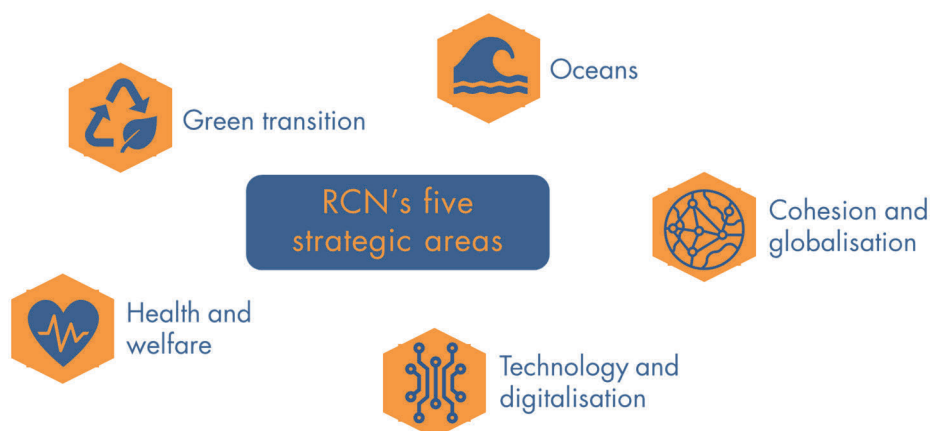
The research and innovation (R&I) landscape in Norway is underpinned by Norway's overarching ambition for research and higher education, namely to help facilitate growth in overall value creation, to create new and profitable jobs, to restructure the Norwegian economy and to help implement a transition towards a greener society (Ministry of Education and Research 2019). The development of a strong knowledge base through research is necessary to fulfil these ambitions but also to train the Norwegian workforce (Ministry of Education and Research 2019). The Long-Term Plan for Research and Higher Education¹ (hereafter LTP) details the Norwegian government's ambitions and policy for research and higher education in Norway. The LTP establishes ten-year objectives and priorities and concrete goals for efforts in the upcoming four-year period. It sets the course for policy development and investments in research and higher education in Norway.

The Research Council of Norway (RCN) plays a critical role in the Norwegian and international research and innovation landscape, as the national funding agency for R&I. In its current strategy (2020–2024), the RCN details priorities and goals to achieve a well-functioning research and innovation system to help realise the objectives of the LTP (Research Council of Norway 2020a). As part of its current strategy (2020–2024), the RCN has articulated the following three primary objectives, with the overarching view of achieving a 'well-functioning research and innovation system' (Research Council of Norway 2020a):

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

Within this framework, the RCN has also identified five core 'strategic areas' (as shown in Figure 1) within which to focus its priorities and portfolio plans and within which deliver high-impact research and innovation (Research Council of Norway 2020a).

Figure 1. The five strategic areas identified by the RCN in its current strategy (2020–2024)



¹ The Long-Term Plan for Research and Higher education 2019-2028 – Meld. St. 4 (2018-2019) Report to the Storting (white paper).

1.1. Objectives of the study

Against this backdrop, 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 2020a) and is intended to help frame thinking about the future of R&I in relation to these strategic areas in Norway. As noted above, 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 challenges; and
- Identify a series of system-level structural measures to facilitate the development of a resilient R&I environment in Norway.

For this 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 overarching objectives (over a roughly ten-year time frame) and eventually contribute to enriching lives locally, nationally and internationally.² Structural 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. In the context of this study, they are intended to be a range of measures (with varying levels of specificity and generally cutting across multiple strategic areas) that help develop a resilient R&I environment in Norway and also address the wider performance of the R&I system in terms of the RCN's three overarching objectives.

This report, one in a series of nine reports, presents an analysis of trends, future directions and potential missions for the health and welfare strategic area.³

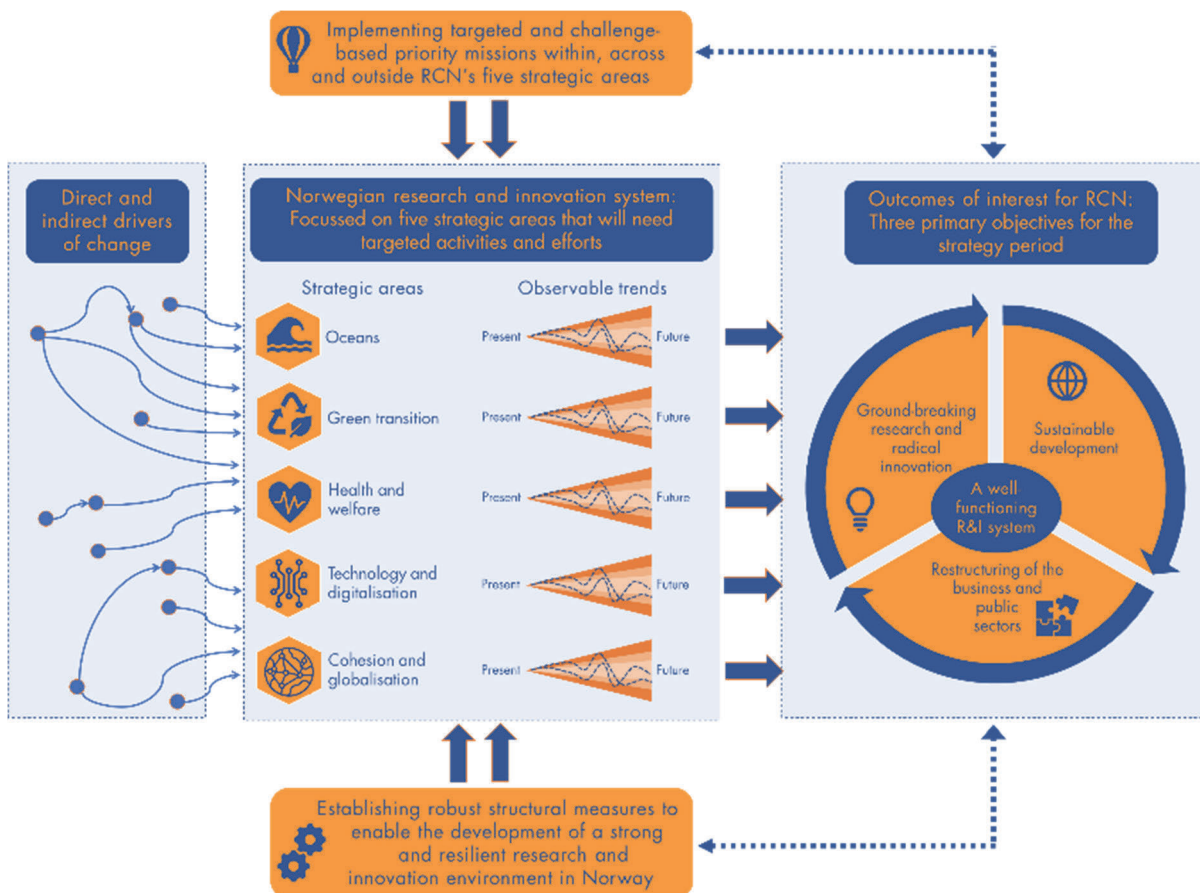
² More broadly, missions are systemic policies that operate both as a means of steering economic growth in a particular direction (by, for example, steering investments towards particular societal challenges) and as a tool that can be used to get there (by, for example, setting clear, problem-focused objectives) (Mazzucato 2018). Further details are provided in Chapter 6 of this report.

³ This report on health and welfare is one in a series of nine reports presenting the findings of the study. The other reports are as follows: Cohesion and globalisation: An analysis of trends, future directions and potential missions to address societal challenges in Norway (Gloinson et al. 2021); 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); A summary of potential cross-cutting missions to address future societal challenges in Norway (Gunashekar et al. 2021a); Structural measures to develop a resilient research and innovation environment in Norway (Skjoldager et al. 2021c); 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).

1.2. Conceptual framework for the study

Our overall conceptual framework (Figure 2) was targeted at providing a key analytical tool to enable us to carry out a rigorous, detailed and comprehensive futures analysis for the RCN. It is based on a participatory approach involving a range of diverse stakeholders, detailed trend analyses and rigorous scenario planning that contributed to the conceptualisation and achievement of the overarching aims of the study, i.e. to identify a set of potential priority missions related to the RCN’s five strategic areas and underlying structural measures to enable the development of a robust, resilient and socially responsible research and innovation environment in Norway.

Figure 2. Conceptual framework for the study



Source: Study team analysis

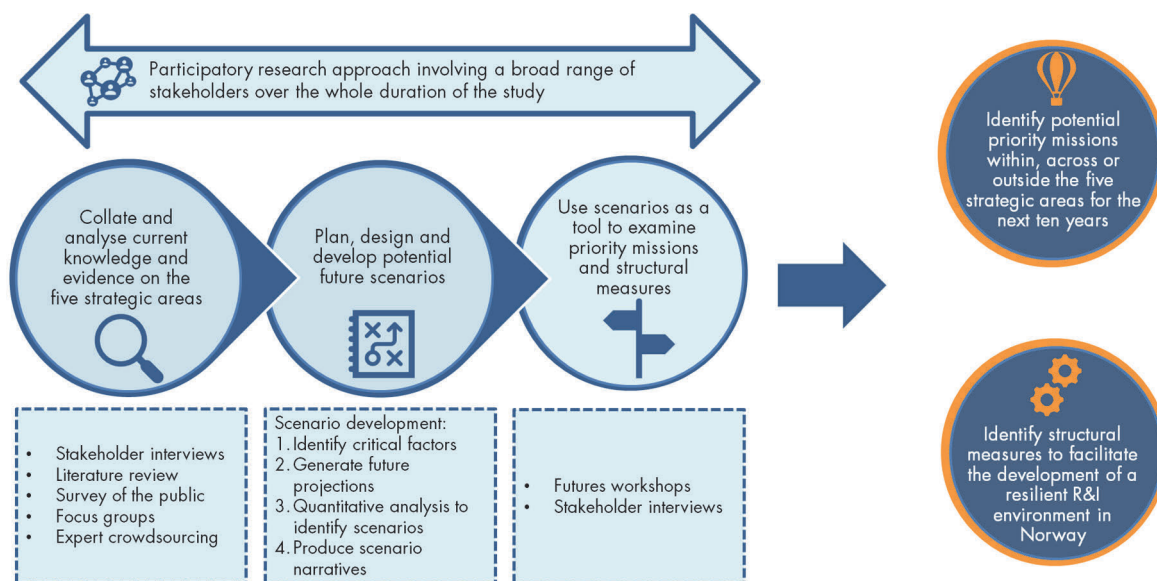
The conceptual framework for the study shown in Figure 2 provides a systems-level view of the various high-level interconnected components of the R&I ecosystem. A series of potentially interconnected drivers (as shown on the left of the figure) can either directly or indirectly influence or cause change in the wider Norwegian R&I system. The system itself is characterised by a series of observable trends or discernible patterns of change relating to the five strategic areas, as illustrated in the middle of the figure. An evidence-based foresight approach to explore a range of plausible futures can help the RCN arrive at decisions ‘today’ that will potentially mitigate future risks and enable future opportunities to be better anticipated. The conceptual framework therefore illustrates the importance not only of realising benefits for the Norwegian R&I system, but also of managing and mitigating against risks. As shown on the right of the figure, the

system is also composed of the main outcomes of interest to the RCN, which are their primary objectives over the current strategy period (2020–2024) (i.e. sustainable development, ground-breaking research and radical innovation, and restructuring of the business and public sectors). If these outcomes are achieved, this could help realise the RCN’s overarching desired outcome of a ‘well-functioning research and innovation system’. To accomplish these high-level goals, it is necessary to have a set of policy levers or actions that can help steer the system towards the outcomes of interest. Therefore, identifying and implementing a set of targeted, timebound and challenge-based actions – or priority missions – within and across (or even outside) the RCN’s strategic areas could form the basis for recognising concrete focus areas for the future. Furthermore, implementing the missions successfully will require the establishment or improvement – in parallel – of key underpinning structural measures at a systemic level. Thus, a mix of appropriate structural measures, together with a set of carefully developed priority missions – and both involving diverse stakeholders – could help the RCN meet its current objectives and ultimately contribute to enriching lives locally, nationally and internationally.

1.3. Summary of the methodology

This section provides a summary of the research approach and methodology. A detailed description of the methodology is provided in the accompanying methodology report (Gunashekar et al. 2021c). We adopted a mixed-methods, participatory approach to the research to achieve the study objectives, as illustrated in Figure 3. The methods included literature reviews, stakeholder interviews, focus groups, a survey of the public, crowdsourcing ideas and information from experts, future scenario analyses and workshops. 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.

Figure 3. High-level overview of our approach to implementing the research

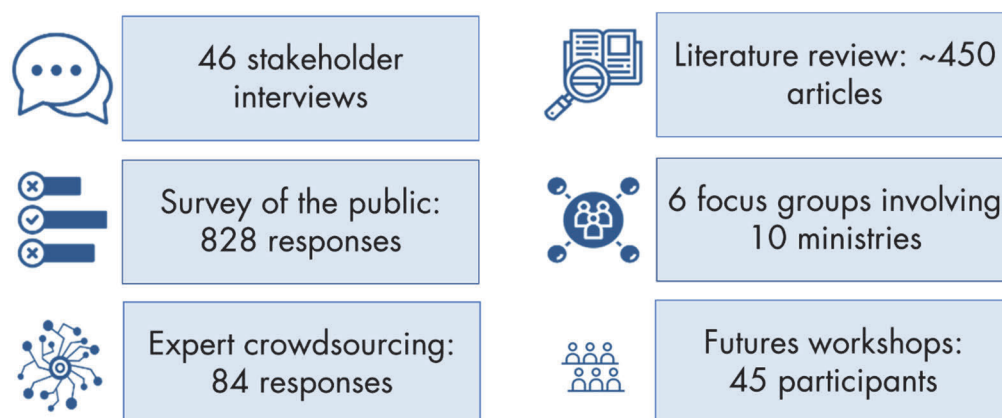


Source: Study team analysis

Trend analyses

As noted in the previous section, each strategic area is characterised by several trends that are shaping developments and driving change within those areas. In the first phase of the study, we carried out a detailed trend analysis for each strategic area, by collecting and analysing wide-ranging evidence to help develop a robust knowledge and information base. The information collected in the trend analysis enabled us to develop a deep and rounded understanding of the status quo and direction of travel within (and outside) the R&I landscape for each strategic area (oceans, green transition, health and welfare, technology and digitalisation, and globalisation and cohesion). Specifically, we identified the main trends, enablers, barriers and uncertainties that will potentially shape the strategic area over the next ten years or so. The trend analyses also directly informed the indicative priority missions⁴ and structural measures. The trend analysis synthesised evidence from the main data collection activities, as outlined in Figure 4.

Figure 4. Main data collection activities undertaken in the research



Source: Study team analysis

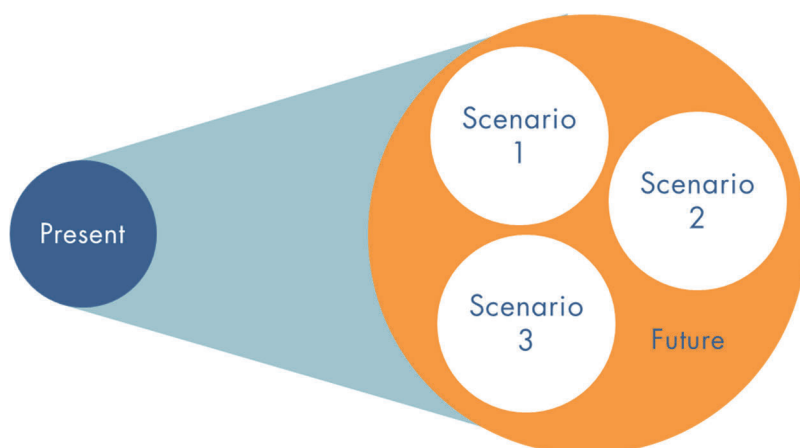
Scenario methodology

In the second phase of the study, we designed and developed plausible future scenarios using the information collected in the trend analyses (Figure 5). Scenarios are stories or narratives that are used to describe the alternative and possible ways in which a situation or environment might develop in the future (Government Office for Science 2017). Within each scenario, there is a complex network of influence factors⁵ that shape that future (Gausemeier et al. 1998).

⁴ For clarity and ease of reference, we reiterate what we mean by missions in the context of this study. We regard missions as targeted, timebound, concrete priority actions to help solve one or more societal challenges that the RCN, together with other stakeholders, could consider implementing in the future. The missions will help the RCN achieve its overarching objectives (over a roughly ten-year time frame) and eventually contribute to enriching lives locally, nationally and internationally. Further information is provided in Chapter 6 of this report.

⁵ In this study, the influence factors have been found based on the trends, barriers, enablers and uncertainties we identified in the trend analyses.

Figure 5. Plausible future scenarios, presenting a wide range of potential future states



To build scenarios of sufficient depth and distinctiveness, we used a rigorous and iterative process that involved the examination of the different factors, enablers, barriers and drivers of change that are shaping developments within, across and outside the five strategic areas. We generated two sets of scenarios by combining different aspects of the five strategic areas (in Figure 5, the orange area represents an exemplar set of three distinct future scenarios). Each scenario set comprised four distinct scenarios based on 15–20 prioritised political, economic, social, technological, legal and environmental (PESTLE) factors from the trend analyses that could influence the strategic areas (specifically, these factors were derived from the trends, enablers, barriers and uncertainties that were identified in the trend analyses). The two scenario sets were as follows:

- **Scenario set 1 (*Norway in a national context*):** The first scenario set broadly focuses on Norway in a national context, largely relating to the Norwegian domestic agenda. This scenario set encompasses health, welfare, education, work and skills, cohesion, and relevant aspects of technology and digitalisation, and it also covers some aspects related to green transition (for example, in relation to the circular economy).
- **Scenario set 2 (*Norway in a global context*):** The second scenario set focuses on Norway in an international or global context, primarily relating to Norway’s outward-facing role. It broadly covers themes related to climate, oceans, energy, transport, food, biodiversity, globalisation and relevant aspects of technology and digitalisation.

Examining potential missions and structural measures

The different scenarios facilitate the anticipation of what might happen in the next 20 years and help reflect changes in the R&I system as well as the wider, ‘macro’ environment. We used the scenario sets as the basis for discussions at two virtual foresight workshops, attended by a total of 45 stakeholders (across academia, industry, the third sector and the RCN). Using the scenarios to represent a range of distinct and plausible future states, workshop participants examined and validated a series of indicative priority missions and discussed potential structural measures. Following the workshops, a set of interviews were conducted with additional stakeholders and further desk research was carried out. The indicative missions and structural measures were further refined and updated based on feedback received at the workshops and on the additional desk research and interviews.

1.3.1. Caveats of the analysis

When reading and interpreting the analyses presented in this report, the reader needs to consider some caveats. This report analyses the trends, future directions and potential missions in the health and welfare strategic area of the RCN's current strategy. Health and welfare are wide-ranging, complex and rapidly evolving areas, not just in Norway, but also more broadly, in a global context. To accomplish the key objectives of the study while implementing the research within the timelines, we have had to keep the research focused on key topics of importance, not aiming for a systematic coverage of all topics. While the areas of focus might not be exhaustive, as outlined in the previous section, we adopted a participatory approach to the study – involving a diverse range of stakeholders – and incorporated a variety of different methods to triangulate the evidence. This has enabled us to cover a wide spectrum of important issues related to health and welfare in Norway.

Furthermore, the research presented in this report is part of a larger study that also includes four other broad strategic areas (oceans, green transition, technology and digitalisation, and cohesion and globalisation). Depending on the discussion in the literature and supported by interviewee inputs, where relevant in the analysis presented in this report, we have also considered cross-cutting implications of the strategic areas on each other. Notably, the technology and digitalisation and cohesion and globalisation strategic areas are predominantly cross-cutting in terms of their breadth of influence on the other strategic areas. Nevertheless, this report is intended to be stand-alone, and therefore the emphasis is on the trends and future socio-economic directions observed in relation to health and welfare.

Finally, the ideas for the priority missions that we have articulated are not intended to be definitive or exhaustive. Each mission is proposed as an indicative idea at this stage, based on the evidence collected during the research. The missions were examined and validated at stakeholder workshops and then further updated based on feedback received at the workshops and from the RCN. The collection of missions that we have presented for the health and welfare strategic area represent a broad spectrum of ideas for further consideration and exploration by the RCN – and other stakeholders that might be involved in the process to implement any potential missions in the future.

1.4. Outline of the report

The remainder of the report is structured as follows:

- In Chapter 2, we describe the trends shaping the health and welfare landscape in Norway.
- In Chapter 3, we provide an overview of the barriers and enablers to health and welfare research and innovation in Norway.
- In Chapter 4, we describe the key uncertainties and policy challenges that influence developments regarding health and welfare in Norway.
- In Chapter 5, we summarise the future scenarios we employed at the foresight workshops to examine the indicative missions and structural measures related to the health and welfare strategic area (as well as the other strategic areas).

- Finally, in Chapter 6, we provide a list of indicative priority missions for the health and welfare strategic area in Norway.
- In the Annexes, we present the comprehensive versions of the scenario narratives for both scenario sets and a high-level overview of all the indicative mission ideas that have been articulated within and across the RCN's five strategic areas.

2. Trends shaping the health and welfare landscape in Norway

This chapter presents the key trends influencing the development of the health and welfare landscape in Norway. In the following discussion, we have drawn on the published literature (both peer-reviewed and grey literature) and additional information and insights provided by a range of stakeholders across academia, industry, government, the third sector and the RCN.⁶

Box 1. Summary of key trends related to the health and welfare strategic area

- **Trend 1:** Rapid developments in technological innovation and digitalisation are impacting health and welfare in Norway.
- **Trend 2:** Labour market needs are changing in Norway.
- **Trend 3:** Demographic changes in Norway increasingly present health, social welfare and economic challenges.
- **Trend 4:** Increasing personalisation of medicine and healthcare presents several opportunities.
- **Trend 5:** Research and innovation related to welfare and health are dealing with more complex issues.
- **Trend 6:** Non-communicable diseases are having an increasingly significant impact in Norway.
- **Trend 7:** There has been a significant effort to reform and strengthen health and healthcare in Norway.
- **Trend 8:** There is increasing demand for qualified healthcare personnel in Norway.
- **Trend 9:** The prevalence of mental disorders in Norway is increasingly important.
- **Trend 10:** Education challenges are expected to grow as Norway upskills and employment market needs diversify.

2.1. Context

Ensuring good health and access to welfare services is necessary to deal with demographic and social changes in the Norwegian population and globally (Research Council of Norway 2020a). Thematically, the health and welfare strategic area is broadly characterised as encompassing ‘human health and health-promoting conditions, prevention, diagnostics, treatment of diseases and functional limitations, rehabilitation and organisation and streamlining of services in the health and care sector’ (Research Council of Norway 2020a). In the context of the RCN’s work, this applies to basic research, applied research and development, and innovation that is research based (Research Council of Norway 2020a).

Norwegians lead longer and healthier lives than the citizens of many European countries (World Health Organization 2020b). Since the 2000s, life expectancy has increased consistently as a result of effective

⁶ As noted previously, interviewee inputs are cited in the discussion using anonymised, unique identifiers ‘INT-HW-XX’, where XX is a number between 01 and 12. We also conducted a small number of cross-cutting interviews that covered multiple strategic areas; these have been cited throughout the report using the anonymised, unique identifiers ‘INT-CC-XX’.

public health policy that has reduced the likelihood of risk factors having an impact on Norway, and as a result of the health system's capacity to deliver high-quality treatment and care to the population (OECD & European Observatory on Health Systems and Policies 2019). However, Norway spends more on health per capita than any other EU country, and a significant share of funding is dedicated to long-term health and welfare delivery (OECD & European Observatory on Health Systems and Policies 2019). Norway also faces additional challenges, with an ageing population that is expected to put pressure on Norwegian health budgets, requiring strategies to improve effectiveness and to strengthen health and welfare for individuals with chronic illnesses (OECD & European Observatory on Health Systems and Policies 2019). Other challenges relate to social inequality in health, education and living conditions in Norway and globally (World Health Organization 2020b).

The RCN notes that the provision of adequate health and welfare services to a diverse population requires more research-based knowledge to effectively reduce inequalities in health and living conditions (Research Council of Norway 2020a). These measures include ensuring adequate living conditions and educational opportunities for children and young people and implementing health promotion from a young age (Norden 2014; OECD & European Observatory on Health Systems and Policies 2019). Digital and technological solutions will also play an important role in the future of health and welfare (World Health Organization 2019). It is necessary to strengthen the knowledge base and basic research, to facilitate broad-based public health efforts that are cross-sectoral and to understand the best ways to protect the population from health threats, both nationally and globally (Research Council of Norway 2020a). As a part of this changing landscape, the RCN's strategy highlights that the RCN will invest in research and innovation to promote i) 'satisfactory and sustainable healthcare for all segments of the population'; ii) 'strong, competitive health industries'; iii) 'reduced exclusion and high participation in the labour force'; and iv) 'a sustainable welfare system adapted to demographic changes' (Research Council of Norway 2020a).

2.2. Key trends shaping the health and welfare landscape

Trend 1: Rapid developments in technological innovation and digitalisation are impacting health and welfare in Norway

Technological innovation and digitalisation are key drivers for transforming health systems in order to allow for efficient preventive, predictive and person-centred care approaches (World Health Organization 2020b).⁷ Artificial Intelligence (AI), big data, machine learning, mobile technologies, telehealth platforms, and nanotechnology – and the intersection between several of these technologies – are playing a crucial role in enabling digital transformation across health systems (World Health Organization 2019; OECD & European Observatory on Health Systems and Policies 2019; Research Council of Norway 2020a; INT-HW-1; INT-HW-5). Norway has positioned its health system in a way that leverages technological developments through its comprehensive health databases (INT-HW-1; INT-HW-3; INT-HW-5) and through establishing entities that oversee the digitalisation of the healthcare sector, namely the Norwegian Directorate of eHealth, the Norwegian Health Network and the National System for the Managed

⁷ Input from survey of the public.

Introduction of New Health Technologies ('New Methods')⁸ (World Health Organization 2020b). Currently, the use of electronic systems for exchanging patient information, e-prescriptions, telemedicine and health-related mobile applications is widespread across Norway (Directorate of eHealth Norway 2019; Statistics Norway 2020). Additionally, AI-based solutions, sensor technologies, web-based programmes and remote digital monitoring of patients are being integrated in treatment approaches in Norway (Ministry of Health and Care Services 2020). In its National Health and Hospital Plan 2020–2023, Norway aims to further strengthen its digital approach and adapt to new ways of providing health-related services and enabling personalised medicine. It also aims to continue to develop its digital infrastructure through the implementation of management, forecasting and prediction tools in the national e-health systems (Ministry of Health and Care Services 2020). Interviewees also noted that there has been an acceleration in initiatives for the personalisation of medicine and healthcare following the COVID-19 pandemic (INT-HW-7; INT-HW-6).

'the introduction of relatively simple digital planning tools could result in shorter queues and better resource utilisation...'

Survey respondent

In the welfare sector, it is predicted that technology will have a significant impact. Norway ranks high in international rankings for information and communications technology (ICT) developments and is perceived to be technologically mature (Norwegian Board of Technology 2017). For example, one interviewee noted that the Norwegian Labour and Welfare Administration (Arbeids- og velferdsdirektoratet, NAV) have used enabling technologies (INT-HW-5). NAV are increasingly using data-driven technologies to provide advice and predictions for the users of their services (Norwegian Labour and Welfare Administration 2019). NAV can employ information about users, their life situation and the results that can be achieved in order to motivate or suggest activities for users who receive employment-related follow-up (Norwegian Labour and Welfare Administration 2019). However, it has been noted that Norway still has potential to develop in this area, for example, by using interactive technologies for citizens to engage with public services, to provide personalised services (through, for example, smart teaching materials in schools), and to provide predictive instruments (Norwegian Board of Technology 2017).⁹ One interviewee thought that progress with the use of new technologies has been slower in the welfare sector than in the health sector (INT-HW-9). They said that Norway has achieved a lot with the use of technology for children's digital security and as a learning tool for those working in welfare services (INT-HW-9).

⁸ The National System for Managed Introduction of New Health Technologies within Specialist Health Services in Norway was launched in 2013. The aim of the programme was to systematically use health technology assessments to inform decision making to 'i) improve patient safety; ii) provide patients equal access to new methods that are effective and can fulfil safety and cost-effectiveness requirements; iii) ensure that new methods that are ineffective and/or harmful are not introduced and that obsolete health technologies are disinvested; iv) provide an appropriate decision-making platform for priority setting based on health technology assessments; v) ensure rational use of resources; and vi) establish a systematic and predictable process for the introduction of new methods' (World Health Organization 2020b).

⁹ For example, it has been suggested that the Norwegian tax administration can carry out targeted checks by using predictive models to identify tax issues where there is a high probability of errors (Norwegian Board of Technology 2017).

Trend 2: Labour market needs are changing in Norway

Norway's labour market is generally considered to be well functioning, as most jobs in Norway are secure, workers receive adequate remuneration, and there is low job strain (OECD 2019b). However, there are some challenges, with declining employment rates in certain groups, especially for young and prime-aged men. It has been noted that immigrants and people with disabilities tend to have poorer labour market outcomes than the rest of the population (OECD 2019b). Moreover, Norway is expected to face more challenges with the slowdown in productivity growth, new technologies, the changing nature of work, and globalisation (OECD 2019b). Norway is also expected to face additional challenges with the restructuring of the economy that will follow from a potential shift away from the oil and gas sector (OECD 2019b). With regard to welfare provision, one interviewee noted that the competence requirements in many sectors could increase (for example, in the child welfare sector) (INT-HW-9).

Technological innovation and digitalisation may also lead to jobs being lost to automation (World Bank Group 2019). Between 2009 and 2014, an estimated 7–9 per cent of jobs in Norway were lost to automation, representing around 166,000–200,000 jobs (Fölster 2020). Unemployment is a significant stressor that affects the mental health of individuals and is associated with higher levels of depressive symptoms (Pelzer et al. 2014). As well as having these intra-personal consequences, unemployment can also have inter-personal impacts – hidden and often overlooked social processes that affect unemployed people's social well-being (Giuntoli et al. 2015).

A potential means of narrowing the employability skills gap is to emphasise 'soft' skills, such as creativity and critical thinking – as these skills are crucial not only for delivering business value, but also for adapting hard skills as workforce needs change (Radin et al. 2020). The OECD suggests that Norway can help individuals in making informed choices through the provision of skills, such as forecasting and career guidance (OECD 2020c). The OECD also recommends that Norway should promote learning in the workplace and the effective use of skills, such as through increased coordination between the labour market and higher education institutions, reskilling with a focus on digital skills, and improved certification of skills that are required in the workplace (OECD 2020c).

Trend 3: Demographic changes in Norway increasingly present health, social welfare and economic challenges

The average age of the world's population is increasing, primarily due to a combination of rising life expectancies and declining fertility rates (World Health Organization 2021). This is particularly the case in more economically developed countries, such as Norway, where the number of people aged 80 years and over is projected to double over the coming two decades (Norwegian Institute of Public Health 2016a). On the other hand, the proportion of 0–14-year-olds has decreased in the past decade, and it is estimated that this will lead to a rise in the old-age dependency ratio (the proportion of people aged 65+ to those aged 15–64) from 26 per cent in 2018 to 40 per cent by 2050 (World Health Organization 2020b). The health and social impacts of an ageing population are significant, with the changing ratio of working people to elderly people placing a strain on the human and financial resources necessary to meet growing demand for health and social care (Tinker 2002; Ministry of Health and Care Services 2018; INT-HW-1; INT-HW-2; INT-HW-12). These impacts are estimated to require an increase of 35 per cent by 2035 in the number of person-years (Research Council of Norway 2020b). Potential solutions to this problem, such as reducing

pension pay-outs, increasing tax and increasing the retirement age, are likely to be unpopular. However, the nature of the problem means that all these solutions may be required simultaneously (Nikel 2020).

Currently, Norway has one of the highest shares of expenditure on long-term care compared with other OECD countries (World Health Organization 2020b). With the growth in the aged population, it is estimated that the budgetary pressure on long-term care expenditure will increase (Research Council of Norway 2020a) and that the foundation for funding of pensions, care and health services may suffer (Ministry of Finance 2013). As part of its strategy for an 'age-friendly' society, the Norwegian government seeks to leverage the current demographic changes by extending working life for older people, supporting activity and participation in civil society and counteracting negative attitudes, such as age discrimination, as well as promoting age-friendly local communities and adopting new technology to support the autonomy of older people (Ministry of Health and Care Services 2016).

Other demographic changes, such as immigration, also present health, social and economic challenges. After the enlargement of the EU in 2004, Norway experienced an unprecedented increase in immigration, despite not being member of the EU (Cappelen et al. 2011). In 2000, Norway's immigrant population was around 5 per cent, and by 2016, this had increased to 13.4 per cent (Slettebak 2020). This increase in immigration has led to concerns about the potential for increased social inequality and that there might be a threat to the Norwegian work-life regime and welfare state (Slettebak 2020).

Trend 4: Increasing personalisation of medicine and healthcare presents several opportunities

Digital and health technology innovation have enabled a shift in medicine and healthcare towards a patient-centred approach (World Health Organization 2019). Specifically, the integration of genomics, big data and advanced computing in personalised medicine have facilitated the prediction and prevention of disease, as well as precision diagnostics, tailored interventions and a more active role of patients in managing their own healthcare needs (World Health Organization 2019; INT-HW-6; INT-HW-8; INT-HW-12). One interviewee thought that the increasing personalisation of medicine will create a new generation of users, where users and patients take on the role of customers and become drivers of innovation, thereby changing the patient-doctor dynamics (INT-HW-11). Nordic countries have been considered to be particularly well placed for realising the promise of personalised medicine, given their comprehensive population-based administrative registers in the healthcare sector, high-quality biobanks, and potential for collaboration between countries, given the similarities between their health systems (Joint Committee of the Nordic Medical Research Councils 2018). In Norway, the Norwegian Directorate of Health has established the Norwegian Strategy for Personalised Medicine in Healthcare 2017–2021, which aims to support the development of personalised medicine approaches, namely by leveraging existing research and innovation funding schemes and promoting knowledge development through collaboration across funding bodies (Norwegian Directorate of Health 2016). Other initiatives include the development of health data programmes, platforms and research infrastructures, as well as large research and innovation projects, to unlock the potential of Norwegian health data (Joint Committee of the Nordic Medical Research Councils 2018; INT-HW-12). One interviewee mentioned that one of the largest biotechnology deals made in Norway is personalised vaccine for cancer patients (INT-HW-3). Such initiatives aim to leverage the benefits of the current trends in the increasing use of health data for healthcare personalisation and patient-

centred care (The Joint Committee of the Nordic Medical Research Councils 2018). In terms of research infrastructure, there has been considerable progress, and several platforms have been implemented, including the Biobank Norway, Health Registries for Research, Norwegian Genomics Consortium, the Norwegian Primary Care Research Network, as well as analysis platforms for sensitive data (The Joint Committee of the Nordic Medical Research Councils 2018). Other large research and innovation projects and funding initiatives have also been developed to support advances in personalised medicine (The Joint Committee of the Nordic Medical Research Councils 2018).

Trend 5: Research and innovation related to welfare and health are dealing with more complex issues

With the change in demographics and the increase in the ageing population, the Norwegian health and care services are set to deal with larger-scale challenges in the near future (Ministry of Health and Care Services 2017). Research is one of the key drivers for providing the tools to tackle such challenges in an evidence-based, sustainable and innovative manner (OECD 2017c). Norway is already one of the OECD countries with the highest share of research and development in health and healthcare research funded and performed in universities (OECD 2017c). However, its high scientific performance has not necessarily been reflected in its research excellence ranking in comparison with other countries (OECD 2017c). Norway's innovation performance has also been considered to be mixed and in need of support for further diversification (OECD 2017c). More recently, the Norwegian healthcare system has undergone several changes to tackle such issues. One interviewee noted that treatment is changing and that there are new ways of conducting clinical trials, using health data to document what constitutes 'good treatment', and that treatment is introduced earlier than before for patients (INT-HW-5). For example, the Health&Care21 Strategy has been developed by universities, hospitals, municipalities, the private sector, government agencies and users to address research and innovation in health and care (OECD 2017c). This strategy outlines ten initiatives and five main priorities to foster knowledge sharing for municipalities, place health and care as an industrial policy priority, allow for increased accessibility and utilisation of health data, promote an evidence-based health and care system, and foster internationalisation of research (Ministry of Health and Care Services 2017). The Norwegian government has supported these priorities and strategic areas by fostering research and innovation through increased funding for basic research and industry-oriented instruments (Ministry of Health and Care Services 2017). Additionally, in 2017, there was an increase in funding for research performed in hospitals and in innovation projects, as well as changes to the education system to ensure it fulfils the future needs of the healthcare system (OECD 2017c). In the welfare sector, there are also some gaps in dealing with the increasing complexity of the issues faced by vulnerable children and young people, as this area is faced with large knowledge gaps, many small and fragmented research environments, lack of funding in basic research and declining overall funds for research (Research Council of Norway 2021; INT-HW-8)

Trend 6: Non-communicable diseases are having an increasingly significant impact in Norway

Non-communicable diseases (NCDs) account for more than 70 per cent of all annual deaths on a global scale, presenting both a public health and economic challenge across all countries (World Health Organization 2020a). The World Health Organization has published a set of monitoring indicators to assess

progress of countries in implementing recommended interventions to prevent and tackle NCDs (World Health Organization 2020a). In Norway, 87 per cent of all deaths are caused by NCDs, which is higher than the global average (World Health Organization 2020a).

'Health is greatly affected by lifestyles, including what we eat and drink, as well as how we maintain our physical health. Welfare is affected by things such as health, social networks, and living conditions. (...) It is important to focus on prevention rather than treatment in the health and welfare system. For instance, the focus could be on ensuring access to nature in residential areas and making sure that areas in the whole of Norway are used for recreational and health and welfare purposes.'

Survey respondent

To tackle this issue, Norway has implemented several of the interventions recommended by the WHO, including the implementation of action plans to tackle NCDs and setting national NCD targets for 2025, as well as developing systems for monitoring cause-specific mortality data, health examination surveys every five years, national public awareness campaigns, evidence-based national guidelines for the management of major NCDs and treatment options for high-risk groups (World Health Organization 2020a). The Norwegian Ministry of Health and Care Services has also outlined in its strategy several key initiatives to tackle NCDs, namely the strengthening of integrated and coordinated approaches focusing on preventive measures and early diagnosis, high-quality treatments, user and patient engagement towards a more active role in treatment and use of standard statistics to monitor developments (Ministry of Health and Care Services 2013). Through the implementation of such measures, Norway aims to reduce the number of premature deaths from NCDs by 25 per cent by 2025 (Ministry of Health and Care Services 2013). However, Norway still has to progress further on some aspects of NCD management, as it has only partially achieved the WHO standards for reducing NCD risk factors (World Health Organization 2020a).

'More research on challenges concerning dementia is needed. Increase staff in nursing homes and hospitals. Increase the educational capacity in nursing and for intensive care nurses. The obesity problem must be tackled more ambitiously.'

Survey respondent

Trend 7: There has been a significant effort to reform and strengthen health and healthcare in Norway

Significant emphasis has been placed on reforming and strengthening health and healthcare in Norway (OECD & European Observatory on Health Systems and Policies 2019). One interviewee noted that there has been significant willingness for institutions to implement innovation and digitalisation: policy changes have been implemented for improving the coordination of care between municipalities and hospitals (Coordination Reform) and for providing increased choice for patients in terms of treatments and providers (Choice Reform). Additionally, strategies have been developed to improve primary care (Primary Care and Public Health Reform), ensure quality in the provision of healthcare and patient safety (Strategy on Quality and Patient Safety), improve outpatient care and strengthen coordination between hospitals (National Health and Hospital Plan 2016–2019), tailor education and training of health professionals to meet future health needs (Competence Shift 2020), create an age-friendly society ('Live your whole life' reform), and tackle substance abuse (Drug Reform) (World Health Organization 2020b; OECD 2017c). Some of these

reforms, such as the Primary Care and Public Health Reform, are still in an implementation phase, and results are likely to emerge in the next few years (World Health Organization 2020b). Future developments are also likely to focus on reducing social inequalities in health; preventing loneliness; implementing early interventions focused on younger people; and strengthening primary care, long-term care and specialist care (Ministry of Health and Care Services 2020). There will also be an increased focus on digitalisation, namely through the Directorate of eHealth and the Norwegian Health Network to implement major e-health developments (World Health Organization 2020b).

Trend 8: There is increasing demand for qualified healthcare personnel in Norway

With the changing demographics and increases in the aged population, there are challenges related to the shrinking workforce, lack of financial resources and emerging disease patterns. Such challenges cause strain in the healthcare system and require an increase in workforce numbers. In parallel, with the implementation of new technologies, there is a need for healthcare personnel with the appropriate skill set and competencies (Norden 2014). Predictions for Norway estimate a shortage of healthcare professionals in the near future, particularly for vocationally trained healthcare workers, whereas demand for labour in this sector is expected to increase by 16.9 per cent towards 2022 (Norden 2014). The health and welfare sector in Norway was the sector with the largest employment shortages in the spring of 2019, and it saw an increase from the year before, from 29 to approximately 36 per cent (Ministry of Education and Research 2020). Additionally, the healthcare sector in Norway has a considerable share of unskilled workers, which is not aligned with the requirements of increased competency to address the changes in the healthcare system (Norden 2014). Norway, like other Nordic countries, has developed initiatives to improve the number of healthcare workers. At an educational level, there has been a focus on increasing recruitment and on providing more practical vocational educational pathways. At the workplace level, there has been a focus in recruiting more young people and men to the sector, as well as providing additional training and career opportunities (Norden 2014). These aims are reflected in the Competence Plan 2015, which aims to raise the education level in the care service, increase interdisciplinarity, and improve training and continuing education, as well as decentralise the geographical distribution of educational institutions to also include rural municipalities (2014 Recruitment and Retention of Health Care Professionals in the Nordic Countries). Norway also presents an attractive destination for Nordic healthcare professionals, particularly from Iceland, due to the low rates of unemployment and high wages (Norden 2014). However, Norway has not been actively recruiting healthcare workers from other Nordic countries, given that these face challenges with their own shrinking workforce (Norden 2014). Lower immigration and increasing urbanisation overall has also created challenges for Norway in meeting the demand for healthcare personnel across the country (Ministry of Education and Research 2020).

Trend 9: The prevalence of mental disorders in Norway is becoming increasingly important

Mental health disorders are a key issue faced by European countries and Norway, given their impact across public health and the economy (OECD 2019a).¹⁰ According to the Institute for Health Metrics and

¹⁰ Input from survey of the public.

Evaluation, in 2016 nearly 84 million people across the EU were affected by mental health problems, which means one in six people (OECD 2019a). These problems include anxiety disorders, depressive disorders, substance abuse and severe mental illness, such as bipolar or schizophrenic disorders (OECD 2019a). In Norway, it was estimated in 2016 that over the course of 12 months, around 16–22 per cent of the adult population will experience a mental disorder (Norwegian Institute of Public Health 2016b). The Norwegian Institute of Public Health found that the most common mental health illnesses in 2018 were anxiety, depression and substance abuse disorders (Reneflot et al. 2018). Although further evidence is needed to substantiate these trends, it is predicted that the number of young girls who report on mental health illnesses and who seek help from healthcare professionals is increasing. Therefore there has been a substantial investment by the Norwegian government in improving care for mental disorders. For example, the current national strategy, *Coping with life, 2017–2022*, has prioritised mental health as a key component of public health and aims to support inclusion and participation of people with mental health disorders in society, as well as improve care service, strengthen the knowledge base and promote good mental health in younger people (World Health Organization 2020b). It has also been observed that there is a trend towards de-institutionalisation of mental healthcare, as fewer patients receive inpatient treatment and the average length of stay in inpatient mental healthcare institutions has decreased (World Health Organization 2020b). In parallel, there has been a considerable increase in the number of consultations provided by community mental health centres, and access to psychologists has improved in the municipalities (World Health Organization 2020b).

Trend 10: Education challenges are expected to grow as Norway upskills and employment market needs diversify

Respondents in the survey of the public highlighted that ensuring that future education challenges are met are important to maintain the Norwegian welfare system.¹¹ The proportion of students who complete secondary education in Norway has increased in recent years (Ministry of Finance 2019). However, educational attainment in Norway still differs significantly based on the education that your parents receive, where you live and what school you attend (Ministry of Finance 2019). There are also performance gaps between the immigrant and non-immigrant populations (OECD 2020a). There are also challenges with upper secondary school completion rates in Norway, particularly for students in vocational education (OECD 2020a). Although the higher education system in Norway generally facilitates that graduates have good skills and labour market outcomes, the connection between the education system and the employment market has also been cited as a key challenge for Norway (OECD 2018; Ministry of Education and Research 2021). This lack of connection is expected to be a greater challenge as the Norwegian economy upskills and becomes more diverse (OECD 2018). One interviewee said that Norwegian higher education institutions are challenged to offer short-term courses and training to make education more accessible to the Norwegian population (INT-CC-2). The Norwegian government has also outlined the need for more systematic collaboration between higher education institutions and industry to ensure that the education Norwegian students receive is relevant to the demands that exist in the employment market (Ministry of Education and Research 2021). Norway has high education expenditure, but performance in the Programme for

¹¹ Input from survey of the public.

International Student Assessment (PISA) has been declining over time (OECD 2020a). Although investment in higher education has been high in Norway, there has not been an increase in the number of students who complete their higher education on time, nor in the participation of groups that are disadvantaged (OECD 2020a).

3. Barriers to and enablers of health and welfare R&I in Norway

This chapter discusses the main enablers of and barriers to developing the health and welfare area in Norway. As with the previous chapter, we have collated evidence from the published literature and also drawn on the insights provided by stakeholders that we interviewed from across academia, industry, government, the third sector, and the RCN.¹²

Box 2. Summary of key barriers and enablers related to the health and welfare strategic area

Key barriers

- Health and welfare R&I in Norway take place in a complex ecosystem.
- Interdisciplinary health and welfare research is limited and tends to be bottom-up.
- Healthcare is expensive in Norway.
- The geographical spread and location of citizens in Norway create barriers to health and welfare delivery.
- Labour shortages in the health sector will place limits on health and welfare provision.
- Digital inclusion, competence and ethics pose challenges to health and welfare in Norway.
- Social inequality in health and welfare is a key barrier to progress.
- Gaps exist in the treatment of mental health disorders.
- Aspects of Norway's regulatory framework could potentially limit innovation.
- The rise of antimicrobial resistance presents challenges.

Key enablers

- Support towards inter-professional collaboration has been a policy priority in Norway.
- Patient engagement and public health–promotion policies in Norway are important.
- Municipalities have a central role in healthcare delivery in Norway.
- Funding and support are being provided for health professional training and practice.
- Users have a strong voice in the Norwegian healthcare system.
- Medical treatment needs are mostly met in Norway.
- The opportunities offered by digitalisation are enabling developments within the Norwegian health and welfare sector.

3.1. Key barriers

Health and welfare R&I in Norway take place in a complex ecosystem

The Norwegian research and innovation system for health is characterised by a complex interplay of different stakeholders (World Health Organization 2020b). In addition, research and innovation faces strict regulations (OECD 2017c). The LTP aims to improve coordination; however, the Norwegian health

¹² As noted previously, interviewee inputs are cited in the discussion using anonymised, unique identifiers 'INT-HW-XX', where XX is a number between 01 and 12.

research and innovation system is still considered uncoordinated and siloed (INT-HW-2; INT-HW-3; INT-HW-5; INT-HW-12), with most types of funding supporting individual basic research, projects and education rather than developing clusters or networks (Bundgard Vad et al. 2019; OECD 2017c). There are also very few interactions with healthcare providers at different levels of the system and with actors who operate outside health and care (which traditionally has been narrowly defined) (OECD 2017c). Therefore, although institutions benefit from considerable autonomy, there is a need for improvements regarding sharing documentation, engaging in cross-sectoral cooperation and providing strategic steering of research and innovation for health and welfare (Bundgard Vad et al. 2019; Ministry of Labour and Social Affairs 2021). One interviewee highlighted that some are working towards closing the gap between healthcare systems and industry by fostering collaborations between the private and public sectors (INT-HW-1). Another interviewee highlighted the importance of capitalising on Norway's data infrastructure and research to provide commercial solutions to the general public, as well as the need for closer collaboration between the RCN and Innovation Norway (INT-HW-3).

Interdisciplinary health and welfare research is limited and tends to be bottom-up

Health research in Norway has been characterised as driven by researchers' interests, without prioritising the needs of patients and citizens (OECD 2017c). There is also a need to embed interdisciplinary approaches within research to foster effective innovation (OECD 2017c). In addition, although there have been mandates to change governance structures of universities in order to promote stronger linkages between universities, industry and broader society, there are still a number of gaps, namely in terms of lack of incentives for researchers to engage in research commercialisation (e.g. patents) or outreach activities (OECD 2017; INT-HW-3). In addition, although there are instruments aiming to link universities and regional stakeholders, these tend to target regions with industrial configurations already in place, rather than regions most in need of investments (Benneworth et al. 2017). In the welfare sector, there is also a lower level of interdisciplinary activities with sectors other than the public sector (Hutchinson & Korazim-Körösy 2017). This is because most social workers in Norway are employed in the public services and tend to be more regulated and unified than countries that have smaller public welfare systems (Hutchinson & Korazim-Körösy 2017). Moreover, in Norway, the government is more involved in determining the research and education conducted by welfare institutions, which necessitates less collaboration (Hutchinson & Korazim-Körösy 2017).

Healthcare is expensive in Norway

Norway currently ranks as one of the countries with the highest per capita health expenditure, which accounted for 10.4 per cent of Norway's GDP in 2017 (or fifth highest in the WHO European Region) (World Health Organization 2020b). Healthcare has therefore been considered relatively expensive in Norway (OECD 2017c). Expenditure related to public health has increased from 8.0 per cent in 2007 to 10.4 per cent in 2017 (OECD 2019a). This trend in increasing expenditure is likely to continue with the changing population demographics, namely the ageing population, and the changing technology landscape (OECD 2019a). Estimates show that public health expenditure in Norway is expected to rise by 1.2 percentage points between 2016 and 2070 (OECD 2019a). This will likely increase expenditure and create additional challenges for the healthcare system (OECD 2017c). As a result, although public expenditure on medicine and health R&D has been high, business expenditure on R&D in pharmaceuticals and other

biomedical technologies has not been high (OECD 2015). This lack of expenditure is in part related to the absence of a critical mass of sizeable Norway-based pharmaceutical companies (OECD 2017c), as well as to having most of the large public research funding directed to universities, hospitals (through the regional health authorities), and institutes (OECD 2017c; Jakobsen et al. 2017). Nonetheless, there is potential for Norway's health industry, given that it is growing at a fast pace and is considered to be a dynamic sector (OECD 2017c; Jakobsen et al. 2017).

The geographical spread and location of citizens in Norway create barriers to health and welfare delivery

Norway faces challenges in terms of accessibility to healthcare across its territory, particularly in rural and sparsely populated areas (Kasper et al. 2017; World Health Organization 2020b). Specifically, there is an unequal distribution of hospitals, as well as differences on a regional level in terms of accessibility to general practitioners (Norwegian Directorate of Health 2018). Additionally, most specialist care is found in urban areas, meaning that people in rural areas are required to travel longer distances to access such services (World Health Organization 2020b). One interviewee highlighted that municipalities are responsible for a large spectrum of services for which they do not always have capacity and that there is a need to merge services across municipalities for better coordination and for preventing services from breaking down (INT-HW-2). As noted above, these challenges are also present in the education sector in Norway, as educational attainment in Norway differs based on where you live and what school you attend (Ministry of Finance 2019).

Labour shortages in the health and care sector will place limits on health and welfare provision

Norway is set to face key challenges in the provision of health and welfare professionals.¹³ These challenges are being driven by an increase in the elderly population with a higher life expectancy, as well as by a lack of professionals with qualifications that match future needs of the healthcare system (Norden 2014; INT-HW-1; INT-HW-2; INT-HW-3; INT-HW-5). One interviewee noted that the shortage of health personnel also relates to educational capacity in the country and that innovation and technology can support changes in the use of both the capacity of healthcare personnel and their ability to deliver services that can meet the needs of users in Norway (INT-HW-5). With the current organisation of the health and care services, it is expected that the number of employees in the health and care sector will increase from one eighth of all employees in 2021 to one third of all employees in 2060, marking an increase of 111,000 person-years (Holmøy et al. 2014; Ministry of Finance 2021). Some of these challenges can be tackled by investing in the education and training of new professionals, as well as by increasing the retention rate (OECD 2017c; Statistics Norway 2020). The migrant workforce could also fill some of the gaps in the provision of healthcare; however, low levels of immigration have made it difficult for the Norwegian government to pursue this option (Norden 2014; Ministry of Education and Research 2020).

¹³ Input from survey of the public.

Digital inclusion, competence and ethics pose challenges to health and welfare in Norway

Norway is well positioned to leverage the benefits associated with digital transformation, given its ranking for this sector across monitoring instruments, such as the European eGovernment Benchmark (European Commission 2016). Norway is also in the lead to becoming a key player in the digitalisation of healthcare, given its comprehensive data registries containing health-related data since the 1950s (OECD 2017a). However, to deliver effective and secure digital transformation, there is a need to strengthen digital inclusion and competence across all life phases, as well as across all population groups (e.g. migrants and refugees) (OECD 2017a; INT-HW-5). Norway has pursued digital service delivery in several sectors, including health and care provision with significant coverage of ICT services in hospitals, general practitioner practices and municipalities for exchanging patient information, as well as advances in telemedicine, e-prescriptions and other digital approaches (World Health Organization 2020b). However, although the usage of ICT is high among the Norwegian population, there are significant gaps in this approach in terms of prioritising the citizen perspective and in terms of user engagement in the development of such technologies (OECD 2017a). One interviewee also mentioned that there is a lack of inclusion as digital literacy is not effectively considered (INT-HW-1). To prevent a potential digital divide, the government has outlined in its digital agenda, with the aim of providing guidance to facilitate the use of digital technology by the population when accessing health and care service (Ministry of Local Government and Modernisation 2016). In addition, the increased use of data through such approaches as genetic mapping, AI and big data poses ethical challenges and dilemmas, namely in terms of privacy protection of sensitive data (Norwegian Artificial Intelligence Research Consortium 2021). Emerging technologies for health and welfare pose further challenges in terms of the digital divide within the population when accessing healthcare services and in terms of conflicts of interest between stakeholders.

Social inequality in health and welfare is a key barrier to progress

Inequalities in health are one of the key challenges faced by Norway, a country in which social inequalities prevail to a larger extent compared with many other European countries (Norwegian Institute of Public Health 2016b; INT-HW4). These issues are reflected across the Norwegian territory, with municipalities and counties showing differences in life expectancy that have been linked to socio-economic factors, such as income and educational attainment (World Health Organization 2020b). Overall, people with the highest levels of education and socio-economic status live longer and have better health in comparison with others with a lower education and socio-economic status (Norwegian Institute of Public Health 2016c). This has been attributed to some extent to the higher prevalence of risk factors, such as smoking, in segments of the population with lower income and education (World Health Organization 2020b). Differences in educational attainment are found across all age groups, as well as between men and women (Norwegian Institute of Public Health 2016c). These differences are increasing over time, and there is a need to address them to improve overall public health (Norwegian Institute of Public Health 2016c). One interviewee highlighted social cohesion as a key principle for addressing these challenges and building a strong healthcare system (INT-HW-4). Additionally, according to the OECD, the LTP before the revision in 2018 did not provide clear policy approaches to address societal challenges in health and welfare. This is illustrated by the fact that there were no changes in funding structures or policies as a result of the previous LTP and that the

underlying approach was focused on initiatives from research and science. There is little funding in place to tackle societal challenges and no change in the origins and destination of funds provided by the government (OECD 2017c).

Gaps exist in the treatment of mental health disorders

In Norway, approximately 16–22 per cent of the adult population will experience a mental health disorder over a period of 12 months (Norwegian Institute of Public Health 2016b). These are most commonly anxiety disorders, depression and substance use issues. There is a gap in mental health treatment. For example, several municipalities offer only follow-up by general practitioners as the main publicly service available (Knapstad et al. 2020). To address this issue, from 2020, it has become a requirement for municipalities to provide access to a contracted psychologist (World Health Organization 2020b). Mental health issues are reported to also be significant across younger sectors of the population, leading to poorer educational attainment and difficulty in transitioning to the workplace, as well as increased risk of requiring lifetime mental health services, creating additional economic and social costs (OECD 2014).

Aspects of Norway's regulatory framework could potentially limit innovation

Lack of flexibility in regulations can potentially create barriers for innovation and public private collaborations. In Norway, there has been an investment of developing basic knowledge, which has not sufficiently considered the overall regulatory landscape required for innovation to occur (OECD 2017b). There has also been a lack of strategic and long-term thinking regarding public procurement processes, as well as limited trust between public and private stakeholders. Such factors, alongside the lack of financial and regulatory support for entrepreneurship and commercialisation of research outputs, are regarded as key obstacles preventing the development of research-based innovation (Norden 2010). One interviewee also mentioned that there are challenges with access to data for the health industry and that new standards and systems need to be implemented in the electronic health infrastructure, in a timely manner (INT-HW-1). Another interviewee highlighted that there needs to be a balance between a strong regulatory framework and the possibility to innovate (INT-HW-4).

The rise of antimicrobial resistance presents challenges

Antimicrobial resistance is becoming an increasing threat for countries worldwide due to the widespread use of antibiotics. Such trends represent a challenge for both public health and the economy (Roope et al. 2019). In Norway, this issue is relatively less significant in comparison with other countries; however, there have been several outbreaks of Vancomycin-resistant enterococci (abbreviated as VRE) in hospitals, and the number of infections caused by bacteria that produce extended-spectrum beta-lactamase (ESBL) has increased significantly over the past few years. Incidence of antimicrobial resistance is also increasing for other types of bacteria, such as Methicillin-resistant *Staphylococcus aureus* (abbreviated as MRSA) (Norwegian Institute of Public Health 2017). Norway has been able to manage this challenge through implementation of health measures across institutions. Additionally, surveillance systems have been developed to monitor resistance to antibiotics, including the Norwegian Surveillance System for Communicable Diseases (Meldingssystem for smittsomme sykdommer, MSIS), the Norwegian Surveillance System for Antimicrobial Drug Resistance (Norsk overvåkningssystem for antibiotikaresistens hos mikrober, NORM) and the Norwegian Surveillance System for Antimicrobial Drug Resistance – Veterinary

Medicine (Norsk overvåkningssystem for antibiotikaresistens hos mikrober fra fôr, dyr og næringsmidler, NORM-VET). The Ministry of Health and Care Services (Helse- og omsorgsdepartementet, HOD) has also developed an action plan for antibiotic resistance in health services (Norwegian Institute of Public Health 2017). However, with the increasing levels of antibiotic use, other factors, such as increased travel and contamination of food supply chains with resistant bacteria, antimicrobial resistance has the potential to become a key challenge for the Norwegian health system, as has already been observed in other parts of the globe (Norwegian Institute of Public Health 2017; INT-HW-3).

3.2. Key Enablers

Support towards inter-professional collaboration has been a policy priority in Norway
Inter-professional collaboration has been an important enabler for increasing efficiency, quality and participation in healthcare and social work across the Norwegian welfare system. To this end, the Norwegian Labour and Welfare Administration (NAV) was created through a merger between one municipality-run office (Social Services) and two state-run offices (the Labour and Employment Office and the National Insurance Service) (Pedersen 2020). This organisation implements social and labour policies encompassing a wide range of service provisions thus fostering inter-professional collaborations (Pedersen 2020). Additionally, the introduction of the ‘health in all policies’ approach in the 2011 Public Health Act has mandated that health must be integrated in policies and action plans across all sectors, providing counties with the responsibility for intersectoral planning (Pedersen 2020). There have been collaborations between different ministries to develop strategies integrating more than one policy area, such as the National Action Plan on Better Nutrition, in which seven ministries cooperated (World Health Organization 2020b).

Patient engagement and public health–promotion policies in Norway are important

The Norwegian healthcare system is universal and nationalised, meaning that all inhabitants regardless of gender, socio-economic status and geographical location have equal access to services, as stated in the 1999 Patients’ Rights Act (World Health Organization 2020b). In Norway, there has also been a key focus on supporting active involvement of patients in the decision making regarding their medical treatment, through prioritisation of health communication in healthcare strategies (INT-HW-1). The government has focused on providing the tools to facilitate that process, namely through online platforms that provide guidance and information to users (Kasper et al. 2017). For example, research has been funded by regional health authorities to develop shared decision-making tools, as well as a platform hosting patient decision aids and corresponding implementation strategies (Kasper et al. 2017). Public health promotion has also been a key priority in Norway, and it has been integrated in public health policies, such as the Public Health Act. Among these, there has been a focus on addressing social inequity in health, namely through the National Strategy to Reduce Social Inequalities in Health, to ensure that positive drivers of health are equality distributed among the population (Fosse & Helgesen 2017). Patients’ rights are a key priority in Norway’s healthcare policy, and this is reflected in its comprehensive legislation and approach to patient choice and complaint procedures (World Health Organization 2020b).. The Norwegian healthcare system has been strengthened through time and, more recently, has focused on such issues as addressing children’s

right to be heard as a patient, the right to confidentiality, and shared decision making within the healthcare system (World Health Organization 2020b; Kasper et al. 2017).

Municipalities have a central role in healthcare delivery in Norway

In Norway, health and social care has become increasingly decentralised given the shift in responsibilities from the state and the counties to the municipalities (World Health Organization 2020; INT-HW-2). In parallel, there has been a focus on improving coordination of specialist and primary care across hospitals and municipalities through the ‘coordination reform’ (Torjesen & Vabo 2014). Therefore, municipalities have had an increasingly important role in providing healthcare, by implementing public health measures and health-promotion programmes at a local level (OECD & European Observatory on Health Systems and Policies 2019). The Health&Care21 Strategy and the government’s action plan on the strategy focused on the role of municipalities; these were important to meet the demands of research and innovation in the health and healthcare sector and illustrated that municipalities are important actors in health, knowledge and innovation (OECD 2017c).

Funding and support are being provided for health professional training and practice

In order to address the impending challenges regarding the shortage of healthcare professionals, the Norwegian Ministry of Health and Care Services has promoted several initiatives through the Care Plan 2015, the Care Plan 2020, the Competence Plan 2015, and the Quality Reform in Higher Education (Ministry of Health and Care Services 2020a). These initiatives aim to increase both the workforce and their educational levels; measures have included grants for basic education, training, tertiary vocational education and continuing education for employees in the care sector. For example, the Norwegian Directorate of Health has awarded grants under the Competence Plan 2015 to support recruitment and skills development initiatives. Grants have also been provided to municipalities to support initiatives that provide formal training and continuing and supplementary education for their employees (Norden 2014). Norway also invests significantly in its healthcare system. Public sources cover more than 85 per cent of this expenditure, which is the highest share found in Europe. Central and local governments, as well as the National Insurance Scheme, are the key sources of financing. Private health financing remains low in Norway, despite recent increases. The current financing structure aims to allow providers the possibility of ensuring the most suitable combination of healthcare services for patients, while minimising costs (World Health Organization 2020b). One interviewee thought that the capacity of the health industries in Norway is stronger than it has ever been (INT-HW-12).

Users have a strong voice in the Norwegian healthcare system

In Norway, users of healthcare services have an active involvement in the healthcare system, with approximately one in ten adults being members of patient organisations (Statistics Norway 2020). One interviewee also thought that this is facilitated by the high levels of trust in the healthcare system in Norway (INT-HW-11). These organisations vary in their structure and scope and tend to be associated with user committees, which act as legal entities of regional health authorities and local trusts (World Health Organization 2020b). In recent times, there has also been a focus on implementing shared decision-making approaches in the policy agenda of the Norwegian government, allowing users to be a part of the decision-making process regarding healthcare innovation (Kasper 2017). Additionally, the Patients’ Rights Act

(1999) mandates that patients are entitled to be active participants in decisions regarding their healthcare (World Health Organization 2020b).

Medical treatment needs are mostly met in Norway

In Norway, healthcare coverage is universal, and most Norwegians report that their care needs are met through their healthcare system. However, there is a level of socio-economic inequality, leading to those of the Norwegian population in the lowest income quintile having higher levels of unmet medical needs than those in the highest income quintile (OECD 2019a). This is particularly the case for services not fully covered by the national health insurance scheme. Dental care is one such service, and approximately 5 per cent of Norwegians reported unmet needs on this front in 2017 due to financial reasons (OECD 2019a).

The opportunities offered by digitalisation are enabling developments within the Norwegian health and welfare sectors

Digital technologies are becoming increasingly integrated in the provision of health services in Norway through electronic systems for exchanging patient information, e-prescriptions, telemedicine and health-related mobile applications (Directorate of eHealth Norway 2019; Statistics Norway 2020), as well as advances being made in technologies, such as AI (National Health and Hospital Plan 2020–2023). Additionally, Norway has well-structured data registries providing health-related data, which can support the development of data-driven approaches and technologies (Norwegian Artificial Intelligence Research Consortium 2021). This insight was echoed by two interviewees, who mentioned that Norway has a very efficient health record system and comprehensive health databases (INT-HW-1, INT-HW-2), although it was highlighted that these can be difficult to use and require considerable investment in terms of data management (INT-HW-2). Furthermore, the establishment of the Directorate of eHealth by the Norwegian health authorities, as well as its National Health Data Programme and the Health Registries for Research project/initiative, allow Norway to leverage the benefits of digital transformation across its healthcare system, as well as promote public health (World Health Organization 2020b). Digitalisation is also important for the Norwegian welfare state and creates opportunities for public services. Technology can simplify the contact between citizens and public administration (for example by allowing notification and application forms to be filled out and submitted online). Technology and digitalisation are also predicted to help place users at the centre of welfare provision in Norway (Norwegian Board of Technology 2017).

4. Uncertainties and policy challenges associated with transforming health and welfare in Norway

In this chapter, we discuss the various uncertainties and policy challenges associated with potentially transforming health and welfare in Norway. Where relevant, and drawing on the evidence from the literature and expert insights, we also present ideas for potential solutions to some of these challenges. As noted previously, to achieve its overarching objectives and strategic area-related vision, the RCN will need to adopt a multi-stakeholder approach of collaborating and engaging with diverse stakeholders in the wider R&I ecosystem in Norway and develop targeted priority missions, while also establishing new (or updating existing) underpinning structural measures.

Box 3. Summary of uncertainties and policy challenges

Uncertainties

- The green transition is changing the way the health and welfare sector is regarded and forcing a rethink of how its environmental and climate impacts can be reduced.
- Climate change continues to be a crucial challenge, directly and indirectly influencing developments regarding health and welfare in Norway.
- The COVID-19 pandemic has laid bare the risks associated with global interconnectedness and interdependence.
- Despite the many opportunities offered by digitalisation, the longer-term impacts across the health and welfare sector remain uncertain.
- There is some uncertainty around public trust in the political system and its implications for health and welfare in Norway.

Policy challenges

- There is a need for an intersectoral and interdisciplinary approach regarding research and innovation in the health and welfare system.
- Lack of collaboration and characteristics of regulatory frameworks could act as barriers to innovation, alongside lack of investment in commercialisation of research outputs.
- Data-driven approaches and wider digitalisation have resulted in untapped potential in the context of health and welfare data.
- Decentralisation of healthcare system and social inequalities present key challenges.
- Changing demographic trends are placing pressure on the healthcare system.

4.1. Uncertainties

The green transition is changing the way the health and welfare sector is regarded and forcing a rethink of how its environmental and climate impacts can be reduced

The green transition is changing how all sectors and industries – including health and welfare – are regarded and challenging stakeholders to think about how the environmental and climate impacts of each can be potentially reduced or mitigated against (World Health Organization 2018; INT-HW-1). In line with this

national and international priority, it will be important for Norway to consider whether any reduction in consumer spending and/or travel caused by its health and welfare sector can be achieved. The COVID-19 pandemic has resulted in conflicting trends in this area for healthcare provision. On the one hand, unnecessary travel has been reduced due to the rapid rollout of telehealth solutions for both chronic (Healthcare Denmark 2020) and emergency (Price 2020) care in Norway. On the other hand, the carbon footprint of (often single-use) personal protective equipment supplied to health and welfare services operating throughout the pandemic worldwide has been significant (Rizan et al. 2020).

Climate change continues to be a crucial challenge, directly and indirectly influencing developments regarding health and welfare in Norway

Climate change is a key issue underpinning several challenges faced by all countries. This issue was highlighted by interviewees as a prominent area of uncertainty for the future (INT-HW-3, INT-HW-4). One interviewee mentioned that climate change and global warming will lead to increased population movement and migration (INT-HW-4), which may impact the policies related to equitable access currently outlined in the Norwegian Health Plan and lead to an increase in socio-economic inequality (Debesay et al. 2019). In addition, climate change affects human health, namely through changes in patterns of disease and pathogen geographical distribution, as well as disaster-related injury, all of which may present new challenges to the healthcare system (Schwerdtle et al. 2018).

The COVID-19 pandemic has laid bare the risks associated with global interconnectedness and interdependence

The term globalisation describes the increasingly interconnected and interdependent nature of the economic and academic trends that are an inherent aspect of the 21st century (Altbach & Knight 2007). The 1990s and early 2000s have been described as the age of ‘peak globalisation’ (Flew 2018). Since the late 2000s, there has been debate over whether globalisation is slowing down (Flew 2018) – a process that has been named ‘slowbalisation’ (PricewaterhouseCoopers 2020) – or simply evolving into a different form. The COVID-19 pandemic has laid bare the risks associated with global interconnectedness and interdependence (e.g. dependence on global supply chains) (Fontaine 2020), and it remains to be seen what long-standing impact this crisis will have on globalisation. Interviewees mentioned that there is considerable uncertainty surrounding additional waves of infectious diseases and that there is a need for increased disaster resilience (INT-HW-1; INT-HW-3; INT-HW-11). On the other hand, one interviewee also mentioned that the COVID-19 pandemic has enabled faster progress with regard to digitalisation of healthcare systems (INT-HW-1).

Despite the many opportunities offered by digitalisation, the longer-term impacts across the healthcare sector remain uncertain

Technological developments, such as AI, big data analytics and genomics, hold great potential for transforming the delivery of services across the healthcare sector (World Health Organization 2019). However, digital transformation of the healthcare system creates challenges and uncertainties at several levels. First, several technologies rely on the availability of patient data (World Health Organization 2019). Therefore, it is necessary to have regulations and systems that ensure the safety, transparency and ethical use of data (World Health Organization 2019; The Joint Committee of the Nordic Medical Research

Councils 2018). Health data scandals or major data privacy violations may risk compromising population trust in digital technologies and, thereby, undermine the success of such approaches (INT-HW-1). Second, the digitalisation of health systems may lead to exacerbation of the current digital divide among the population, and it may create additional inequalities (World Health Organization 2019). Therefore, more research is required to assess impacts of digitalisation across all sectors of society that factors in legal, ethical and social science perspectives. There is also a risk of the private sector taking control of digital transformation and health data, leading to the loss of government oversight (World Health Organization 2019). To prevent this scenario, it is necessary for the government to form equitable partnerships with academia, health organisations and industry, to be prepared to evaluate and implement emerging technologies in a timely manner (World Health Organization 2019). Furthermore, digital transformation is leading to a societal transformation with changes in the types and nature of jobs, and there is, therefore, a potential need for a framework that allows workforce training to effectively integrate future labour market needs (OECD 2019b). Currently, there is uncertainty around how these factors will be addressed and how they will converge; however, it is clear that strong and knowledgeable leadership is required to ensure that the future of digital health is not completely 'technology led' (World Health Organization 2019).

There is some uncertainty around public trust in the political system and its implications for health and welfare in Norway

Across Europe, there appears to have been a general increase in the support of right-leaning populist political parties, and Norway has been no exception to this trend (Grindheim 2019). Several factors have been cited as key drivers for this changing political landscape, namely globalisation, immigration, and social and economic inequalities (Grindheim 2019). Interviewees highlighted that these issues may constitute some of the most prominent areas of uncertainty in the near future, which prompts a need for a focus on evidence-based work to support future developments across all sectors (including health and welfare) (INT-HW-3, INT-HW-4, INT-HW-12). For instance, high levels of trust are important for the roll out of technology in healthcare delivery and will be important for implementation in the future (Directorate of eHealth Norway 2021).

4.2. Key policy challenges and potential solutions associated with transforming the health and welfare strategic area

There is a need for an intersectoral and interdisciplinary approach to R&I in the health and welfare system

Innovation in healthcare systems requires the coordinated action of several stakeholders (OECD 2017c). In Norway, there has been a strategic effort to provide a framework to foster research and innovation in health and welfare, namely by prioritising healthcare in the Long-Term Plan and by implementing reforms, such as the 2012 Coordination Reform and the Health&Care21 Strategy (World Health Organization 2020b; Ministry of Health and Care Services 2017). However, challenges remain to be addressed in terms of the degree of sectoral compartmentalisation, the lack of coordination between different levels within its healthcare system and the limited interaction with stakeholders in the private sector (OECD 2017c). There has also been insufficient focus on or financial support for addressing broader societal challenges (OECD 2017c). Existing interdisciplinary approaches have also not allowed for innovation to occur in a way that

meets the needs of patients (OECD 2017c). Potential solutions to address such challenges rely on devising ‘broadly integrated programmes’ that have societal challenges as a key priority and that are inclusive of all stakeholders; they also rely on promoting interdisciplinary and multidisciplinary approaches that cut across sectoral boundaries (OECD 2017b).

Lack of collaboration and the characteristics of regulatory frameworks could act as barriers to innovation, alongside lack of investment in commercialisation of research outputs

Innovation typically requires the support of an appropriate regulatory framework that enables the translation of research outcomes into applications that benefit society. Norway invests a significant proportion of its R&D funding in medical and health sciences (OECD 2017c). However, most of this funding is directed towards universities, hospitals and institutes, rather than pharmaceuticals and other biomedical technologies (OECD 2017c). Therefore, there is a largely untapped potential in industry–academia collaborations for healthcare innovation in Norway (Norden 2010). However, there are several barriers that prevent this potential from being explored. These barriers include a focus on cost-savings and a reliance on established or large suppliers in public procurement processes, the absence of knowledge on how to use more flexible approaches within the regulatory framework, the lack of trust between public and private stakeholders, the absence of financial support for commercialisation and of policy measures to engage private investment, and lack of incentives to foster entrepreneurship and innovation in healthcare institutions (Norden 2010). On a larger scale, there are low levels of cooperation between Nordic partners and a reliance mostly on existing national networks (Norden 2010). There are, however, potential solutions to address some of these challenges. Some examples of best practice in procurement include the network InnoMed, which focuses on needs-driven innovation in healthcare systems (STIP Compass 2019). There have also been initiatives that foster entrepreneurship, namely through the implementation of regional institutions with expertise on commercialisation, in order to enable commercialisation of research outcomes produced by hospitals and universities (Norden 2010). Entrepreneurship can also be leveraged within the healthcare sector by having national authorities set innovation standards or indicators for research activities (Norden 2010). There are also several opportunities to stimulate innovation through collaborations across the Nordic market and through the development of networks that bring together different types of stakeholders (Norden 2010).

Data-driven approaches and wider digitalisation have resulted in untapped potential in the context of health and welfare data

Data-driven approaches have become a key factor for improving the design, delivery and impact of public services (OECD 2017a). Such approaches hold the potential to enable digital transformation of the healthcare sector towards providing preventive, predictive and person-centred care (World Health Organization 2020b). Norway benefits from a comprehensive digital infrastructure of health data, including patient journals, central health registers, national medical quality registers, biobanks and databases of public health studies (OECD 2020; INT-HW-12). The Norwegian government has also invested in promoting the development of an integrated digital healthcare system by fostering cooperation between public and private organisations for the digitalisation of healthcare and by strengthening the interoperability of the existing databases (OECD 2020b). For example, the Action Plan for Implementation of the

Health&Care21 Strategy (2015) prioritises the increase of innovation in healthcare through technology implementation and the appropriate governance and regulatory structure for data accessibility (Ministry of Health and Care Services 2017).

However, some challenges have been flagged in terms of fragmentation of efforts, as well as a lack of centralised governance and leadership to make digital transformation a reality (OECD 2017a). One interviewee also thought that the care system is currently fragmented (INT-HW-12). There is also a need to develop stronger policies on open government data in order to foster data-driven innovation in the public sector while complying with data protection and personal privacy regulations (OECD 2017a). The OECD Digital Government Review of Norway highlights that a potential solution would be to develop a formal strategy that integrates the key priority areas for the management and governance of the public data value chain (OECD 2017a). There have also been shortcomings identified for the current health and quality registries in terms of incompleteness of data on and coverage of certain medical areas, such as epilepsy, mental health and substance abuse, despite their increasing prevalence (World Health Organization 2020b). Recommendations from an audit included the need to foster cooperation between different regional health authorities and the implementation of performance management and monitoring mechanisms, as well as a better integration of Statistics Norway and the health registries for improving data management processes (World Health Organization 2020b).

Decentralisation of the healthcare system and social inequalities present key challenges

In Norway, there has been an increased decentralisation of healthcare services from the state and counties towards municipalities (World Health Organization 2020b). This shift has allowed for the provision of specialised care at a local level (Weerkamp et al. 2014; Singhal et al. 2014), which is particularly beneficial for patients in long-term care (Van Eenoo et al. 2018). There has also been an effort from the Norwegian government to coordinate care between hospitals and municipalities through the 2012 Coordination Reform, and larger municipalities were created to provide more robust services (Sogstad et al. 2020). However, some challenges remain to be addressed in the provision of healthcare services to the Norwegian population. Namely, there is a lack of consistency in the quality of services provided by different municipalities, given the different degrees of specialisation of services and educational levels of staff (Sogstad et al. 2020). Specifically, larger municipalities are found to have a higher specialisation of care services and higher formal staff competencies, which challenges the aim of equitable healthcare service delivery across Norway (Sogstad et al. 2020; Sibandze & Scafide 2018).

Changing demographic trends are placing pressure on the health and welfare system

The current shift in population demographics in Norway towards an ageing population creates challenges in terms of demand for skilled healthcare personnel that is able to address the increased frailty and burden of chronic conditions (Ministry of Education and Research 2020; Norden 2014). Therefore, there is a need of providing appropriate care in a community setting by assessing local needs and developing alternative approaches for long-term care that diminish the burden in hospitals and inpatient settings (OECD 2016). Examples of important initiatives implemented to address these challenges include the primary healthcare unit types *distriktsmedisinsk senter* (centres for rural medicine) and *sykestue* (hospitals) (OECD 2016). There is also a need to invest in developing the workforce through approaches that support recruitment and

retention of healthcare personnel. The upskilling of the Norwegian workforce will also require investments in developing a workforce that can meet the increasingly complex welfare needs of the entire Norwegian population (OECD 2020a). These include investing in recruitment and raising the educational level in the care service through vocational training and continued education (Norden 2014; Ministry of Education and Research 2020; OECD 2017c).

5. Future scenarios to examine potential missions and structural measures

This chapter presents the scenarios (to 2040) that were developed to examine the future of the different strategic areas and the wider R&I system in Norway. It is important to highlight that the scenarios are not intended to be predictions or forecasts of the future. Instead, they represent a range of plausible future states that have been generated using a combination of factors and future projections of the factors that could reasonably occur together. The scenarios represent a wide spectrum of possible futures that are sufficiently differentiated from each other. A summary of the approach to developing and using the scenarios is provided in Section 1.3 and further elaborated upon in the following sections. A detailed description of the methodology used to develop the scenarios is provided in the accompanying methodology report (Gunashekar et al. 2021c).

5.1. Future scenarios to 2040

As noted in Section 1.3, to build scenarios of sufficient depth and distinctiveness, we constructed two scenario sets, by combining various elements associated with the five strategic areas (oceans; green transition; technology and digitalisation; technology and digitalisation; and cohesion and globalisation). Each scenario set comprised four future scenarios based on 15–20 prioritised political, economic, social, technological, legal and environmental (PESTLE) factors from the trend analyses¹⁴ that could influence the strategic areas (specifically, these factors were derived from the trends, enablers, barriers and uncertainties that were identified in the trend analyses).

By having two sets of scenarios, each with a relatively large number of PESTLE factors, we were able to maintain the detail and richness required in the scenarios to support the examination of meaningful missions and policy actions for each of the strategic areas, while at the same time allowing the missions to be set against a broader landscape. Furthermore, with the two sets of scenarios, we were able to effectively deal with the relatively wide-ranging strategic areas of cohesion and globalisation and technology and digitalisation (as well as green transition, to a degree).¹⁵ Below we recap the two scenario sets:

- **Scenario set 1 (*Norway in a national context*):** The first scenario set broadly focuses on Norway in a national context, largely relating to the Norwegian domestic agenda. This scenario set encompasses such themes as health, welfare, education, work and skills, cohesion, and relevant aspects of technology and digitalisation, and it also covers some aspects related to green transition (for example, in relation to the circular economy).
- **Scenario set 2 (*Norway in a global context*):** The second scenario set focuses on Norway in an international or global context, primarily relating to Norway's outward-facing role. It broadly

¹⁴ In the first phase of the study, we carried out a detailed trend analysis for each strategic area, by collecting and analysing wide-ranging evidence to help develop a robust knowledge and information base. Specifically, we identified the main trends, enablers, barriers, and uncertainties that will potentially shape the strategic area over the next ten years or so.

¹⁵ These two strategic areas are very interconnected with different sectors, cut across the other strategic areas, and are inter-related with each other as well.

covers themes related to climate, oceans, energy, transport, food, biodiversity and globalisation, as well as relevant aspects of technology and digitalisation.

As noted above, we developed four distinct future scenarios to 2040 for each scenario set. Because of their cross-cutting and wide-ranging nature, the cohesion and globalisation and the technology and digitalisation strategic areas (and to some extent green transition as well), as well as the corresponding indicative missions, were discussed in relation to both scenario sets.¹⁶ The scenarios were used as methodological tools during two foresight workshops to examine a series of indicative priority missions and discuss ideas for potential structural measures.¹⁷ The workshops were attended by a range of diverse stakeholders from across academia, industry, the third sector and the RCN.

In the sections below, for both scenario sets, we provide the high-level summaries of the corresponding scenarios followed by a figure containing the key characteristics and underpinning factors of the four scenarios. In Annex A, we present more detailed one-page narratives of the scenarios that have been developed.¹⁸

¹⁶ The other strategic areas are health and welfare and oceans.

¹⁷ The two workshops covering the two scenario sets – Norway in a national context and Norway in a global context – were organised on 23 and 24 March 2021, respectively.

¹⁸ The scenario narratives were shared with the workshop participants in advance of the workshops and were discussed in detail during the workshops.

5.2. Summaries of the scenarios corresponding to future scenario set 1: *Norway in a national context*

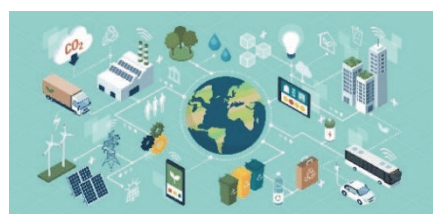
The health and welfare strategic area was primarily discussed in the workshop covering this scenario set, although relevant aspects of health and welfare were also discussed in the second workshop focusing on Norway in a global context (see Annex A for the full scenario narratives).

Scenario 1: Protectionist decline



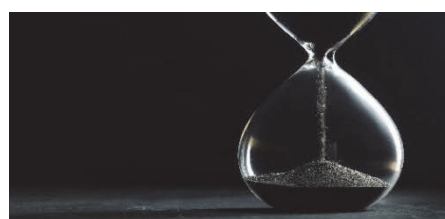
Key storyline: Against a backdrop of global protectionist trends, technology adoption and innovation in Norway's healthcare sector has stalled. Greater national spending on health and welfare has led to some advances in care but has so far failed to deliver a joined-up system. Despite increased growth in some sectors, such as domestic food production, overall productivity growth and labour force participation are low and trust in public institutions is declining.

Scenario 2: Going green together



Key storyline: Sustainability, an inclusive society and local delivery of services are now at the core of Norway's approach. Healthcare has been decentralised, and, in common with other sectors, targeted use of technology is seen as a way to improve efficiency and reduce waste. There has also been a focus on education and digital competence to reduce social inequalities. Open science has been key to the success of green initiatives at the national and local level, from green builds and urban farms, as city living remains popular.

Scenario 3: Slowly changing society



Key storyline: Norway has experienced only gradual change over the past several years. There has been some success in the healthcare sector in responding to more complex needs of a changing population, compounded by the effects of climate change. But limited interdisciplinary collaboration and cooperation with industry, as well as a lack of vision on green initiatives, give rise to concerns that Norway will not have the necessary skills to adapt to future changes in the national and global landscape.

Scenario 4: Technological trajectory



Key storyline: Norway has focused on technological advances to promote economic growth and support its sustainability goals. Digital solutions have been extensively integrated into healthcare. Most Norwegians have internet access, but digital literacy and a willingness to share data are prerequisites for participation in many activities. The technological transformation of employment has also meant many Norwegians have been able to move out of cities to escape effects of climate change.

Figure 6. Key characteristics and underpinning factors of the four scenarios associated with scenario set 1 (Norway in a national context)

		Protectionist decline	Going green together	Slowly changing society	Technological trajectory
Health and welfare	Demand and access to health and welfare services	↔	↑	↔	↔
	Collaboration and interdisciplinarity	↓	↑	↔	↑
	Development and adoption of telemedicine and telecare	↔	↑	↔	↑
Economy and society	Discrimination and hate speech	↑	↓	↔	↔
	Use of social media to spread disinformation	Increasingly used, with impact on the spread of misinformation	Increasingly used, but little impact on misinformation	Increasingly used, with impact on the spread of misinformation	Increasingly used, with impact on the spread of misinformation
	Trust in public administration	↓	↑	↔	↔
	Net immigration	↔	↓	↔	↔
	Natural resource wealth	Slow growth or stagnation	Steady growth, with greater share from sustainable sources	Steady growth, but no change in share from sustainable sources	Steady growth, but no change in share from sustainable sources
Location of jobs and housing and greening initiatives	Skilled labour availability to match employment demand	↓	↑	↔	↑
	Location of jobs and housing	More dispersion with mixed transport links	Continued trend for jobs to be located in large cities and transport-friendly locations	Continued trend for jobs to be located in large cities and transport-friendly locations	More dispersion with mixed transport links
	Ability of Norway to adapt to environmental change	↔	↑	↔	↑
	Circular infrastructure for energy, water and waste supply	Focussed on current approaches	Develop rapidly and are implemented at national, regional and local levels	Rapid development, but implementation is localised	Rapid development, but implementation is localised
Technology, digital skills and digital threats	Digital skills	Digital divide increases	Digital skills increase, digital divide decreases	Digital skills and digital divide remains as now	Digital divide increases
	Digital security and cyber security protection	Norway is unable to respond, digital and cyber security threats demand increase protection	Norway is better able to respond, decreasing digital and cyber security threats	Norway is unable to respond, digital and cyber security threats demand increase protection	Norway is better able to respond, decreasing digital and cyber security threats
	Data sharing	↓	↑	↑	↑
	Technology convergence and use of enabling technologies	↓	↑	↔	↑
Research and innovation	Globalisation of research and innovation and data sharing	Decrease in international data sharing and collaboration	Increasing international data sharing and collaboration (open and distributed)	Increasing international collaboration and data sharing (closed)	Increasing international data sharing and collaboration (open and distributed)
	Funding for research and innovation	Decreases	Sufficient and continuous for different actors	Fragmentation	Sufficient and continuous for different actors

Source: Study team analysis

5.3. Summaries of the scenarios corresponding to future scenario set 2: *Norway in a global context*

We present the summaries for this scenario set for information purposes only. As noted previously, the health and welfare strategic area was primarily discussed in the workshop for scenario set 1, although health constituted parts of some of the scenarios in this scenario set as well (see Annex A for the full scenario narratives).

Scenario 1: Protectionist decline



Key storyline: Political instability has led to a poorly performing global economy and protectionist attitudes towards trade and research and innovation. Even within Norway, there has been little progress so far on initiatives to green the economy, which continues to focus on developing the oceans.

Scenario 2: Global greening



Key storyline: Products and services that have a low impact on the environment and climate are now central to the global economy. Change is being achieved through government-, industry- and consumer-led initiatives, with Norway at the forefront of all of these. There has been a focus on ensuring openness and transparency of research, seen as key to a green

future.

Scenario 3: Slowly shifting power



Key storyline: A lack of clear international vision has resulted in slow progress by 2040 on both climate change goals and transformational change from technology convergence, as research remains fragmented. Global trading pattern relationships reflect the steady drift of economic power away from the west, while melting ice in the High North has created

commercial opportunities and tensions for Norway.

Technological trajectory



Key storyline: By 2040, technology is all-pervasive: a key driver of economic growth, changing the nature of employment for many and impacting on daily life. Technological advances have not delivered on climate change goals and continue to be resource intensive. Norway is increasingly looking to new international partners for trade and research collaboration.

Figure 7. Key characteristics and underpinning factors of the four scenarios associated with scenario set 2 (Norway in a global context)

		Protectionist decline	Global greening	Slowly shifting power	Technological trajectory
Green transition	Demand and support for circular products	↓	↑	↓	↔
	Circular infrastructure for energy, water and waste supply	Circular economy remain focussed on current approaches to water/energy/waste	Circular initiatives develop rapidly and implemented at national, regional and local levels	Circular economy remain focussed on current approaches to water/energy/waste	There is rapid development in circular initiatives, but implementation remains localised
	Investments/innovations to reduce emissions from oil	↓	↑	↔	↔
	Ability of Norway to adapt to climate change	↓	↑	↓	↓
	Food security and supply	Norway maintains security of food supply with higher share of domestic production	Norway maintains security of food supply with higher share of domestic production	Norway maintains security of food supply with same share of productions as now	Norway maintains security of food supply with same share of productions as now
	Low-carbon business models (international)	No change in emergence	Rapid emergence	No change in emergence	Emergence in some sectors
Oceans	Sustainable aquaculture	Little expansion in aquaculture sector	Expanded aquaculture sector with expanded share of sustainable farming	Expanded aquaculture sector with expanded share of sustainable farming	Expanded aquaculture sector but no increase in share of sustainable farming
	Norwegian shipping industry	Greening of international shipping industry remains as now	Greening of international shipping industry is extensive	Greening of international shipping industry remains as now	Greening of the shipping industry increases
Globalisation and society	Norway's trade linkages with other countries	↓	↑	↔	↑
	Norwegian co-operation with EU/EEA	↓	↑	↔	↑
	Natural resource wealth	Slow growth or stagnation	Steady growth, with greater share from sustainable sources	Steady growth, but no change in share from sustainable sources	Steady growth, but no change in share from sustainable sources
	Make up of geopolitical landscape	Less stable with a shift in global power	More stable with greater cooperation with and stability in Norway's partner countries	No change in stability of the geopolitical landscape	No change in the stability of the geopolitical landscape
	Natural resource wealth	Slow growth or stagnation in the economy	Steady growth in Norway's wealth with a greater share from sustainable sources	Steady growth in Norway's wealth, but no change in the share from sustainable sources	Steady growth in Norway's wealth, but no change in the share from sustainable sources
	Skilled labour availability (to match employment demand)	↓	↑	↔	↑
	Technology convergence and the use of enabling technologies	↓	↑	↔	↑
Research and innovation	Globalisation of research and innovation and data sharing	Decrease in international data sharing and collaboration	Increasing international data sharing and collaboration (open and distributed)	Increasing international collaboration and data sharing (closed)	Increasing international data sharing and collaboration (open and distributed)
	Funding for research and innovation	Decreases	Sufficient and continuous for different actors	Fragmentation	Sufficient and continuous for different actors

Source: Study team analysis

6. Indicative priority missions to help develop the health and welfare strategic area

As noted previously, a set of policy levers or actions will be required by the RCN to help steer the R&I system towards its main outcome of interest (i.e. achieving a ‘well-functioning research and innovation system’) through 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 2020a). Developing a series of strategically selected priority missions – within and across (or even outside) the RCN’s five strategic areas – that could potentially be implemented over the next few years could help contribute to this. For this study, we regard missions as targeted, timebound, concrete priority actions to help solve one or more societal challenges that the RCN, together with other stakeholders could consider implementing in the future. These challenge-based missions will help the RCN achieve its overarching objectives (over a roughly ten-year time frame) and eventually contribute to enriching lives locally, nationally and internationally. More generally, missions are systemic policies that operate both as a means of steering economic growth in a particular direction (by, for example, steering investments towards particular societal challenges) and as a tool that can be used to get there (by, for example, setting clear problem-focused objectives) (Mazzucato 2018). Because missions are so closely connected to societal challenges, public purpose and societal impact lie at the heart of missions. They also aim to generate innovation across sectors, actors and disciplines and to enable bottom-up solutions and experimentation across multiple sectors. Missions are challenges that cannot be solved by a single project in research and innovation, but, rather, require a portfolio of interacting projects as well as the implementation of wider policy measures.

In the sections below, we discuss a set of indicative priority missions for the health and welfare strategic area. Drawing on information collected during the trend analyses and expert inputs throughout the study, the mission ideas have been proposed, as far as possible, for areas where Norway has competitive advantages; where its institutional capacities and capabilities are strong; and where national, social, economic or environmental challenges are critical – nationally and where, relevant, internationally. The priority mission ideas we have highlighted are not intended to be definitive and are proposed as indicative ideas at this stage, based on the analysis of the evidence gathered. They represent a broad spectrum of ideas for further consideration and exploration by the RCN and other stakeholders that might be involved in the process to implement potential missions in Norway in the future. Some mission ideas are wide ranging and cover one or more other strategic areas while others are more specific. Furthermore, some missions overlap and interact with other missions. All the missions will require an active, multi-stakeholder approach in order to be implemented and are cross-cutting in terms of sectors and disciplines involved. In general, their implementation will also need to effectively incorporate relevant social sciences, humanities, legal and ethical perspectives. Finally, the missions must engage the public regularly and be evaluated against a set of clearly defined criteria set out upfront.

A preliminary set of priority missions and associated focus areas were discussed and validated by stakeholders (across academia, industry, the third sector and the RCN) at two foresight workshops to understand their implications (for example, in terms of impact and feasibility) against the RCN’s objectives across the

different futures exemplified in the scenarios.¹⁹ We also tested the mission ideas in interviews with a selection of stakeholders from academia, industry, the third sector and the public sector. Following the workshops, the indicative missions were refined based on feedback received at the workshops and from the RCN. For each indicative mission presented below, we have also suggested a selection of potential targeted focus areas, in addition to highlighting broad links to the United Nations (UN) Sustainable Development Goals (SDGs) (United Nations 2021),²⁰ the clusters under Pillar II of Horizon Europe (European Commission 2021a),²¹ and other EU missions identified in Horizon Europe (European Commission 2021b).²² The focus areas²³ are exemplar and are not intended to be definitive; rather they represent a range of potential areas of emphasis in relation to the missions for further consideration by the RCN and other stakeholders. It is important to note that each of the target focus areas presented below will eventually need to be specified with clear, measurable and timebound goals, arrived at by the stakeholders involved in selecting and implementing the missions.

We have also articulated a set of indicative, cross-cutting missions that are intentionally comprehensive and could apply horizontally to several (and in some cases all the) strategic areas and potentially to other areas of R&I as well. These have been discussed in an accompanying report (Gunasekar et al. 2021a).

Finally, it is important to note that the priority missions will need to be developed and built on top of a set of robust and coordinated structural measures in the Norwegian R&I environment. Structural measures will address the performance of the Norwegian R&I system in terms of the three overarching objectives of the RCN for the current strategy period. Establishing new and/or strengthening existing underpinning structural measures will enable the development of a resilient, inclusive and thriving R&I environment in Norway within which the missions can be effectively and efficiently implemented in the future. We have proposed a series of potential structural measures in an accompanying report (Skjoldager et al. 2021c).

In Box 4 below, we summarise the indicative missions (and corresponding exemplar targeted focus areas) for the health and welfare strategic area and from Section 6.1.1 onwards, we present details of the missions using a standard template (in Box 5, we provide a key to the missions template). In Annex B, we present an

¹⁹ The two workshops covering the two scenario sets – Norway in a national context and Norway in a global context – were organised on 23 and 24 March 2021, respectively.

²⁰ The UN SDGs are: SDG1: No poverty; SDG2: Zero hunger; SDG3: Good health and well-being; SDG4: Quality education; SDG5: Gender equality; SDG6: Clean water and sanitation; SDG7: Affordable and clean energy; SDG8: Decent work and economic growth; SDG9: Industry, innovation and infrastructure; SDG10: Reduced inequalities; SDG11: Sustainable cities and communities; SDG12: Responsible consumption and production; SDG13: Climate action; SDG14: Life below water; SDG15: Life on land; SDG16: Peace, justice and strong institutions; and SDG17: Partnerships for the goals.

²⁰ The Horizon Europe Clusters under Pillar II includes: (1): Health; (2): Culture, Creativity and Inclusive Society; (3): Civil Security for Society; (4): Digital, Industry and Space; (5): Climate, Energy and Mobility; and (6): Food, Bioeconomy, Natural Resources, Agriculture and Environment.

²¹ The Horizon Europe Clusters under Pillar II includes: (1): Health; (2): Culture, Creativity and Inclusive Society; (3): Civil Security for Society; (4): Digital, Industry and Space; (5): Climate, Energy and Mobility; and (6): Food, Bioeconomy, Natural Resources, Agriculture and Environment.

²² Five EU mission areas have currently been proposed as part of Horizon Europe: (i) Conquering Cancer: Mission Possible; (ii) A Climate Resilient Europe – Prepare Europe for Climate Disruptions and Accelerate the Transformation to a Climate Resilient and Just Europe by 2030; (iii) Mission Starfish 2030: Restore our Ocean and Waters; (iv) 100 Climate-Neutral Cities by 2030 – By and for the Citizens; and (v) Caring for Soil Is Caring for Life.

²³ To varying degrees, the missions and focus areas capture evidence analysed during the trend analyses. Specifically, we analysed the key trends, barriers, enablers and uncertainties identified in the trend analysis to suggest potential areas of focus for each priority mission.

infographic that provides a high-level overview of *all* the indicative mission ideas that have been articulated within, across and outside the RCN's five strategic areas (oceans; green transition; health and welfare; technology and digitalisation; and cohesion and globalisation).

Box 4. Summary of indicative missions and corresponding exemplar targeted focus areas related to the health and welfare strategic area

- ***Indicative mission 1: Actively address the impacts of non-communicable diseases in Norway***
Exemplar targeted focus areas: Reduce (X% reduction in) the number of deaths caused by non-communicable diseases (NCDs); actively treat, prevent and reduce the prevalence of risk factors in the Norwegian population (e.g. harmful use of alcohol, physical inactivity, salt/sodium intake, tobacco use, raised blood pressure, diabetes, obesity, air pollution); improve system-wide responses, such as drug therapies (e.g. to prevent heart attacks and strokes), medicines and technologies to treat NCDs; and support and improve the quality of life of people affected by NCDs in Norway (across all segments of the population).
- ***Indicative mission 2: Substantially reduce the prevalence and impact of mental illness in Norway***
Exemplar targeted focus areas: Improve and ultimately transform the way in which mental illness in Norway is effectively prevented, detected, diagnosed (including early interventions), and treated, to help reduce its prevalence and impact throughout society (e.g. at home and in work environments); ensure that evidence-based research efforts are concentrated in these and other, related areas (such as the causes of mental illness and recovery from mental illness) and translated into practice (e.g. to improve the reach and outcome of mental health services throughout Norway); and support and improve the quality of life of people affected by mental illness in Norway (across all segments of the population).
- ***Indicative mission 3: Establish Norway as a global knowledge leader in personalised medicine and healthcare***
Exemplar targeted focus areas: Put Norway at the forefront of developing cutting-edge and responsible personalised medicine approaches and patient-centred care; translate these into practice to improve patient care and outcomes and to avoid unnecessary health costs; roll these out across all segments of the population in Norway; and actively address the potential ethical, societal and legal challenges involved in development and adoption.
- ***Indicative mission 4: Accelerate people-centred, data-driven strategies to digitally transform and improve Norway's health and care system***
Exemplar targeted focus areas: Further leverage Norway's research and innovation strengths in data-driven technologies (e.g. AI, machine learning, nanotechnology, biotechnology) and the translation of these into practice to improve the prevention, diagnosis and treatment of diseases and illnesses; actively address the potential ethical, societal and legal challenges involved in development and adoption; and ensure that all segments of the population in Norway are positively impacted.
- ***Indicative mission 5: Improve the quality of life and health of an ageing society in Norway***
Exemplar targeted focus areas: Ensure that people in Norway can live longer lives (e.g. X extra years) healthily and independently while reducing the inequalities between different parts of society; increase the number of healthcare personnel with relevant skills and capabilities to support an ageing population (and ensure the retention of these personnel); increase the adoption of relevant technologies and related services that contribute to healthier and independent living for the elderly (including helping with social connectedness and other areas related to improving quality of life); and ensure adequate support structures are established and available to all segments of Norwegian society.

- ***Indicative mission 6: Actively contribute to healthy, safe and sustainable food systems***
Exemplar targeted focus areas: Increase sustainable, climate-resilient food production – nationally and globally; increase access to safe and healthy food while reducing food waste and loss; ensure that food production systems can provide food to improve quality of life and health; stimulate innovations/technology development and adoption to accelerate the transformation of food systems (e.g. in relation to improving productivity, supply chain efficiency and transparency); actively position Norway as an international thought and knowledge leader with regard to effective food systems governance; and promote international cooperation (e.g. in relation to R&D, agricultural practices) between stakeholders to stimulate the creation of economically, socially and environmentally sustainable food systems.
- ***Indicative mission 7: Play a leading role in tackling antimicrobial resistance (in Norway and globally) and actively share expertise***
Exemplar targeted focus areas: Put in place systems to improve the effective diagnosis and surveillance of antibiotic-resistant infections and antibiotic use in Norway and internationally; contribute to further reducing the demand for (new) antibiotics; provide thought leadership to help improve awareness and understanding of antimicrobial resistance; actively share experiences, approaches and expertise in combating antimicrobial resistance internationally; and actively invest in developing alternatives to current antibiotics.
- ***Indicative mission 8: Ensure decent work for all people in Norway***
Exemplar targeted focus areas: Promote and accelerate inclusive, diverse and decent work for all people in Norway across all segments of the population (including integration of immigrants into the labour market); increase youth employment; improve quality of work, working conditions, job satisfaction, etc.; ensure equal access; and achieve productive employment for the Norwegian workforce that can adapt to digitalisation/automation.
- ***Indicative mission 9: Contribute to Norway’s digital transformation by creating a diverse, digitally and soft-skilled workforce***
Exemplar targeted focus areas: Progressively reduce and eliminate the shortage in advanced digital and soft skills, training and competencies, to enable people to work in and adapt to the rapidly evolving digital economy in Norway and globally (including upskilling and reskilling workers); and lead the way and demonstrate knowledge leadership in ensuring equal opportunities, eliminating disparities and overcoming bias and systemic barriers for all segments of the population working in the digital economy (e.g. women, minority ethnic communities, older people, the young workforce, disabled people).
- ***Indicative mission 10: Actively enable digital transformation at all levels of government in Norway***
Exemplar targeted focus areas: Make better and more responsible use of a range of digital technologies, data and platforms as enablers of public services at both local and national level (to deliver more targeted, inclusive and user-centric services); improve operations, work processes, productivity, user experience, accountability and transparency (and reduce risks); promote activities and behaviours that involve the responsible use of data and evidence to inform decision making; proactively focus on workforce development related to developing and maintaining skills (digital and soft); and promote cooperation/collaboration within and across ministries/municipalities and with other stakeholders (including the private sector) (e.g. to share learnings, to share good practice, to build capacity).

Box 5: Key to the mission templates presented below

- **Key challenges that the mission aims to address:** Details some of the challenges that the mission will contribute to addressing.
- **Exemplar targeted focus areas:** Lists a selection of potential targeted focus areas for the mission. Implementing the priority missions will require the design and implementation of a portfolio of diverse projects involving multiple stakeholders, ideally, as noted previously, in areas where Norway demonstrates strengths and has competitive advantages. The exemplar targeted focus areas could be used to inform the development of potential R&I projects. Furthermore, it is important to note that each of the target focus areas will need to be specified with clear, measurable and timebound goals that are decided by the stakeholders involved in implementing the mission.
- **Links to the RCN strategic areas:** Specifies the links to the strategic area(s) identified in the RCN's current strategy for the next ten years (Research Council of Norway 2020a).
- **Links to UN Sustainable development goals (SDGs):** Specifies the UN SDG(s) that the priority mission is linked to (United Nations 2021).
- **Links to clusters of Horizon Europe's Global Challenges pillar (Pillar II):** Specifies the cluster(s) within Pillar II of Horizon Europe) (Global Challenges and European Industrial Competitiveness) that the mission is linked to (European Commission 2021a).
- **Intersection with other priority missions:** Specifies the other indicative priority mission(s) that the priority mission is interconnected with.
- **Involvement of key stakeholders:** Implementing this priority mission will require targeted research, innovation and investment from the RCN and other potential stakeholders (e.g. the public sector; the private sector and industry; civil society organisations; citizens). Importantly, it will also necessitate catalysing active cooperation and collaboration among these diverse stakeholders (including public engagement). In this section, we list some of these potential key stakeholders.

6.1.1. Priority mission area 1: Actively address the impacts of non-communicable diseases in Norway

Key challenges that the mission aims to address	
<ul style="list-style-type: none"> • Reducing deaths caused by non-communicable diseases in Norway²⁴; • Reducing non-communicable disease risk factors (e.g. high blood pressure, high blood glucose concentrations, dietary habits, physical inactivity, tobacco use and alcohol consumption)²⁵; • Improving the overall quality of life of people impacted by NCDs; and • Reducing the overall number of premature deaths resulting from non-communicable diseases. 	
Exemplar targeted focus areas	
<ul style="list-style-type: none"> • Reduce (X% reduction in) the number of deaths caused by non-communicable diseases; • Actively treat, prevent and reduce the prevalence of risk factors in the Norwegian population (e.g. harmful use of alcohol, physical inactivity, salt/sodium intake, tobacco use, raised blood pressure, diabetes, obesity, air pollution); • Improve system-wide responses, such as drug therapies (e.g. to prevent heart attacks and strokes), medicines and technologies to treat NCDs; and • Support and improve the quality of life of people affected by NCDs in Norway (across all segments of the population). 	
Links to RCN Strategic Areas	Links to UN SDGs
<ul style="list-style-type: none"> • Health and welfare (primary link) 	<ul style="list-style-type: none"> • SDG 3: Good Health and Well-being
Links to clusters of Horizon Europe's Global Challenges Pillar II	Links to EU mission areas identified in Horizon Europe
<ul style="list-style-type: none"> • Health 	<ul style="list-style-type: none"> • Conquering Cancer: Mission Possible
Intersection with other priority mission(s) identified in this study	
<ul style="list-style-type: none"> • Substantially reduce the prevalence and impact of mental illness in Norway • Establish Norway as a global knowledge leader in personalised medicine and healthcare • Accelerate people-centred data-driven strategies to digitally transform and improve Norway's health and welfare system • Improve the quality of life and health of an ageing society in Norway • Contribute to Norway's digital transformation by creating a diverse, digitally and soft-skilled workforce • Actively enable digital transformation at all levels of government in Norway 	
Involvement of key stakeholders	
<ul style="list-style-type: none"> • Sectors (e.g. health, social care, welfare, pharmacy, life sciences) • Norwegian higher education institutions and research organisations • International organisations (e.g. WHO, Global Asthma Network, Non-communicable Disease Alliance, World Bank, OECD, Unicef, World Cancer Research Fund, European Commission) • National and regional government health agencies (e.g. Ministry of Health and Care Services, Norwegian Institute of Public Health, Norwegian Medicines Agency, Norwegian Directorate of Health, Central Norway Pharmaceutical Trust, Northern Norway Regional Health Authority, Southern and Eastern Norway Regional Health Authority, Western Norway Regional Health Authority, Industrial Development Corporation of Norway) • Voluntary organisations (e.g. Frivillighet Norge, European Network of National Civil Society Associations, Aurora, Barnekreftforeningen, Blå Kors Norge, Internasjonal helse- og sosialgruppe, Kreftforeningen, Nasjonalforeningen for folkehelsen, Mat&Atferd, Norsk Helse- og Avholdsforbund) • The Research Council of Norway and Innovation Norway 	

²⁴ In Norway, 87 per cent of all deaths are caused by NCDs, which is higher than the global average (World Health Organization 2020a). NCDs account for over 70 per cent of all annual deaths on a global scale, presenting both a public health and economic challenge across all countries (World Health Organization 2020a). The World Health Organization has published a set of monitoring indicators to assess progress of countries in implementing recommended interventions to prevent and tackle NCDs (World Health Organization 2020a).

²⁵ See, for example Nujhat et al. (2020).

6.1.2. Priority mission area 2: Substantially reduce the prevalence and impact of mental illness in Norway

Key challenges that the mission aims to address	
<ul style="list-style-type: none"> • Reducing mental health disorders, a key issue faced by other European countries and Norway^{26,27}; • Reducing mental disorder risk factors (e.g. the rise in the number of new disability pensions due to mental disorders); and • Improving the knowledge base on mental illnesses. 	
Exemplar targeted focus areas	
<ul style="list-style-type: none"> • Improve and ultimately transform the way in which mental illness in Norway is effectively prevented, detected, diagnosed (including early interventions), and treated, to help reduce its prevalence and impact throughout society (e.g. at home and in work environments); • Ensure that evidence-based research efforts are concentrated in these and other, related areas (such as the causes of mental illness and recovery from mental illness) and translated into practice (e.g. to improve the reach and outcome of mental health services throughout Norway); and • Support and improve the quality of life of people affected by mental illness in Norway (across all segments of the population). 	
Links to RCN Strategic Areas	Links to UN SDGs
<ul style="list-style-type: none"> • Health and welfare (primary link) 	<ul style="list-style-type: none"> • SDG 3: Good Health and Well-being
Links to clusters of Horizon Europe's Global Challenges Pillar II	Links to EU mission areas identified in Horizon Europe
<ul style="list-style-type: none"> • Health 	<ul style="list-style-type: none"> • Conquering Cancer: Mission Possible
Intersection with other indicative priority mission(s) identified in this study	
<ul style="list-style-type: none"> • Actively address the impacts of non-communicable diseases in Norway • Establish Norway as a global knowledge leader in personalised medicine and healthcare • Accelerate people-centred data-driven strategies to digitally transform and improve Norway's health and care system • Improve the quality of life and health of an ageing society in Norway • Contribute to Norway's digital transformation by creating a diverse, digitally and soft-skilled workforce • Actively enable digital transformation at all levels of government in Norway 	
Involvement of key stakeholders	
<ul style="list-style-type: none"> • Sectors (e.g. health, social care, technology, education, employment) • Norwegian higher education institutions and research organisations • International health agencies (e.g. World Health Organization, OECD, European Commission) • National and regional government health and welfare agencies (e.g. Ministry of Health and Care Services, Norwegian Institute of Public Health, Norwegian Medicines Agency, Norwegian Directorate of Health, National Insurance Administration, Norwegian Board of Health, Norwegian Labour and Welfare Organisation, National Centre for Suicide Research and Prevention, the Central Norway Pharmaceutical Trust, Northern Norway Regional Health Authority, Southern and Eastern Norway Regional Health Authority, Western Norway Regional Health Authority, district psychiatric centres, Industrial Development Corporation of Norway) • Voluntary organisations (e.g. Frivillighet Norge, European Network of National Civil Society Associations, Aurora, Blå Kors Norge, Internasjonal helse- og sosialgruppe, Nasjonalforeningen for folkehelsen, Mat&Atferd, Norsk Helse- og Avholdsforbund) • The Research Council of Norway and Innovation Norway 	

²⁶ In Norway, approximately 16–22 per cent of the adult population will experience a mental disorder in a 12-month period. This encompasses anxiety disorders, depression, and substance use disorders (Norwegian Institute of Public Health 2016b).

²⁷ See, for example Mykletun et al. (2009), Norwegian Labour and Welfare Administration (2018), Norwegian Institute of Public Health (2016b) and Ministry of Health and Care Services (2008).

6.1.3. Priority mission area 3: Establish Norway as a global knowledge leader in personalised medicine and healthcare

Key challenges that the mission aims to address	
<ul style="list-style-type: none"> Improving the prediction and prevention of disease, precision diagnostics, tailored interventions and a more active role for participants in managing their own healthcare needs; Furthering Norway's strong position in personalised medicine, with population-based healthcare administrative registers, biobanks, and the potential for collaboration with other Nordic countries given similarities between health systems; and Improving the links between digitalisation targets and patient treatment targets, strengthening teams-based and multidisciplinary care provision, rolling out personalised medicine across Norway's regions, and contributing to developing population-oriented information. 	
Exemplar targeted focus areas	
<ul style="list-style-type: none"> Put Norway at the forefront of developing cutting-edge and responsible personalised medicine approaches and patient-centred care; Translate these into practice to improve patient care and outcomes and to avoid unnecessary health costs; roll these out across all segments of the population in Norway; and Actively address the potential ethical, societal and legal challenges involved in development and adoption. 	
Links to RCN Strategic Areas	Links to UN SDGs
<ul style="list-style-type: none"> Health and welfare (primary link) Technology and digitalisation 	<ul style="list-style-type: none"> SDG 3: Good Health and Well-being
Links to clusters of Horizon Europe's Global Challenges Pillar II	Links to EU mission areas identified in Horizon Europe
<ul style="list-style-type: none"> Health Digital, Industry and Space 	<ul style="list-style-type: none"> Conquering Cancer: Mission Possible
Intersection with other priority mission(s) identified in this study	
<ul style="list-style-type: none"> Actively address the impacts of non-communicable diseases in Norway Substantially reduce the prevalence and impact of mental illness in Norway Accelerate people-centred data-driven strategies to digitally transform and improve Norway's health and welfare system Improve the quality of life and health of an ageing society in Norway Contribute to Norway's digital transformation by creating a diverse, digitally and soft-skilled workforce Actively enable digital transformation at all levels of government in Norway 	
Involvement of key stakeholders	
<ul style="list-style-type: none"> Sectors (e.g. health, social care, life sciences and pharmaceuticals, technology) International organisations (e.g. World Health Organization, OECD, European Commission, United Nations) National and regional government health agencies (e.g. Ministry of Health and Care Services, Norwegian Institute of Public Health, Norwegian Medicines Agency, Norwegian Directorate of Health, Norwegian Association of General Medicine, Norwegian Data Protection Authority, Central Norway Pharmaceutical Trust, Northern Norway Regional Health Authority, Southern and Eastern Norway Regional Health Authority, Western Norway Regional Health Authority, National Centre for eHealth Research, Industrial Development Corporation of Norway) Voluntary organisations (e.g. Frivillighet Norge, European Network of National Civil Society Associations, Aurora, Barnekreftforeningen, Blå Kors Norge, Internasjonal helse- og sosialgruppe, Kreftforeningen, Nasjonalforeningen for folkehelsen, Mat&Atferd, Norsk Helse- og Avholdsforbund) The Research Council of Norway and Innovation Norway 	

6.1.4. Priority mission area 4: Accelerate people-centred, data-driven strategies to digitally transform and improve Norway's health and welfare system

Key challenges that the mission aims to address	
<ul style="list-style-type: none"> Improving telehealth and welfare offerings across Norway²⁸; Improving data and image sharing among healthcare and welfare providers in Norway; and Contributing to new data models, increased collaboration, and transformation towards a preventative approach. 	
Exemplar targeted focus areas	
<ul style="list-style-type: none"> Further leverage Norway's research and innovation strengths in data-driven technologies (e.g. AI, machine learning, nanotechnology, biotechnology, etc.) and the translation of these into practice to improve the prevention, diagnosis and treatment of diseases and illnesses²⁹; Actively address the potential ethical, societal and legal challenges involved in development and adoption; and Ensure that all segments of the population in Norway are positively impacted. 	
Links to RCN Strategic Areas	Links to UN SDGs
<ul style="list-style-type: none"> Health and welfare (primary link) Technology and digitalisation 	<ul style="list-style-type: none"> SDG 3: Good Health and Well-being
Links to clusters of Horizon Europe's Global Challenges Pillar II	Links to EU mission areas identified in Horizon Europe
<ul style="list-style-type: none"> Health Digital, Industry and Space 	<ul style="list-style-type: none"> Conquering Cancer: Mission Possible
Intersection with other indicative priority mission(s) identified in this study	
<ul style="list-style-type: none"> Actively address the impacts of non-communicable diseases in Norway Substantially reduce the prevalence and impact of mental illness in Norway Establish Norway as a global knowledge leader in personalised medicine and healthcare Improve the quality of life and health of an ageing society in Norway Contribute to Norway's digital transformation by creating a diverse, digitally and soft-skilled workforce Actively enable digital transformation at all levels of government in Norway 	
Involvement of key stakeholders	
<ul style="list-style-type: none"> Sectors (e.g. health, social care, life sciences, pharmaceuticals, education and learning, technology, environment, climate) Norwegian higher education institutions and research organisations International organisations (e.g. World Health Organization, OECD, European Commission, United Nations) National and regional government health agencies (e.g. Ministry of Health and Care Services, Norwegian Institute of Public Health, Norwegian Medicines Agency, Norwegian Directorate of Health, Norwegian Association of General Medicine, Norwegian Data Protection Authority, Central Norway Pharmaceutical Trust, Northern Norway Regional Health Authority, Southern and Eastern Norway Regional Health Authority, Western Norway Regional Health Authority, National Centre for eHealth Research, Industrial Development Corporation of Norway) Voluntary organisations (e.g. Frivillighet Norge, European Network of National Civil Society Associations, Aurora, Barnekreftforeningen, Blå Kors Norge, Internasjonal helse- og sosialgruppe, Kreftforeningen, Nasjonalforeningen for folkehelsen, Mat&Atferd, Norsk Helse- og Avholdsforbund) The Research Council of Norway and Innovation Norway 	

²⁸ See, for example Department for Business, Energy & Industrial Strategy (2021), European Cluster Collaboration Platform (2021) and Nordic Health 2030 (2018).

²⁹ Norway can also further leverage data-driven strategies and data spaces for technologies related to cloud, data and artificial intelligence, to create registries that can benefit research and innovation in other sectors where Norway has competitive advantages (i.e. health, earth observation and the Arctic, maritime through Barentswatch, and energy).

6.1.5. Priority mission area 5: Improve the quality of life and health of an ageing society in Norway

Key challenges that the mission aims to address³⁰	
<ul style="list-style-type: none"> • Providing solutions to the demographic challenges that Norway faces in the coming years; • Ensuring that Norwegians can stay independent for longer; • Ensuring that Norwegians can participate through their employment and their communities and can remain connected to others in society; • Ensuring that solutions for the ageing population are spread out across Norway's regions; • Ensuring a reduction in chronic diseases among the elderly; and • Improving the balance between demand and supply of health and care workers on a national level. 	
Exemplar targeted focus areas³¹	
<ul style="list-style-type: none"> • Ensure that people in Norway can live longer lives (e.g. X extra years) healthily and independently while reducing the inequalities between different parts of society; • Increase the number of healthcare personnel with relevant skills and capabilities to support an ageing population (and ensure the retention of these personnel); • Increase the adoption of relevant technologies and related services that contribute to healthier and independent living for the elderly (including helping with social connectedness and other areas related to improving quality of life); and • Ensure adequate support structures are established and available to all segments of Norwegian society. 	
Links to RCN Strategic Areas	Links to UN SDGs
<ul style="list-style-type: none"> • Health and welfare (primary link) • Cohesion and Globalisation 	<ul style="list-style-type: none"> • SDG 3: Good Health and Well-being • SDG 10: Reduced Inequalities
Links to clusters of Horizon Europe's Global Challenges Pillar II	Links to EU mission areas identified in Horizon Europe
<ul style="list-style-type: none"> • Health • Culture, creativity and inclusive society 	<ul style="list-style-type: none"> • Conquering Cancer: Mission Possible
Intersection with other indicative priority mission(s) identified in this study	
<ul style="list-style-type: none"> • Actively address the impacts of non-communicable diseases in Norway • Substantially reduce the prevalence and impact of mental illness in Norway • Establish Norway as a global knowledge leader in personalised medicine and healthcare • Accelerate people-centred, data-driven strategies to digitally transform and improve Norway's health and welfare system • Contribute to Norway's digital transformation by creating a diverse, digitally and soft-skilled workforce • Actively enable digital transformation at all levels of government in Norway 	
Involvement of key stakeholders	
<ul style="list-style-type: none"> • Sectors (e.g. health, social care, life sciences, pharmaceuticals, technology, education and learning, finance, transport) • Norwegian higher education institutions and research organisations • International organisations (e.g. World Health Organization, OECD, European Commission, United Nations) • National government health agencies (e.g. Ministry of Health and Care Services, Norwegian Institute of Public Health, Norwegian Medicines Agency, Norwegian Directorate of Health, Norwegian Association of General Medicine, Norwegian Data Protection Authority, Central Norway Pharmaceutical Trust, Northern Norway Regional Health Authority, Southern and Eastern Norway Regional Health Authority, Western Norway Regional Health Authority, National Centre for eHealth Research, Industrial Development Corporation of Norway) • Voluntary organisations (e.g. Frivillighet Norge, European Network of National Civil Society Associations, Aurora, Barnekreftforeningen, Blå Kors Norge, Internasjonal helse- og sosialgruppe, Kreftforeningen, Nasjonalforeningen for folkehelsen, Mat&Atferd, Norsk Helse- og Avholdsbund) • The Research Council of Norway and Innovation Norway 	

³⁰ See, for example Department for Business, Energy & Industrial Strategy (2021), European Cluster Collaboration Platform (2021), Ministry of Education and Research (2020) and Norwegian Institute of Public Health (2014).

³¹ Potentially, Norway can improve bottom-up and top-down R&D by, for example, leveraging the Health&Care21 process.

6.1.6. Priority mission area 6: Actively contribute to healthy, safe and sustainable food systems

Key challenges that the mission aims to address	
<ul style="list-style-type: none"> • Improving ecological farming; • Improving sustainable food movements; • Increasing the number of innovative solutions (e.g. local food systems, producer cooperatives, calculators of food footprints); • Improving the sustainability of fish farming; • Improving knowledge among consumers and the food retail sectors; • Improving the safeguarding of water, soil and air quality, while minimising greenhouse gas emissions; and • Reducing food loss and waste. 	
Exemplar targeted focus areas	
<ul style="list-style-type: none"> • Increase sustainable, climate-resilient food production – nationally and globally; • Increase access to safe and healthy food while reducing food waste and loss • Ensure that food production systems can provide food to improve quality of life and health; • Stimulate innovations/technology development and adoption to accelerate the transformation of food systems (e.g. in relation to improving productivity, supply chain efficiency and transparency); • Actively position Norway as an international thought and knowledge leader with regard to effective food systems governance; and • Promote international cooperation (e.g. in relation to R&D, agricultural practices) between stakeholders to stimulate the creation of economically, socially and environmentally sustainable food systems. 	
Links to RCN Strategic Areas	Links to UN SDGs
<ul style="list-style-type: none"> • Green transition (primary link) • Health and welfare • Technology and digitalisation 	<ul style="list-style-type: none"> • SDG 2: Zero Hunger • SDG 3: Good Health and Well-being • SDG 6: Clean Water and Sanitation • SDG 12: Responsible Consumption and Production • SDG 13: Climate Action
Links to clusters of Horizon Europe’s Global Challenges pillar	Links to EU mission areas identified in Horizon Europe
<ul style="list-style-type: none"> • Health • Food, Bioeconomy, Natural Resources, Agriculture and Environment 	<ul style="list-style-type: none"> • Caring for Soil Is Caring for Life
Intersection with other priority mission(s) identified in this study	
<ul style="list-style-type: none"> • Actively address the impacts of non-communicable diseases in Norway • Protect, value and restore Norwegian biodiversity and reduce its degradation and loss • Play a leading role in tackling antimicrobial resistance (in Norway and globally) and actively share expertise • Contribute to Norway’s digital transformation by creating a diverse, digitally and soft-skilled workforce • Actively enable digital transformation at all levels of government in Norway 	
Involvement of key stakeholders	
<ul style="list-style-type: none"> • Sectors (e.g. retailers, farmers, fish farming, seafood, health, environment, public, leisure) • Norwegian higher education institutions and research organisations • International organisations (e.g. Food and Agricultural Organization of the United Nations, International Fund for Agricultural Development, World Food Programme, World Health Organisation, OECD) • National government agencies (Norwegian Farmer’s Union, Ministry of Agriculture and Food, Norwegian Food Safety Authority, Ministry of Climate and Environment, Ministry of Foreign Affairs, Ministry of Justice and Public Security, Industrial Development Corporation of Norway) • Voluntary organisations (e.g. Frivillighet Norge, European Network of National Civil Society Associations, Miljøagentene, Norges Naturvernforbund, Norsk Friluftsliv, Natur og Ungdom) • The Research Council of Norway and Innovation Norway 	

6.1.7. Priority mission area 7: Play a leading role in tackling antimicrobial resistance (in Norway and globally) and actively share expertise

Key challenges that the mission aims to address	
<ul style="list-style-type: none"> • Reducing the number of healthy people colonised with resistant bacteria and the number of patients who have infections caused by these bacteria in Norway and globally; • Preventing infections and limiting antibiotic consumption; • Reducing the use of antibiotics in animals in Norway and globally; • Increasing surveillance for safe delivery of medical treatment in the future; • Addressing the challenge of stalled antibiotics development internationally; • Increasing knowledge about what causes the development and spread of antibiotic resistance; and • Contributing to Norway's existing role a driving force in international and normative work to strengthen access, responsible use and development of new antibiotics, vaccines and better diagnostic tools. 	
Exemplar targeted focus areas	
<ul style="list-style-type: none"> • Put in place systems to improve the effective diagnosis and surveillance of antibiotic-resistant infections and antibiotic use in Norway and internationally; • Contribute to further reducing the demand for (new) antibiotics; • Provide thought leadership to help improve awareness and understanding of antimicrobial resistance; • Actively share experiences, approaches and expertise in combating antimicrobial resistance internationally; and • Actively invest in developing alternatives to current antibiotics. 	
Links to RCN Strategic Areas	Links to UN SDGs
<ul style="list-style-type: none"> • Health and welfare (primary link) • Cohesion and globalisation 	<ul style="list-style-type: none"> • SDG 3: Good Health and Well-being • SDG 14: Life Below Water • SDG 15: Life on Land
Links to clusters of Horizon Europe's Global Challenges pillar	Links to EU mission areas identified in Horizon Europe
<ul style="list-style-type: none"> • Health • Food, Bioeconomy, Natural Resources, Agriculture and Environment 	<ul style="list-style-type: none"> • A Climate Resilient Europe – Prepare Europe for Climate Disruptions and Accelerate the Transformation to a Climate Resilient and Just Europe by 2030 • Mission Starfish 2030: Restore our Ocean and Waters • Caring for Soil Is Caring for Life
Intersection with other priority mission(s) identified in this study	
<ul style="list-style-type: none"> • Protect, value and restore Norwegian biodiversity and reduce its degradation and loss • Actively contribute to healthy, safe and sustainable food systems • Contribute to Norway's digital transformation by creating a diverse, digitally and soft-skilled workforce • Actively enable digital transformation at all levels of government in Norway 	
Involvement of key stakeholders	
<ul style="list-style-type: none"> • Sectors (e.g. health, farming, husbandry, care, hospitality, environment, food, agriculture) • Higher education institutions and research organisations • Norwegian national agencies (National Institute of Public Health, Ministry of Health and Care Services, Ministry of Trade, Industry and Fisheries, Ministry of Agriculture and Food, Norwegian Food Safety Authority) • International organisations (European Commission, European Centre for Disease Prevention and Control, Food and Agricultural Organization of the United Nations, World Organisation for Animal Health, World Health Organization, Industrial Development Corporation of Norway) • Voluntary organisations (e.g. Frivillighet Norge, European Network of National Civil Society Associations, Miljøagentene, Norges Naturvernforbund, Norsk Friluftsliv, Natur og Ungdom) • The Research Council of Norway and Innovation Norway 	

6.1.8. Priority mission area 8: Ensure decent work for all people in Norway

Key challenges that the mission aims to address	
<ul style="list-style-type: none"> • Increasing youth employment; • Improving integration of immigrants into the labour market; • Improving aspects of work, such as quality of work, working conditions, job satisfaction; • Improving equal access to the employment market; and • Improving productive employment. 	
Exemplar targeted focus areas	
<ul style="list-style-type: none"> • Promote and accelerate inclusive, diverse and decent work for all people in Norway across all segments of the population (including integration of immigrants into the labour market); • Increase youth employment; • Improve quality of work, working conditions, job satisfaction, etc.; • Ensure equal access; and • Achieve productive employment for the Norwegian workforce that can adapt to digitalisation/automation. 	
Links to RCN Strategic Areas	Links to UN SDGs
<ul style="list-style-type: none"> • Cohesion and globalisation (primary link) • Health and welfare • Oceans • Green transition • Technology and digitalisation 	<ul style="list-style-type: none"> • SDG 4: Quality Education • SDG 8: Decent Work and Economic Growth
Links to clusters of Horizon Europe’s Global Challenges pillar	Links to EU mission areas identified in Horizon Europe
<ul style="list-style-type: none"> • Culture, Creativity, and Inclusive Society 	<ul style="list-style-type: none"> • A Climate Resilient Europe – Prepare Europe for Climate Disruptions and Accelerate the Transformation to a Climate Resilient and Just Europe by 2030
Intersection with other priority mission(s) identified in this study	
<ul style="list-style-type: none"> • Contribute to Norway’s digital transformation by creating a diverse, digitally and soft-skilled workforce 	
Involvement of key stakeholders	
<ul style="list-style-type: none"> • All sectors • Norwegian higher education institutions and research organisations • International organisations (e.g. World Bank, International Labour Organisation, European Commission, OECD, United Nations Development Programme, International Organisation of Employers) • National government agencies (Ministry of Research and Education, Ministry of Labour and Social Affairs, Norwegian Labour and Welfare Administration, Ministry of Children and Families, Industrial Development Corporation of Norway) • Voluntary organisations (e.g. Frivillighet Norge, European Network of National Civil Society Associations) • The Research Council of Norway and Innovation Norway 	

6.1.9. Priority mission area 9: Contribute to Norway’s digital transformation by creating a diverse, digitally and soft-skilled workforce

Key challenges that the mission aims to address	
<ul style="list-style-type: none"> • Ensuring that the education systems adapts to developments in the digital economy; • Filling skills gaps in key industries, including (but not limited to) healthcare, financial services and retail; • Ensuring the effective use of skills; • Ensuring the active supply of skills; • Contributing to the governance arrangements of Norway’s skills system; • Engaging stakeholders in the entire policy cycle; and • Building integrated information systems. 	
Exemplar targeted focus areas	
<ul style="list-style-type: none"> • Progressively reduce and eliminate the shortage in advanced digital and soft skills, training and competencies, to enable people to work in and adapt to the rapidly evolving digital economy in Norway and globally (including upskilling and reskilling workers); and • Lead the way and demonstrate knowledge leadership in ensuring equal opportunities, eliminating disparities and overcoming bias and systemic barriers for all segments of the population working in the digital economy (e.g. women, minority ethnic communities, older people, the young workforce, disabled people). 	
Links to RCN Strategic Areas	Links to UN SDGs
<ul style="list-style-type: none"> • Technology and digitalisation (primary link) • Cohesion and globalisation • Health and welfare • Oceans • Green transition 	<ul style="list-style-type: none"> • SDG 4: Quality Education • SDG 5: Gender Equality • SDG 8: Decent Work and Economic Growth • SDG 9: Industry, Innovation and Infrastructure • SDG 16: Peace, Justice and Strong Institutions
Links to clusters of Horizon Europe’s Global Challenges pillar	Links to EU mission areas identified in Horizon Europe
<ul style="list-style-type: none"> • Culture, Creativity and Inclusive Society • Digital, Industry and Space 	<ul style="list-style-type: none"> • Conquering Cancer: Mission Possible • A Climate Resilient Europe – Prepare Europe for Climate Disruptions and Accelerate the Transformation to a Climate Resilient and Just Europe by 2030 • Mission Starfish 2030: Restore our Ocean and Waters • 100 Climate-Neutral Cities by 2030 – By and for the Citizens • Caring for Soil Is Caring for Life
Intersection with other priority mission(s) identified in this study	
All indicative priority missions	
Involvement of key stakeholders	
<ul style="list-style-type: none"> • All sectors • Norwegian higher education institutions and research organisations • Norwegian national agencies (e.g. Ministry of Labour and Social Affairs, Ministry of Local Government and Modernisation, Ministry of Education and Research, Sami Parliament, Industrial Development Corporation of Norway) • International organisations (e.g. United Nations, World Bank, OECD, European Commission, World Economic Forum) • Voluntary organisations (e.g. Frivillighet Norge, European Network of National Civil Society Associations) • The Research Council of Norway and Innovation Norway 	

6.1.10. Priority mission area 10: Actively enable digital transformation at all levels of government in Norway

Key challenges that the mission aims to address	
<ul style="list-style-type: none"> • Countering the fragmented implementation of digital technologies across the public sector; • Providing key institutional actors with the means to promote the use of common guidelines, standards and digital solutions in different policy sectors; • Responding to changing citizen and business needs and expectations; • Strengthen coordination and synergies with local government; • Increasing the priority assigned to the development of digital and data-related leadership and skills; and • Simplifying and streamlining data-sharing practices. 	
Exemplar targeted focus areas	
<ul style="list-style-type: none"> • Make better and more responsible use of a range of digital technologies, data and platforms as enablers of public services at both local and national level (to deliver more targeted, inclusive and user-centric services); • Improve operations, work processes, productivity, user experience, accountability and transparency (and reduce risks); • Promote activities and behaviours that involve the responsible use of data and evidence to inform decision making; • Proactively focus on workforce development related to developing and maintaining skills (digital and soft); and • Promote cooperation/collaboration within and across ministries/municipalities and with other stakeholders (including the private sector) (e.g. to share learnings, to share good practice, to build capacity). 	
Links to RCN Strategic Areas	Links to UN SDGs
<ul style="list-style-type: none"> • Technology and digitalisation (primary link) • Cohesion and globalisation • Health and welfare • Oceans • Green transition 	<ul style="list-style-type: none"> • SDG 4: Quality Education • SDG 9: Industry, Innovation and Infrastructure • SDG 16: Peace, Justice and Strong Institutions
Links to clusters of Horizon Europe's Global Challenges pillar	Links to EU mission areas identified in Horizon Europe
<ul style="list-style-type: none"> • Culture, Creativity and Inclusive Society • Digital, Industry and Space 	<ul style="list-style-type: none"> • Conquering Cancer: Mission Possible • A Climate Resilient Europe – Prepare Europe for Climate Disruptions and Accelerate the Transformation to a Climate Resilient and Just Europe by 2030 • Mission Starfish 2030: Restore our Ocean and Waters • 100 Climate-Neutral Cities by 2030 – By and for the Citizens • Caring for Soil Is Caring for Life
Intersection with other priority mission(s) identified in this study	
All indicative priority missions	
Involvement of key stakeholders	
<ul style="list-style-type: none"> • All sectors • Norwegian higher education institutions and research organisations • Norwegian national agencies (e.g. Difi – Agency for Public Management and eGovernment, Norwegian Association of Local and Regional Authorities, Ministry of Local Government and Modernisation, Ministry of Finance, Ministry of Research and Education, Agency for Financial Management, Industrial Development Corporation of Norway) • International organisations (e.g. United Nations, World Bank, OECD, European Commission, World Economic Forum) • Voluntary organisations (e.g. Frivillighet Norge, European Network of National Civil Society Associations) • The Research Council of Norway and Innovation Norway 	

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Annex A. Future scenario narratives used in the study

In this annex, we present the comprehensive versions of the future scenario narratives across both scenario sets (i.e. Norway in a national context and Norway in a global context). The scenarios were used in the foresight workshops as a tool to examine and debate a set of potential priority missions and discuss ideas for wider structural measures. The narratives were shared with the workshop participants in advance of the workshops. Because of their cross-cutting nature, the cohesion and globalisation and the technology and digitalisation strategic areas (and to some extent green transition as well), were covered by both scenario sets. To aid the reader, before presenting the detailed scenario narratives, we again outline the two broad scenario sets:

- **Scenario set 1 (*Norway in a national context*):** The first scenario set, consisting of four future scenarios, broadly focuses on Norway in a national context, largely relating to the Norwegian domestic agenda. This scenario set encompasses such themes as health, welfare, education, work and skills, cohesion, and relevant aspects of technology and digitalisation, and it also covers some aspects related to green transition (for example, in relation to the circular economy).
- **Scenario set 2 (*Norway in a global context*):** The second scenario set, consisting of four future scenarios, focuses on Norway in an international or global context, primarily relating to Norway's outward-facing role. It broadly covers themes related to climate, oceans, energy, transport, food, biodiversity and globalisation, as well as relevant aspects of technology and digitalisation.

Alongside each scenario narrative, we also outline the associated key characteristics and underpinning factors of the scenarios.³²

³² The arrows in the scenario narratives signify as follows: An upwards-facing arrow indicates an increase in the projection/future direction of travel for the factor, a downwards-facing arrow indicates a decrease in the projection/future direction of travel for the factor, and an arrow that goes in both directions horizontally indicates that the projection/future direction of travel for the factor remains the same as the current situation.

A.1. Future scenario narratives for the scenario set pertaining to ‘Norway in a national context’

Scenario 1: Protectionist decline

Global developments

Shifts in geopolitical power in the 2020s led to a period of political instability over the next decade with serious implications for global trade. Struggling to maintain supply chains, countries increasingly put pressure on locally based companies to serve their needs first. Many countries have adopted a protectionist approach, increasingly looking inwards to protect their own populations. As a result, Norway has become increasingly dependent on primary exports. Even within the EU, which initially sought to maintain a united front, there are divergent views on how to tackle current problems of climate change and stagnant economic growth.

Health and welfare in Norway

The delivery of health and welfare in Norway has also been affected by protectionism. Unable to make proper use of collaboration and imports of medical equipment from other countries, the Norwegian government has struggled to use technology and innovation to meet the complex health needs of the Norwegian population. However, there has been increased national spending on the healthcare sector in terms of research and training, as well as frontline delivery, although medical and care services have not been linked up. Approaches to complex health needs related to an overall increase in life expectancy, population ageing and immigration are largely reactive, with limited capability in preventative strategies. Protectionism presents a significant impediment to pharma and life sciences, hindering the development of industries that thrive on collaboration and sharing.

Societal and economic development

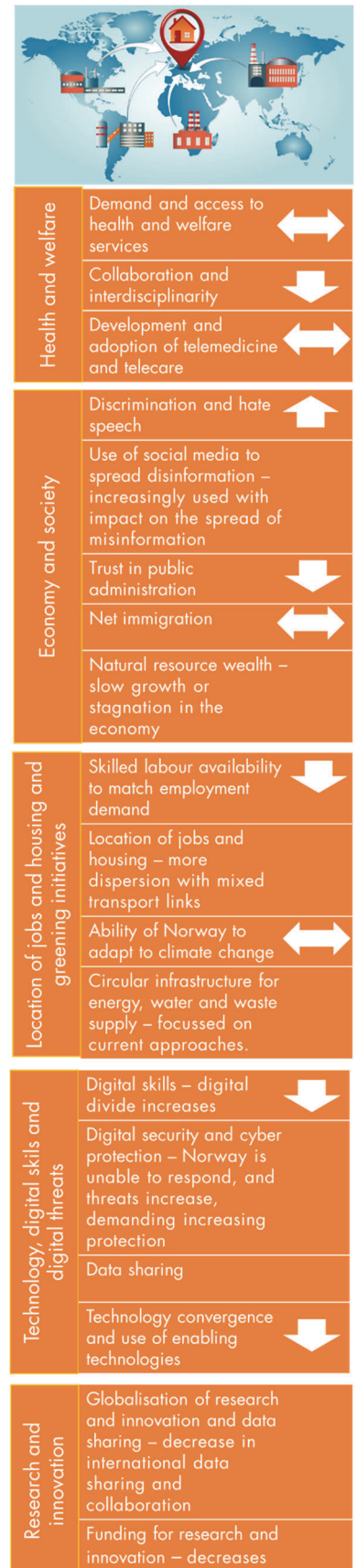
With the slowdown in sovereign wealth fund growth and unpredictability in global markets, Norwegian business and consumer confidence is low. At the same time, the ageing population in Norway has increased spending on social services and pensions. Norway has continued to accept some migrants from countries affected by instability or the effects of climate change, from a pragmatic perspective – to not make the current international situation worse – and to meet some of its labour shortages. However, reduced cooperation with the EU means that skilled labour is generally in short supply. Despite increased growth in some sectors, such as domestic food production, overall productivity growth and labour force participation are low and trust in public institutions is declining. Stagnant economic growth has also reduced much-needed investment in a digital infrastructure that facilitates data sharing, adequately deals with cyber and privacy protection threats, and helps increase the digital skills of the Norwegian population. There is a lack of transnational cooperation of social media, and social media continues to be used extensively to influence public debate on immigrants, spread hate speech and polarise Norwegian society.

The location of jobs and housing and greening initiatives

With limited employment opportunities in urban areas, where the effect of increasing temperatures is also more apparent, Norwegians are dispersing across smaller cities and towns. However, this dispersal is limited by a lack of investment in public transport and digital connectivity. The decrease in urbanisation has positive impacts on health outcomes of populations, with less traffic and pollution. Recent investments have also improved access to health and welfare services across different geographical locations in Norway, although research and training still tends to be city based. There have been some successes in greening domestic energy and linking up waste and energy across the public sector, but the circular economy is not seen as the way forward by politicians or citizens.

Research and innovation

Overall, funding in the R&I sector has reduced, and it is fragmented due to general mistrust of the government and international actors. Norwegian actors are finding it difficult to compete in the world market. These issues are further amplified by the absence of coordination and collaboration across stakeholders in the R&I system in a national and international arena, as well as limited data sharing. Furthermore, the lack of relevant competencies in the labour market required for meeting current and future demands of the sector has created longer-term challenges. In Norway, the absence of infrastructure and funding to support partnerships, combined with restrictions on data access and sharing, has prevented Norway from leveraging and capitalising on the data economy and on the digitalisation trends in the health, pharma and life sciences.



Scenario 2: Going green together

Global developments

During the 2020s there was a realisation across governments, industry leaders and populations that the relationship with the planet is key and resources and time are finite. This led to efforts at the international level and activism at the local level to build a green agenda. Norway, already a leader in renewable energy and decarbonised transport, has focused on further reducing its environmental and climate impact.

Health and welfare in Norway

Norway has undergone significant demographic changes, with a shift towards a higher number of senior citizens. This has created pressure for the healthcare system due to increased demand for services. On the other hand, there is increased access to health and welfare services as a result of policies promoting decentralisation towards municipalities and increasing digitalisation of the healthcare sector. Telehealth has become the default option, allowing for a more targeted and less resource-intensive provision of services, reducing unnecessary travel. Access to healthcare has also improved through strategies focused on reducing and preventing social inequalities in health, such as prevalence of risk factors in population sectors with lower income and education. Alongside these changes, there has been an increase in digital skills across the Norwegian population due to efforts from the government to build digital competence by adapting the education curricula and providing adequate training across all age groups and sectors. These educational programmes have also sought to develop other relevant employment skills as the economy continues to move from a consumption to a green approach.

Societal and economic development

Norway has seen a decline in hate speech and discrimination, partly as a result of interventions, such as the increased capacity of authority to tackle these issues, especially in the online environment. Internet and smartphone use remain high in Norway. With the higher level of digital competence across all demographics and improved data security and ethics standards, social media is generally seen as a reliable source, used to facilitate a range of peer-to-peer activities and communications, from grassroots to government. Pockets of misinformation remain, however, and attract a vocal minority. Data security standards have also created tensions given the overregulation perceived by the Norwegian population.

The location of jobs and housing and greening initiatives

The success of Norway's approach is reflected in the level of trust in Norway's public administration, which continues to grow. This has been important in fostering green transition initiatives through the interconnection between citizens, local governments and local businesses. Cross-sectoral cooperation and cooperation across different governance levels have promoted a circular economy at national, regional and local levels. The Government Pension Fund of Norway has managed to adequately manage climate risks by investing in climate change policy and new technology. This is particularly the case within regions with higher population density, such as cities, where the adaptation of the built environment has been an important priority for the green transition, and green initiatives, such as urban farming and 'green builds' that are fully carbon neutral, have become more widespread. Additionally, citizens have a more prominent role in the green transition through higher levels of engagement in innovation and green entrepreneurship, as well as through local activism. There are, however, challenges in fostering behavioural change; older generations show more reluctance to adapting to new social norms, while younger generations feel they are being asked to pay too much of the price for climate change.

Research and innovation

Open science and increased data sharing have made research more accessible to citizens and policy makers, which has been particularly beneficial in supporting evidence-based policy for the green transition. Increased data availability has also allowed researchers to better evaluate the effectiveness and acceptability of initiatives, and to determine how Norway can best leverage and adapt to these. Aligned with the focus on cybersecurity in the EU Framework Programme, Norway has made a key priority to embed data protection and information security in its information and communications technology policy strategy, which has allowed for a better response to digital and cyber security threats, which have now decreased. Additionally, the green transition has led to a redistribution of jobs, away from jobs in a fossil-fuelled industry towards jobs in a green economy.



Health and welfare	Demand and access to health and welfare services	↑
	Collaboration and interdisciplinarity	↑
	Development and adoption of telemedicine and telecare	↑
Economy and society	Discrimination and hate speech	↓
	Use of social media to spread disinformation – increasingly used, but little impact on the spread of disinformation	
	Trust in public administration	↑
	Net immigration	↓
	Natural resource wealth – steady growth in the economy, greater share of wealth from sustainable sources	
Location of jobs and housing and greening initiatives	Skilled labour availability to match employment demand	↑
	Location of jobs and housing – located in big cities and transport-friendly locations	
	Ability of Norway to adapt to climate change	↑
	Circular infrastructure for energy, water and waste supply – develop rapidly and are implemented at national, regional and local levels	
Technology, digital skills and digital threats	Digital skills – decrease, digital divide increases	
	Digital security and cyber protection – Norway is better able to respond, decreasing threats	
	Data sharing	↑
Research and innovation	Technology convergence and use of enabling technologies	↑
	Globalisation of research and innovation and data sharing – increasing international data sharing and collaboration (open and distributed)	
	Funding for research and innovation – sufficient and continuous	

Scenario 3: Slowly changing society

Global developments

The mid- to late 2020s saw a return to business as usual for most of the world and Norway. Strategic alliances have largely remained the same, and there is a slow but steady drift of economic power and influence away from Western powers. Although there have been periods of strong support for environmental activism, particularly in Europe, this has not been sustained, and internationally there has not been a real impetus for change. There has been some progress towards reducing emissions, but without a clear vision at the international level, this progress has not been sufficient, and the impacts of climate warming are starting to be felt.

Health and welfare in Norway

Trends towards technological innovation and digitalisation in the healthcare system in Norway have continued, and there are areas of Norway where there is strong technological innovation. However, these are not widely rolled out across different regions in Norway, and there are challenges with collaboration between the private and public sectors. Some private initiatives exist in the healthcare sector, but the Norwegian system continues to rely heavily on public funds, and measures to improve care coordination have been only partly successful. The healthcare workforce has been only partly able to meet the growing health and long-term care needs that have resulted from Norway's ageing population, increased immigration, and the effects of climate change. There is also a reluctance to address the underlying issues of social inequalities in life expectancy, disparities among income groups, and behavioural risk factors.

Societal and economic development

Regional conflicts and climate change have created increased pressure on immigration globally, but Norway has always had strong measures in place to ensure education and employment for migrants. Despite this, tensions still exist, particularly with regard to cultural integration. With only incremental changes in the make-up of the Norwegian welfare provision and labour markets, trust in public institutions remains relatively high, but there is concern about Norway's strategy for ensuring it has the necessary digital and employment skills to deal with changes in the national and global landscape. Although there is good digital provision in Norway, lack of appropriate regulation of the digital space means that social media continues to be a source of misinformation, feeding potential social divisions.

The location of jobs and housing and greening initiatives

There has been an increasing concentration of the Norwegian population in urban areas, as a thicker labour market in the cities has been better able to meet the demand of workers with specific qualifications. At the same time, commercial activity has opened up in the Arctic following the lack of impetus to deal with climate change internationally, which has accelerated the melting of the sea ice in the Arctic. This has accelerated economic growth in counties in northern Norway, but challenges persist with ensuring that there is access to labour with the necessary skills and expertise to make use of an improved knowledge base and value creation in the North. Regional development initiatives also remain weakly connected and do not really support the Sami community and their employment and business opportunities. Because Norwegians are concentrated in cities, it has been easy to join together energy and waste initiatives across hospitals and public sector buildings. This has also facilitated the creation of city-led initiatives, but their wider take-up has not been incentivised. Many Norwegians feel that they are already playing their part with renewable energy and electric vehicle use. Although people have greater access to services in urban areas, the concentration of people in cities also means that there are increased pressures of mass marketing, availability of unhealthy food choices and access to transport, which all have an effect on lifestyles and negative health outcomes.

Research and innovation

National and international collaboration for R&I continues to increase, but researchers continue to voice concerns about data sharing, and funding for interdisciplinary research is limited. The lack of collaboration between industry and the higher education sectors also poses key challenges for Norway. The skills that Norwegians obtain through higher education are not fully aligned with the skills needed in the labour market, particularly as new areas of innovation open up and automation, the application of artificial intelligence and broader technology convergence start to change the nature of employment. There is a fragmented funding landscape that is largely focused on excellent science, while the translation into innovation outputs is limited. In health, Norway concentrates health R&D in university research, and there is weak coordination between the different key actors in the R&D health system, which has had resulted in a lack of cost-effectiveness in the development of pharmaceuticals in Norway.



Health and welfare	Demand and access to health and welfare services	↔
	Collaboration and interdisciplinarity	↔
	Development and adoption of telemedicine and telecare	↔
Economy and society	Discrimination and hate speech	↔
	Use of social media to spread disinformation – increasingly used, with impact on the spread of disinformation	
	Trust in public administration	↔
	Net immigration	↔
	Natural resource wealth – steady growth in the economy, no change in share of wealth from sustainable sources	
Location of jobs and housing and greening initiatives	Skilled labour availability to match employment demand	↔
	Location of jobs and housing – located in big cities and transport-friendly locations	
	Ability of Norway to adapt to climate change	↔
	Circular infrastructure for energy, water and waste supply – rapid development, but implementation localised	
Technology, digital skills and digital threats	Digital skills – remains as now	
	Digital security and cyber protection – Norway is unable to respond, demanding increased protection	
	Data sharing	↑
Research and innovation	Technology convergence and use of enabling technologies	↔
	Globalisation of research and innovation and data sharing – increase in international data sharing and collaboration	
	Funding for research and innovation – fragmentation	

Scenario 4: Technological trajectory

Global developments

In line with the prevailing international view, Norway has focused on technological advances to promote economic growth and support its sustainability goals. Technology and the knowledge-based economy have been the main tenets of the Norwegian R&I agenda, from both an international and a domestic perspective, with new technologies and their convergence having brought about significant advances in health and welfare. However, changes in employment have created new social inequalities.

Health and welfare in Norway

Many digital solutions have been integrated into health and welfare services, which has helped to address the continued demand and pressure for these services. Automation and artificial intelligence are commonplace in healthcare, and telehealth has become the default option for health and welfare. Digital technology, such as robotics, is used to help support the autonomy of older people. Thanks to its comprehensive health databases and its ability to exploit large amounts of patient data, Norway was able to rapidly digitalise the health sector. In addition, health data; an improved focus on funding; and developments in and convergence of bioinformatics, genetic engineering, biotechnology and nanotechnology have enabled Norway to move towards personalised medicine, which has made great strides since the 2020s. Overall, this has led to a more patient-centred health system. However, there are concerns that the health system is becoming 'twin-track', because users have to be digitally competent and willing to share personal data to access it and because some advanced treatments are only available privately.

Societal and economic developments

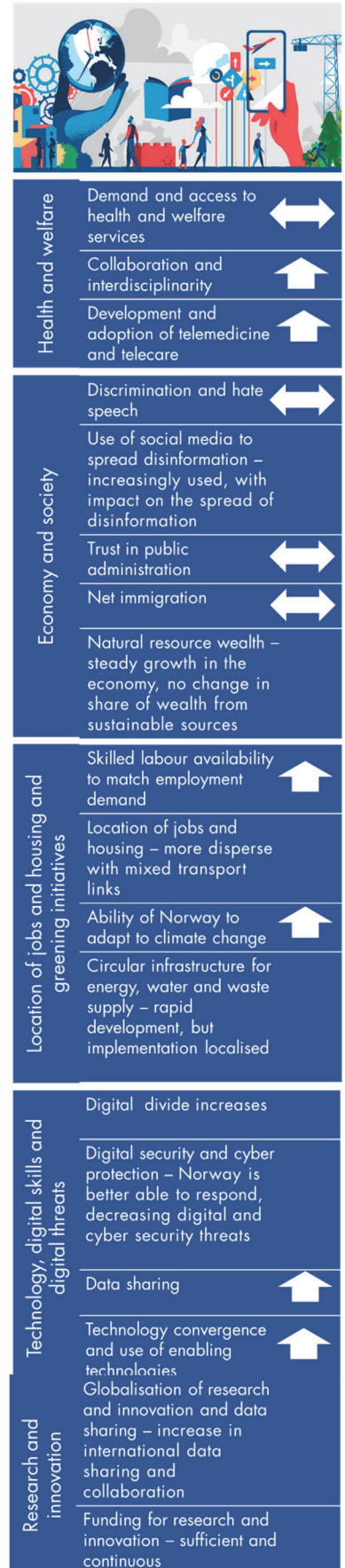
Although a substantial part of the Norwegian population now has access to Internet and service industries, such as banking, finance and tourism, have achieved efficiency gains and improved their business processes, some people are being left behind in terms of their digital skills even though the economy is doing well. Technology convergence and development has been led by Norwegian industry, and central and local government and other public sectors have not fully integrated common systems for user-friendly digital services. There is acceptance from the public that data generally has to be shared to access services and participate in society, and the Norwegian population continues to have a relatively stable level of trust in its public institutions. However, trust in government has, at the same time, not increased, and the perceived lack of control around data privacy and security issues threatens to reduce it further. The application of advanced technologies has contributed to efficiencies in transport, health, agriculture and food, and manufacturing industries, at the same time transforming employment in these industries. Norway has actively addressed these changing employment needs through education and training policies. Although overall immigration to Norway has remained stable, there has been a shift in the type of immigrant, to higher-skilled, wealthier immigrants. However, the need for some low-skilled labour remains, and political tensions around the role of immigrants in the Norwegian economy and society persist.

The location of jobs and housing and greening initiatives

Remote working has been the norm since the 2020s. Investment in digital infrastructure has continued, and many Norwegians have moved out of urban centres to smaller cities and towns, where the impacts of climate change are currently more supportable. The Internet and social media are key elements of this lifestyle, with vast amounts of data changing hands and control of platforms still in the hands of Big Tech companies that actively resist regulation. Norway is not alone in struggling to police misinformation, and it has invested heavily with partners in cyber security prevention.

Research and innovation

The increased use of artificial intelligence, big data and genomics in Norwegian society has been associated with a steadily rising demand for data and data sharing both nationally and internationally. Norway has been able to widely deploy technologies across sectors due to increasing collaboration and funding for collaboration across sectors. However, R&I initiatives for developments in technology tend to be geared towards developments in the natural sciences. There is a lack of recognition of the human, ethical and legal challenges that emerge with increased data sharing and resulting privacy and cyber security threats, which contributes to a growing distrust of pervasive technology in Norway.



A.2. Future scenario narratives for the scenario set pertaining to 'Norway in a global context'

Scenario 1: Protectionist decline

Global landscape

Shifts in geopolitical power that came to the fore in the 2020s led to a period of political instability over the next decade, with serious implications for global trade. Struggling to maintain supply chains, countries increasingly put pressure on locally based companies to serve their needs first. By 2040, this has led to mistrust even among former close allies. Many countries have adopted a protectionist approach, increasingly looking inwards to protect their own populations. Even within the EU, which initially sought to maintain a united front, member states have divergent views on how to tackle current problems of climate change and stagnant economic growth. At the international level, cooperation on climate goals has plummeted and targets agreed at the last United Nations Climate Change Conference, five years ago, look increasingly unattainable. The negative impacts of climate change have been limited only by the poorly performing global economy.

Trade and availability of skilled labour

The uncertainty in global trade has seen countries re-shore food production and manufacturing. In Norway, as elsewhere, there has been investment in automation and additive manufacturing to support this move. Although there has been an increase in immigration from countries affected by instability or climate effects, reduced cooperation with the EU means that skilled labour is in short supply. Norway remains a trusted partner for energy, but export demand for the industry has fallen, and some countries have chosen to invest in home-grown renewable energy to secure their supply. Demand for Norwegian seafood products and shipping in global markets is also down, and Norway's imports of manufactured items have also declined.

Circular initiatives

Despite Norway's success in greening its domestic energy and transport sectors, successive governments have found it increasingly difficult to encourage further behavioural change through circular economy initiatives when consumption is down and many in the population are worrying about how to pay their bills. Stagnant economic growth has meant that much-needed investment in digital infrastructure has also stalled. Compounding this, the levels of public trust in science and technology are at an all-time low, and a few high-profile cyber-attacks have dominated the headlines.

Research and innovation

Research and innovation in Norway has been affected by reduced funding and the loss of some external collaborators, as mistrust also pervades this sector; long-term investment in research loses out to short-term policy needs as both governments and industry tighten their belts. Most funding now comes from national bodies and aims at least to facilitate collaboration between public and private sectors domestically. Opportunities are seen to develop the ocean and onshore environments for food and energy production. There is also an ambition to develop new applications using skills and innovations from the petroleum sector that could boost the economy.



Green transition	Demand and support for circular initiatives	↓
	Circular infrastructure for energy, water and waste supply – remains focussed on current approaches	
	Investments/innovations to reduce emissions from oil	↓
	Ability of Norway to adapt to climate change	↓
	Food security and supply – Norway maintains security of food supply with higher share of domestic production	
Oceans	Low-carbon business models (international) – no change in emergence	
	Sustainable aquaculture – little expansion in the aquaculture sector	
Globalisation and society	Norwegian shipping industry – greening of international shipping industry remains as now	
	Norway's trade linkages with other countries	↓
	Norwegian cooperation with EU/EEA	↓
	Natural resource wealth – slow growth or stagnation	
	Make up of geopolitical landscape – the geopolitical landscape becomes less stable with a shift in global power	
Research and innovation	Skilled labour availability (to match employment demand)	↓
	Technology convergence and the use of enabling technologies	↓
	Globalisation of research and innovation and data sharing – decrease in international data sharing and collaboration	
	Funding for research and innovation – decreases	

Scenario 2: Global greening

Global developments

During the 2020s, there was a further realisation across governments, industry leaders and populations that their relationship with the planet is key and resources and time are finite. This led to efforts at the international level and activism at the local level to build a green agenda. The EU sees the benefits not only of greater internal cooperation, but also of building external relations and leading by example. Relations between major powers have improved as these countries see value in pursuing a 'green economy' approach, focusing on innovative solutions for all sectors, rather than securing ownership of rapidly depleting resources. Regions like Africa and South America are now recognised for their valuable resources, but regional disparities still remain. The impacts of climate change are happening at a slower rate, but the longer-term focus is on adaptation, as the current trajectory, tracking close to a 2°C increase, looks hard to maintain.

Circular economy

The top-down approach means that low-carbon business models have developed across many sectors where there are international trade sectors, and this is matched by a demand within Norway, in Europe, and internationally for products and services that have a low impact on the environment and climate. A circular economy approach has been central to this. Some change has been industry led, some has been driven by international agreements and legislation; Norway has worked hard within supra-national institutions to further this agenda and support regional change through overseas aid. But changing consumer attitudes has also been key, and top-down approaches are balanced against initiatives driven by communities and government at the local level, where quality of life is displacing consumption as a measure of success and there is a focus on local production and consumption. Yet tensions persist among different stakeholder groups, with some advocating a more relaxed approach to the environment given the gains made in recent years.

Renewable energy

There has been a rapid move away from fossil fuel dependence to electricity from renewables, linked to expanding regional grids. The Government Pension Fund of Norway has managed to adequately manage climate risks by investing in climate change policy and new technology. International travel and transport of goods have not returned to levels seen in the 2010s. Norway has invested heavily in offshore renewables and is a key proponent of greener and smarter shipping – one area where hydrogen has taken off.

Circular initiatives and technology in Norway

In Norway, circular initiatives have been introduced in relation to key sectors of energy, waste and water by the government, but there is also a supportive environment for local solutions, resulting in a boom in green entrepreneurship that enjoys easy access to European markets. Technology and data are seen as key to sustainable solutions, from food to retail, with many of these starting at a small scale, seizing supply chain opportunities offered by a move to low-carbon business models by bigger companies at the national and international level and the public sector. However, technology is seen as the means and not the end. Norway has also seen its aquaculture exports expand, although for fresh products these have focused on EU markets, and the domestic share of food production has also increased.

Research and innovation

There has been investment in research, which is seen as key to a green future, both within the EU and in Norway. This has been accompanied by greater collaboration between these partners and internationally. To facilitate openness in research and innovation, the EU has also worked together with industry and national governments to develop protocols for data sharing, improved data security and authentication. While there has been action to re-align education and training to better match skills to the changing employment opportunities in Norway, these systems are still seen as being slow to respond. Collaborative research in social sciences has also been important to maintain momentum towards climate goals and global stability, keeping citizens educated and engaged.



	Demand and support for circular initiatives ↑
Green transition	Circular infrastructure for energy, water and waste supply – develop rapidly and implement at national, regional and national levels
	Investments/innovations to reduce emissions from oil ↑
	Ability of Norway to adapt to climate change ↑
	Food security and supply – Norway maintains security of food supply with higher share of domestic production
	Low-carbon business models (international) – rapid emergence
Oceans	Sustainable aquaculture – expanded aquaculture sector with expanded share of sustainable farming
	Norwegian shipping industry – greening of international shipping industry is extensive
Globalisation and society	Norway's trade linkages with other countries ↑
	Norwegian cooperation with EU/EEA ↑
	Natural resource wealth – steady growth, with greater share from sustainable sources
	Make-up of geopolitical landscape – more stable, with greater cooperation and stability in Norway's partner countries
	Skilled labour availability (to match employment demand) ↑
	Technology convergence and the use of enabling technologies ↑
Research and innovation	Globalisation of research and innovation and data sharing – increase in international data sharing and collaboration (open and distributed)
	Funding for research and innovation – sufficient and continuous

Scenario 3: Slowly shifting power

Global developments

The mid- to late 2020s saw a return to business much as usual for most of the world. Although Britain's exit from the European Union did result in a small shift in trading patterns, strategic alliances have largely remained unchanged, and the slow but steady drift of economic power and influence away from Western powers has continued. Regional conflicts rumble on, but wider geopolitical tensions, for a while the focus of global attention, have now largely eased. The intervening years have seen the usual rounds of climate and trade summits, but existing supra-national structures are losing their relevance. Although there have been periods of strong support for environmental activism, particularly in Europe, this had not been sustained, and internationally, it has not led to impetus for real change. There has been some steady progress towards reducing carbon emissions, but, as foreseen, without a clear vision at the international level, this has not been sufficient, and the impacts of climate warming are starting to be felt.

Economic trends

Economic trends towards increasing supply chain efficiencies through automation, artificial intelligence, and distributed ledger technologies have continued, as have efforts to decarbonise the transport and energy sectors. Electric cars are now increasingly widespread, but there is a lack of consensus on greening international shipping and aviation. Progress in other sectors, which depend on commercial incentives for citizens and businesses, is more limited. The circular economy is still seen as a key solution by the EU, but it has not gained much traction across member states, especially when other problems seem more pressing.

Oceans

The ocean has become an important focus for the Norwegian economy. There is continued demand for sustainable gas from Norway's key partners as they transition towards net-zero, and Norway has expanded its ocean-bed carbon storage capability to decarbonise its gas exports. Other offshore technologies, such as solar panels and wave energy converters, are being explored to supplement its hydropower and offshore wind farms. As a knowledge leader in the oceans sector, Norway has exported these solutions, often as part of its efforts to support developing countries. At the same time, Norway has seen increased demand for seafood, leading to an expansion in that sector. However, by 2040, the ability of the ocean to sustain all this activity is not clear. The impacts of climate change are particularly felt in the High North, and these changes have accelerated changes in Arctic ecosystems and the loss of sustainable habitats for Arctic species. Norway is increasingly looking to Europe and the Nordics for collaboration to solve some of these challenges. The rapid melting of the sea ice in the Arctic in recent years has reduced some of the natural ice borders between countries, creating a renewed focus on opportunities for commercial activity in the region but also tensions with other nations.

The circular economy in Norway

Norway has opted for a government-led approach to the circular economy, mainly focusing on its energy and waste sectors as areas where these approaches could be the most beneficial. Local initiatives aimed at reducing consumption through reuse, repairing and recycling are encouraged but currently not incentivised, and many Norwegians feel that by leading on renewable energy and electric vehicle use, they are already playing their part. Green shipping is one area where Norway is leading the way again, having introduced electric batteries and carbon capture technologies into its domestic fleet.

Research and innovation

Funding for research and development has remained fragmented both within Norway and externally. Norway has continued to co-operate closely with its EU/EEA partners. Substantial funding has been available in some areas, but the closed nature of collaboration between institutions and the lack of focus on monitoring and data sharing have meant that resources have not been targeted appropriately; there has been a lack of investment in interdisciplinary collaboration; and challenges remain with the translation of excellent science into innovations. Norwegian efforts in technology convergence have remained broad, covering energy, electronics and optics, the environment, and health. But because much research is still undertaken by the private sector and because the humanities, social science and legal perspectives on technology have not been systematically addressed, this has so far not led to the expected transformational change.



Green transition	Demand and support for circular initiatives	↓
	Circular infrastructure for energy, water and waste supply – focussed on current approaches to water/energy/waste	
	Investments/innovations to reduce emissions from oil	↔
	Ability of Norway to adapt to climate change	↓
	Food security and supply – maintains food supply with same share of production as now	
Oceans	Low-carbon business models (international) – no change in emergence	
	Sustainable aquaculture – expanded aquaculture sector, with expanded share of sustainable farming	
Globalisation and society	Norwegian shipping industry – greening of international shipping industry remains as now	
	Norway's trade linkages with other countries	↔
	Norwegian cooperation with EU/EEA	↔
	Natural resource wealth – steady growth, but no change in share from sustainable sources	
	Make-up of geopolitical landscape – no change in the stability of the geopolitical landscape	
Research and innovation	Skilled labour availability (to match employment demand)	↔
	Technology convergence and the use of enabling technologies	↔
Research and innovation	Globalisation of research and innovation and data sharing – increase in international data sharing and collaboration (closed)	↑
	Funding for research and innovation – fragmentation	

Scenario 4: Technological trajectory

Global developments

After some turbulence at the start of the 2020s, the focus has been on revitalising the global economy, which is seen as a key driver for reducing global inequalities and achieving inter-regional stability. As economic and geopolitical power has continued to shift towards the BRIC (Brazil, Russia, India and China) countries, Western democracies have looked to establish new regional relationships that have opened up opportunities for Norway for trade, investment and R&I collaboration. Norway has continued to play an active role in international institutions, but the prevailing international view has been that climate change goals can be achieved through digitalisation and technological advances. Consumption is still regarded as an important driver of economic growth, and the green agenda has somewhat taken a back seat. This is reflected in the current pace of environmental change, with the result that by 2040, there is a growing clamour for more action

The use of technology

Technology has played a key role in recent economic growth, impacting on many areas of daily life as using the Internet for entertainment, socialising shopping, working, accessing services and education has become the norm. Automation and AI are commonplace across a range of sectors, and technology convergence has led to a re-alignment in the transport, health, agriculture, food and manufacturing industries, resulting in new players and new business models. Although the perception is that power remains in the hands of a few, rapid regional expansions have created new firms. Technology has contributed to reducing carbon emissions, from large-scale carbon capture and storage and green hydrogen generation, to small-scale urban farming. Innovative technological solutions have also been implemented to both reduce and remove marine biowaste and plastics. But technology is now seen by some as a problem too in terms of resource and energy use. The past decade has also seen considerable movement of goods and people across the planet, as well as continued urbanisation. And, while changes in employment brought about by technological advances have been accommodated in some countries through forward-looking skills and education strategies, this is by no means the norm, potentially introducing new inequalities.

The Norwegian economy

The Norwegian economy has also shown strong growth, fuelled by a continued close relationship with Europe but also by new trade links, providing technology partners and new markets for seafood products and energy solutions. Norway has invested in integrating energy and waste systems at a national level, collaborating closely with European neighbours on these and exporting this expertise. It has also continued to expand its carbon capture and storage capability, but hydrogen from sea-splitting, first trialled as part of shipping, is a potential new export. There has also been rapid growth in green initiatives in other areas that are often technology led. There is demand for sustainable solutions at the European level, but without real cross-sectoral synergies, it remains difficult for new green companies to expand outside Norway.

Research and innovation

Technology and the knowledge-based economy have been the main tenets of the Norwegian R&I agenda both from an international and from a domestic perspective, with technology seen to underpin many sustainability objectives. To promote openness and transparency in international data sharing and collaboration, public funding from national bodies and the EU has been supplemented by the development of new relationships with universities and research institutes, including in South-east Asia and South America. This has resulted in a rapid expansion in the research base, without having to be overly dependent on a small number of foreign economies and the private sector. A key part of the agenda has also been developing a base of highly skilled workers, both through an open-door policy for overseas researchers and an agile, responsive higher education sector. But less focus has been placed on training for those who have seen their jobs displaced.



Green transition	Demand and support for circular initiatives	↔
	Circular infrastructure for energy, water and waste supply – rapid development, but implementation remains localised	
	Investments/innovations to reduce emissions from oil	↔
	Ability of Norway to adapt to climate change	↓
	Food security and supply – maintains food supply with same share of production as now	
Oceans	Low-carbon business models (international) – emergence in some sectors	
	Sustainable aquaculture – expanded aquaculture sector, with no change in share of sustainable farming	
Globalisation and society	Norwegian shipping industry – greening of international shipping industry increases	
	Norway's trade linkages with other countries	↑
	Norwegian cooperation with EU/EEA	↑
	Natural resource wealth – steady growth, but no change in share from sustainable sources	
	Make-up of geopolitical landscape – no change in the geopolitical landscape	
Research and innovation	Skilled labour availability (to match employment demand)	↑
	Technology convergence and the use of enabling technologies	↑
	Globalisation of research and innovation and data sharing – increase in international data sharing and collaboration (open and distributed)	
	Funding for research and innovation – sufficient and continuous	

Annex B. Set of indicative priority missions related to the RCN's five strategic areas

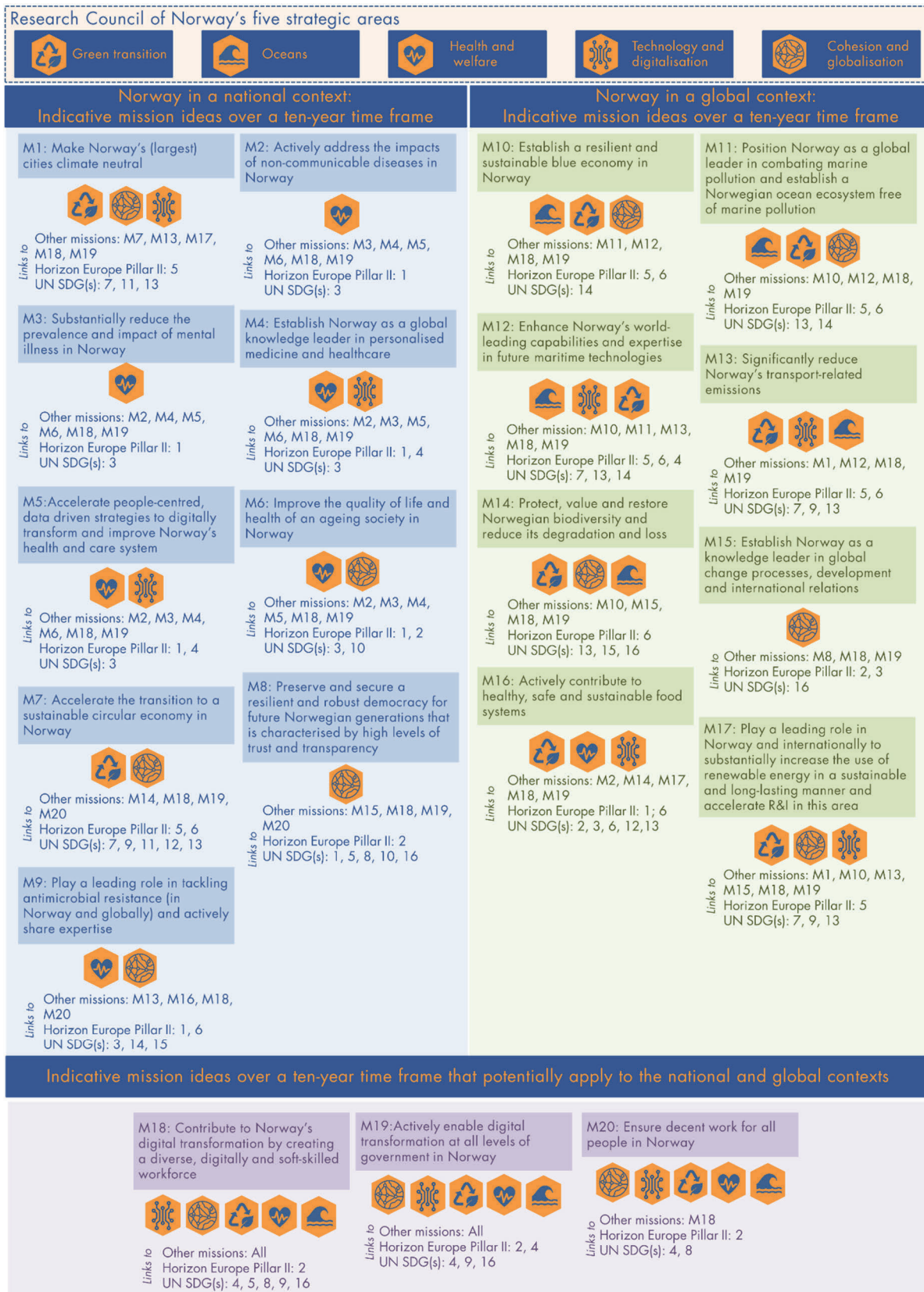
In the infographic below, we provide an overview of indicative mission ideas that have been articulated within, across and outside the RCN's five strategic areas (oceans; green transition; health and welfare; technology and digitalisation; and cohesion and globalisation).³³ The priority missions have been structured according to the two high-level scenario sets discussed in Chapter 5 and Annex A. As highlighted previously, all the missions are cross-cutting in terms of potential sectors and disciplines involved and will need a multi-stakeholder approach to be implemented. The spectrum of target focus areas for each mission will need to be specified with distinct, measurable and timebound goals that are decided by the stakeholders involved in selecting and implementing the missions. Furthermore, their implementation will also require social sciences, humanities, legal and ethical perspectives to be effectively incorporated. Finally, the missions must engage the public regularly and in a meaningful manner, and also be evaluated against a set of clearly defined criteria that are set out upfront.

³³ In the infographic, we highlight the broad links between the priority missions and the United Nations Sustainable Development Goals (UN SDGs) and the clusters under Pillar II of Horizon Europe.

The UN SDGs are: SDG1: No poverty; SDG2: Zero hunger; SDG3: Good health and well-being; SDG4: Quality education; SDG5: Gender equality; SDG6: Clean water and sanitation; SDG7: Affordable and clean energy; SDG8: Decent work and economic growth; SDG9: Industry, innovation and infrastructure; SDG10: Reduced inequalities; SDG11: Sustainable cities and communities; SDG12: Responsible consumption and production; SDG13: Climate action; SDG14: Life below water; SDG15: Life on land; SDG16: Peace, justice and strong institutions; and SDG17: Partnerships for the goals.

The Horizon Europe Clusters under Pillar II includes: (1): Health; (2): Culture, Creativity and Inclusive Society; (3): Civil Security for Society; (4): Digital, Industry and Space; (5): Climate, Energy and Mobility; and (6): Food, Bioeconomy, Natural Resources, Agriculture and Environment.

Figure B.1 Indicative priority missions proposed within and across the five strategic areas



Source: Study team analysis