

Chapter 5.

Tackling societal challenges through research and innovation and public sector innovation in Norway

This chapter discusses the state-of-the-art and potential of the Norwegian research and innovation system to address major challenges facing society, which is one of the three overarching objectives of the government's Long-Term Plan. The first and second parts analyse respectively the investment and progress towards achieving this objective. The third part focuses on the strategies and policies supporting actors involved in these activities. The last section presents a synthesis of the achievements to date and remaining challenges in tackling societal challenges through research and innovation and public sector innovation in Norway and presents some high-level conclusions.

Tackling societal challenges has a prominent place both in the LTP and on the government's general agenda. Norway earmarks a significant funding to research on areas relevant to societal challenges (particularly health, energy, the environment and climate) and the RCN runs a multitude of programmes that target both specific themes and the generic ability particularly in the public sector to address societal challenges.

R&D investment to tackle societal challenges

In many advanced countries the strategic agendas driving research and innovation policies have already shifted towards environmental and societal challenges. This has led to a reorientation of national research and innovation policies, reflected in increased public budgets for R&D in areas associated with environmental and health-related objectives. Norway itself has a strong tradition of investing in research on societal challenges and significant shares of its R&D expenditure are directed to areas such as health. Since the mid-1980s, important government documents on future research policy orientations presented regularly to the Storting as White Papers (the *Stortingsmeldinger*) have had dedicated priority areas focusing on societal challenges.

Norway has one of the highest shares of R&D budgets earmarked to societal challenges (22%), above the OECD average and its traditional comparator countries such as Denmark or even Sweden, which hosted the Lund Declaration and had strong ambitions in this matter (OECD, 2016a). Norway's investment is especially strong in the area of health and care, which accounts for almost 17% of all R&D expenditures (see Figure 5.1).

This structure of R&D expenditures in Norway is the result of a significant increase of research funding on medicine and health. Starting in 2003, this increase has been considerably higher than for any other field of science (see Figure 5.2). In 2015, expenditure for R&D in medicine and health accounted for more than one-quarter of total R&D funding in the higher education and institute sectors (including hospital trusts). In 2015, R&D personnel in medical and health sciences accounted for 37% of all R&D personnel (full-time equivalents) at Norwegian higher education institutions.¹ In 2014, Norway had the second-highest direct budget support for health R&D among the OECD countries after the United States (OECD, 2015a). The largest single source of these funds is the direct allocation by the Ministry of Health and Care Services to four regional health authorities, which in turn allocate the money among their hospitals.

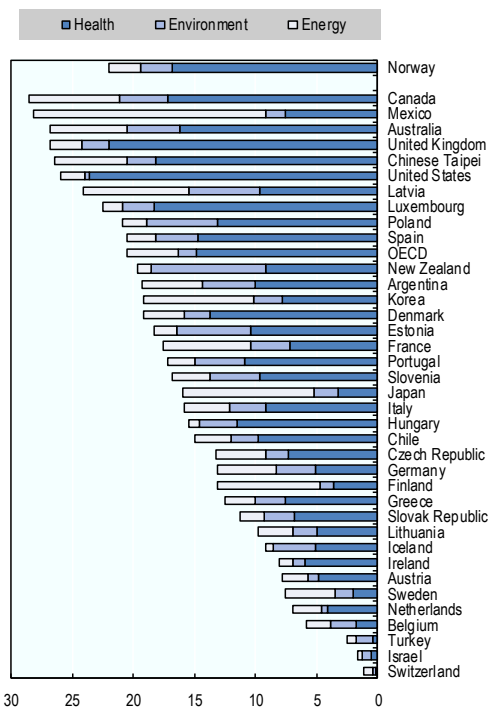
Looking at R&D expenditure by thematic area and performing sector, the largest area for the business sector is energy, followed by maritime, food and health. In the HEI sector (which includes university hospitals), as mentioned before, health is the dominant sector by far (see Table 5.1).

The main actors engaged in societal challenges

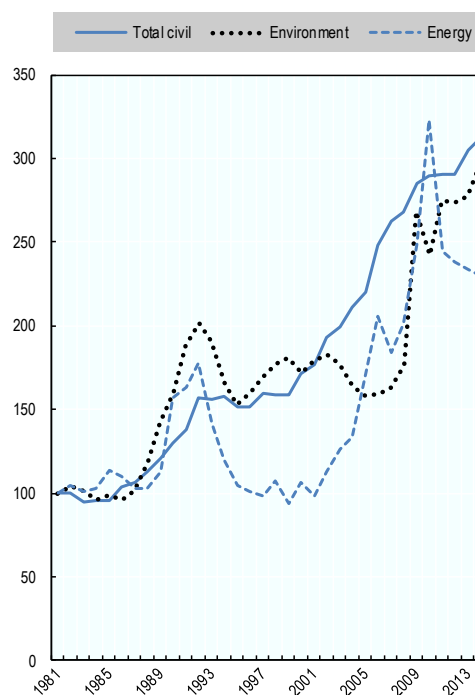
Government shapes many of the framework conditions for tackling societal challenges. It decides on what basis, to whom and for what, public funding for research is allocated. It funds, governs and monitors education – most of which is public in Norway. It thus has an overarching responsibility for ensuring the provision and functionality of resources and systems for education, skills and knowledge necessary for tackling societal challenges.

Figure 5.1. R&D budgets earmarked to societal challenges

A. Share of R&D budgets earmarked to societal challenges, 2016 or latest year available



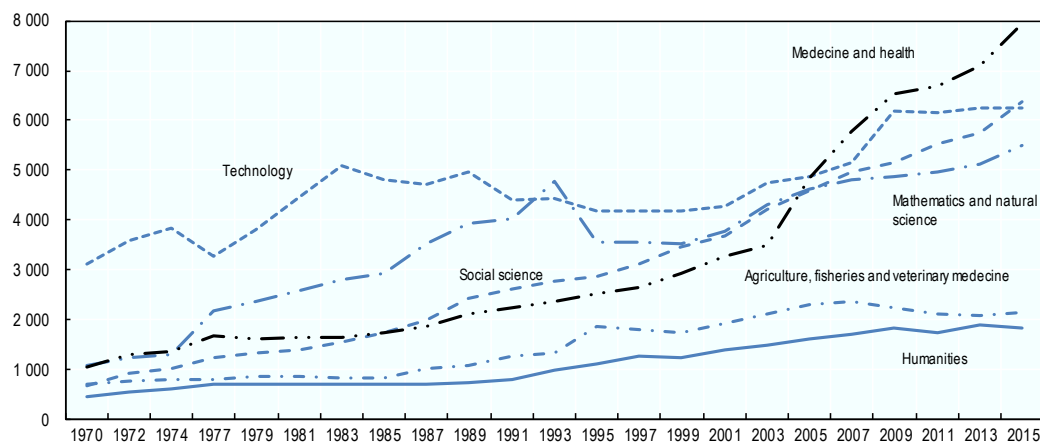
B. R&D budgets earmarked to societal challenges, billion USD 2010 PPPs (1981=100, 1981-2015), Norway



Sources: OECD (2016b), *OECD Science, Technology and Innovation Outlook 2016* http://dx.doi.org/10.1787/sti_in_outlook-2016-en (for Panel A); OECD (2016c), *OECD R&D Statistics (RDS) Database*, www.oecd.org/sti/rds (for Panel B).

Figure 5.2. Current expenditure for R&D to higher education and institute sector according to field of science, 2015 prices

Million NOK



Source: Data provided by Research Council of Norway (RCN) based on Statistics Norway and Nordic Institute for Studies in Innovation (NIFU).

Table 5.1. R&D expenditure by thematic area and performing sector, 2015

Million NOK

	Total	Business sector	Institute sector	HEI sector
Thematic area				
Energy	9 376	6 094	2 119	1 164
Including renewable energy	1 738	584	690	463
Including petroleum	5 699	4 254	1 035	410
Environment	3 029	1 384	956	689
Climate	2 525	424	1 276	826
Marine	1 861	292	924	644
Maritime	2 125	1 582	349	194
Food	4 367	1 940	1 813	615
Health and care	9 757	1 479	2 278	6 000
Welfare	1 244		524	720
Education	1 378		102	1 276
Other public sector	722		334	388
Development research	513		127	386
Travel	139		46	93

Note: Thematic areas can overlap and can therefore not be added up according by sector.

Source: Data provided by Research Council of Norway (RCN) based on Statistics Norway and Nordic Institute for Studies in Innovation (NIFU).

RCN and the Ministry of Health and Care Services might be singled out as particularly important actors when it comes to funding research that can contribute to tackling societal challenges. RCN channels funding from ministries into programmes with various aims, including tackling societal challenges (programmes discussed later) while the Ministry of Health and Care Services allocates significant funding for research on health and care to the four regional health authorities which in turn allocate them among their hospitals.

Laws, regulations and policies governing the use of data, competition, procurement also play a key role in enabling and promoting innovation and in creating markets for solutions that might contribute to tackling societal challenges. Finally, government has a critical responsibility in ensuring that policies, laws or regulations in different areas or sectors do not conflict with each other. Cross-sectoral and both horizontal (across policy domains) and vertical (international-national-regional-local) policy co-ordination are particularly important given the cross-cutting nature of many societal challenges.

Universities need to ensure that the research and education performed at their institutions is of high quality and relevant to tackling societal challenges. The latter requires a combination of blue sky research, interdisciplinary and multidisciplinary research and education, and mutually beneficial interaction and two-way flows of knowledge with “users” of knowledge and other relevant stakeholders.

PRIs often work relatively closely with universities, on the one hand, and companies or the public sector, on the other hand. They provide an important platform for “translating” research into useful knowledge and solutions and might be nimbler in responding to demand, and changes in demand, for knowledge and research.

With regards to public sector innovation, the Government Agency for Public Management and e-Government (Difi) was established in 2008 with the mission “to strengthen the government's work in renewing the Norwegian public sector and improve

the organisation and efficiency of government administration” (Difi homepage). Difi is also the secretariat for the “Digitalisation Council” (Digitaliseringsrådet), which primarily gives voluntary advice and guidance on plans for ICT projects submitted by public authorities. It thus acts as a quality assurance mechanism for ICT projects ranging from NOK 10 million to NOK 750 million, supplementing the external quality assurance scheme operated by the Ministry of Finance for all public investments above NOK 750 million. Strategic use of ICT is one of the five priorities of the government’s “Program for better governance and leadership in government”. Several other agencies and public sector actors have important functions regarding public sector innovation and renewal, such as the Directorate of eHealth, the Directorate of Health under the Ministry of Health and Care Services, the Centre of Competence on Rural Development, etc.

The Research Council has several initiatives and programmes for promoting research and innovation in and for the public sector. Innovation Norway’s most prominent initiative for the public sector are the Public Sector R&D contracts (OFU). The Ministry of Industry, Trade and Fisheries has an important responsibility for public procurement and has been working to strengthen innovation procurement in various ways. Finally, the Ministry of Education and Research views its role as securing the provision of generic knowledge and education resources and ensuring that the research and education systems function well as a whole, including for the public sector and the provision of public services.

Progress towards addressing societal challenges

Scientific performance

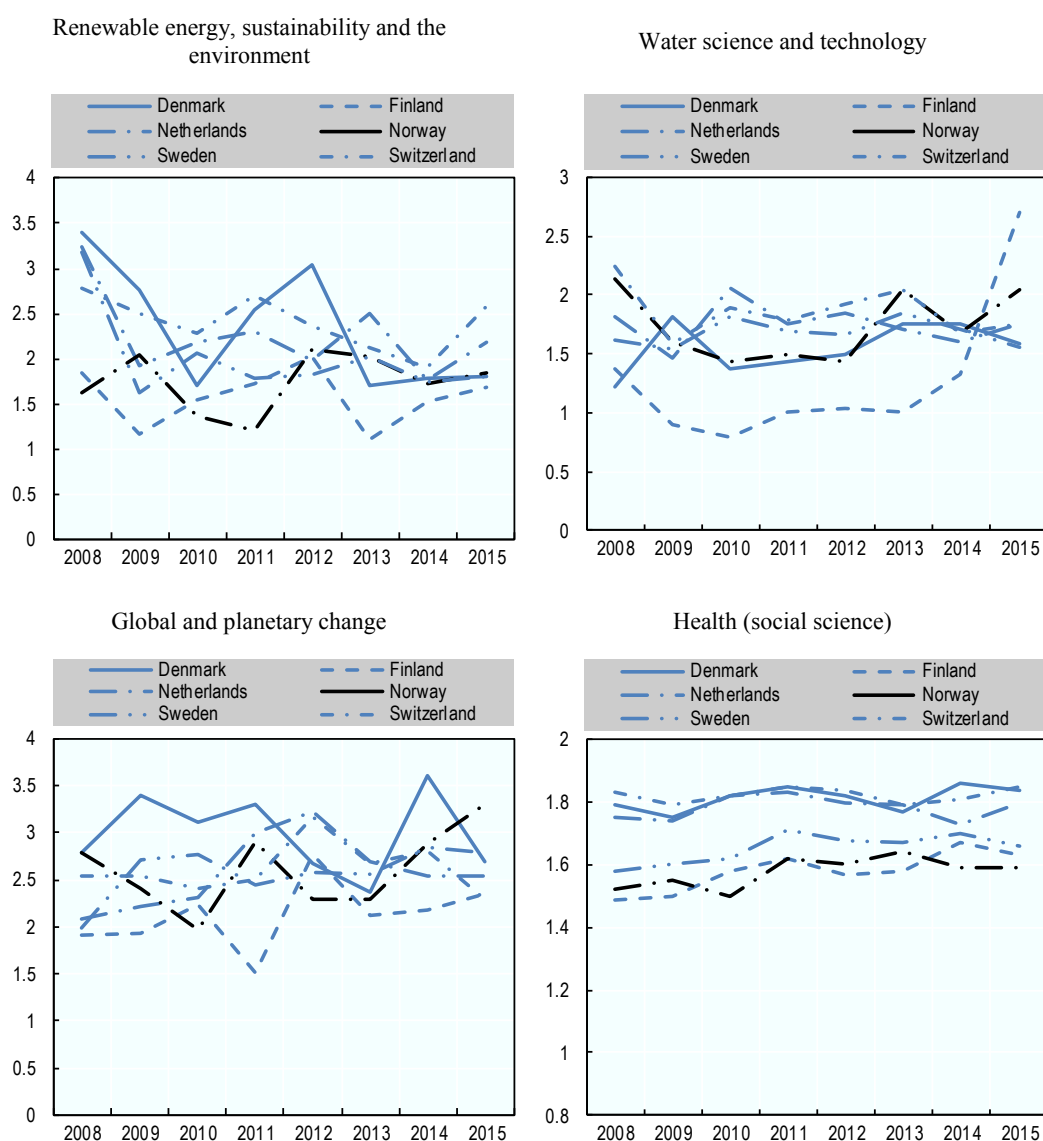
The significant research funding allocated to areas regarded as relevant for social challenges over the past three decades, has enabled capacity building in these areas, resulting in some clear successes in terms of scientific impact. Thus, for example, the citation impact² for Norwegian publications in the area of “Global and Planetary Change” has consistently been higher than the citation impact for all Norwegian publications since 2008. Furthermore, in recent years, in contrast to Norway’s performance for all disciplines, its citation impact in this field has been higher than that for most other countries with which Norway is frequently compared.³ In “Water Science and Technology” Norway has also recently emerged as a strong performer in terms of citation impact, only recently surpassed by Finland. In the social sciences applied to the health sector, however, as well as to a lesser extent in renewable energy, Norway is lagging behind its comparator countries in terms of research excellence and shows no clear sign of improvement (Figure 5.3).⁴

Norway remains strong in areas which, although they have now been well integrated into the sustainable development agenda, are still pillars of the former paradigm, contributing to climate change and environmental problems. The Norwegian University of Science and Technology (NTNU) in Trondheim, for instance, is ranked as one of the world-leading institutions in “Oil and Gas” by Thomson Reuters (2016), based on its volume of publications and high normalised citation impact. Most other institutions in this top 10 of most influential research institutions in this field are from the United Kingdom and the United States.

The European Union’s Horizon 2020 framework programme focuses on a series of societal challenges, including health, demographic change, food security, sustainability, clean energy, green transport, climate action, and inclusive and secure societies. Norway

has been relatively successful in the programmes relating to societal challenges with a 2.6 return rate overall in this area, exceeding the national goal of 2% (Piro, Scordato and Aksnes, 2016). It has been particularly strong in areas such as food security, blue growth and bio-economy with a return rate of 7% as well as energy, environment (including climate change). However, health constitutes a notable exception with Norway submitting significantly fewer project applications than other comparable countries (Austria, Denmark, Finland, Netherlands, Sweden). Norway also has much lower funding per project than any of the other five countries and a low return rate in the programme “Health, demographic change and well-being” (1.1%) (Piro, Scordato and Aksnes, 2016).

Figure 5.3. Field-Weighted Citation Impact (FWCI) publications, 2008-15, selected countries



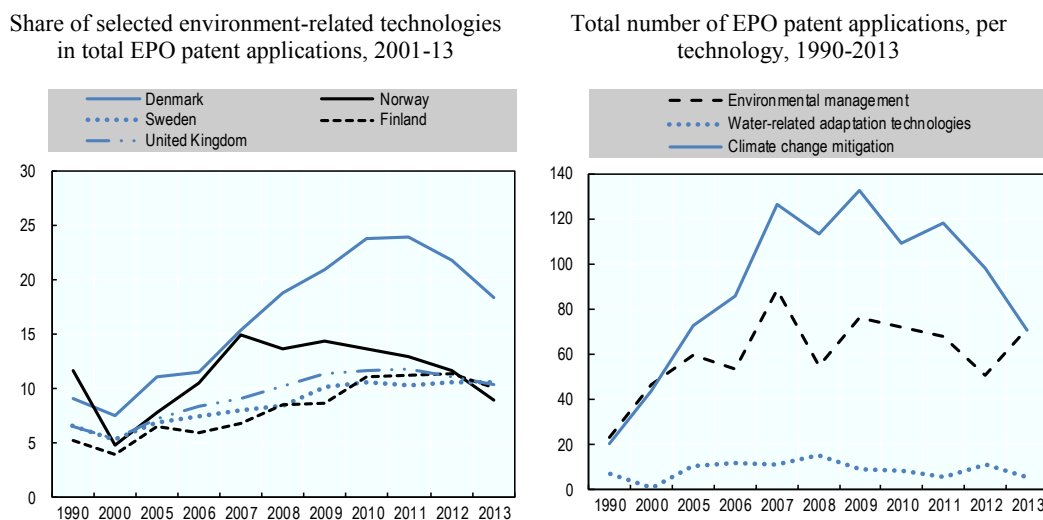
Source: Author's calculations based on SciVal® database, Elsevier B.V. (accessed 24 October 2016).

Innovation performance

Measuring the innovation performance of Norway with regards to societal challenges is difficult. Addressing societal challenges goes well beyond the traditional technological areas where indicators such as the number of patents or spin-offs are meaningful. Furthermore, even when only considering the “tip of the iceberg” of innovation for societal challenges, i.e. its technological dimension, the pervasiveness and cross-sectoral dimension of these innovations make the selection of, for instance, a relevant patent class complicated.

Taking into consideration these important caveats the Figure 5.4 shows the evolution of the number and share of patents applied for in the area of selected environment-related technologies, i.e. technologies relevant to environmental management, water-related adaptation and climate change mitigation. Norway appears here also in a rather good position compared to some of the leading countries in the field; however, significantly behind Denmark and experiencing a clear declining trend since 2010, while other countries have kept on increasingly patenting in this area during the same period. The reduction of the number of patents is particularly pronounced in the sub-area of climate change mitigation technologies, which include crucial technologies such as renewable energy generation, waste treatment, clean transport technologies and, not least in the case of Norway, mitigation technologies applied in the oil refining and petrochemical industry.

Figure 5.4. European Patent Office patent applications, selected environment-related technologies



Notes: The patent statistics presented here are constructed using data extracted from the Worldwide Patent Statistical Database (PATSTAT) of the European Patent Office (EPO) using algorithms developed by the OECD. The relevant patent documents are identified using search strategies for environment-related technologies. Please refer to: [www.oecd.org/environment/consumption-innovation/ENV-tech%20search%20strategies.%20version%20for%20OECDstar%20\(2016\).pdf](http://www.oecd.org/environment/consumption-innovation/ENV-tech%20search%20strategies.%20version%20for%20OECDstar%20(2016).pdf). They were developed specifically for this purpose. They allow identifying technologies relevant to environmental management, water-related adaptation and climate change mitigation. An aggregate category labelled "selected environment-related technologies" includes all of the environmental domains presented here.

Source: OECD (2017c), *OECD Innovation in Environment-related Technologies Database*, http://stats.oecd.org/Index.aspx?DataSetCode=PAT_DEV (accessed 17 April 2017).

The Norwegian public sector, at central and local levels, benefits from a lot of dynamic incremental and bottom-up innovation (see for example Teigen, Ringholm and Aarsæther, 2013; Haug, 2014). Innovation in the municipal sector is of particular importance given both its significant size, in terms of share of total national output, and the fact that municipalities as a whole are responsible for a large portion of social and care services in Norway (Teigen, 2013). However, a large share of innovations happening in the public sector is defined as incremental (Foyen, 2011). The LTP identified “renewal of the public sector” as a clear priority, acknowledging that the comparatively large size of the public sector – in terms of employment and resources – and its responsibility to provide high-quality and efficient services to the population.

Strategies and policies to support societal challenges

Government intervention is essential to maximise the contribution of research and innovation to societal challenges for reasons relating to the nature of public goods and the public sector and the complexity of many of the problems which require regulatory changes. Market mechanisms will provide insufficient incentives for the private sector to invest in these activities (see also Box 5.4).

Societal challenges in the Long-Term Plan

Societal challenges are one of the three pillars in the LTP emphasising the government’s commitment to this priority. The LTP identifies global challenges such as “climate change, security and preparedness, disease and epidemics, safe access to energy, water and food” and also changing demographics and a “growing percentage of elderly citizens”. It also emphasised the fact that the three overarching pillars of the LTP are interconnected: the ability to find solutions to societal challenges is enhanced by excellent science and new solutions in turn can contribute to strengthening competitiveness and innovation. The RCN is tasked with following up the funding of research to tackle societal challenges.

Before the LTP, societal challenges already figured prominently in public research funding. The sector principle has probably contributed to giving societal challenges a prominent role in research funding since ministries have a better knowledge of the concrete needs – as well as of the necessary and acceptable trade-offs– related to these challenges in their respective policy fields. Based on this intimate understanding of societal challenges and their implications, ministries of environment, energy, transport and justice and public security, for example, can better articulate elaborated demands directly to research performers or to RCN, in connection with concrete challenges, such as combating pollution and increasing the use of renewable and environmentally sustainable transportation, strengthening prevention of crime, fighting terrorism and increasing public security. While the LTP clearly identify tackling societal challenges as one of the three overriding objectives, it does not pinpoint specific societal challenges that should be prioritised but rather calls more generally for a strengthening of Norway’s ability to tackle societal challenges. In practice, policy efforts and programmes seem to centre around areas such as health, education, welfare, environment, ageing, seas and oceans and climate. Neither does the LTP identify mechanisms, initiatives or approaches to achieve this overarching objective. It only states in general terms that multidisciplinary approaches and multi-stakeholder collaborations and partnerships will be required for developing the required solutions:

Knowledge is put to use where people, organisations and cultures meet. The success of new solutions, whether they involve change, adaptation or new technology, requires a wide range of perspectives from the humanities, health and care disciplines and social science. This is crucial in achieving greater understanding of which solutions can actually be implemented in our society, and how this can best be accomplished.

Against this backdrop, each of the six LTP priorities of enabling technologies, world-leading research environments, better public services, an innovative business sector and investments in seas and oceans and climate, the environment and energy are seen as ways of strengthening Norway's ability to tackle societal challenges and turning some of them into economic opportunities.

Box 5.1. Societal challenges and the strategic debate “excellence versus relevance”

In its second report presented in 2016, the Productivity Commission appointed by the Ministry of Finance was critical of strategic research funding, particularly challenge-driven research and innovation funding, arguing that the government should invest in excellent curiosity-driven research, and thus adopt a less directional research and innovation policy. It claims that there was an extensive political skewing of research funding towards social objectives and that government should fund basic research to a much larger degree, with less focus on allocating research funding according to social challenges. It states that “the Norwegian research council model may have led to an imbalance to the disadvantage of research of high scientific quality, as a result of many other considerations which affect the distribution of research funds” (NOU 2016). The Commission propagates that researchers rather than government, or the Research Council, should prioritise what research should be done and, by extension, on the basis of which research results, innovation should happen (Koch, 2016).

Critics of the Productivity Commission's findings argue that already today the majority of research funding is not allocated strategically but rather as a block grant to universities. The Research Council – the single most important actor when it comes to competitively allocated public research funding to universities and research institutes – only accounts for around one-fourth of public research funding and only a portion of the RCN's funding is allocated on the basis of strategic or thematic priorities (Koch, 2016; Lykve, 2016). The ability of universities and researchers to make strategic priorities is also questioned by the authors, pointing to their weak track record and a strong proclivity towards path dependency (ibid). Finally, they question the democratic legitimacy of delegating research prioritisation to researchers (ibid). An alternative view to the Productivity Commission can also be found in Sarewitz (2016) and Gulbrandsen (2017) who argue that research orientation and interaction with users are found to strengthen both the quality and societal value of science. When left too much to its own devices and sheltered from “the real world”, science can actually be “self-destructing” rather than “self-correcting”. The Productivity Commission argued that reducing earmarks to thematic areas or societal aims in Norwegian research funding is necessary in order to raise research quality to an internationally competitive level, thus pointing to a perceived tradeoff or relative incompatibility between research excellence and societal relevance, at least from the perspective of research funding allocation decisions. However, an evaluation of the engineering sciences commissioned by the RCN in 2015 showed that research groups or institutions that scored high on research excellence also scored high on societal relevance and impact. Norway appears to have a good track record of funding high quality research in areas which are considered of relevance to society – in terms of identified social challenges such as climate and the environment – but also to Norwegian industry, such as the marine and maritime industry and oil and gas. The evaluation of engineering sciences in Norway carried out in 2015 identified marine technology and climate and fossil fuel research as research fields where Norwegian engineering science is significantly outperforming, pointing out that “[t]he excellence in these areas corresponds with the key technologies in Norway, which indicates a good linkage between research and industry” (RCN, 2015a).

Source: Koch, P. (2016), ”Rattso 2: Very good, but bothering innovation policy”, *Innovasjonsbloggen*, <https://innovasjonsbloggen.com/2016/02/15/rattso-2-mye-bra-men-bommer-pa-innovasjonspolitikken>.

Wirth regards to public sector renewal specifically, the LTP listed three overarching aims: 1) more knowledge-based public services; 2) a public sector that drives innovation; and 3) a knowledge system for better health and care services. The LTP emphasised the importance of the private sector in contributing to and participating in the renewal of the public sector, e.g. in developing technology, providing expertise and co-operating with the public sector in developing solutions. Improving the ability of the municipal sector to provide good services to its citizens is prioritised in the LTP, as is the health and care sector. In its implementation, emphasis so far has been on raising knowledge base and evidence-based decision making in the public sector, e.g. through public sector PhDs, a programme run by the RCN.

The RCN's programmes towards societal challenges

The three core missions of the Research Council are to promote research quality, contribute to tackling societal challenges and to strengthen innovation in the business sector. Formulated slightly differently, one of their key tasks is to fund research and promote innovation in areas of relevance to society where Norway needs more knowledge and competence.

Many of the RCN's programmes target specific societal challenges such as health, welfare, climate, environment, or promote generic efforts aimed at promoting responsible research and innovation or public sector renewal (see Table 5.2), as opposed to larger and more open programmes. This might be partially explained by the fact that RCN is tasked by various ministries to run its R&D programmes through detailed requests (see Chapter 6), which tend to prevent the Council from being able to design broader programmes.

Table 5.2. **Examples of RCN programmes targeting societal challenges**

Programme	Societal challenge
BEDREHELSE	Better health and quality of life
BYFORSK	Research and innovation for cities of the future
CLIMIT	Research and commercialisation of carbon capture storage (CCS)
FME	Centres for environment-friendly energy research
GLOBVAC	Global health and vaccination research
HELSEVEL	Health, care and welfare services research
MARINFORSK	Marine resources and the environment
MILJØFORSK	Environmental research for a green transition
KLIMAFORSK	Large-scale programme on climate research
SYKEFRAVAER	Sickness absence, work and health
TRANSPORT	Transport 2025
VAM	Welfare, working life and migration
SAMRISKII	Societal Security
NORGLOBAL	Norway – Global partner (research in support of global efforts towards the UN's Sustainable Development Goals)
POLARFORSK	The Polar Research Programme
ENERGIX	Large-scale programme for energy research
SAMANSVAR	Responsible innovation and corporate social responsibility
DEMOS	Democratic and effective governance, planning and public administration
FINNUT	Research and innovation in the educational sector
FORKOMMUNE	Research and innovation in the municipal sector
FORREGION	Research-based regional innovation
OFFPHD	Public sector PhD scheme

In this aspect, RCN differs from the Swedish Government Agency for Innovation (Vinnova), which has a rather broad mandate and task to promote innovation for sustainable development (ecologically, economically and socially) and is given rather broad autonomy with regard how to achieve this (OECD, 2016). The Agency has created an umbrella programme for “Challenge-Driven Innovation” (UDI) (for an analysis of this programme, see Palmberg and Schwaag Serger, 2017). The Dutch government also runs an initiative called “Green Deals” with a broad focus on green growth and social issues. Green Deals is a joint initiative by the Dutch Ministries of Economic Affairs (EZ), Infrastructure and the Environment (I&M) and the Interior and Kingdom Relations (BZK). Both the Swedish and Dutch initiatives have a strong emphasis on involvement of companies and public sector actors (such as municipalities). Whereas UDI focuses on developing innovative solutions in multi-actor consortia which join the supply and demand side, Green Deals targets the stage “when innovations are actually put into practice, a phase during which projects often encounter barriers”.⁵ The primary mechanism for UDI is the funding of consortia which have been created to target specific challenges, while for the Green Deals the aim is to remove barriers in order to help sustainable initiatives get off the ground and to accelerate this process where possible. This includes a wide range of actions far beyond the research and innovation areas, such as removing obstacles in legislation and regulations and providing access to networks and capital market. Finally, Finland recently launched the Strategic Research Council, with a mandate to fund long-term and programme-based research aimed at finding solutions to the major challenges facing Finnish society (OECD, 2017b). The government regularly identifies priority areas for funding. The Finnish approach has a clear focus on research, differentiating it from UDI and Green Deals which are more strongly oriented towards innovation.

RCN’s programmes span both research and innovation but tend to be more targeted to specific areas than the other countries’ initiatives and, viewed as a whole, they also have a somewhat stronger emphasis on research than innovation, when compared with the Swedish and Dutch initiatives, though not the Finnish one (see table 5.3). Innovation Norway’s activities are less structured according to societal challenges than the examples given above, though it has identified health and healthcare as a prioritised area.

Table 5.3. **Research and innovation initiatives targeting societal challenges in Norway, Sweden, the Netherlands and Finland**

Programmes targeting societal challenges	Thematic focus	Focus on research or innovation?	Primary mechanism
RCN programmes	Numerous programmes targeting specific challenges	Both but with slight leaning towards research	Funding projects; building research and innovation capacity in the public sector
Challenge-Driven Innovation Program (UDI), Sweden	Broad focus	Applied research, development and innovation?	Funding projects, promoting new consortia around specific challenges
Green Deals, Netherlands	Emphasis on green growth	Clear emphasis on innovation	Removing barriers to the implementation of innovations (regulation, financing networks)
Strategic Research Council, Finland	Broad focus on major challenges to Finnish society (though identification of priority areas by government)	Research	Funding research with special attention to dissemination

Other policies and programmes to address societal challenges

In addition to the funds channelled through the RCN, several ministries allocate funds directly to research institutes and universities for research on issues of relevance to societal challenges. Although, as in most countries, it is not easy to track all efforts for a given transversal policy objective. They include notably actions from the Ministry of Health and Care Services, which allocates the vast majority of its research funding on health and care issues to the regional health authorities, the Ministry of Local Government and Modernisation, the Ministry of Climate and Environment, the Ministry of Transport and Communications, the Ministry of Labour and Social Affairs and the Ministry of Justice and Public Security.

In its budget for 2017, the Ministry of Local Government and Modernisation (KMD) earmarked 6.5 m NOK to be allocated directly to the Norwegian Institute for Regional and Urban Research (for research on sustainability and vitality in sparsely populated regions), (KMD budget, 2017). The Ministry of Justice and Public Security allocates research funding directly to the Norwegian Defence Research Establishment (FFI), to the Norwegian Police University College, to the Centre for Cyber and Information Security and to the Transatlantic Council on Migration.

In addition to the above-mentioned research-oriented initiatives, there are a number of public technology programmes targeting societal challenges such as energy, climate, environment and transport. Enova is a public enterprise owned by the Ministry of Petroleum and Energy, established in 2001 to promote a transition to environmentally sustainable energy production and use, and the development of energy and climate technology. Enova offers investment support for energy projects, where it seeks to derive maximum value in terms of energy for the support it provides. The energy support covers all sectors, including transport, and also includes subsidies to households for investments in energy-smart solutions. Enova's other main objective is new energy and climate technology, aiming to reduce emissions and contribute to a long-term restructuring of energy end-use and production. In 2016 it pledged a total of NOK 515 million in support of 80 projects developing or implementing new energy or climate technology. For the period 2012-16, total pledged support to new technology was NOK 3 761 million for 179 projects. Technology projects in industry can be of a substantial scale.

The Environmental Technology Programme was established in 2010, constituting the main part of the National programme for environmental technology (2010-13). It is administered by Innovation Norway. The programme supports pilot and demonstration projects developing environmental technology (technologies that directly or indirectly improve the environment: more environmentally friendly products and processes, reducing pollution, increased resource efficiency, etc.). Support is mainly in the form of grants, or a combination of grants and loans. Support levels vary from 25% to 45% depending on the size of the firm. Since its introduction, annual allocations under the programme have increased rapidly, from NOK 140 million in 2010 to NOK 461 million in 2016. The programme was evaluated in 2014 (Espelien et al., 2014). Based on the information available at that time, evaluators described it as a public funding scheme with a relatively high degree of success. The evaluator's assessment and the companies' own statements indicate that the programme generates a high degree of additionality, with evaluator's calculations showing that one unit of public funding triggers 3.6 units in private investment. The evaluation also characterised the programme as lacking a clear definition of objectives, and found potential for improvement in the way projects are selected.

CLIMIT is the national programme for research, development and demonstration of technology for CO₂ capture, transport and storage. It is organised as a co-operation between the RCN and Gassnova, a public enterprise responsible for managing the state's interests in CCS. The RCN is responsible for the R&D part of the programme, while Gassnova is responsible for the pilot and demonstration activities. The total budget in 2016 was NOK 255 million, of which the R&D part was NOK 105 million. CLIMIT was established in 2005.

The Technology Center Mongstad (TCM) is the world's largest facility for testing and development of CO₂ capture technologies, and a main pillar of the government's strategy for CO₂ capture, which sets the ambition of realising at least one full-scale demonstration facility for CO₂ capture in Norway by 2020. The government owns 75% of the TCM through Gassnova, and partner petroleum companies own the remaining 25% (Statoil owns 20%). The TCM co-operates with national and international companies and research institutions developing CO₂ capture technology. The TCM has also initiated the CCS Test Centre Network, an international co-operation between CO₂ capture test centres. Around NOK 5 billion was spent on planning and construction of the technology centre from 2006 until its launch in 2012. The Ministry of Petroleum and Energy allocated NOK 617 million to Gassnova in 2017 for R&D services from the technology centre, which also covers the government's share of the operating and borrowing costs. The ministry also allocated NOK 330 million to Gassnova for the planning of a full-scale demonstration facility for CO₂ capture, with a view to taking an investment decision in 2018.

Pilot T is the name of a proposed scheme for innovation, pilot projects and R&D for transport, which was proposed by the Ministry of Transport and Communications in the National Transport Plan 2018-29 in April 2017. The scheme will include a competitive instrument where various participants in the relevant fields will be able to test new solutions in practice. To supply the necessary expertise and to ensure the quality of the piloting activity, the scheme may also include research funding. The scheme is planned to be administered by the existing actors in the public support system for STI.

The ministry has also invited the municipality of Oslo and the county municipalities to participate in a competition called "Smarter Transport in Norway", in order to stimulate local innovation and development in the public transport sector. The plan is to allocate NOK 100 million to be distributed between from one and three winners in 2018-23. The competition is open to concrete solutions that implement new technologies, and that make use of zero-emission technologies where applicable. The National Transport Plan anticipates an allocation of NOK 1 billion to Pilot T and the "Smarter Transport in Norway" competition for the period 2018-29.

Initiatives and programmes to promote innovation in the public sector

RCN and Innovation Norway have instruments and initiatives targeting public sector innovation and renewal. Since 1968 there are Public Sector R&D contracts (OFU), run by Innovation Norway with funding from the Ministry of Trade, Industry and Fisheries, where suppliers co-operate with a customer from the public sector in developing a service or product. An evaluation of the programme in 2012 found that it had contributed to the modernisation and improvement of the productivity of the public sector and therefore recommended increasing its funding and reach (Oxford Research, 2012).

RCN has a number of programmes aimed at strengthening evidence-based decision making, knowledge resources and innovation in the public sector (see Table 5.2). In particular, the primary focus of the DEMOS programme is to “increase knowledge about, and the development of, a democratic and efficient public sector”. It had a budget of NOK 28 million in 2016, and runs until 2024. The RCN has proposed an increase of the innovation component in the DEMOS programme of NOK 10 million for 2017, and to increase the use of public innovation projects. Other programmes are also relevant to public sector reform in various areas, such as the FINNUT programme for the education sector, the TRANSPORT programme, and the SAMRISK programme on societal security.

The RCN has also proposed to start up a new programme in 2017 on research and innovation in the municipality sector (FORKOMMUNE) with NOK 17 million, with an ambition to increase the annual budget in the following years RCN is also planning an innovation programme with municipalities as project leaders and a researcher linked to the project.

The government presented a “Digital Agenda for Norway” in 2016, which identified “effective digitisation of the public sector” as one of its five prioritised areas, the others being “a user-centric focus”, ICT as a key input for innovation and productivity, “strengthened digital competence and inclusion” and data protection (KMD 2016a; see KMD, 2016b for the full text in Norwegian). The White Paper sets out clear and ambitious goals for advancing digitisation in the public sector. Among other things it commits to a “digital-by-default strategy”, putting pressure on agencies to digitise its services and operations. It calls for integrated information management across agencies and includes competence-building measures for civil servants. It requires all public agencies to co-operate with collaborate with Difi and the Norwegian Association of Local and Regional Authorities on digitisation matters and it has a particular focus on digitisation in municipalities, recognising that “[m]ost public sector services are municipal” (KMD 2016a). In the White Paper, the government charges Difi with the important function of monitoring progress on digitisation in the public sector particularly on measures affecting municipalities. Since 2009, the Ministry has also annually presented so-called “Digitisation Circulars” (“*Digitaliseringsrundskriv*”) which sets out guidelines and instructions for agencies on how to advance with digitisation. The Digitisation Circular 2016 requires ministries to map both the potential for digitisation of services and processes and which services remain to be digitised (KMD, 2016c).

Conclusions on societal challenges’ research and innovation

Mixed effort beside the Ministry of Education and Research and the RCN

So far, most of the research funding for following up the priorities set out in the LTP has come from the Ministry of Education and Research and the Ministry of Trade, Industry and Fisheries. It has taken longer for some other ministries to allocate, or reallocate, funding according to LTP priorities. There are large differences in how much individual ministries spend on research, both in absolute terms and in relation to their total budgets. Some ministries that are responsible for important societal challenge areas allocate little funding to research and innovation. One example is the Ministry of Justice and Public Security which allocates large sums of money to fighting crime and policing but only 0.2% of its total budget to knowledge creation and innovation on these issues. Others are the Ministry of Local Government and Modernisation, the Ministry of Transport and Communications, the Ministry of Labour and Social Affairs, the Ministry

of Children and Equality and the Ministry of Finance, all of which spend less than 1% of their budget on R&D.

Thus, there are important areas of societal challenges (such as security and crime prevention, transport, social affairs) where, judging by the R&D budgets of the responsible ministries, there is relatively little focus on research, innovation and renewal.

Furthermore, there is a wide variation in how much of respective ministries' R&D spending is channelled through the RCN, which has implication on both the efficiency of the research being undertaken and on the possibilities of interdisciplinary and cross-sectoral co-operation between the different projects and programmes. The Ministries of Health and Defense stand out as two ministries that spend considerable amounts on R&D – both in absolute terms and in relation to their budgets – but channel very little of their R&D spending through the RCN (see Figure 6.2 in Chapter 6).

There is a view that some sector ministries underinvest in research in areas prioritised in the LTP. This was the case for instance of projects in the area of the renewal of the public sector. The Ministry of Education and Research has a separate budget that originally comes from a research fund created in 2002 (see Chapter 6). They can use this fund to finance areas in the LTP which are not covered by other line ministries. It is not clear which areas have been financed with the resources drawn from this “common pot”.

Particularly, the Ministry of Local Government and Modernisation has not yet taken an active role in orchestrating, co-ordinating and driving public sector renewal. This would be especially instrumental since municipalities, which fall under the purview of this minister, are key actors in the provision of a number of public and social services (in education, healthcare, social and welfare services etc.). There are therefore significant potential synergies between the two main missions of the ministry. It has, however, not contributed significantly to the overarching goals LTP in terms of funding. While the importance of experimentation and learning in the public sector is acknowledged the ministry does not appear to dedicate significant resources to these activities. The ministry's efforts regarding public sector innovation and renewal focus on digitalisation, working primarily through Difi, the Agency for Public Management and e-Government. It allocated around 10 million NOK to IKTPLUSS, the RCN's programme for ICT research and digital innovation, in 2016 and proposes the same figure for 2017 (KMD, 2016d).

Lack of cross-sectoral co-ordination

Innovations in areas such as integration, healthcare, green growth, social mobility and cohesion are often interrelated and require systemic change and horizontal policy co-ordination. Norway's sector principle has ensured that many ministries feel ownership for research in their respective areas and can contribute to setting research agendas, both within their own ministries and underlying agencies and through RCN initiatives and programmes. However, tackling societal challenges – precisely because of their cross-cutting nature – require effective co-ordination across ministries and sectors that does not just result in ministry representatives defending their own ministry's interests. Thus, co-ordination must imply a clear common vision and ambition that goes beyond a “lowest-common-denominator-approach”. The need for improved co-ordination was also identified in the “Program for better governance and leadership in government” presented by the government in 2014. It highlighted that interventions to address societal challenges and to realise the potential of ICT investments and digitisation have to be better integrated and co-ordinated across sectoral, ministerial and other boundaries.

In particular, the analysis of the health and care sector reveals clear co-ordination problems between ministries regarding research, innovation and education in the context of the sector principle. This results in a tendency to build small research systems and agendas around specific issues (see Box 5.2).

Box 5.2. Research and innovation in the health and care sector

Health research and innovation takes place in a complex system with different key actors under the authorities of different ministries, with strict regulations and a weak tradition of interactions both among healthcare providers at the different levels of the healthcare system but also with actors outside the narrowly defined realm of health and care (e.g. industry and other private actors, entrepreneurs, social sciences, etc.).

In recent years, Norway has undertaken a number of important changes in the healthcare system and the research funded and performed in hospitals has increased significantly. The government has launched an ambitious strategy process for research and innovation in health and care resulting in the Health&Care21 Strategy and followed this up by presenting a “Government Action Plan for Implementation of the Health&Care21 Strategy”. The government has sought to promote innovation in healthcare by funding innovation projects and by promoting awareness-building and learning platforms. There is also an increasing policy focus on public procurement as a means of driving innovation and national business development in healthcare. Efforts are also being made to reform the education system to meet the changing needs and nature of healthcare provision.

However, while lots of innovation projects are being carried out both in hospitals and in primary care facilities, there is no structure for diffusing, scaling or robustly testing promising innovations. Moreover, in addition to supporting innovation projects that have been generated bottom up, there is a need for leadership that enables and promotes innovation “from the top” since this sector is characterised by strict regulations and procedural requirements, which can result in a culture and atmosphere that is not conducive to experimentation and change.

The research financed by the regional health authorities, mainly allocated to hospital trusts, could benefit from more interdisciplinary approaches including the incorporation of social sciences and technological and engineering sciences, neither of which is naturally present in hospitals. Furthermore, even though the Ministry of Health and Care Services (MHCS) emphasises the importance of the “usefulness” of the research it funds through the hospital trusts, the research is not very needs-driven, but mainly bottom-up driven by researchers’ interests. The emphasis on patient involvement in the design of research projects is laudable and important. However, it is not a guarantee that the research effort as a whole will be more oriented towards areas where there is greatest need or relevance. This would require patient, user or citizen involvement not just at the project level but also at the level of programme design and prioritisation. Paradoxically, while much of the research in hospitals can be described as “applied research”, it is not necessarily needs- or challenge-driven from a societal perspective since the prioritisation is left up to the individual researchers. However, the MHCS has tried to identify some overarching priorities in its annual instructions letters to the regional health authorities in areas such as addiction, mental health, the elderly and women’s health.

Innovation and primary care are two areas which appear to fall in between the remit of ministries’ responsibilities and co-ordination. The MTIF is seen as responsible for innovation but does so primarily from a business perspective and refuse to prioritise the industry and “pick the winners”. The MHCS focuses on the quality and efficiency of medical care provision and has up until rather recently not seen innovation as an integral driver of this; The MER has focused on bottom-up funding and excellence of research; The Ministry of Local Government and Modernisation has not assumed responsibility for strengthening the research and innovation capacity and performance of municipalities (with exception of certain aspects of digitalisation).

The LTP’s clear identification of healthcare and the public sector as prioritised areas but also the fact that it linked health, welfare and modernisation have made an important and necessary contribution to advancing research and innovation in healthcare. The development of the Health&Care21 Strategy and the government’s action plan has also been instrumental. The focus on municipalities brought attention to the demands for knowledge and innovation in this sector and to the fact that municipalities are important actors in this new landscape of health, knowledge and innovation.

Policies should be implemented not only at the level of individual areas but also at the systemic level. The former, often referred to as the “niche level”, requires measures to support experimentation and learning in a given area, most often with a strong involvement from users and a wide array of stakeholders. At the system level, where these niches compete and are combined, large-scale transformations require an interdisciplinary and intersectoral interaction framework, in the form of wide-ranging strategies, roadmaps and platforms.

While incremental innovation in niche areas appears to be accepted and facilitated in Norway, transformative change at the systemic level may require new instruments, organisation and co-ordination. Solutions for societal challenges often require a multidisciplinary approach. Furthermore, they require translational activities in which different solutions are first developed in close co-operation with users and then tested in different contexts. Much bottom-up experimentation and incremental innovation is under way, for example, in municipalities and in education, healthcare and in the provision of public services, one of the great strengths of the Norwegian public sector. However, there is little systematic policy experimentation and learning with a focus on disseminating, scaling up and incentivising the wider implementation of successful initiatives and approaches. Incentives, mechanisms and structures for scaling good practices are often lacking in the public sector, an area that merits closer scrutiny.

Overall, therefore, there is a need for a co-ordinating function for innovation in the public sector or an architecture for ensuring structured learning and driving systemic change (examples of these can be found in Mindlab in Denmark, the Government Policy Analysis Unit of the Prime Minister’s Office in Finland or the UK Prime Minister’s Delivery Unit).

Overemphasis on the development of the basic knowledge base underpinning societal challenges

The focus of actions to address societal challenge, including in the LTP, is still strongly on supporting research in the hope that it will lead to solutions. For the reasons outlined above, a linear approach is particularly unsuitable for tackling many of the societal challenges Norway, and the world, face today. There is still relatively little systemic focus on innovation to tackle societal challenges and on the transformative and institutional changes that might be needed to develop, test and scale successful approaches and solutions. The latter requires a need for balancing evidence and action (OECD, 2017a), for promoting more “learning by doing” and reflexive governance.

The sector principle has been useful in creating “ownership” for research, and its importance for policymaking, across a wide range of ministries. However, combined with the strong focus on research in the LTP, it may also inadvertently have contributed to an emphasis on research at the expense of innovation, the latter of which is sometimes still regarded as belonging to the domain of – and therefore primarily the responsibility of – the Ministry of Industry, Trade and Fisheries.

Twenty-one processes as an important but insufficient complement to the Long-Term Plan

Starting before the LTP, so-called “21-Forums” were created at the initiative of the government in a number of areas such as oil and gas, climate, energy and marine research. These initiatives have been described as “actor-driven strategy work

commissioned by the government or a ministry to promote research-based value creation and development in important societal areas” (TOF, 2015).⁶ The “21-forums” are OG21 (oil and gas), Energi21 (energy), Klima21 (climate), Maritim21 (maritime), Hav21 (marine), Bygg21 (construction), HelseOmsorg21 (health and care, see Box 5.3) and Skog22 (forestry). The recent white paper on industry announced that new 21 processes for digitalisation of trade and industry as well as for the processing industry will be initiated (MTIF, 2017).

Box 5.3. The “21-Forums” and the “Health&Care21 Strategy”

The 21-Forums draw up sectoral R&D strategies and serve as advisory bodies and stakeholder forums. The objective of the 21-forum strategy processes is to obtain strategic advice from industry, research and other actors to develop STI policies that prepare for industries and a society of the 21st century. Since 2001 several 21-forum processes have been initiated. The 21-strategies are formulated by committees that serve as advisory bodies and stakeholder forums. The committees are appointed by the government ministries and with representatives from businesses, research institutions and public administrations. The committees both formulate strategies for R&D and innovation and serve as forums for strategic collaboration. For some of the strategies the committees function as permanent advisory bodies that advise the government of the implementation of the strategic recommendations, and may be given the task of updating the strategies

In 2013, the Ministry of Health and Care Services initiated a process for developing a “Health&Care21 Strategy”. The ministry appointed 15 people to make up the Health&Care21 Strategy Committee, representing industry, universities and university colleges, hospitals, regional health authorities, user organisations, and government agencies. The Ministry also established a “Strategic Forum on Health and Care Research and Innovation (Chief Executives’ Forum)”. The three overall aims of the strategy were better public health, breakthrough research at a high international level and national economic and business development. The Strategy, submitted by the Committee to the government in June 2014, identified five main priority areas – knowledge mobilisation for the municipalities, health and care as an industrial policy priority, easier access to and increased utilisation of health data, an evidence-based health and care system, a stronger emphasis on internationalisation of research. Based on the strategy, the government drafted an “Action Plan for Implementation of the Health&Care21 Strategy” in November 2015 in which it identified and committed itself to carrying out a number of initiatives to implement the Health&Care21 Strategy. A Health Care 21 Advisory Board, with a dedicated Secretariat, funded by the Ministry of Health and Care Services and located at RCN, has an ongoing remit for overseeing the implementation of all the recommendations in the original strategy. This high-level, multi-stakeholder group, provides advice to Ministries and other users.

In response to the strategy, the government reported that it had “increased funding of basic research and the industry-oriented instruments for research and innovation” as well as establishing three new health research programmes at the RCN “targeting public health, treatment, development of services and innovation and global health” (Norwegian Ministries, 2017). A further response was the commissioning of a report – jointly by the Ministry of Education and Research and the Ministry of Health and Care Services – on the barriers to co-operation between universities and hospitals which was presented in December 2016 (MER and MHCS, 2016).

According to an evaluation by the Norwegian Board of Technology (Teknologirådet) and the RCN, the main task of the 21 processes is to advise ministries on how research and development can contribute to a certain thematic area and how initiatives can best be organised and supported (TOF, 2015). In particular, the 21 processes focus primarily on co-ordinating activities within their respective area, on supporting political priorities (stotte vedtatt politikk) and on creating consensus among the participants (ibid). The

evaluation concludes that “the 21 processes are expected to co-ordinate and optimise – rather than challenge – the direction of adopted (existing) policies.”

The 21 processes tend to promote dialogue with actors within, rather than across, sectors or areas. The processes would have benefited from involving more actors who could have contributed more “outside perspectives” and ensured a broader societal context and anchoring. The literature on ‘Responsible Research and Innovation’ (RRI) – which has arisen concurrently with a growing focus in research and innovation policy on tackling societal challenges – emphasises the importance of responsive and reflexive strategy processes and programmes. Such an approach in turn acknowledges and tries to address complexity, risk taking, experimentation, uncertainty, and a cross-sectoral and inter-, multi-, or cross-disciplinary perspective (see, for example, Kuhlmann and Rip, 2014, 2016; Stilgoe, Owen and Macnaghten, 2013). The aforementioned evaluation concluded that the 21 processes “lack the type of broad reflexiveness which a responsive RRI process requires” (TOF, 2015).

Box 5.4. The “challenge” with societal challenges

In recent years, a growing body of literature has pointed to the challenges and limitations of research funding, but also science technology and innovation policies in ensuring the transformative change needed to tackle societal challenges. They point to issues such as institutional and systemic failures, particularly resistance to change, the radically enhanced need for policy experimentation and learning, but also policy co-ordination, new forms of stakeholder involvement and reflexive governance (see, for example, Weber and Rohracher, 2012; Geels, 2002; Schot and Geels, 2008; Kuhlmann and Rip, 2014, 2016). There are several “challenges” with promoting innovation to tackle societal challenges which differentiate them from more general and non-directional promotion of innovation. Firstly, they tend to be very complex, sometimes also referred to as “wicked”, problems, involving stakeholders that transcend disciplines, constituencies or policy areas (OECD, 2017a). This also means that few societal challenges can be slotted neatly into existing governmental or organisational structures. Ministerial and organisational silos (often accentuated in coalition governments where different parties run different ministries) and turf wars also contribute to the difficulty in driving system renewal and transformation. Secondly, there is rarely a track record or well-established best practice to fall back on, for example there are few precedents on how to deal with climate control, with the refugee crisis, or with an ageing population. A related problem is that, often, “the perspectives on what is the problem and what constitutes its resolution differ across various societal groups” (Kuhlmann and Rip, 2014). Thirdly, they are often characterised by uncertainty, unpredictability and rapidly changing conditions.

A further complicating factor concerning societal challenges is that they are often located in or strongly linked to the public sector and the provision of public goods. They often involve systems that cannot be “turned off”, such as education or the continuous provision of healthcare. More fundamentally, the public sector is often characterised by strong risk aversion and resistance to change and a lack of mechanisms for promoting innovation, experimentation and the scaling of successful solutions (see also OECD 2017). Part of this has to do with the imbalance between the risk of failure (“wasting taxpayers’ money”) and the difficulty in appropriating the gains of successful innovation (“you don’t get elected or promoted for preventing cost increases”) (see also RCN and DAMVAD, 2012). The nature of the public sector, and its complicated relation to innovation can be summed up as the following:

...public services cannot be made obsolete. They can and should be continually renewed but their core function must remain constant. This structural dilemma requires a non-standard approach because any intervention aimed at transformation must be at once sympathetic and disruptive to the old system (OECD 2017a).

The 21 processes provide an important and valuable complement to the LTP in bringing together stakeholders within thematic areas to agree on, co-ordinate and further advance efforts to strengthen prioritised sectors and areas. They are at the same time strongly sector-driven and consensus-oriented processes which lack a broader and more visionary perspective and the ability to accommodate and drive the transformative (and often disruptive) change that is likely to be necessary to address the grand challenges our societies face today. Furthermore, they tend to be quite nationally oriented, as epitomised by the Health&Care 21 process and strategy, lacking a strong global dimension with regard to both supply and demand of knowledge and innovation but also the need for international co-operation to tackle societal challenges.⁷

Centres for Research-Based Innovation Barriers to public sector innovation and renewal

The public sector is a key actor and stakeholder in tackling many societal challenges and this is particularly so in countries like Norway, where the public sector is relatively large. The government has emphasised the importance of increasing competence, leadership and knowledge resources in and for the public sector. In particular, there is an ambitious agenda for digitisation of the public sector where Norway is already one of the leading countries globally.

Similar to the other Nordic countries, Norway has a comparatively large public sector, particularly in terms of share of total employment.⁸ The public sector accounted for 34.6% of total employment in 2013 compared to an OECD average of 21.3%. It is generally considered to be working well, both in international comparisons and when looking at citizens' confidence in both government and the public sector (OECD, 2015b). However, an ageing population, increasing public expenditures for pensions, healthcare and elderly, weak productivity development in the public sector, increased complexity in public administration are putting pressure on the public sector to adapt by developing new methods, solutions, organisations and partnerships for delivering good and cost-effective public services in the public sector (see, for example NOU, 2016).

Many of the challenges increasingly facing the public sector – and its ability to provide efficient, effective and high quality public services in the future – are interrelated and require systemic change and horizontal policy co-ordination. Examples of these are integration, healthcare, green growth, social mobility and cohesion etc. What currently seems to be missing is a co-ordinating function for innovation in the public sector or an architecture for ensuring structured learning and for driving systemic change (examples of these can be found in Mindlab in Denmark, the Government Policy Analysis Unit of the Prime Minister's Office in Finland or the UK Prime Minister's Delivery Unit).

The RCN views itself as being able to assume the following roles in promoting innovation in the public sector: Funding body, advisor, providing meeting arenas, knowledge dissemination and brokerage, national and international knowledge development, mediator and network building, implementation driver, promotion and creation of co-operation between public and private sector, guardian of the main principles of the innovation strategy of excellence, breadth and impact (“spiss-bredde-nytte”) (RCN and Damvad, 2012). In recent years, RCN has taken and supported a wide range of initiatives aimed at catalyzing and enabling innovation in the public sector, indicating a strong commitment to this area. However, it cannot be the responsible for the overall architecture which is required for driving systemic change, including ensuring the systematic upscaling of good practices, the removal of institutional, regulatory and other

barriers, establishing conducive incentive structures, strengthening public procurement as a driver of innovation and the creation of demand / markets where necessary.

Norway is in fact confronted with many of the principal challenges of innovation in the public sector. An analysis by RCN and Damvad (2012) acknowledged that there are significant barriers to innovation in the public sector, such as political factors, organisational issues, incentive structures and regulations. In particular, it criticised that it is unclear who is responsible for public sector innovation in Norway and that several ministries that should be at the forefront refrain from engaging in innovation in the public sector, for example regarding municipalities. Ministers claim that they are not rewarded for innovation, which lead them to focus increasingly on control and regulations rather than on creating spaces for renewal and innovation (RCN and Damvad, 2012). Similarly, a government report from 2014 argued that Parliament is more concerned with plans, targets and decisions than results (KMD, 2014). Norway has also particular difficulties in ensuring the scaling up and implementation of successful pilot projects in the public sector, partially because scalability is not taken into consideration in innovation projects. It also acknowledged that a lot of research – by its very nature – tends to be empirical, i.e. backward-looking, when there is a need for forward-looking analysis (RCN and DAMVAD, 2012). In its analysis of innovation in municipalities in Norway in 2013, Teigen points out that diffusion of innovation in the municipal sector an important but under-analysed issue.

Notes

1. NIFU R&D Statistics Database, www.foustatistikkbanken.no.
2. Here measured by the Field-Weighted Citation Impact (FWCI) in order to factor in the difference in citation rates across disciplines. Data originated from the SciVal database, last accessed on 24 October 2016.
3. The Norwegian Institute for Public Health, one of the top ten publishing institutions in Norway, has seen a dramatic increase in its citation impact from 1.6 in 2011 – nearly identical to the Norwegian overall citation impact in that year – to 3.09 in 2015, far above the level of Norway as a whole (1.59).
4. Similar results are found when considering the other fields related to health (i.e. medicine, health professions, etc.).
5. www.greendeals.nl/english/green-deal-approach.
6. Authors' translation.
7. It should however be noted that there is a section on global health and a section on high quality and internationalisation in the Health&Care21 strategy (Norwegian Ministries, 2017).
8. In 2013, reaching 33%, Norway had the highest share of its labour force occupied in the public sector, and recorded one of the most significant increase from 2009 (OECD, 2015b).

References

- Foyn, F. (2011), *Innovasjon i offentlig sektor [Innovation in the Public Sector]*, Statistics Norway (SSB), Oslo.
- Espeli, A. et al. (2014), “Veien fra FoU til Marked for Miljøteknologi. Evaluering Av Miljøteknologiordningen” [“The road from R&D to the environmental technology market: Evaluation of the Environmental Technology Program”], 10/2014, MENON Business Economics, Oslo.
- Geels, F. (2002), “Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case study”, *Research Policy* Vol. 31, pp. 1257–1274.
- Gulbrandsen, M. (2017), “Er det sammenheng mellom vitenskapelig kvalitet og samfunnsnytte?” [“Is there a connection between scientific quality and community benefit?”], presentation at the RCN Conference on the knowledge base for research and innovation policy, 2 March 2017, Hotel Bristol, Oslo.
- Haug, A.V. (2014), “Innovasjonsteori og framveksten av digital forvaltning” [“Innovation theory and the emergence of digital management”], in: Baldersheim, H. and L.E. Rose (eds.), *Det kommunale laboratorium. Teoretiske perspektiver på local politikk og organisering [The Municipal Laboratory: Theoretical Perspectives on Local Politics and Organization]*, third edition, Fagbokforlaget, Bergen.
- KMD (2016a), *Digital Agenda for Norway in Brief. ICT for a Simpler Everyday Life and Increased Productivity*, Meld. St. 27 (2015-2016), Report to the Storting (white paper), Ministry of Local Government and Modernisation.
- KMD (2016b), *Digital agenda for Norge. IKT for en enklere hverdag og økt produktivitet [Digital agenda for Norway. ICT for an easier everyday life and increased productivity]*, Meld. St. 27 (2015–2016), Report to the Storting (white paper), Ministry of Local Government and Modernisation.
- KMD (2016c), *Digitaliseringsrundskrivet*, The Ministry of Local Government and Modernisation, 25 November 2016.
- KMD (2016d), *Prop. 1 S (2016-17), Proposisjon til Stortinget (forslag til stortingsvedtak) for budsjettåret 2017 [Proposition to the Storting (Proposal for a Parliamentary Resolution) for the Financial Year 2017]*, The Ministry of Local Government and Modernisation, <https://www.regjeringen.no/contentassets/57979690b3ef4486be00173573d7d93b/no/pdfs/prp201620170001kmdddpdfs.pdf>
- KMD (2014), *Program for bedre styring og ledelse i staten 2014-2017 [Program for Better Governance and Leadership in the State 2014-2017]*, The Ministry of Local Government and Modernisation, www.regjeringen.no/contentassets/52c1fb7d0429412891ac02ec69196c3b/program_for_better_styring_og_ledelse_i_statens.pdf.

- Koch, P. (2016), “Rattsø 2: Mye bra, men bommer på innovasjonspolitikken” [”Rattsø 2: Very good, but bothering innovation policy”], *Innovasjonsbloggen*, Innovation Norway, 15 February 2016, <https://innovasjonsbloggen.com/2016/02/15/rattsø-2-mye-bra-men-bommer-pa-innovasjonspolitikken>.
- Kuhlmann, S. and R. Arie (2016), *Grand Societal and Economic Challenges: A Challenge for the Norwegian Knowledge and Innovation System*, RCN.
- Kuhlmann, S. and A. Rip (2014), *The Challenge of Addressing Grand Challenges. A Think Piece on How Innovation Can Be Driven Towards the “Grand Challenges” as Defined under the Prospective European Union Framework Programme Horizon 2020*, January.
- Lykve, K. (2016), ”Produktivitetskomisjonens blindsoner”, *Nytt Norsk Tidsskrift*, Vol. 33/3, pp. 242-249.
- MER and MHCS (2016), *Samordning mellom universiteter og helseforetak. Identifikasjon av utfordringsbilder med forslag til løsninger*, Kunnskapsdepartementet og Helse- og Omsorgsdepartementet [Co-ordination Between Universities and Health Enterprises. Identification of Challenges and Suggestion of Solutions], Ministry of Education and Ministry of Health and Care Services, <https://www.regjeringen.no/contentassets/e09927fe98d741d8af6e5976fc9007cf/samordning-mellom-universiteter-og-helseforetak---rapport-fra-arbeidsgruppe-nedsatt-av-kunnskapsdepartementet-og-helse--og-omsorgsdepartementet.pdf>.
- MTIF (2017), “Industrien – grønnere, smartere og mer nyskapende” [“Industry: Greener, smarter and more innovative”], Meld. St. 27 (2016-17), Ministry of Trade, Industry and Fisheries, Oslo, www.regjeringen.no/no/dokumenter/meld.-st.-27-20162017/id2546209/sec.
- Norwegian Ministries (2017), *The Government Action Plan for Implementation of the Health&Care21 Strategy: Research and Innovation in Health and Care (2015-2018)*, Ministry of Health and Care Services, https://www.regjeringen.no/contentassets/3dca75ce1b2c4e5da7f98775f3fd63ed/action_plan_implementation_healthcare21_strategy.pdf.
- NOU (2016), “At a turning point: From a resource-based economy to a knowledge economy”, Official Norwegian Report of the Productivity Commission, 2016, Oslo (in Norwegian), <https://www.regjeringen.no/contentassets/64bcb23719654abea6bf47c56d89bad5/no/pdfs/nou201620160003000dddpdfs.pdf>.
- OECD (2017a), “Working with change: Systems approaches to public sector challenges”, OECD Observatory of Public Sector Innovation, preliminary version, www.oecd.org/media/oecdorg/satellitesites/opsi/contents/images/h2020_systemsthinking-fin.pdf.
- OECD (2017b), *OECD Reviews of Innovation Policy: Finland 2017*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264276369-en>.
- OECD (2017c), *OECD Innovation in Environment-related Technologies Database*, http://stats.oecd.org/Index.aspx?DataSetCode=PAT_DEV (accessed 17 April 2017).
- OECD (2016a), *OECD Reviews of Innovation Policy: Sweden 2016*, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264250000-en>.
- OECD (2016b), *OECD Science, Technology and Innovation Outlook 2016*, OECD Publishing, Paris, http://dx.doi.org/10.1787/sti_in_outlook-2016-en.

- OECD (2016c), *OECD R&D Statistics (RDS) Database*, www.oecd.org/sti/rds.
- OECD (2015a), *OECD Science, Technology and Industry Scoreboard 2015: Innovation for Growth and Society*, http://dx.doi.org/10.1787/sti_scoreboard-2015-en.
- OECD (2015b), *Government at a Glance 2015*, OECD Publishing, Paris, http://dx.doi.org/10.1787/gov_glance-2015-en.
- Owen, R., P. Macnaghten and J. Stilgoe (2012), “Responsible research and innovation: From science in society to science for society, with society”, *Science and Public Policy*, Vol. 39, pp. 751-760.
- Oxford Research (2012), “Mer av det gode: evaluering av forsknings- og utviklingskontrakter OFU/IFU programmet” [“More of the good: Evaluation of research and development contracts OFU/IFU programme”], Kristiansand.
- Palmberg, C. and S. Schwaag Serger (2017), “Towards next generation PPP models – insights from an agency perspective”, SITRA, forthcoming.
- Piro, F.N., L. Scordato and D.W. Aksnes (2016), Choosing the right partners – Norwegian participation in the EU Framework Programmes, NIFU 2016:41, Oslo.
- RCN (2015a), “Basic and long-term research within engineering science in Norway”, report from the principal evaluation committee.
- RCN and DAMVAD (2012), “Innovasjon i offentlig sektor. Kunnskapsoversikt och muligheter. Hovedrapport” [“Innovation in the public sector: Knowledge overview and opportunities. Main report”].
- Sarewitz, D. (2016), “Saving science”, *The New Atlantis*, spring/summer, pp.5-40.
- Schot, J. and F. Geels (2008), “Strategic niche management and sustainable innovation journeys: Theory, findings, research agenda and policy”, *Technology Analysis & Strategic Management*, Vol. 20/5, September.
- Stilgoe, J., R. Owen and P. Macnaghten (2013), “Developing a framework for responsible innovation”, *Research Policy*, Vol. 42, pp. 1568-1580, www.sciencedirect.com/science/article/pii/S0048733313000930.
- Teigen, H.(2013), “Kommunane som innovatører”, in Ringholm, Teigen and Aarsæther (eds.) (2013), *Innovative kommuner*, pp.31-52, Cappelen Damm AS, Livonia, Latvia.
- Teigen, H., T. Ringholm and N. Aarsæther (2013), “Innovatør frå alders tid” [“Innovator from age”], in: Ringholm, Teigen and Aarsæther (eds.) (2013), *Innovative kommuner*, pp.13-30, Cappelen Damm AS, Livonia, Latvia.
- TOF (2015), “21-processenes samfunnsansvar”, Teknologirådet och Forskningsrådet [Technological Council and Research Council].
- Thomson Reuters (2016), “Disruptive, game-changing innovation, 2016 State of Innovation”, http://images.info.science.thomsonreuters.biz/Web/ThomsonReutersScience/%7B81d76ae6-9d3b-453c-8f7c-b76a3c80046d%7D_2016_State_of_Innovation_Report.pdf.
- Weber, M. and H. Rohracher (2012), “Legitimizing research, technology and innovation policies for transformative change: Combining insights from innovation systems and multi-level perspective in a comprehensive ‘failures’ framework”, *Research Policy*, Vol. 41, pp. 1037-1047.



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