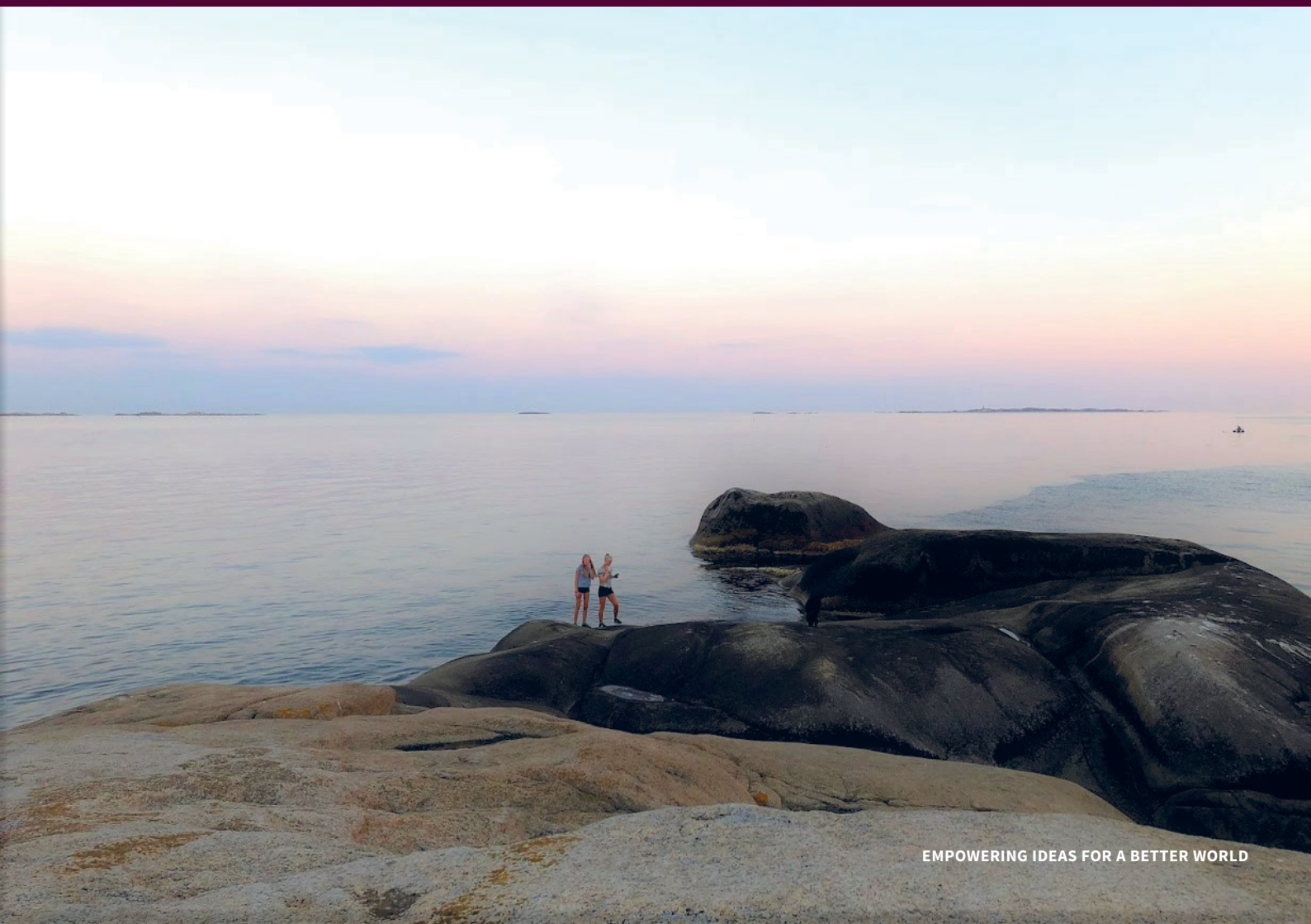
The Research Council of Norway

Evaluation of KLIMAFORSK



EMPOWERING IDEAS FOR A BETTER WORLD

Evaluation of KLIMAFORSK

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Sammendrag

Evalueringsmandatet

Evalueringen av KLIMAFORSK ble initiert av Norges forskningsråd våren 2020. Målet med evalueringen var å etablere en systematisk oversikt over erfaringer og resultater fra KLIMAFORSK i perioden 2013-2020.

Evalueringen dekker de vitenskapelige og strukturelle målene for KLIMAFORSK som formulert i KLIMAFORSK programplan, herunder en vurdering av samarbeidet mellom KLIMAFORSK og andre nasjonale og internasjonale programmer. I tillegg til å vurdere om KLIMAFORSK sine mål er oppfylt, gir evalueringen anbefalinger for videreutvikling av Forskningsrådets klimaportefølje.

Evalueringen bygger på dokumentstudier; Forskningsrådets data og statistikk over KLIMAFORSK's utlysninger, tildelinger og prosjektresultater; intervjuer; en elektronisk undersøkelse blant relevante interessenter samt en bibliometrisk analyse. Oversikter over de fem beste publikasjonene for hvert prosjekt, rapportert av prosjektlederne, danner også grunnlag for å evaluere måloppnåelsen. Evalueringskomiteen møttes ti ganger i perioden september 2020 til mars 2021.

Mål for KLIMAFORSK

KLIMAFORSK var et såkalt "Stort program", og ett av flere programmer som finansierer klimaforskning i Forskningsrådet. Forskningsrådets virkemiddel Stort program ble brukt til å realisere nasjonale forskningspolitiske prioriteringer og ble innført i 2004 da syv slike programmer ble igangsatt. NORKLIMA var et av disse og ble etterfulgt av KLIMAFORSK i 2013.

Ifølge KLIMAFORSK programplan er hovedmålet for programmet "å føre til fremragende forskning og kunnskap om klima til beste for samfunnet". Dette målet er operasjonalisert i tre faglige og syv strukturelle mål. De faglige målene er at programmet, gjennom forskning innenfor alle fagområder, skal gi:

1. økt kunnskap om naturlige og menneskeskapte klimaendringer
2. økt kunnskap om effekter av klimaendringer på natur og samfunn
3. økt kunnskap om omstilling til et lavutslippssamfunn og tilpasning til klimaendringer

De strukturelle målene er at KLIMAFORSK gjennom samarbeide med andre forskningsvirkemidler samt egne utlysninger og tildelinger, skal ha en formålstjenlig portefølje av prosjekter samt fremme:

1. samarbeid og arbeidsdeling i klimaforskningen
2. dristighet og faglig fornyelse i prosjektene
3. norske forskningsmiljøers internasjonale synlighet og bidrag
4. utviklingen av en ny generasjon klimaforskere
5. kompetanse og anvendbar kunnskap i samfunnet
6. målrettet kommunikasjon og formidling
7. bruk av tilgjengelige data og forskningsinfrastruktur

Programorganisering og virkemidler

Klima- og miljødepartementet er KLIMAFORSKs viktigste finansiør, etterfulgt av Kunnskapsdepartementet, Landbruks- og matdepartementet (fram til 2016) og Nærings- og fiskeridepartementet (fram til 2018). KLIMAFORSK programstyre var ansvarlig for strategiske prioriteringer og virkemidler for å nå programmets mål. Programadministrasjonen hadde ansvar for drift og administrativ oppfølging av prosjekter under programmet. Programstyret bestod av ti medlemmer fra forskningsinstitusjoner, industri og offentlig forvaltning med ett medlem fra Miljødirektoratet. To av medlemmene var fra andre nordiske land.

KLIMAFORSK har gjennomført en årlig hovedutlysning etter en tematisk syklus som tilsvarer de tre faglige målene. I tillegg gjennomførte KLIMAFORSK tre utlysninger av 40 millioner kroner til å støtte Fri klimaforskning (FRIKLIM). FRIKLIM-utlysningene var åpne for alle temaene i programplanen. KLIMAFORSK har hatt ansvar for eller deltatt i 45 utlysninger, hvorav 15 i samarbeid med andre programmer. Åtte av disse involverte andre programmer i Forskningsrådet, mens de resterende syv var deltakelse i internasjonale utlysninger.

KLIMAFORSK bevilget totalt 1.368 milliarder kroner til 296 prosjekter i perioden 2014-2020, fordelt på syv prosjekttyper: Forskerprosjekter, Samarbeidsprosjekter (forskerprosjekter med brukermedvirkning), Kommunikasjons- og formidlingsprosjekter, Gjestestipend, Stipend for utenlandsopphold, Støtte til arrangementer og Andre prosjekter. Forskerprosjekter er programmets hovedinstrument. KLIMAFORSK har finansiert 132 Forskerprosjekter. De resterende midlene er først og fremst bevilget til 21 Samarbeidsprosjekter, med sikte på å styrke brukermedvirkningen i klimaforskningen.

Evalueringsresultater

Evalueringskomiteen konkluderer at KLIMAFORSK har nådd sitt hovedmål om å fremme fremragende forskning og kunnskap om klima til beste for samfunnet. KLIMAFORSK har lykkes i å bygge både en bedre forståelse av klimasystemet på prosessnivå og i å generere viktig kunnskap og data som er relevante for samfunnet på politikkrelevante tidsskalaer. Forskningsaktivitetene har vært tilstrekkelig koordinert og arbeidet har gitt økt tillit til klimaprognoser og regionale konsekvenser av klimaendringer. Bidragene fra den enkelte forskningsaktivitet er imidlertid i hovedsak inkrementelle. Fremragende vitenskapelige prestasjoner er sjeldne, men KLIMAFORSK har vært medvirkende til å sette norsk klimaforskning i forkant av internasjonal innsats med et sterkt bidrag til IPCC og relevante forskningsinfrastrukturer.

Evalueringskomiteen konkluderer med at de fleste vitenskapelige og strukturelle målene er nådd, ikke ved enkelt-utlysninger, men gjennom syklusene med hovedutlysninger, FRIKLIM-utlysningene, bidrag til felles nasjonale og internasjonale utlysninger, og ved å bidra til å utnytte forskningsinfrastruktur.

Anbefalinger

Evalueringskomiteens anbefalinger følger de historiske linjene å søke kunnskap for å finne løsninger på klimautfordringene. En viktig marsjordre er 2030-agendaen og de 17 bærekraftsmålene. Dette bør være referansepunkter for fremtidig klimaforskning.

Alle store globale utfordringer, inkludert klimaendringer, krever kunnskap både fra disiplinær, tverrfaglig og transfaglig forskning. Det er imidlertid behov for bedre verktøy for å muliggjøre tverrfaglig forskning, og for mer forskningssamarbeid nasjonalt, regionalt og globalt.

Etter sin grundige studie av KLIMAFORSK-programmet har evalueringskomiteen formulert flere anbefalinger for vurdering. Anbefalingene er strukturert langs tre linjer: Forskningstemaer og fokusområder; Implementering; og Indikatorer, monitorering og evaluering. Anbefalingene er ikke prioritert. Evalueringsutvalget understreker imidlertid anbefalingene om 2030-agendaen og bærekraftsmålene, og anbefalingene om tverrfaglig forskning.

Evaluation of KLIMAFORSK

Visiting address: Drammensveien 288
The Research Council of Norway
P.O.Box 564
NO-1327 Lysaker

Telephone: +47 22 03 70 00
Telefax: +47 22 03 70 01
post@rcn.no
www.rcn.no

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Preface from the Research Council of Norway

Global warming is one of the greatest challenges of our time. The issues are complex, and the questions require effort from a wide range of sectors and disciplines, nationally and internationally. We need knowledge of the processes that drive climate change and the effects of these changes, as well as solutions for the transition to a sustainable carbon neutral society.

KLIMAFORSK was established in 2013 as a Large-scale Programme. It was an ambitious initiative, strongly rooted in both Norwegian research and climate policy. The objectives of the programme were to enhance the quality of Norwegian climate research, and raise knowledge and awareness of climate change, including its impacts and solutions. KLIMAFORSK has funded research with the objective of providing a solid science-based foundation for public policy decision-making and a basis for innovative climate-solutions.

KLIMAFORSK was terminated as a Large-scale Programme in 2019 and integrated into a broader Climate and Polar research portfolio, where many of the same goals and objectives have been continued. As part of this transformation of the climate research portfolio The Research Council of Norway decided it would be useful to evaluate achievements and lessons learnt from KLIMAFORSK and consider recommendations for the development of future climate research priorities. The evaluation of KLIMAFORSK was initiated by the Research Council of Norway (RCN) in 2020.

The appointed international Evaluation Committee started its work in September 2020. The task of the committee has been to assess the objectives of KLIMAFORSK and, based on lessons learnt, develop recommendations for the direction of future Norwegian climate research and innovation. This report summarizes the findings and recommendations of the Evaluation Committee. We appreciate the effort of the committee for completing this demanding task, despite not being able to meet physically due to COVID-19-restrictions.

We expect that this evaluation will provide helpful input to the Research Council, in particular to the Climate and polar portfolio board in their work to develop a portfolio plan for climate research, as well as to relevant ministries and research institutions and communities, providing advice to further develop Norwegian climate research and innovation.

The work has been carried out efficiently by the members of the Evaluation Committee and the secretariat Menon Economics. We are grateful to all and would especially like to thank Tora Aasland for leading the work. We would also like to thank all participating individuals that have provided contributions through survey and interviews.

Oslo, April 2021

Kristin Danielsen
Executive Director

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Executive summary

The evaluation mandate

The evaluation of KLIMAFORSK was initiated by the Research Council of Norway (RCN) in the spring 2020. The objective of the evaluation is to establish a systematic review of experiences and results from KLIMAFORSK over the period 2013-2020.

This evaluation covers KLIMAFORSK's scientific and structural objectives as formulated in the KLIMAFORSK work programme, including an assessment of the collaboration with international and domestic programmes. In addition to assessing whether KLIMAFORSK's objectives have been met, the evaluation provides recommendations for the further development of RCN's climate research portfolio.

The evaluation builds on document studies, RCN data and statistics on KLIMAFORSK fund allocations, and project results, in addition to qualitative interviews, an electronic survey with relevant stakeholders, and a bibliometric analysis. Overviews of the top five publications for each project as reported by the project managers also form a basis for evaluating the achievements of KLIMAFORSK. The Evaluation Committee met ten times over the period September 2020 to March 2021.

Objectives of KLIMAFORSK

KLIMAFORSK was a so-called "Large-scale Programme", and one of several programmes funding climate research under the Research Council of Norway. The RCN instrument Large-scale Programme was used to realize national research policy priorities and introduced in 2004 when seven such programmes were initiated, NORKLIMA being one of those. NORKLIMA was succeeded by KLIMAFORSK in 2013.

According to the KLIMAFORSK work programme, the primary objective is "**to promote outstanding climate research and generate essential knowledge about the climate for the benefit of society**". This objective is operationalized in three scientific and seven structural objectives. The scientific objectives state that the programme will fund research activities in all subject fields and disciplines to increase knowledge about:

1. natural and anthropogenic climate change (SO1)
2. the impacts of climate change on nature and society (SO2)
3. the transition to a low-emission society and adaptation to climate change (SO3)

The structural objectives state that the KLIMAFORSK programme will cooperate with other research funding instruments and target its own funding announcements and grant allocations to develop an effective project portfolio, and will work to:

1. Promote cooperation and task distribution in climate research
2. Encourage boldness in scientific thinking and scientific innovation in research projects
3. Enhance the international profile and contribution of Norwegian research groups
4. Foster the development of a new generation of climate researchers

5. Expand expertise and applicable knowledge in society
6. Facilitate targeted communication and dissemination activities
7. Increase the use of available data and research infrastructure

Programme organisation and instruments

The Ministry of Climate and Environment is the main financier of KLIMAFORSK, followed by the Ministry of Education, the Ministry of Agriculture and Food (until 2016), and the Ministry of Trade and Industry (until 2018). The KLIMAFORSK Programme board was responsible for the strategic priorities and instruments for achieving the programme's objectives. The programme administration was responsible for operations and administrative follow-up of projects under the programme. The Programme board included ten members from research institutions, industry, and public administration with one member from the Norwegian Environment Agency. Two members were from other Nordic countries.

KLIMAFORSK has announced an annual major call following a thematic cycle corresponding to the three scientific objectives. In addition, KLIMAFORSK announced three calls with NOK 40 million funding for 'Free Climate Research' (FRIKLIM). The FRIKLIM calls cover all the topics in the work programme. KLIMAFORSK has been responsible for or participated in 45 calls, of which 15 were collaborations with other programmes. Eight of the collaborative calls involved other RCN programmes, while the remaining seven were international calls.

KLIMAFORSK allocated a total of NOK 1,368 billion to 296 projects during the period 2014-2020, in seven project types: Researcher Projects, Collaborative Projects (researcher projects with user participation), Communication and dissemination projects, Guest Research Scholarship, Scholarship for research stays abroad, Support for events and Other projects. Researcher Projects is the programme's main instrument. KLIMAFORSK has funded 132 Researcher Projects. The remaining funds have primarily been allocated to Collaborative Projects (21) aiming to strengthen user participation in climate research.

Evaluation results

The Evaluation Committee concludes that KLIMAFORSK has achieved its primary objective of promoting outstanding climate research and generating essential knowledge about the climate for the benefit of society. KLIMAFORSK has succeeded in building both an improved understanding of the climate system at a process level and in generating essential knowledge and data relevant for society on policy-relevant timescales. Research and development activities have been sufficiently coordinated and efforts targeted across the programme to deliver increased confidence in climate projections and regional impacts. However, the contributions from individual research activities are mainly incremental. Outstanding scientific achievements are rare, but KLIMAFORSK has been instrumental in placing Norwegian climate research at the forefront of international efforts with a strong contribution to IPCC and relevant research infrastructures.

The Evaluation Committee concludes that most of the scientific and structural goals have been achieved, not by individual calls but through the 2-3 cycles of funding announcements, the FRIKLIM

calls, contribution to joint national and international calls, and by contributing to and exploiting new and existing research infrastructure.

Recommendations

The recommendations from the Evaluation Committee follow the historic lines of seeking knowledge to find solutions to the climate challenges. One important marching order is the 2030 Agenda and the 17 Sustainable Development Goals (SDGs). These should be points of reference for future climate research.

All big global challenges, including climate change, require knowledge both from disciplinary as well as interdisciplinary and transdisciplinary research. There is, however, a need for better tools to enable interdisciplinary research, and for more research collaboration nationally, regionally, and globally.

After a thorough study of the KLIMAFORSK programme, the Evaluation Committee has formulated several recommendations for future consideration. The recommendations are structured along three lines: research themes and focus areas, implementation and programming, and indicators, monitoring, and evaluation. The recommendations meet different levels in the research processes. There is no detailed prioritization. However, the Evaluation Committee specifically highlights the recommendations concerning the 2030 Agenda and the SDGs, and the recommendations concerning inter- and transdisciplinary research.

1 Introduction

The evaluation of KLIMAFORSK was initiated by the Research Council of Norway (RCN) in the spring 2020. As defined in its mandate, the objective of the evaluation was:

- to establish a systematic review of experiences and results from KLIMAFORSK.
- to identify and analyse the programme's structure, organization, and goal achievement, including an assessment of the collaboration with other programmes, and an assessment of whether the link between climate and environmental research has or has not contributed to the goal achievement of KLIMAFORSK.
- to establish a basis for further development of the climate research portfolio and recommend which priorities that should be set in the future to meet the challenges and research needed to meet the scientific objectives and ambitions set by the budget allocations.

In general, the evaluation covers the period 2013 to 2020, but one section of the bibliometric analysis includes publications from climate-relevant projects financed by RCN for a longer period (2010-2019). The appointed international Evaluation Committee started its work in September 2020. In the following sections, the evaluation process, the evaluation tasks, the main data sources, limitations, and structure of report are presented.

1.1 The Evaluation Committee and the evaluation process

The Evaluation Committee consisted of:

- Tora Aasland, Chair
- Associate Professor Tina-Simone Neset, Linköping University
- Research Leader Steffen M. Olsen, Danish Meteorological Institute
- Head of Section Herdis Laupsa, The Norwegian Environment Agency
- Executive Director Måns Nilsson, Stockholm Environment Institute
- Professor Bo Elberling, Copenhagen University (till December 2020[1])
- Professor Michael Tjernström, Stockholm University (till October 2020[2])

Partner Kaja Høiseth-Gilje, senior economist Nina Bruvik Westberg, partner Annegrete Bruvoll and senior analyst Christine Mee Lie from Menon Economics, served as secretariat for the Evaluation Committee. Lena Cappelen Endresen, Ivar Berthling and Carina Leander coordinated the evaluation project on behalf of RCN.

The Evaluation Committee had its first meeting in September 2020, followed by 10 meetings. The last meeting was held in March 2021. All meetings took place digitally due to the COVID-19 restrictions.

[1] *Bo Elberling was a member of the Evaluation Committee until December 2020.*
[2] *Michael Tjernström was chair of the Evaluation Committee until October 2020.*

1.2 The evaluation tasks

The mandate includes an evaluation of whether KLIMAFORSK's scientific and structural objectives, as formulated in the KLIMAFORSK work programme, have been reached, and which factors have contributed to their achievement.

The Evaluation Committee was asked to consider the implications of the findings in this report for future RCN climate research priorities, with reference to three main objectives in the current Climate- and polar research portfolio plan:

- A rapid transition to a zero emissions society and effective adaptation to climate change
- Increased international research and innovation cooperation to address global societal challenges in areas where Norway is particularly well-equipped to make a difference
- A sustainable bioeconomy and responsible management of the environment, natural resources, nature and land areas

The Climate- and polar research portfolio plan replaced the work programme for KLIMAFORSK (as well as the Polar Programme - POLARPROG) in 2020, and the objectives are in line with and supports the RCN (2020) strategy, *Empowering ideas for a better world. Strategy for the Research Council of Norway 2020-2024*. The strategy aims to achieve sustainable development and groundbreaking research.

The mandate specified six topics to be covered in the evaluation:

- Results and goal achievement
- The players involved in KLIMAFORSK
- International research cooperation
- Scientific objectives and priorities
- Project types and funds
- Cooperation with other research funding activities

The Evaluation Committee has focused the evaluation on the goal attainment of the three scientific and the seven structural goals in the KLIMAFORSK work programme.

1.3 Data sources

A combination of document studies, RCN data and statistics on KLIMAFORSK fund allocations and project results, qualitative interviews, an electronic survey, a bibliometric analysis, and project managers' top five publications as reported by the project managers are the basis for this evaluation. The most important data sources have been the RCN's background material including the bibliometric analysis, and survey and interviews with relevant stakeholders.

Background material includes previous studies and evaluations, annual reports from the programme, as well as the work programme and other strategy documents associated with KLIMAFORSK and other related programmes.

RCN data and statistics can be divided into two main types: The first is administrative data, such as funds spent, number of calls and number and types of projects. The second is data provided from the RCN project data base and its tagging system.

Each RCN-funded project is tagged to be able to extract information and statistics from the projects. The tagging system provides the characteristics of each project through a large number of tags, some of which are related to programme-specific objectives. In addition to characteristics such as topic ("Climate" for the KLIMAFORSK projects), discipline, area of application and more, there are separate tags for KLIMAFORSK's three scientific objectives. Thus, one may track the allocation of KLIMAFORSK funds according to the scientific objectives of the programme. The tags are not mutually exclusive. For example, a KLIMAFORSK project may deliver on, and therefore be tagged with, more than one of the three scientific objectives. For that reason, multiple counting may occur. Tagging is done by the RCN project officer for each project in its starting phase and is based on their assessments of relevant tags. Routines are in place to ensure unified use of the tagging system, and quality controls are regularly performed. For this evaluation report, information and statistics drawn from the tagging system are based on 296 KLIMAFORSK-funded projects with start date during the period 2014-2020.

KLIMAFORSK has a wide range of stakeholders whose experiences and perspectives are relevant to the evaluation. A survey was conducted among representatives associated with the Programme board, representatives from users of the research in the form of different ministries and directorates, climate research centres and project leaders, as well as the administration at the RCN. The survey covered a wide range of topics, including the scientific objectives, the structural objectives (when relevant), the administration of the programme (when relevant) and how the programme may be adjusted to support further goal achievement. The survey was sent to 115 stakeholders, of which 66 responded (57 percent). Around 67 percent of the respondents are scientific project leaders. See Appendix A for an overview of responses by stakeholder category.

In addition, five in-depth interviews were conducted with representatives from each group of stakeholders. The interviews covered the same topics as the survey but allowed for more in-depth mapping. The interview guide is presented in Appendix B.

All project managers of completed projects were asked to report the five most important publications from the project to date. This publication list was used to assess the research projects. In addition, a bibliometric analysis was carried out by RCN (see Appendix D).

1.4 Limitations

The work of the Evaluation Committee has been subject to a number of limitations. KLIMAFORSK has ambitious goals and a total set of ten objectives, while indicators for assessing the goal attainment are limited. The work programme suggests indicators for the objectives, but not all are solid, and for some of the objectives the data sources are scarce. Due to the situation related to the COVID-19 pandemic, the Evaluation Committee has not been able to meet in person, posing another limitation to the collegial work it has been able to do.

KLIMAFORSK has made use of seven different instruments; Researcher Projects, Collaborative Projects (researcher projects with user participation), Communication and dissemination projects, Guest Research Scholarship, Scholarship for research stays abroad, Support for events and Other projects. The Evaluation Committee has not assessed the relative strength and weaknesses of the instruments applied.

In addition to the information provided by the bibliometric analysis, the Evaluation Committee requested information regarding differences in terms of quantity of scientific output (journal articles, books, book chapters etc.) from projects under the different scientific objectives. The database of completed projects is too scarce to perform a detailed analysis of this, but the figures do not point to any significant differences. This question will not be further commented upon in the evaluation.

1.5 The structure of the report

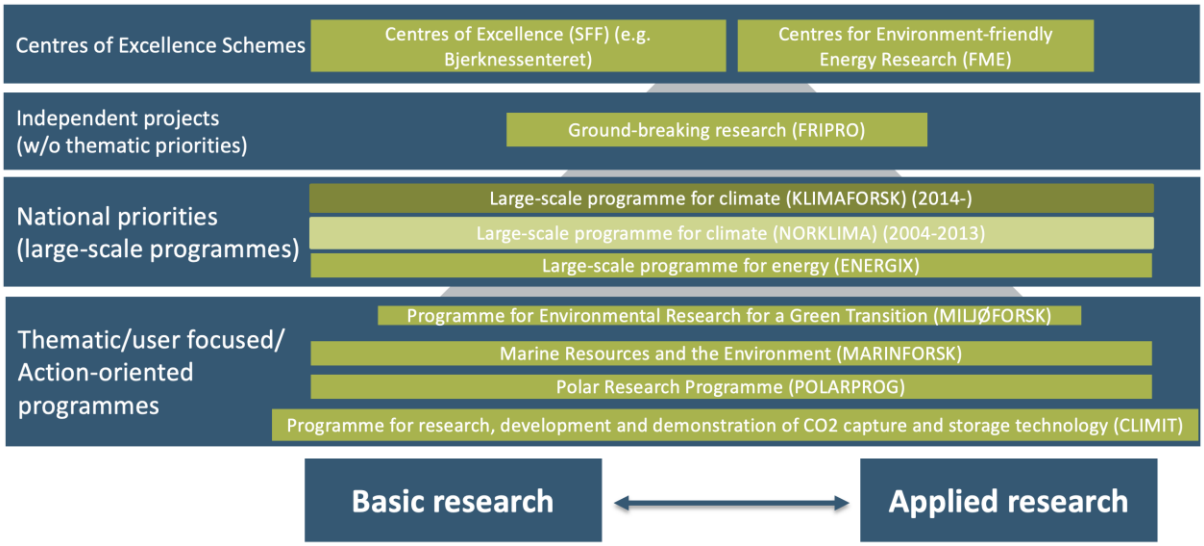
Chapter 2 places KLIMAFORSK in the broader context of climate research under RCN. Chapter 3 describes KLIMAFORSK, including its objectives, sources of funding and types of projects funded. The three scientific goals are described and evaluated in chapter 4, followed by a description and evaluation of the seven structural goals in chapter 5. Overall conclusions and recommendations for future climate research are presented in the final chapter.

2 Climate research under the Research Council of Norway

2.1 The balance between basic and applied climate research

A key dimension related to the RCN's programmes within climate, is the balance between basic and applied research (towards innovation and engaging industry). We will not go into this in depth here but point out that it is important to see KLIMAFORSK as part of this science policy landscape. In Figure 2.1, KLIMAFORSK is placed together with other relevant programmes in RCN, illustrating that KLIMAFORSK is a funding tool intended for both basic and applied research.

Figure 2.1 RCN's possibilities in climate research



Along the vertical axis, is variation in the type of investment - with outstanding research centres at the top and more thematic / user-driven programmes at the bottom. Major programmes such as KLIMAFORSK, which constitute national initiatives, are in the middle of the pyramid. Along the horizontal axis, is the dimension from basic research to applied research. SFF and FRIPRO funds within climate will this focus exclusively on basic research, while the FME funds are directed exclusively at applied research (and innovation). Many of the large programmes and the thematic / user-driven ones, on the other hand, are designed to cover the entire spectrum from basic research to applied research. Several of these programmes also have activities ranging from applied research to innovation.[3]

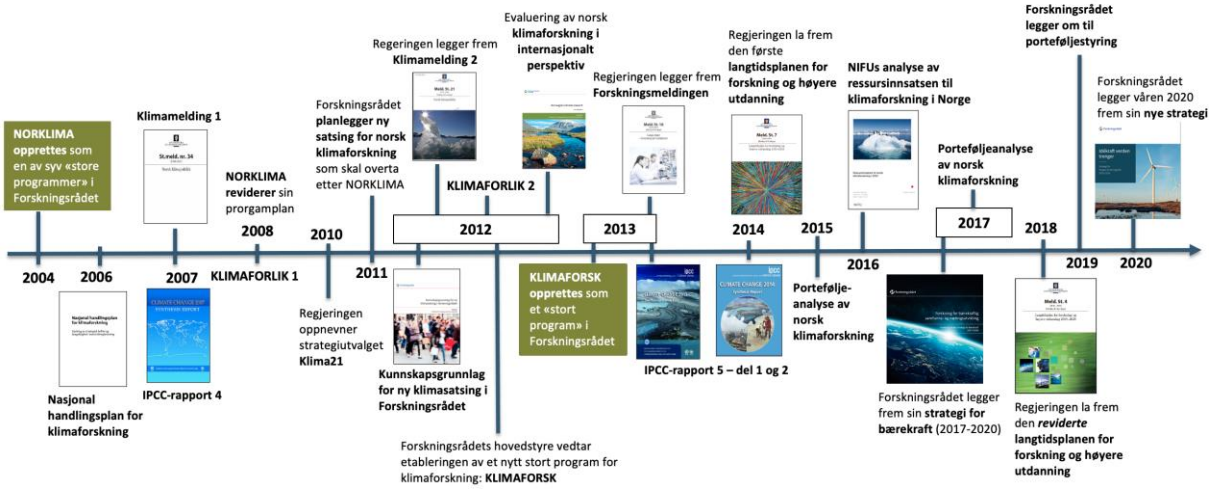
2.2 NORKLIMA as a backdrop to KLIMAFORSK

KLIMAFORSK's predecessor the Large-scale Programme on Climate Change and Impacts in Norway (NORKLIMA) was established in 2004. NORKLIMA brought together the three previous research programmes KlimaProg, KlimaEffekter and Polar Klimaforskning. The aim was to integrate the various

[3] *In addition, RCN programmes such as BIA, Skattefunn and DEMO2000 have a programme layout that supports innovation and demonstration projects - and which can be seen in the extension of the right axis in the figure.*

parts of climate research across old programmes, disciplines, sectors, and types of research, and in the long run secure more support and funding for climate research from several ministries. It was thus a point to clarify that the area of responsibility for climate research lies within the sectoral responsibility of several ministries.

Figure 2.2 Timeline – from NORKLIMA to KLIMAFORSK and the general development in Norwegian climate research policy



In 2008, NORKLIMA revised its work programme based on experiences with the programme and developing knowledge needs in society. During this period the UN Climate Panel IPCC presented its fourth report, the Climate Research Committee delivered a National Action Plan for Climate Research, and the Norwegian government launched a separate Climate Report. Informed by this new knowledge base the work programme developed a stronger focus on social sciences, especially research on society's adaptation to climate change. The Programme board set a goal that 1/3 of the project portfolio should be social sciences and humanities. With this target, NORKLIMA was at the forefront internationally in the integration of social sciences in climate research.[4]

In 2012, the RCN's Executive Board decided that KLIMAFORSK should be established to replace NORKLIMA in 2013. KLIMAFORSK was established as a ten-year Large-scale Programme. In 2016, KLIMAFORSK was redefined as an ongoing programme without a fixed programme period.

2.3 KLIMAFORSK as part of the Climate- and polar research portfolio

In 2019 RCN transitioned from program management to portfolio management, which has affected how the RCN plans and manages its activities. Work programmes and plans at the programme level have been replaced with portfolio plans and activities. 16 portfolios have been established, each with a Portfolio board. The former programmes are regarded as budgets under the Portfolio boards. Climate research is placed under the Climate and polar portfolio board and KLIMAFORSK is one of the budgets

[4] *In comparison, about 20 percent of social science projects in the environmental programme (incl. Climate) under the EU's 7th Framework Program, which ran in the period 2007-2013.*

under this board. The board is responsible for all climate-related projects in RCN, including those that are funded by other RCN budgets as well as EU-funded projects. The current Climate- and polar research portfolio plan is to be finalized in June 2022. This evaluation and its recommendations will serve as an important contribution to the further development of the plan.

3 About KLIMAFORSK

3.1 The establishment of KLIMAFORSK as a Large-scale Programme

The international evaluation of Norwegian climate research in 2012 was a central part of the knowledge base for the establishment and organization of KLIMAFORSK (Research Council of Norway, 2012). A main finding in the evaluation report was that Norway has world-leading research groups on the climate system. The report also found that Norway has the highest number of published articles on climate research per capita in the world. This indicates an active research environment, and clear contributions from this research activity can be traced in international arenas, such as the IPCC. At the same time, the evaluation showed that while the research groups held high scientific standards, they were small and fragmented. The report recommended further development of climate related social science research. The evaluation committee also assessed NORKLIMA as a programme and concluded that although the programme achieved the goal of stimulating climate research, the researchers perceived it more as a funding programme than a coordinated research programme. As a result, one of the recommendations was to establish a new Large-scale Programme over a ten-year period.

In addition to the findings and recommendations of the 2012-evaluation report, extensive preparatory work was done to design the new programme, KLIMAFORSK. This included consultations with, and mapping of knowledge and research needs, through the involvement of research groups, public administration, businesses and other relevant actors. The results were compiled and summarized in the document; *The knowledge base for a new climate initiative in the Research Council*[5]. A committee was appointed to write the first draft of the KLIMAFORSK work programme. The committee emphasized the need a programme that could contribute to societal transformation as well as provide the scientific basis for realising Norwegian and global climate objectives. Both the Paris Agreement goals, and relevant UN Sustainable Development Goals were highlighted. The draft was subject to a public consultation (and in parallel it formed the basis for the first KLIMAFORSK call). After these extensive preparations the final work programme was established.

NORKLIMA put the social sciences on the agenda, and KLIMAFORSK continued this focus by establishing a scientific objective dedicated to the transition to a low-emission society and societal adaptation to climate change. KLIMAFORSK aimed to be an ambitious programme strongly rooted in both Norwegian research and climate policy. As a Large-scale Programme in the RCN, it had a broad responsibility compared to "action-oriented programmes", which had more limited responsibilities and were aimed primarily at policymaking. A Large-scale Programme was expected to cover the spectrum from basic research to applied research and to take responsibility for scientific development within the theme in question.

The first project grants from KLIMAFORSK were paid out in 2014.

[5] *Kunnskapsgrunnlag for en ny klimasatsing i Forskningsrådet 2012*

3.2 Objectives of KLIMAFORSK

The work programme applying from 2013 (and superficially revised in 2018) states that KLIMAFORSK's primary objective is "**to promote outstanding climate research and generate essential knowledge about the climate for the benefit of society**". This objective is operationalized in three scientific and seven structural objectives:

Scientific objectives: The programme will fund research activities in all subject fields and disciplines to increase knowledge about:

1. natural and anthropogenic climate change (SO1)
2. the impacts of climate change on nature and society (SO2)
3. the transition to a low-emission society and adaptation to climate change (SO3)

Structural objectives: The KLIMAFORSK programme will cooperate with other research funding instruments and target its own funding announcements and grant allocations to develop an effective project portfolio, and will work to:

1. Promote cooperation and task distribution in climate research
2. Encourage boldness in scientific thinking and scientific innovation in research projects
3. Enhance the international profile and contribution of Norwegian research groups
4. Foster the development of a new generation of climate researchers
5. Expand expertise and applicable knowledge in society
6. Facilitate targeted communication and dissemination activities
7. Increase the use of available data and research infrastructure

3.3 Sources of funding

The Ministry of Climate and Environment is the main financier of KLIMAFORSK, with important contributions from the Ministry of Education, the Ministry of Agriculture and Food (until 2016), and the Ministry of Trade and Industry (until 2018) (see Table 3.1).

Table 3.1 Annual funding from Norwegian ministries to KLIMAFORSK, 2014-2020, NOK million. Source: RCN

	2014	2015	2016	2017	2018	2019	2020	Sum
Ministry of Climate and Environment	84	84	83	83	88	90	103	**615**
Ministry of Education and Research – SO	51	62	75	68	57	52	52	**416**
Ministry of Agriculture and Food	7	7	7					**21**
Ministry of Trade, Industry and Fisheries	2	2	2	2	2			**10**
Total per year	**144**	**154**	**167**	**153**	**147**	**142**	**155**	**1 062**

3.4 KLIMAFORSK Programme board and administration

The KLIMAFORSK Programme board was appointed by, and reported to, the former Research Board of the Division for Energy, Resources and the Environment. The Programme board was responsible for achieving the programme's objectives using available instruments. Activities were carried out in accordance with the intentions and objectives of the Research Council's strategy, the work programme, the guidelines from the Council's Executive Board and the Research Board of the Division for Energy, Resources and the Environment, as well as guidelines and priorities from funding ministries. The programme's priorities, research tasks and financial framework were annually assessed and adjusted in response to changes in the national budget and annual allocation letters from the funding ministries, but always in compliance with the overall principles and guidelines for research programmes as set out by the Research Council.

The Programme board (2013-2019) consisted of ten members from universities, institutes, industry, and government agencies in Scandinavia. The members covered all thematic areas within the programme. In 2019, the board was dissolved and replaced by a Portfolio board for climate and polar research. Some of the Programme board members from the POLARPROG programme and KLIMAFORSK programme were appointed to this board to ensure continuity.

The programme administration consisted of a programme coordinator assisted by personnel with scientific and administrative expertise. The administration has facilitated the implementation of the Programme board's decisions through the administrative operations of the programme.

3.5 Calls and allocations

KLIMAFORSK has allocated a total of NOK 1,368 billion to projects in the period 2014-2020.

Table 3.2 Overview of allocated budget to started projects per year, number of projects started and disbursed funding per year to active projects* Source: RCN

	2014	2015	2016	2017	2018	2019	2020	Sum
Total budget in started projects (NOK million)	286	261	145	207	75	166	227	**1 368**
Total number of started projects	51	59	44	45	33	29	35	**296**
Annual payments to active projects (NOK million)	55	139	190	189	159	147	170	**1** 048

* The total allocation is higher than the funding to KLIMAFORSK (NOK 1,062 billion in Table 3-1) because funding to KLIMAFORSK is per year, while funding to projects includes project costs into the future.

KLIMAFORSK funds have been allocated across 45 calls, some in collaboration with other programmes and some consisting of KLIMAFORSK funds only.

The main annual KLIMAFORSK call has been published in a cycle corresponding to the three scientific objectives: 1) natural and anthropogenic climate change (Climate system); 2) Impacts of climate

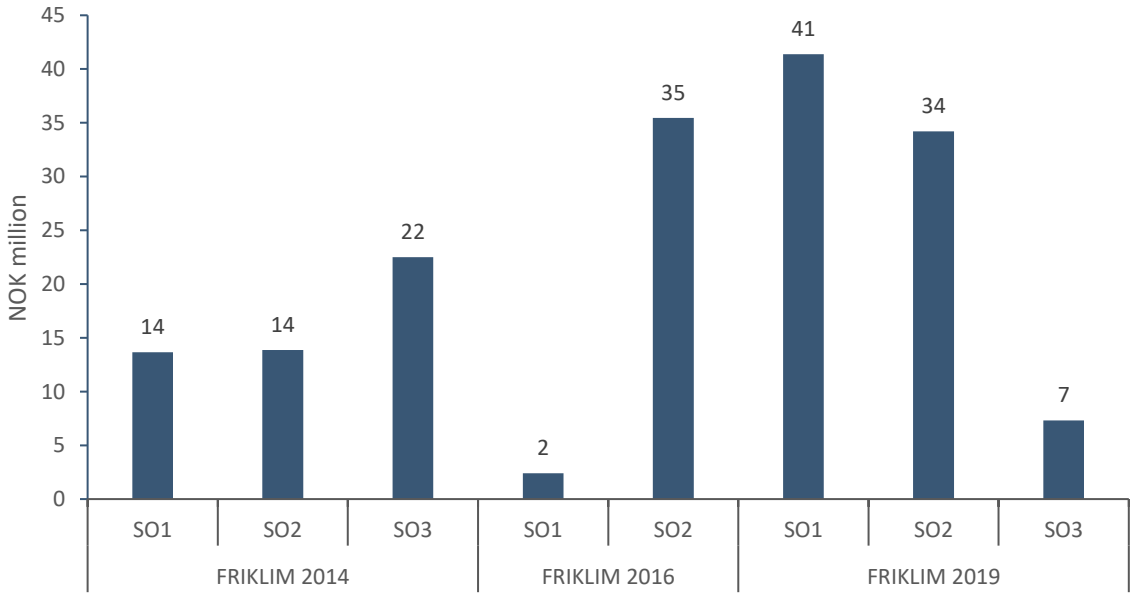
change on nature and society (Impacts); and 3) Transition to a low-emission society and adaptation to climate change (Transition). This cycle, shown in Figure 3.1, has been followed to provide predictability to the applicant communities. Remaining parts of the annual budget have been set aside and used in other relevant thematic calls and for international cooperation. In 2018 the main call cycle had completed two rounds (see Figure 3.1).

Figure 3.1 Cycle of annual main KLIMAFORSK calls in 2013-2020 with reference to the three scientific objectives

During the same period KLIMAFORSK has announced NOK 40 million funding for 'Free Climate Research' (FRIKLIM) three times, in 2014, 2016 and 2019 (in total NOK 120 million). FRIKLIM calls have covered all topics in the KLIMAFORSK work programme.

Figure 3.2 shows the funding to FRIKLIM-projects (2014-2020) sorted by the three scientific objectives. The total amount allocated to FRIKLIM Researcher Projects (NOK 170 million) is larger than the sum of NOK 120 million that was announced in these three calls, because other RCN budgets, earmarked to strengthen excellent projects (in 2014) and excellent projects and humanities (in 2019), have been used to fund additional FRIKLIM-proposals.

Figure 3.2 Funding in NOK million per scientific objective per FRIKLIM call. Source: RCN tagging system



In total 22 FRIKLIM projects (Researcher Projects) have been financed by KLIMAFORSK, and tagged with the scientific objectives as shown in Table 3.3.

Table 3.3 Number of FRIKLIM projects per scientific objective. Source: RCN

Scientific objective	Number of FRIKLIM projects
SO1 (Climate system)	6
SO1 + SO2 (Climate system + Impacts)	3
SO2 (Impacts)	8
SO2 + SO3 (Impacts + Transition)	1
SO3 (Transition)	4
Total	**22**

Collaboration with other programmes

KLIMAFORSK has collaborated extensively with other programmes, both nationally in the RCN and internationally, in order to respond to research needs, opportunities and policy priorities.

An example of an early and large collaborative call is the NOK 240 million “Ecosystem call" in 2014. Participating programmes were KLIMAFORSK, MARINFORSK, MILJØFORSK, and POLARPROG. Afterwards there has been a series of collaborative calls with all or some of the same programmes. The administrative follow-up of funded projects has been distributed between programmes after such collaborative calls. In 2016 KLIMAFORSK participated with eight other programmes in a collaborative call "BYFORSK". The call allocated NOK 71 million to projects that "promote cities as a solution arena for transition to a sustainable society". One of the six funded projects was administered as a KLIMAFORSK-project.

An example of another large collaborative call is the 2019 allocation of NOK 125 million for "Collaborative projects on research that will promote societal transformation in connection with climate change". The call was a combined effort where KLIMAFORSK engaged other funding budgets. The call aimed to generate more knowledge about Norway’s transformation towards a society with greenhouse gas emissions that meet national targets for 2030 and 2050, as well as the targets set out in the Paris Agreement. The purpose was also to provide greater insight into how Norway can best adapt to climate change. The call targeted proposals from social sciences, natural sciences and humanities that incorporated global, European, national and local perspectives with the aim of producing new knowledge of relevance for decision-making in society. Participating funding budgets were KLIMAFORSK (NOK 90 million), the Research Programme on Sustainable Innovation in Food and Bio-based Industries (BIONÆR) (NOK 20 million), the Europe in Transition programme (EUROPA) (NOK 5 million), the Programme on the Cultural Conditions Underlying Social Change (SAMKUL) (NOK 5 million) and the Research Programme on Societal Security and Safety (SAMRISK) (NOK 5 million). As no proposals met the objectives of the EUROPE programme, they withdrew from the call. Thus NOK 120 million was available for funding in the end. As a result of the call, 11 projects were funded, all of them administered as KLIMAFORSK-projects.

In recent years, the importance of understanding the connections and interdependence between climate and biodiversity and thus seeing climate and environmental problems as interrelated issues, has become increasingly clear. As a response, and since the "Ecosystem call" collaboration in 2014,

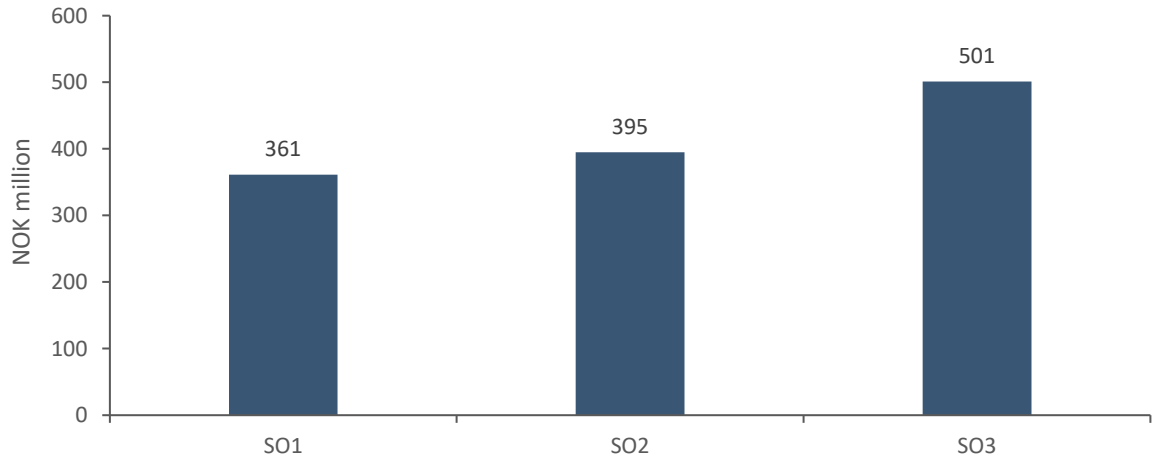
KLIMAFORSK has collaborated with the MILJØFORSK programme in seven calls. Another example of how KLIMAFORSK has responded to developing research needs and new opportunities is that, as the impact of climate change on health has gained increased attention, KLIMAFORSK has participated in the Belmont Forum call Climate, Environment and Health (see Chapter 5.3) and thus facilitated collaboration between climate- and health researchers.

Internationally, KLIMAFORSK has also participated in several collaborative calls in the framework of JPI Climate and other Belmont Forum calls.

KLIMAFORSK has also had smaller targeted calls, such as a special call in 2016 for researchers to write publications aimed at the IPCC's 2018 1.5 °C Special Report, and the call for "Knowledge platforms for climate policy instruments" (*Etablering av kunnskapsplattformer for klimapolitiske virkemidler)* in 2018. The latter was made possible as a result of the earmarked *Lavutlipp2030* funds that has been a priority from The Ministry of Climate and Environment to RCN each year from 2017. These funds have been allocated across relevant thematic programmes that contribute to furthering research and innovation on reducing emissions.

Figure 3.3 shows how the funds (2014-2020) to all KLIMAFORSK projects are divided between the three scientific objectives. The third scientific objective has received the most funding (NOK 501 million). This is partly explained by the fact that by 2020 there has been three main calls for the second and third objective, and two for the first objective (see Figure 3.3.1). In addition, 9 out of 21 Collaborative Projects are marked with the third objective. In comparison, the amount allocated to Researcher Projects is relatively even across the three scientific objectives, in the range NOK 337-343 million. See Chapter 3.6 for more details on Researcher and Collaborative Projects.

Figure 3.3 KLIMAFORSK-funding from all calls sorted by scientific objectives (SO).[6] Source: RCN tagging system.



[6] The figure does not include all funding under KLIMAFORSK, as some funding has not been marked with a scientific objective.

3.6 Types of projects funded

KLIMAFORSK has funded 296 projects, making use of seven different instruments; Researcher Projects (132), Collaborative Projects (researcher projects with user participation) (21), Communication and dissemination projects (24), Guest Research Scholarship, Scholarship for research stays abroad, Support for events and Other projects (91 in total). Researcher Projects and Collaborative Projects account for more than 95 percent of the allocated funds. Communication and dissemination projects have been supported in order to secure increased understanding of climate science in society and to facilitate research-based decisions in climate policy and administration.

Researcher Projects

KLIMAFORSK has funded 132 Researcher Projects. The general aim of Researcher Projects is to contribute to important new insights, scientific publication, researcher training and international research collaboration. This project type is used by the RCN to promote renewal and development in research across all disciplines and thematic areas.[7]

The Researcher Project type is also used for the Norwegian part of international projects under JPI Climate (19) and Belmont Forum (8). 68 Researcher Projects had been completed by September 2020.

The number of Researcher Projects initiated each year is given in Table 3.4. The number depends on the main call in the year prior, and other calls where KLIMAFORSK has invested funds, including international calls. Researcher Projects are in general marked with one or more of the scientific objectives, as described in Chapters 4.1.2, 4.2.2 and 4.3.2.[8]

Table 3.4 Number of Researcher Projects funded by KLIMAFORSK initiated per year. Source: RCN

Year	2014	2015	2016	2017	2018	2019	2020	Total
Number of Researcher Projects	31	30	17	24	6	13	11	**132**

The Researcher Projects have received on average NOK 8,4 million. Most of the projects lasted 3-4 years, but from 2019 a project period of up to six years may be granted. The largest grant for a single Researcher Project is NOK 43 million to the project 244647 SUSTAIN - Sustainable management of renewable resources in a changing environment: an integrated approach across ecosystems (2015-2020), led by University of Oslo. SUSTAIN was funded through the "Ecosystem call" in 2014.

Collaborative Projects

KLIMAFORSK has funded 21 Collaborative Projects[9] to generate more user participation in climate research (see Table 3.5). Collaborative projects are used by the RCN when the theme of a call best can

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[77] Researcher Project has undergone a standardization during the period. In 2019 RCN implemented a revision and standardization of its project types, in which Researcher Project and Collaborative Projects were clearly separated. Prior to 2019, Researcher Projects could have non-academic partners, most typically in project reference groups.

[8] Nine of the Researcher Projects are not marked with a scientific objective.

[9] During the KLIMAFORSK period these have had different names, such as Competence project and Collaborative and Knowledge-building Project.

be investigated through research projects with user participation, and further to increase the relevance of research and address important societal challenges. The projects are expected to stimulate and support collaboration between the research communities and those who represent the societal challenge for which funding is sought. Most of the Collaborative Projects have been financed under calls for scientific objective 2 and 3.

Table 3.5 KLIMAFORSK. Number of Collaborative projects initiated per year. *PLATON. Source: RCN

Year	2014	2015	2016	2017	2018	2019	2020	Total
Number of Collaborative Projects		4	1	2	3	(1*)	11	**21**

The design of the Collaboration Projects has undergone a revision in 2019, when the requirements for the user participation was standardized and the commitment of the user partners formalized. Since then, the use of this project type requires a minimum of two partners who represent the societal challenge. There are also requirements related to the partners' participation in the project. Prior to 2019, Collaboration projects were less standardized, but KLIMAFORSK had a requirement that the user partner(s) contributed 10 percent of the project cost, either by funding or by in-kind contributions.

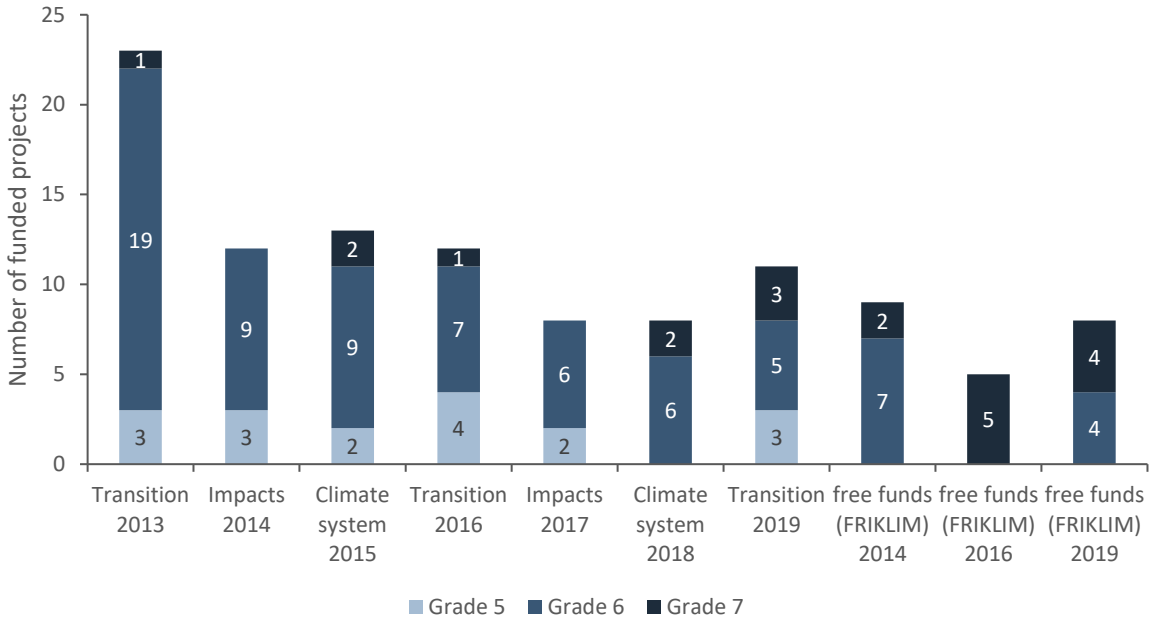
Ten of the Collaborative Projects have been completed as of September 2020. The projects have been funded with an average of NOK 12 million. The largest grant for a single Collaborative Project is NOK 48,5 million to the project 295789 PLATON - Knowledge platform for climate policy instruments (2019-2022), led by CICERO and Statistics Norway (SSB). PLATON is Norway's largest social science climate research project, and its objective is to help politicians and business work towards making Norway a low-emission society.

3.7 Marks

Applications for Researcher and Collaborative Projects to the RCN undergo peer review by a panel of experts (review committee) and receive marks based on a set of criteria. In 2019, the criteria were revised and reduced in number. Since then, three criteria are used: Research Quality / Excellence, Implementation, and Impact. The scale of marks ranges from 1 (Poor) through 2, 3, 4 and 5 to 6 (Excellent) and 7 (Exceptional). These marks are combined into an overall mark.

Figure 3.4 shows the marks for Researcher Projects on Research Quality / Excellence. The RCN rarely grants projects with marks lower than 6 or 7, but KLIMAFORSK (and other RCN programmes) have in some instances funded projects with mark 5 in order to cover earmarked topics that need to be developed and strengthened, or to secure projects with user involvement.

Figure 3.4 Number of KLIMAFORSK projects (Researcher/Collaborative projects) according to marks on the Research Quality/Excellence criterion, by call. Source: RCN[10]



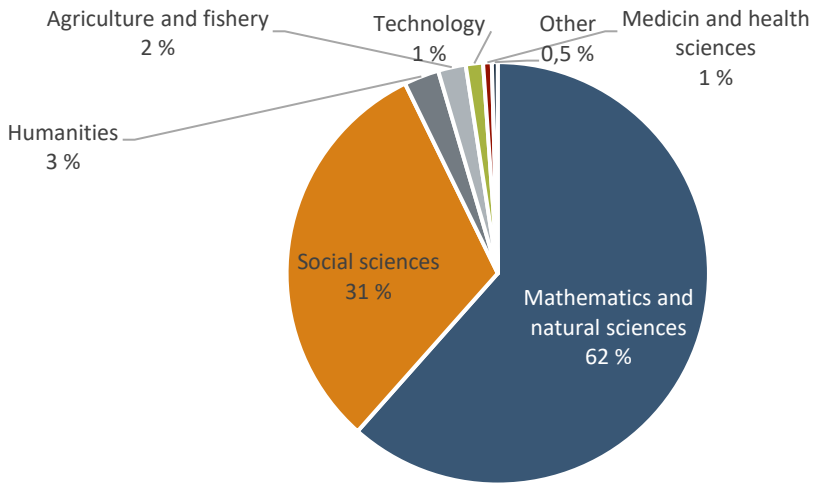
3.8 Disciplines involved in KLIMAFORSK projects

KLIMAFORSK has aimed to engage multiple disciplines in climate research to increase knowledge about the three scientific objectives set out in the work programme.

The RCN tagging system includes tags for seven discipline areas, with sub-disciplines. Figure 3.5 shows the total budget allocated in the years 2014-2020 and the amount of funds tagged per discipline area.[11] Projects marked with the discipline area "Mathematics and natural sciences" have received the largest share of funds, followed by projects in Social sciences.

[10] The figure does not include projects funded through international calls (i.e. JPI Climate, Belmont Forum), where the assessment and corresponding marks have been given outside RCN.
[11] Project funds can be tagged with several discipline areas.

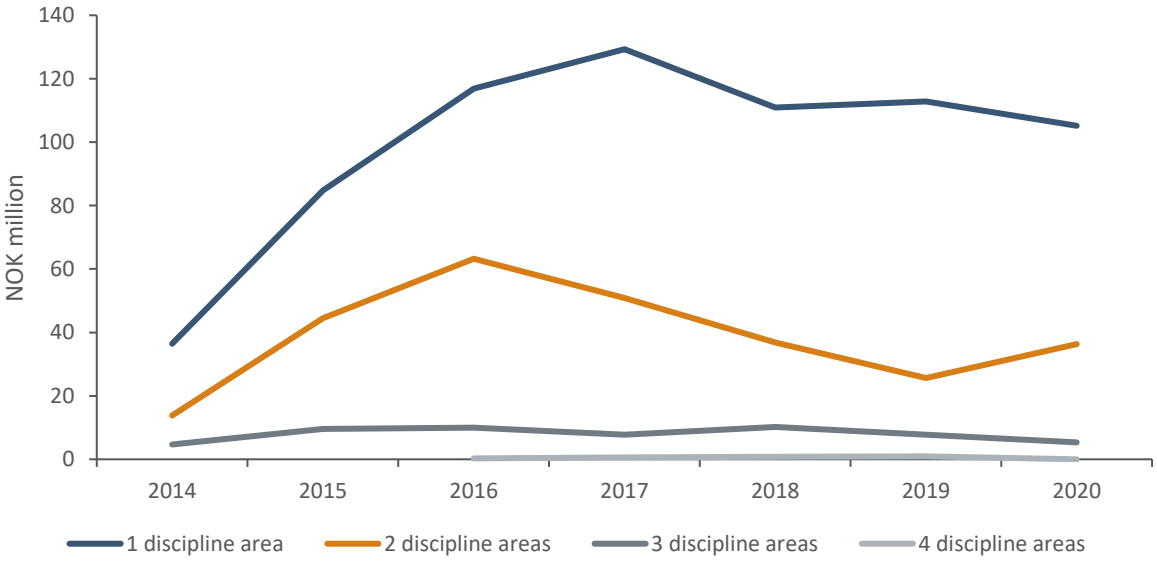
Figure 3.5 Distribution between the seven discipline areas of the total budget allocated to KLIMAFORSK projects started in 2014 or later. Source: RCN



The ambition to engage social sciences and the humanities has been operationalized by inviting this research specifically through several of the call texts. As a result, there has been an increase in research tagged with these discipline areas, from NOK 31 million in 2014 to NOK 71 million in 2020. Social sciences represent the bulk of the increase, while the funds tagged with humanities have increased from NOK 2,8 million in 2014 to NOK 3,6 million in 2020.

A project can be tagged with several discipline areas and associated subdisciplines. Figure 5.6 shows the total budget for projects that are tagged with 1, 2, 3 or 4 discipline areas.

Figure 3.6 Funds (NOK million) to KLIMAFORSK projects active in 2020 and number of discipline areas involved. Source: RCN



Most of the funds to active projects are related to one discipline area (72 percent in 2020), but projects with two or more discipline areas still make up a substantial part of the portfolio (28 percent in 2020).

The most common combination of discipline areas in these projects is Mathematics and natural sciences, and Social sciences. It is important to note that these numbers refer to discipline areas and not sub-disciplines. Thus, collaboration among sub-disciplines, for instance between geosciences and chemistry, is not shown here.

3.9 Previous analyses related to KLIMAFORSK

NIFU's (2016) analysis of the resource input for climate research in Norway in 2014 put KLIMAFORSK into a national perspective. Their analysis was based on a survey of the resource input to Norwegian climate research. Measured in expenditure, NIFU assessed (1) the resource input on climate research compared with other research areas, and (2) which sectors that were active within climate research. They found that the RCN covered around 30 percent of Norwegian climate research's total expenses in both the university and college sector and the institute sector, while it covered around six per cent of the climate-related research costs to the business community.

Since the start of KLIMAFORSK, the RCN itself has also carried out two portfolio analyses of climate research - one in 2017 and one in 2020. These analyses include an assessment of all relevant RCN programmes that target climate research, where KLIMAFORSK is one of several.

The portfolio analysis from 2017 refers to the Research Council's efforts and results, describes the national efforts on climate research and points to some challenges and opportunities (Forskningsrådet, 2017). Among relevant results highlighted is the development and operation of the Norwegian Earth System Model (NorESM), which has been further developed with Norwegian and international expertise, and which has formed the basis of more than 300 scientific articles.

The analysis further points out that calls have been tailored to strengthen the part of the portfolio aimed at societal restructuring, in line with the third scientific objective of KLIMAFORSK. One result of this effort is that the proportion of projects in the social sciences and humanities in KLIMAFORSK's project portfolio, increased from 23 per cent in 2013 to 30 per cent in 2016. Further, that new generations of climate researchers continue to be recruited to the field with the help of KLIMAFORSK funds. At the same time, the analysis shows that there is a need for strengthened efforts in several areas, including emission reduction technology for emission-intensive sectors such as agriculture and transport.

The portfolio analysis also points out that there is a need for «long-term money» in the field, for example in the form of long-term projects or centres to help maintain the intensity and knowledge development in the field. This is an important point in general in Norway's first Long-term plan for research and higher education presented in 2014 (Kunnskapsdepartementet, 2014), as well as in the revised long-term plan from 2018 (Kunnskapsdepartementet, 2018), which to an even greater extent emphasizes climate change as a key issue for Norway. The portfolio analysis from 2017 was part of the RCN's input to revise the long-term plan.

Since 2014, total funding for climate projects from the Research Council and the EU has increased from NOK 403 million to 792 million in 2020. Funding from the Research Council accounts for 81 percent

and from the EU 19 percent in 2020. During the period, the Research Council has increased funding for climate research from NOK 401 million to NOK 639 million. KLIMAFORSK and effort in research infrastructure (INFRASTRUKTUR) represents the largest funding budgets, followed by POLARPROG, FRINATEK and ENERGIX – but the total funding for climate research also includes grants from a large number of funding budgets. EU efforts stems from the entire Horizon 2020 with a centre of gravity in Horizon 2020 Societal Challenge 5 “Climate action, Environment, Resource Efficiency and Raw materials”, European Research Council and Research Infrastructures, including e-Infrastructures.

4 Evaluation of the scientific objectives

The main core of KLIMAFORSK is to fund and promote investigations that enhance our knowledge and understanding of the three scientific objectives natural and anthropogenic climate change (SO1), impacts of climate change on nature and society (SO2) and the transition to a low-emission society and adaptation to climate change (SO3). In this chapter, the Evaluation Committee evaluates whether these three objectives are achieved, based on the project portfolio, the project managers' lists of publications, project reporting to RCN, the bibliometric analysis, and stakeholders' perspectives.

4.1 Natural and anthropogenic climate change

4.1.1 Objective and research needs

KLIMAFORSK's first scientific objective is to increase knowledge about natural and anthropogenic climate change, hereon "climate system" (Research Council of Norway, 2019). The work programme identifies three research needs in order to achieve this objective:

1. Observations and process understanding
2. Climate variability and change
3. Modelling climate evolution at the global and national level

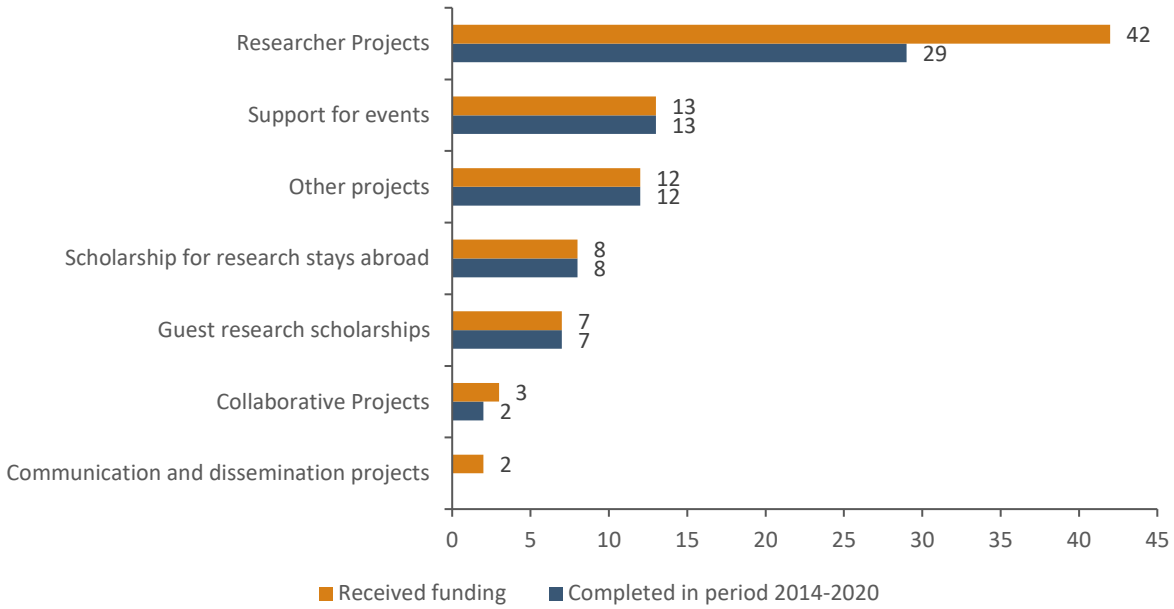
KLIMAFORSK's work programme (Research Council of Norway, 2019) does not state how this objective is to be achieved other than by primarily funding Researcher Projects.

4.1.2 Projects on climate system

KLIMAFORSK has granted NOK 343 million to 42 Researcher Projects on the climate system during the period 2014-2020 (see Figure 4.1).[12] Out of these, 29 projects had funding until 2020 and received in total NOK 226 million over the period 2014-2020. The remaining funds are budgeted for the period 2021-2024.

[12] *Several Researcher Projects are marked with more than one scientific objective. Out of the 42 Researcher Projects, 23 were only marked with the first scientific goal.*

Figure 4.1 Number of projects marked with first scientific objective that received funding in period 2014-2020 and were completed in the same period, by project type. Source: RCN



The majority (30) of the Researcher Projects selected for funding received an overall mark 6 (Excellent) by the referee panel, whereas some projects (6) received mark 7 (Exceptional) and one project mark 5 (Very good). Note that the data available does not include marks for projects that started in 2020.

There are also other project types that are marked with the first scientific objective in RCNs data, predominantly Support for events and Other projects. In total NOK 17 million has been allocated to these other project types, whereof 24 percent of the funding is marked Collaborative Projects. Most projects (except Researcher Projects) were completed in the period 2014-2020 (Figure 4.1).

In the period 2013-2020, two of the main annual KLIMAFORSK calls for projects have been for Researcher Projects on the climate system. In addition, Researcher Projects on the same scientific objective have been funded as part of the FRIKLIM calls, and as part of other collaborative calls where KLIMAFORSK has participated. Other KLIMAFORSK calls may also have contributed indirectly to research on the climate system, as model experiments and analysis of observational records and reanalysis data may form the basis both for research on climate change effects and adaptation.

4.1.3 Knowledge production in terms of publications and citations

The objective of "increased knowledge" has not been defined in the KLIMAFORSK work programme. However, scientific publications of high quality is one possible performance indicator for increased knowledge. High quality publications are also stated as one of the desired results of the programme in the programme logic model (Research Council of Norway, 2019). The bibliometric analysis presented in this evaluation report focuses on the number of scientific publications produced by KLIMAFORSK-funded projects, and their scientific impact measured in terms of number of citations. See Appendix D Bibliometric analysis for a discussion on the limits of using number of citations as a performance indicator.

The bibliometric analysis covers 498 scientific publications in the period 2014-2019.[13] More than half of these publications are within the three subject areas meteorology and atmospheric sciences (168), geosciences multidisciplinary (123) and environmental sciences (99). A publication may be attributed to more than one subject area which means that the sum of publication across subject areas is greater than 498. It is not possible to map subject areas directly onto the first scientific objective, but one can expect publications within the three abovementioned subject areas to contribute to knowledge on the climate system.[14] A number of publications have also been produced on oceanography (50) and physical geography (36), in addition to other subject areas that in part can be linked to climate systems. We do not know the content of the publications listed under the different subject areas, nor which publications stem from funding the first scientific objective.

Table 4.1 Publications from KLIMAFORSK published in the period 2014-2019. Categorized by subject area, number of publications, percentage cited, Category Normalized Citation Impact (CNCI), percentage international collaborators, percentage open access and share of articles with co-authorship between researchers and industry

Name	WoS Docs	% Cited	CNCI	% Int Collab	% OA	Indstr Collab
Total KLIMAFORSK-publications	*498*	*95*	*1,97*	*66*	*70*	*5*
METEOROLOGY & ATMOSPHERIC SCIENCES	168	98	2,02	77	73	1
GEOSCIENCES MULTIDISCIPLINARY	123	99	2,42	65	83	2
ENVIRONMENTAL SCIENCES	99	94	1,66	72	78	1
ECOLOGY	74	93	1,40	65	72	0
OCEANOGRAPHY	50	98	1,91	60	66	0
ENVIRONMENTAL STUDIES	46	87	1,76	54	61	1
GEOGRAPHY PHYSICAL	36	100	1,99	61	58	0
WATER RESOURCES	18	94	1,24	44	67	0
ECONOMICS	14	93	3,38	50	50	0
BIODIVERSITY CONSERVATION	13	100	2,43	77	85	0
GEOGRAPHY	11	91	1,60	55	73	0
MARINE & FRESHWATER BIOLOGY	11	91	1,51	55	45	0
PLANT SCIENCES	10	90	2,14	70	60	0
EVOLUTIONARY BIOLOGY	10	90	0,79	50	70	0
POLITICAL SCIENCE	9	100	2,46	44	89	0
GREEN & SUSTAINABLE SCIENCE & TECHNOLOGY	8	75	0,73	50	75	0
ZOOLOGY	7	100	1,36	43	57	0
INTERNATIONAL RELATIONS	6	100	3,01	50	100	0
FISHERIES	6	100	1,44	67	33	0
ENERGY & FUELS	6	100	1,34	50	67	1
REGIONAL & URBAN PLANNING	5	100	1,57	40	100	0
FORESTRY	5	100	1,23	40	40	0
TRANSPORTATION	5	60	0,50	40	100	0

The perceived relevance and contribution of the publications' knowledge production can be measured in terms of citations. An analysis of the publications' Category Normalized Citation Impact (CNCI) shows that KLIMAFORSK publications within the abovementioned subject areas are more cited than the

[13] The bibliometric analysis is done in InCites based on data from Web of Science. The publications subject areas are retrieved from Web of Science (WoS fields). One publication can be registered with more than one subject area. As described in Appendix D, publications within the social sciences and humanities (SSH), as well as in non-English-speaking journals, are not fully captured. This might make the bibliometric analysis less relevant for projects based in SSH. Whereas 90 percent of the publications from the total portfolio of projects were identified in WoS, the coverage for projects in the humanities and social sciences was 70 percent. See analysis of SSH-projects in Appendix D.

[14] As seen from the bibliometric analysis of KLIMAFORSK projects within humanities and social sciences, some of the publications within these subject areas likely touch on issues relating to the other scientific goals.

average citations within the same field. Publications within the subject area Geosciences Multidisciplinary are particularly recognized (CNCI=2,42).

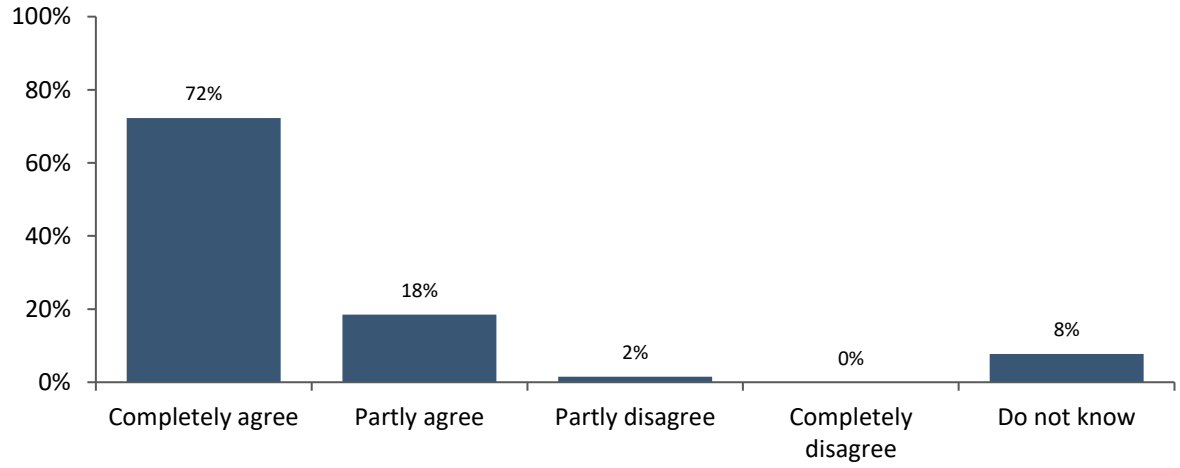
Another indicator on knowledge production, is the number of citations related to KLIMAFORSK funded projects as compared to other Norwegian research within the same subject area. In line with the finding for nearly all subject areas (see Appendix D), the KLIMAFORSK publications under the abovementioned subject areas (meteorology and atmospheric sciences, geosciences multidisciplinary, environmental sciences, oceanography and geography physical) have more citations than Norwegian research within the same subject area that are not funded by KLIMAFORSK. It has not been prioritized to establish a consistent international reference for the purpose of this evaluation.

As stated previously, the KLIMAFORSK programme model does not specify to whom the increased knowledge on climate systems should be available. Publications with open access are expected to reach a larger audience. Between 66-83 percent of the publications derived from KLIMAFORSK in the subject areas meteorology and atmospheric sciences, geosciences multidisciplinary, environmental sciences, oceanography and geography physical are available through open access. The highest percentage is found for geosciences multidisciplinary, which may have contributed to the high number of citations, whereas the lowest share is found for oceanography.

4.1.4 Stakeholders' perspective: Results from survey and interviews

The general perspective among stakeholders is that KLIMAFORSK has achieved the first scientific objective. The majority of survey respondents agree completely or partly to the statement that KLIMAFORSK has contributed to more knowledge about natural and anthropogenic climate change (see Figure 4.2). This holds regardless of stakeholder role (project leader, centre leader, public sector etc.). The five interviewees also agree completely with the abovementioned statement.

Figure 4.2 KLIMAFORSK gives more knowledge about natural and anthropogenic climate change. N=65. Source: Survey to stakeholders



Stakeholders describe KLIMAFORSK as having contributed to the fundamental understanding of the climate and how it reacts to human activity, including greenhouse gas emissions, air pollution,

management of soil areas and geoengineering. They describe this has having resulted in a long list of important scientific publications. Further, KLIMAFORSK is described as contributing to interdisciplinary projects on topics where research was lacking, such as on interactions between climate and hydrology.

KLIMAFORSK has been a main funder of the Norwegian Earth System Model (NorESM-model). The knowledge produced from the NorESM-model is highlighted by several stakeholders. According to an interviewee, funding for this model has allowed for both development, improvements, test-runs and production of data and analysis. This work has also resulted in Norwegian contributions to the IPCC. The importance of these contributions to IPCC are highlighted by several stakeholders. In addition, having world leading researchers on a topic, in this case the climate system, is claimed by one stakeholder to have intrinsic value.

The perceived success of the programme in achieving the first scientific objective is by several interviewees seen in the context of a strong, pre-existing research community. The research community on climate system is described as well-established and highly recognized both nationally and internationally, also prior to KLIMAFORSK. As one interviewee puts it, Norway has “world class researchers” on climate research, and the climate system in particular, whereby grants to these will, and have, contributed to expanding the research front.

There are mixed views with regards to how the first scientific objective has and should have been prioritized compared to the two other objectives. Several stakeholders express the need for more knowledge on how the climate system works. One states that a lot of resources are spent on exploring the climate system using imperfect models and underlines the need for continued funding to improve existing models. Others question to what extent more knowledge about the climate system is necessary, particularly when it comes at the expense of the two other scientific objectives. There is also a worry by some that there has been too much focus on the NorESM-model. One stakeholder states that the RCN should have focused less on requiring researchers to use the abovementioned model, when receiving grants, as this limited researchers.

4.1.5 Assessment of first scientific objective

The portfolio of funded projects spans the programme research needs (section 4.1.1) well and focus to a large degree on climate system processes and earth system components of strategic relevance or concern to Norway. The funded research projects demonstrate the expected integration of climate data and climate prediction capacity in pursuing open research questions related to climate variability and change. The Evaluation Committee finds that there is an adequate focus on past, present and future climate.

It is found that individual research projects dare to challenge established as well as emerging paradigms which is positive. A number of publications in high impact journals can be connected to the funding, but it is less clear if these includes the primary project findings.

The bibliometric analysis reveals that some subject areas contribute relatively minor to the published research from KLIMAFORSK. Considering the critical role of the ocean in the climate system, for climate

variability, skillful predictions and projections, it is particularly concerning that an area like oceanography only contains 50 publications. This is less than one third of publications within meteorology and atmospheric sciences. The Evaluation Committee notes that other funding programmes likely make up for this research need at the national level.

In line with the previous portfolio analysis (Forskningsrådet, 2017), the Evaluation Committee emphasizes that the further development, application and consolidation of the Norwegian Earth System Model (NorESM) is a key element in achieving the first (and second) scientific objective. These efforts ensure a strong Norwegian contribution to Coupled Model Intercomparison Project Phase 6 - CMIP6 (and in turn the Sixth Assessment Report - AR6), constitute a central infrastructure for also future climate research and will be an asset for successful recruitment of the next generation of climate researchers.

4.2 The impacts of climate change on nature and society

4.2.1 Objective and research needs

KLIMAFORSK's second scientific objective is to increase knowledge about the impacts of climate change on nature and society (Research Council of Norway, 2019). The work programme identifies four research needs in order to achieve this:

1. Impacts of climate change on the physical and chemical environment
2. Impacts of climate change on ecosystems
3. Interactions between drivers and feedback effects on the climate system
4. The consequences of climate change for infrastructure, trade and industry and living conditions

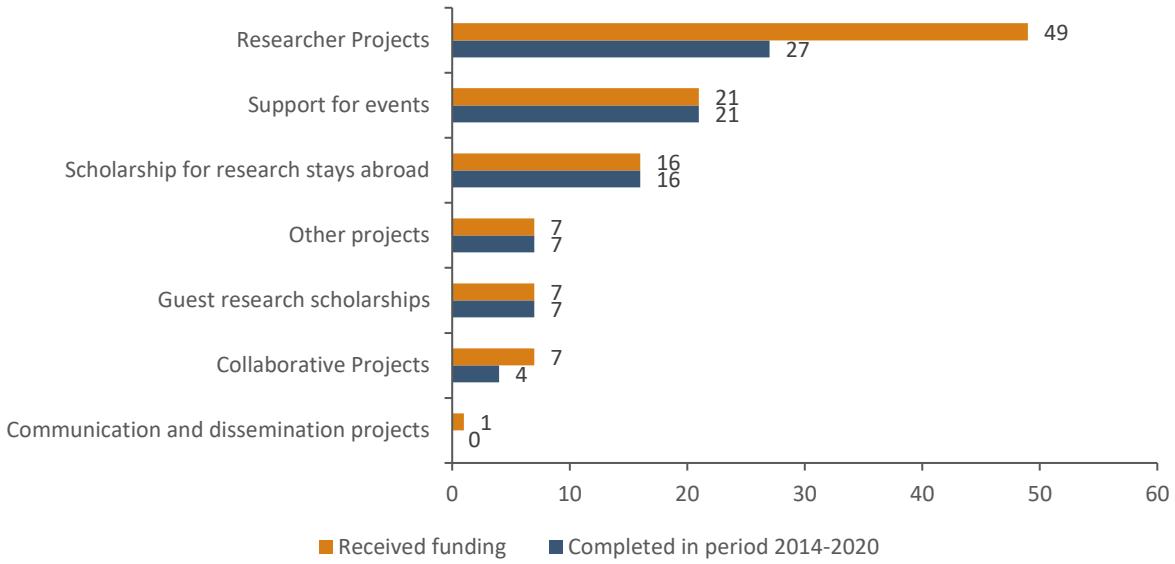
KLIMAFORSK's work programme (Research Council of Norway, 2019) does not state how this objective is to be achieved other than by primarily funding Researcher Projects.

4.2.2 Projects on impacts

KLIMAFORSK has granted NOK 342 million to 49 Researcher Projects on the impacts of climate change during the period 2014-2020 (see Figure 4.3). [15] Out of these, 27 projects had funding until 2020 and received in total NOK 176 million over the period 2014-2020. The remaining funds are budgeted for the period 2021-2024.

[15] *Several Researcher projects are marked with more than one scientific objective. Out of the 49 Researcher projects, 29 were only marked with the second scientific goal.*

Figure 4.3 Number of projects marked with second scientific objective that received funding in period 2014-2020 and were completed in the same period, by project type. Source: RCN



Around two-thirds (31) of the Researcher Projects selected for funding received an overall mark 6 (Excellent) by the panel of experts, whereas the remaining projects received mark 7 (Exceptional) (9) or mark 5 (Very good) (6). Note that the data available does not include marks for projects that started in 2020.

There are also other project types that are marked with the second scientific objective in RCNs data, predominantly Collaborative Projects, Support for events, and Personal scholarships. In total NOK 52 million has been allocated to these other project types, whereof 86 percent of the funding is marked Collaborative Projects. Most projects (excepting Researcher Projects) were completed in the period 2014-2020.

In the period 2013-2020, three of the main annual KLIMAFORSK calls for projects have been for Researcher Projects on the impacts of climate change on nature and society. In addition, research projects on the same scientific objectives have been funded as part of the FRIKLIM calls and as part of collaborative calls where KLIMAFORSK has participated.

4.2.3 Knowledge production in terms of publications and citations

Increased knowledge on impacts of climate change is here captured in terms of number of scientific publications produced by KLIMAFORSK-funded projects in the period 2014-2019, and the quality of these, measured in terms of number of citations.[16]

[16] *See chapter 4.1.3 for a short introduction on why number of scientific publications and number of citations are used as indicators of knowledge production.*

The bibliometric analysis covers 498 scientific publications in the period 2014-2019 (ref. chapter 4.1.3).[17] Again, we do not know the content of the publications listed under the different subject areas, nor which publications stem from funding the second scientific objective. Apart from publications within some subject areas (such as meteorology and atmospheric sciences) publications within all subject areas could have resulted in increased knowledge on the impact of climate change on nature and/or society. Notably KLIMAFORSK has resulted in a few but high-quality publications, as measured by CNCI, within a diverse range of subject areas, including economics, international relations, plant sciences and biodiversity conservation.

Table 4.2 Publications from KLIMAFORSK published in the period 2014-2019. Categorized by subject area, number of publications, percentage cited, Category Normalized Citation Impact (CNCI), percentage international collaborators, percentage open access and share of articles with co-authorship between researchers and industry. Source: RCN

Name	WoS Docs	% Cited	CNCI	% Int Collab	% OA	Indstr Collab
Total KLIMAFORSK-publications	*498*	*95*	*1,97*	*66*	*70*	*5*
METEOROLOGY & ATMOSPHERIC SCIENCES	168	98	2,02	77	73	1
GEOSCIENCES MULTIDISCIPLINARY	123	99	2,42	65	83	2
ENVIRONMENTAL SCIENCES	99	94	1,66	72	78	1
ECOLOGY	74	93	1,40	65	72	0
OCEANOGRAPHY	50	98	1,91	60	66	0
ENVIRONMENTAL STUDIES	46	87	1,76	54	61	1
GEOGRAPHY PHYSICAL	36	100	1,99	61	58	0
WATER RESOURCES	18	94	1,24	44	67	0
ECONOMICS	14	93	3,38	50	50	0
BIODIVERSITY CONSERVATION	13	100	2,43	77	85	0
GEOGRAPHY	11	91	1,60	55	73	0
MARINE & FRESHWATER BIOLOGY	11	91	1,51	55	45	0
PLANT SCIENCES	10	90	2,14	70	60	0
EVOLUTIONARY BIOLOGY	10	90	0,79	50	70	0
POLITICAL SCIENCE	9	100	2,46	44	89	0
GREEN & SUSTAINABLE SCIENCE & TECHNOLOGY	8	75	0,73	50	75	0
ZOOLOGY	7	100	1,36	43	57	0
INTERNATIONAL RELATIONS	6	100	3,01	50	100	0
FISHERIES	6	100	1,44	67	33	0
ENERGY & FUELS	6	100	1,34	50	67	1
REGIONAL & URBAN PLANNING	5	100	1,57	40	100	0
FORESTRY	5	100	1,23	40	40	0
TRANSPORTATION	5	60	0,50	40	100	0

With the exception of some subject areas (water resources, evolutionary biology and geography) the KLIMAFORSK publications have received more citations than publications by Norwegian research not funded by KLIMAFORSK, within the same subject area.

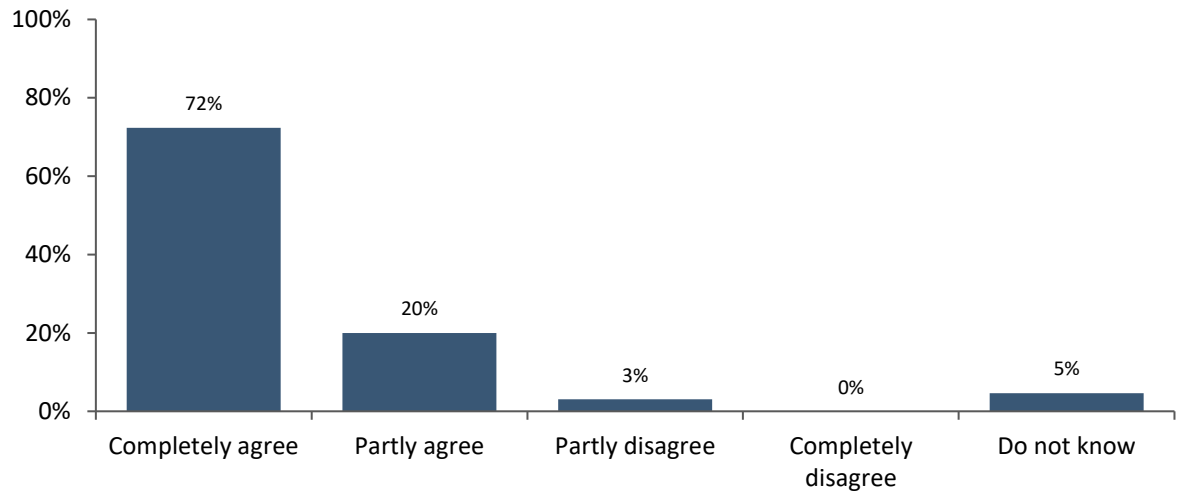
[17] The bibliometric analysis is done in InCites based on data from Web of Science. The publications subject areas are retrieved from Web of Science (WoS fields). One publication can be registered with more than one subject area. As described in Appendix D, publications within humanities and social sciences, as well as in non-English-speaking journals, are not fully captured. The former may result in an underestimation of the number of publications on the impact of climate change on society in particular.

Between 33 and 100 percent of the publications derived from KLIMAFORSK are available through open access. The highest percentage is found for international relations, regional and urban planning and transportation, whereas the lowest share is found for fisheries.

4.2.4 Stakeholders' perspective: Results from survey and interviews

According to the stakeholders, the programme has largely been successful in achieving the second scientific objective. As seen from Figure 4.4, 92 percent of the survey respondents agree completely or partly to the statement that KLIMAFORSK gives more knowledge on the impacts of climate change on nature and society. The five interviewees all agree completely to the same statement.

Figure 4.4 KLIMAFORSK gives more knowledge on the impacts of climate change on nature and society. N=65. Source: Survey to stakeholders



KLIMAFORSK is perceived to have contributed to knowledge production on the consequences of climate change on nature and society, particularly in recent years. According to one interviewee, this is manifested through more emphasis on nature in syntheses on the impacts of climate change. Several stakeholders stress KLIMAFORSK's role in increasing knowledge production on ecosystems and vegetation, such as the impact of extreme weather events. KLIMAFORSK has also contributed to activities in the Norwegian Centre for Climate Services, which has produced reports and products targeting among other municipalities. Results on climate effects stemming from KLIMAFORSK are, according to one stakeholder, now basis for amongst other municipal planning, thus also speaking to the third scientific objective. Others emphasize KLIMAFORSK's contribution to understanding the impacts of climate change on feedback effects between land and sea.

The abovementioned topics are also highlighted as topics in need of more knowledge. For instance, one stakeholder calls for more knowledge on the impacts of climate change on sea and biodiversity. Others point at a knowledge gap on the effects of combined events, such as extreme weather in combination with strong winds and low pressure. There is also a perceived gap relating to the interactions between nature and society. One stakeholder stresses the need for more knowledge on

among other socio-ecological systems and nature-based solutions. Another stakeholder pinpoints the need for more sector-specific knowledge on the impacts of climate change.

There are mixed perspectives on to what extent KLIMAFORSK has favored projects focusing on nature, as opposed to society. Some stakeholders claim that KLIMAFORSK has favored projects on nature, whereas others claim the opposite.

4.2.5 Assessment of second scientific objective

This second scientific objective and identified research needs has a broad and interdisciplinary scope. The complexity makes it challenging to achieve this objective and to evaluate whether the objective is reached, and it only makes sense to apply to the portfolio of projects funded across individual calls. Even here, it will be possible to identify important areas of society and livelihood, of trade, industry and infrastructure that are not adequately covered from a perspective of understanding the consequences and impacts of climate change (past present and future). This is particularly true also for nature, biota and ecosystem functioning. The Evaluation Committee still finds that the granted projects represent an impressive diversity of research into impacts of climate change at high international standards. There is an expected focus on Norway and Norwegian interests but not exclusively. In particular contribution to development of climate services (data) serves to implement a number of the structural objectives, particularly the fifth.

The Evaluation Committee notes a satisfactory number of publications on the subject areas environmental sciences (interdisciplinary) and ecology rank. If depicting a cascade of knowledge from the physical basis into other disciplines, it is noteworthy that even relatively distant fields still seem to contain a critical level of research. There are fewer publications on the subject areas fisheries and forestry, despite societal needs for more research on these topics. The stakeholder survey does however indicate that KLIMAFORSK has been instrumental in generating research in important areas with lack of knowledge, for example on the interplay between climate and hydrology.

The Evaluation Committee finds strong examples of projects exploring the interaction between human activities and nature.

While no specific analysis has been available with regards to the extent to which the consequences of climate change for infrastructure, trade and industry and living conditions were part of the project portfolio funded under the second scientific objective, an overview of the project list indicated that only a minor share of the projects addressed infrastructure, industry and living conditions. The Evaluation Committee notes that only a few of the funded projects included social science research perspectives and competencies and agrees with the comment from one of the stakeholders, that more sector-specific impact studies would be needed.

There are indications also from the survey that the strong focus on NorESM has biased research towards large-scale (global) climate variability and coupled climate systems processes on the expense of a similar strong effort on regional modelling and impacts.

4.3 Transition to a low-emission society and adaptation to climate change

4.3.1 Objective and research needs

KLIMAFORSK's third scientific objective is to increase knowledge about transition to a low-emission society and climate change adaptation. The work programme (Research Council of Norway, 2019) identifies four research needs in order to achieve this:

1. Questions relating to both mitigation and adaptation
2. Questions relating to reducing GHG emissions and increasing carbon sequestration
3. Questions relating to adaptation
4. Questions relating to interactions between mitigation and adaptation

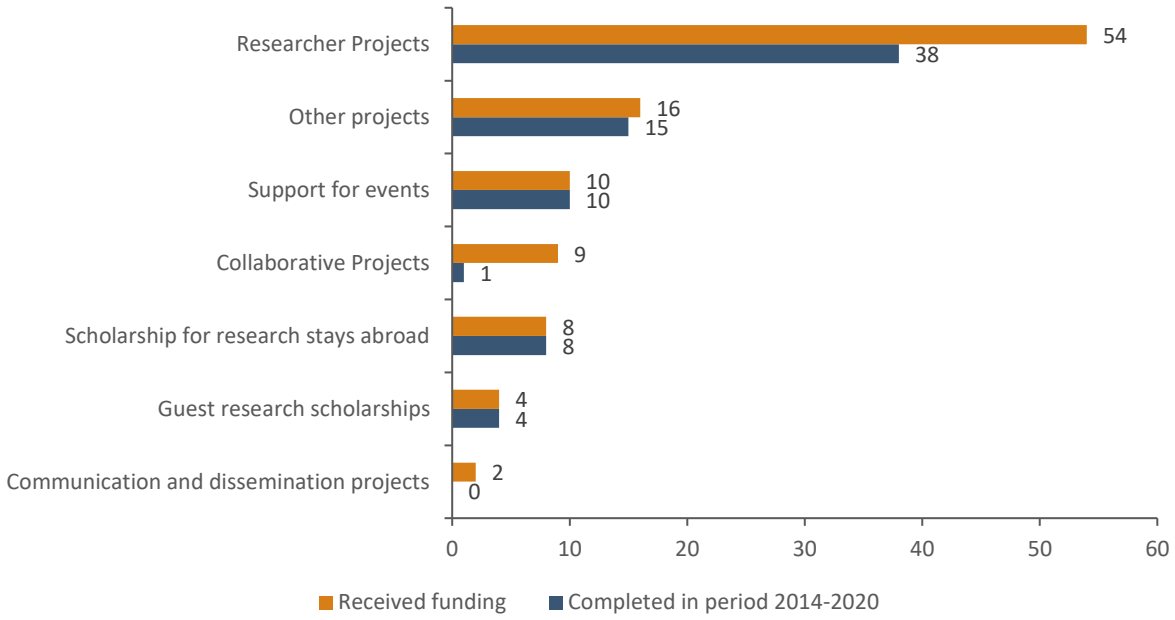
KLIMAFORSK's work programme (Research Council of Norway, 2019) does not state how this objective is to be achieved other than by primarily funding Researcher Projects.

4.3.2 Projects on societal transition

KLIMAFORSK has granted NOK 337 million to 54 Researcher Projects on transition to a low-emission society and adaptation to climate change during the period 2014-2020 (see Figure 4.5).[18] Out of these, 38 projects had funding until 2020 and received in total NOK 225 over the period 2014-2020. The remaining funds are budgeted for the period 2021-2024.

[18] *Several Researcher projects are marked with more than one scientific objective. Out of the 54 Researcher projects, 42 were only marked with the third scientific goal.*

Figure 4.5 Number of projects marked with third scientific objective that received funding in period 2014-2020 and were completed in the same period, by project type. Source: RCN



Around 80 percent (43) of the Researcher Projects received an overall mark 6 (Excellent) by the panel of experts, whereas the remaining projects received mark 7 (Exceptional) (5) or mark 5 (Very Good) (6).[19]

There are also other project types that are marked with the third scientific objective in RCNs data, predominantly Collaborative Projects. In total NOK 164 million has been allocated to these other project types, whereof 60 percent of the funding is marked Collaborative Projects. Most projects, excepting Researcher Projects, were completed in the period 2014-2020.

In the period 2013-2020 three of the main annual KLIMAFORSK calls have been for Researcher Projects and Collaborative Projects on the Low-Emission Society and Adaptation to Climate Change scientific objective. In addition, Researcher Projects on the same scientific objective have been accepted as part of the FRIKLIM calls, and as part of other collaborative calls where KLIMAFORSK has participated.

4.3.3 Knowledge production in terms of publications and citations

Increased knowledge on societal transition (both related to climate mitigation and adaptation) is here captured in terms of number of publications produced by KLIMAFORSK-funded projects in the period 2014-2019, and the quality of these, measured in terms of number of citations.[20]

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[19] All projects marked with the third scientific objective in the RCN data are recorded with a mark, including the one project with 2020 as first year of funding.

[20] See chapter 4.1.3 for a short introduction on why number of scientific publications and number of citations are used as indicators of knowledge production.

With the exception of publications within some subject areas (such as meteorology and atmospheric sciences) publications within all subject areas entering into the bibliometric analysis shown in Table 4.1 could have resulted in increased knowledge relevant to the third scientific objective.

Publications within humanities and social sciences are likely to be particularly relevant to the second and third scientific objectives. KLIMAFORSK projects that are tagged (in the RCN tagging system) with humanities and social sciences (46 projects in total) have resulted in 162 publications in the period 2014-2019. 114 of these publications were found in WoS and entered into a separate bibliometric analysis, shown in Table 4.3.[21] These 114 publications are a subset of the 498 publications analysed above. As previously mentioned, publications within economics, international relations and political science stand out in terms of CNCI score.

Table 4.3 Publications in the period 2014-2019 under KLIMAFORSK projects within humanities and social sciences. Categorized by subject area, number of publications, percentage cited, Category Normalized Citation Impact (CNCI), percentage international collaborators, percentage open access and share of articles with co-authorship between researchers and industry. Source: RCN

Research field	WoS Docs	% Docs Cited	CNCI	Top 10%	% Int Collab	% OA	Indust Collab
Dataset Baseline	114	88	2,15	26	55	63	1
ENVIRONMENTAL SCIENCES	39	92	1,62	21	56	62	0
ENVIRONMENTAL STUDIES	33	85	1,61	15	48	61	0
METEOROLOGY & ATMOSPHERIC SCIENCES	24	92	1,90	29	63	58	0
ECONOMICS	14	93	3,41	36	50	50	0
GEOSCIENCES, MULTIDISCIPLINARY	13	100	3,76	38	62	77	0
GEOGRAPHY	10	90	1,64	20	60	80	0
POLITICAL SCIENCE	8	100	2,58	38	50	88	0
GREEN & SUSTAINABLE SCIENCE & TECHNOLOGY	7	86	0,82	14	43	71	0
ENERGY & FUELS	6	100	1,38	17	50	67	1
WATER RESOURCES	6	100	1,50	17	17	67	0
INTERNATIONAL RELATIONS	5	100	3,20	60	60	100	0
REGIONAL & URBAN PLANNING	5	100	1,52	20	40	100	0
TRANSPORTATION	5	60	0,53	0	40	100	0
other	47						

While the total number of publications and other outputs per project might of course have increased after the project reporting, this information is not available for this evaluation.

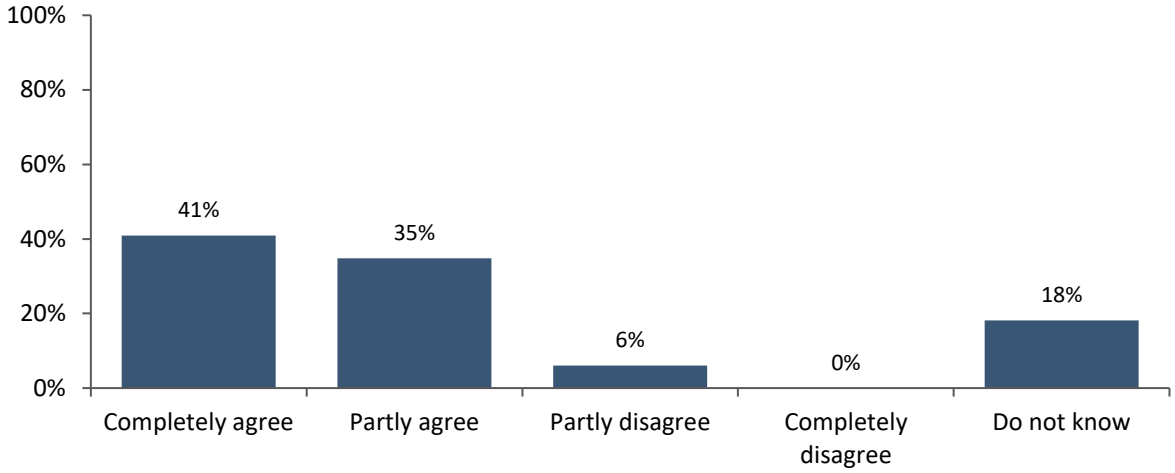
4.3.4 Stakeholders' perspective: Results from survey and interviews

As opposed to the two other scientific objectives, a higher share of respondents only 'partly agreed' with the statement that KLIMAFORSK has contributed to more knowledge production on societal transition. As shown in Figure 4.6, 41 percent agree completely with the statement that KLIMAFORSK has resulted in more knowledge, whereas 35 are partly in agreement. Over one-fifth of the respondents (18 percent) are not sure, whereas the remaining six percent disagree partly. The five

[21] *The database used for the bibliometric analysis, Web of Science, has some limitations in its coverage of humanities and social sciences, especially regarding book-publications and non-English journals. In the present case, the coverage is 70 percent. The results of the bibliometric analysis are expected to be representative for the actual scientific production of projects and disciplines that publish most of their work in English language journals, but less robust for projects and disciplines that communicate through book-publications and/or non-English languages.*

interviewees also have mixed opinions on whether KLIMAFORSK has achieved the third scientific objective.[22]

Figure 4.6 KLIMAFORSK gives more knowledge on the transition to low – emission society and adaptation to climate change N=65. Source: Survey to stakeholders



One interviewee describes KLIMAFORSK as a pioneer programme internationally in including humanities and social sciences into nationally financed climate research projects. The interdisciplinary success of KLIMAFORSK is underlined by a couple of stakeholders.

On the other hand, several stakeholders comment on the need for more climate research from the abovementioned disciplines, for example from economics. One highlights the need for more knowledge on the consequences of choices taken in society, choices often taken within a short time span in for instance the public sector.

Several stakeholders call for more cooperation between KLIMAFORSK and the RCN programme for energy (ENERGIX). Others note that sector-specific adaptation, for instance related to energy (use) and maritime issues was primarily captured through other programmes, such as ENERGIX and maritime programmes.

4.3.5 Assessment of third scientific objective

Based on the bibliometric analysis, the reported outputs from finalised projects as well as the conducted surveys and interviews, the Evaluation Committee concludes that KLIMAFORSK has increased the knowledge on 'Transition to a Low-Emission Society and Adaptation to Climate Change'. Both adaptation and mitigation research are represented in the project portfolio, although fewer projects are focused on adaptation. This is probably due to the fact that one of the three calls related to the third scientific objective was directed entirely to low-emission society. Furthermore, projects that integrate adaptation and mitigation (research need 1 and 4) appear to be scarce. The three targeted calls on societal transitions have increased the share of work within humanities and social

[22] *Helt enig, Delvis enig, Helt enig, helt enig, delvis uenig*

sciences. In addition, five out of 22 FRIKLIM projects financed by KLIMAFORSK are marked with the third scientific objective.

Publications within the disciplines humanities and social sciences are likely to be relevant for the third scientific objective. While the bibliometric analysis does not allow for a precise linkage between number of projects funded in the scientific objective 3 and associated publications, results show that publications within most areas relevant to this scientific objective, are above average citation (CNCI).

The Evaluation Committee agrees that opportunities that increased collaboration with other relevant programmes e.g. ENERGIX and a higher share of projects that include an economic focus, as suggested amongst stakeholders, would be beneficial for enhancing the knowledge base for the climate transition.

5 Evaluation of the structural objectives

The Evaluation Committee's assessment of the structural objectives is based on a description of activities undertaken by KLIMAFORSK, written by RCN, stakeholders' perspectives from survey and interviews and the project portfolio.

5.1 Promote cooperation and task distribution in climate research

5.1.1 Objective

KLIMAFORSK's first structural objective is to promote cooperation and task distribution in climate research.

According to the work programme (Research Council of Norway, 2019), the objective of cooperation and task distribution refers to both national and international climate research. The ability to influence cooperation and task distribution is expected to be particularly strong for RCN's own programmes. For international call collaboration, see chapter 5.3.

The work programme for KLIMAFORSK (Research Council of Norway, 2019) identifies coordinated calls as an indicator for degree of cooperation and task distribution in climate research. The objective is not quantified or further specified. In addition, publications stemming from the combined effort of KLIMAFORSK and other programme(s), the number of PhDs within KLIMAFORSKs scientific objectives financed by other programmes, new research networks and collaborative constellations with other disciplines, subject areas and research sectors are considered relevant indicators in the work programme.

5.1.2 Activities undertaken by KLIMAFORSK

KLIMAFORSK has been a driving force for collaborative calls within the RCN. The KLIMAFORSK administration and Programme board has worked for annual coordinated calls with climate as an integrated theme since the experience with the "Ecosystem call" of NOK 240 million in 2014, where KLIMAFORSK collaborated with the programmes MARINFORSK, MILJØFORSK and POLARPROG (see Chapter 3.5 for more details). This has been possible because the climate challenges concern most sectors, administrative areas, management levels and industries, and the knowledge needs concern several disciplines and thematic areas. Of the 45 calls KLIMAFORSK has arranged or participated in, 15 calls are in collaboration with other programmes. Eight of the collaborative calls involve other RCN programmes, whereas the remaining seven are international calls.

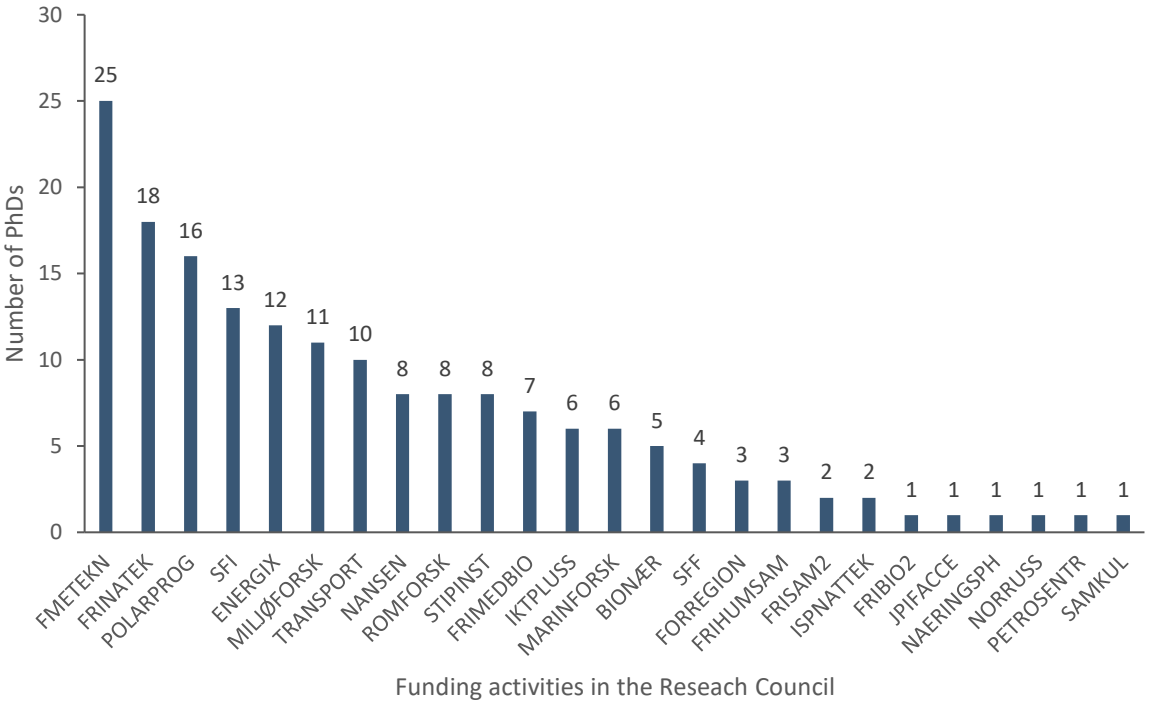
To promote cooperation in climate research, KLIMAFORSK has sought to strengthen the research system by allocating funds to large nationally coordinated projects. Table 5.1 gives examples of four such projects.

Table 5.1 Examples of large nationally coordinated projects. Source: RCN

Project number	Project title (duration)	Scientific Objective	Number of project partners (NO/foreign)	Funds allocated (million NOK)
229771	Earth system modelling of climate Variations in the Anthropocene (2014-2018)	Climate system	6/0	50 058
295789	PLATON - Knowledge platform for climate policy instruments (2019-2023)	Transition	21/4	48 500
244647	SUSTAIN - Sustainable management of renewable resources in a changing environment: an integrated approach across ecosystems (2015-2020)	Impacts	7/6	42 944
294948	EMERALD - Terrestrial ecosystem climate interactions of our EMERALD planet (2019-2023)	Climate system	7/1	29 992

Through collaborative calls and internal cooperation in the RCN with other programmes of relevance to climate research, KLIMAFORSK has worked to develop a portfolio mindset in climate research. The number of PhDs within KLIMAFORSK's topics that are funded by other programmes is an indicator of whether this has been successful. Since 2014, the RCN has registered 173 PhD fellows in projects marked with the topic "Climate", under programmes other than KLIMAFORSK (see Figure 5.1). In comparison, KLIMAFORSK itself has financed 66 PhD fellows, see chapter 5.4.2. A total of 25 programmes have tagged projects with the "Climate" topic. Seven programmes have ten or more doctoral candidates in projects marked with "Climate". These are the Centers for Environmentally Friendly Energy (FMETEKN) and Free Project Support (FRIPRO / FRINATEK), the Polar Programme (POLARPROG), Centers for Research-based Innovation (SFI), and the programmes for energy, environment, and transport research (ENERGIX, MILJØFORSK and TRANSPORT).

Figure 5.1 Number of PhDs in all RCN funding activities marked with the research topic "Climate" in the period 2014-2020. Source: RCN



5.1.3 Stakeholders' perspective: Results from survey and interviews

Survey respondents and interviewees that are or have been part of KLIMAFORSK's Programme board or RCNs administration have been asked whether the collaboration between KLIMAFORSK and other national and international programmes has contributed to climate research.

Several of these stakeholders acknowledge the administration's success in achieving collaborative calls with other RCN programmes. One stakeholder argues that collaboration between programmes is particularly important for climate research. Climate is relevant for almost all RCN programmes yet failure to cooperate may result in topics "falling between chairs". The administration's forward leaning and innovative work has resulted in collaborative calls on topics that would not have been covered otherwise. The stakeholders highlight in particular the collaborations with the polar and environmental programmes (POLARPROG and MILJØFORSK) as successful.

This evaluation is tasked specifically to consider cooperation with environmental research. A few survey respondents have responded to the question of whether there has been a good and appropriate connection to environmental research. These largely state that the collaboration between climate and environmental research has been good, referring among other to collaborative calls with MILJØFORSK, and with BIONÆR in recent years. One stakeholder comments that the connection was limited yet acknowledges that this may still have been appropriate.

5.1.4 Assessment of the first structural objective

The Evaluation Committee finds that KLIMAFORSK has promoted cooperation and task distribution in climate research. KLIMAFORSK has worked actively for increased collaborations, division of labour and concentration within the national research landscape. The committee finds that the programme has succeeded in making collaborative constellations (15 out of 45 calls are collaborative) and expanded the scope of climate research. The programme has achieved a large number of collaborative calls with other RCN programmes. The number of PhDs with the research topic "Climate" in all RCN funding activities, excluding KLIMAFORSK, is almost three times the number of PhDs under KLIMAFORSK. Projects with two or more discipline areas make up a substantial part of the portfolio (28 percent in 2020). However, most of the funds allocated to active projects in 2020 are still related to one broad discipline area (72 percent in 2020) (e.g. "Mathematics and natural sciences").

5.2 Encourage boldness in scientific thinking and scientific innovation in projects

5.2.1 Objective

KLIMAFORSK's second structural objective is to encourage boldness in scientific thinking and scientific innovation in projects. The work programme defines boldness as innovative ideas that can contribute to expanding understanding beyond existing research fronts. This may take the form of research based on original scientific perspectives or research originating in innovative, interdisciplinary collaboration. The work programme acknowledges that these projects in certain cases may be at a larger risk of not achieving their objectives (Research Council of Norway, 2019).

According to the work programme (Research Council of Norway, 2019), 'Free Climate Research' (FRIKLIM) calls are specifically targeted to achieve high-quality research that is both bold and innovative. The following indicators are suggested in the work programme as relevant for assessing project results: number of publications, the impact of publications measured in terms of citation frequency, the journals impact factor, the number of publications with authors from different subject areas and/or sectors and the number of projects with a comparative research design.

5.2.2 Activities undertaken by KLIMAFORSK

All applications to the RCN undergo peer review and receive marks based on a set of criteria designed for the project type in question. RCN, and thus KLIMAFORSK, has used slightly different evaluation criteria for the annual assessment of proposals in the period since 2014, till a new set of three mandatory criteria were established in 2019 (Excellence, Impact and Implementation). A criterium for "Scientific excellence" has always been used and has included elements of boldness, such as: "originality in the form of scientific innovation and/or the development of new knowledge", "the extent to which the proposed work is ambitious, innovative and at the forefront of the research and innovation front", and "the scientific scope in terms of a multi- and interdisciplinary approach". In the new set of criteria, the "Excellence" criterion includes boldness. The mark for the criterion is given based on, among other things, "scientific creativity and originality", "novelty and boldness of

hypotheses or research questions", and "potential for development of new knowledge beyond the current state of the art, including significant theoretical, methodological, experimental or empirical advancement".

KLIMAFORSK has in several of its calls requested 'bold Research Projects' and asked the peers in the application assessment to emphasize boldness in their review. For the assessment of the 2016 FRIKLIM proposals a specific criterion for boldness was used, and the call text read:

Assessment criteria:

> *Project proposals will be assessed on the basis of the general criteria for Researcher projects (see General requirements for Researcher project), in addition to the criterion Boldness in scientific thinking and scientific innovation. Grants will be awarded largely on the basis of the Scientific merit and Boldness in scientific thinking and scientific innovation of a project.*
>
> *The criterion Boldness in scientific thinking and scientific innovation gives an indication of how likely it is that the research projects will lead to significant advances in theory, methodology or scientific knowledge, as opposed to more incremental progress.*
>
> *Relevant elements to be assessed in this context include bold hypotheses, high potential for significant theoretical advancement, original methodology, and creative approach to expanding the current knowledge base in the field.*

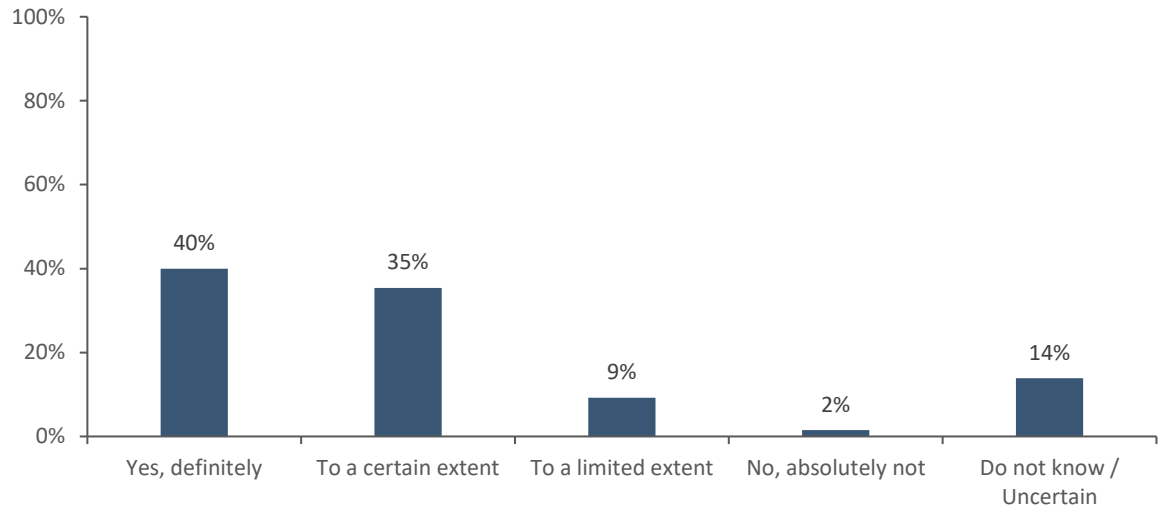
In the 2018 Climate system call, KLIMAFORSK requested in the call text "*[…] bold research projects that answer new issues or have bold and innovative hypotheses in climate system research […]."*

KLIMAFORSK has announced a total of NOK 120 million for 'Free Climate Research' (FRIKLIM), in 2014, 2016 and 2019. In total, 22 projects have been funded as a result of these calls.

5.2.3 Stakeholders' perspective: Results from survey and interviews

All stakeholders have been asked whether KLIMAFORSK has encouraged boldness and scientific innovation in projects. The majority of the survey respondents agree completely or partly with this statement (see Figure 5.2). The remaining respondents are uncertain or do not know (14 percent) or believe that KLIMAFORSK has contributed to a limited extent (9 percent), or not at all (2 percent). These mixed viewpoints are also reflected in the free-text responses in the survey as well as the stakeholder interviews.

Figure 5.2 Has KLIMAFORSK encouraged boldness and scientific innovation in projects. N=65. Source: Survey to stakeholders



Stakeholders that describe KLIMAFORSK as having achieved the second structural objective, identify a wide range of contributing factors and reasons: FRIKLIM is highlighted by several stakeholders as a particularly relevant measure and has, according to one respondent, generated internationally recognized research contributions. Project managers also comment in the survey that they used FRIKLIM to try out new ideas, some of which failed. One researcher calls for more opportunities for innovative projects in other calls as well. Several stakeholders describe KLIMAFORSK's as enabling interdisciplinary projects, particularly within humanities and social sciences. and basic research. Projects that are described as innovative include research on governance of climate and weather services, comparing services between countries, and a project combining meteorological data from models and data on forest damage in risk models. Others argue that KLIMAFORSK has been innovative simply due to the programme's calls for bold and innovative projects and by involving users.

According to one interviewee, they found that the researchers took this criterion seriously in their proposals, describing why the project was bold and innovative. Despite the researchers' efforts, the Programme board found that it was difficult for the experts to actually assess the projects' boldness. This is partly due to difficulties in finding good experts, particularly with experience with interdisciplinary work, but also because what is bold and innovative is difficult to pinpoint.

Two interviewees also question to what extent KLIMAFORSK actually received bold and innovative proposals. Despite calling for innovative projects, the secretariat found themselves reviewing many of the same traditional projects. This may partly be explained by the researchers' risk aversion, minimizing the risk of rejection.

There are mixed views within the research community on to what extent innovation and boldness has and should be prioritized at the expense of other criteria. Others warn against focusing too much on innovation and call instead for more funding to reproduce research with the aim of giving robust knowledge. This is further argued to affect the relevance of knowledge for innovation and society's use of (basic) research, as knowledge must be robust enough to be used.

5.2.4 Assessment of the second structural objective

The achievement of this structural objective has been confirmed entirely or to some degree by 40 and 35 percent of the survey respondents, respectively. However, formal data indicators that support the analysis of specific criteria for this structural objective are scarce.

According to the KLIMAFORSK work programme (2018), particularly the 'Free Climate Research' (FRIKLIM) calls focus on the criteria of boldness and innovation, allowing "research based on original scientific perspectives or research originating in innovative, interdisciplinary collaboration". To what extent this has been included in the evaluation of FRIKLIM funding decisions is unclear, since no specific criteria (points) are assigned to this criterium with the exception of the specific criteria for boldness ("Boldness in scientific thinking and scientific innovation") that was used in the 2016 FRIKLIM proposals assessment. Based on the available data it is not clear how projects under the FRIKLIM call were evaluated using the latter criteria. While bibliometric means are suggested (number of publications and citations), these may not be adequate or/precise measures for scientific innovation. In accordance with the RCNs own assessment, these might include projects that risk not achieving their objectives. Interdisciplinary, or co-creation research, implies to some extent that the progress of the project cannot be determined from the onset, similar to experimental projects, which test novel hypotheses.

The Evaluation Committee notes one important aspect that has been raised, regarding the role of interdisciplinarity, and to what extent projects that aim for a high degree of interdisciplinarity can be properly assessed, due to a lack of experienced reviewers.

5.3 Enhance the international profile and contribution of Norwegian research groups

5.3.1 Objective

KLIMAFORSK's third structural objective is to enhance the international profile and contribution of Norwegian research groups. According to the work programme this is to be achieved by enhancing the quality and capacity of Norwegian research and research-driven innovation (Research Council of Norway, 2019). This includes ensuring the relevance of Norway's research contribution to the activities of the IPCC, which requires publications in international peer-review journals, high citation frequency and a visible presence in international research arenas.

The work programme states that KLIMAFORSK will increase Norwegian participation at the Nordic, European and global levels, as well as in bilateral cooperation with selected countries. International climate research is to be facilitated by means of joint funding announcements with relevant national and international programmes. The programme also seeks to pave the way for more research collaboration and establish research collaborations with countries in the Global South, the latter focusing on societal transition and adaptation to climate change (Research Council of Norway, 2019).

The work programme identifies the following indicators for degree of international research cooperation and international knowledge sharing: the number of international partners in research

projects funded under the programme, number of project managers under the programme who apply for and subsequently receive funding under international funding schemes, number of Norwegian researchers who contribute to IPCC activities, and number of doctoral fellows under the projects who complete research stays abroad (Research Council of Norway, 2019).

5.3.2 Activities undertaken by KLIMAFORSK

International co-operation in research and innovation is a high priority in Norway. With a topic of high international relevance and with strong and specialized Norwegian climate research groups, international collaboration the field of climate has a privileged starting point. KLIMAFORSK has made significant efforts to strengthen Norwegian participation in international research collaboration at the European and global level.

Nordic cooperation

In 2014, KLIMAFORSK, together with RCN programmes POLARPROG and SAMKUL participated with funds in a NordForsk call for Nordic centers of excellence in Arctic research: Responsible Development of the Arctic - Opportunities and Challenges - Pathways to Action. As a result of the call four centres were funded, two of them with Norwegian coordinator.

Mobilising and qualifying for participation in Horizon 2020

Horizon 2020 funded projects with Norwegian participation that are tagged with topic "Climate" in the RCN tagging system, have received almost NOK 1 billion to the Norwegian participants.[23] In Horizon 2020, climate related research and innovation is funded through several parts of Horizon 2020, with Climate action, Environment, Resource efficiency and Raw materials (Societal Challenge 5) as the major channel (55 percent) of the total funding to the Norwegian participants. Approximately one fifth (19 percent) of the total funding to Norwegian participants stems from the European Research Council (ERC). Thematic coordination and collaboration of national funding with the EU framework programmes is important for Norwegian research and innovation, as well as industry and the public sector. KLIMAFORSKs calls and activities have aimed to mobilise and qualify Norwegian applicants to apply project support from the EU. KLIMAFORSK priorities match well with the research and innovation agenda in EUs framework programmes. KLIMAFORSK has stimulated Norwegian actors to take leading roles in the EU projects by being able to apply to KLIMAFORSK for national projects that support or build on the EU project.[24] These independent national projects have thus given several Norwegian actors access to the research and innovation results produced in Horizon 2020. This scheme was started by KLIMAFORSK and is now one of the Research Council's central schemes, and no longer funded by KLIMAFORSK.

A wide range of Norwegian organisations have received funding from the Horizon 2020 to projects tagged with the topic "Climate" in RCN's tagging system (see Figure 5.3). Approximately 50 percent is

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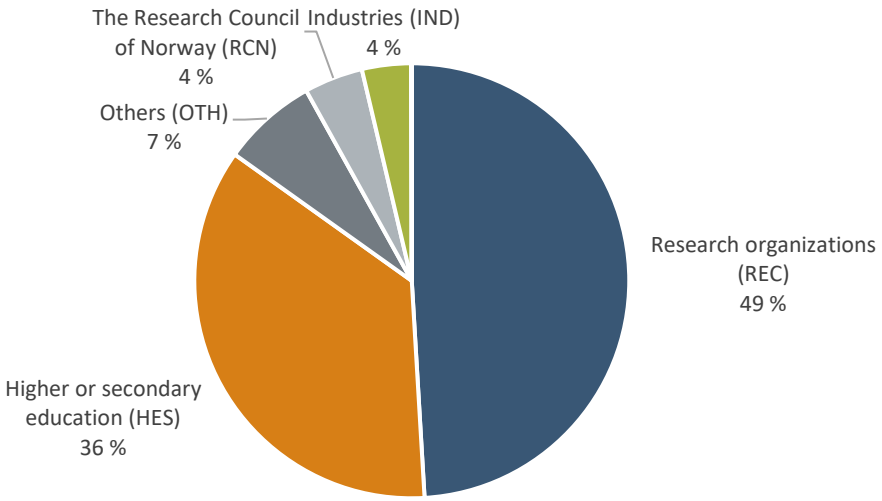
[23] Value of the Norwegian project part, not the total value of the projects (RCN tagging system, Tableau, February 2021).

[24] A total of NOK 6,4 million KLIMAFORSK funds has been spent to such support projects.

allocated to institutes and research organisations and 36 percent to universities (higher or secondary education institutions). The remaining funds are allocated to industries, the RCN, or others.

Figure 5.3 Distribution of Horizon 2020 projects tagged with "Climate" funding to Norwegian project partners by organization type. Source: RCN



Norwegian researchers, the public sector and the industry have had a steady increase and success in the EU framework programmes within climate. An increasing number of Norwegian actors in climate research and innovation both participate in European projects and take the role of coordinator. The Norwegian research community has ambitious plans for EU-participation, in line with the Norwegian government's EU strategy.

Norwegian researchers, the public sector and the business community have for many years had great success in the EU framework programmes in climate research and innovation. One of the main reasons for this is strong national initiatives, programmes and activities, which match the EU's research and innovation agenda well. This has served as a good platform for applying for EU-grants. There has been an increase in Norwegian participation in EU-funded projects in recent years, which shows that a high level of competence has been built up in the Norwegian climate research communities. Participation in EU projects in the field of climate provides access to high-quality international knowledge and expertise for the benefit of research, the public sector and business.

KLIMAFORSK funds spent in international calls: Belmont Forum and JPI Climate

KLIMAFORSK has spent part of its funds in joint calls with the international partnerships Belmont Forum JPI Climate.

KLIMAFORSK funds have been invested in three calls under Belmont Forum, whereof one is joint with JPI-Climate, in the period 2015-2020. Eight projects with Norwegian participation have received funding (KLIMAFORSK funds) from these calls (see Table 5.2).

Table 5.2 Belmont Forum calls funded by KLIMAFORSK in the period 2015-2019. Source: RCN

Year	Call	Number of projects financed	Number of projects with KLIMAFORSK funding	Funding from KLIMAFORSK
2015	Climate Services Collaborative Research action on Climate Predictability and Inter-regional Linkages (joint with JPI-Climate)	9	4	0,7 mill euro
2016	T2S: Transformations to Sustainability (joint call with NORFACE Era-Net)	12	1	0,22 mill euro
2019	CEH I - Climate, Environment and Health	9	3	0,75 mill euro

KLIMAFORSK funds have been invested in five JPI Climate calls in the period 2014-2020 (see Table 5.3). Norwegian research communities have submitted a large number of proposals. 19 of the 55 projects that received funding involve Norwegian participation, including projects where Norwegian researchers are coordinators.

Table 5.3 JPI Climate calls financed by KLIMAFORSK in the period 2014-2020. Source: RCN

Year	Call	Number of projects financed	Number of projects with KLIMAFORSK funding	Funding from KLIMAFORSK
2015	Climate Services Collaborative Research action on Climate Predictability and Inter-regional Linkages (with Belmont Forum)	8	(4)[25]	0,7 mill euro
2016	ERA4CS – Europe for Climate Services	26	7	2,5 mill euro
2018	AXIS - Assessment of Cross- sectoral climate Impacts and pathways for Sustainable transformation	10	6	1,9 mill euro
2019	Next generation climate sciences for oceans	4	2	1 mill euro
2020	SOLSTICE - Enabling Societal Transformation in the Face of Climate Change	7	4	1 mill euro

IPCC

Norway has for many years had a large proportion of experts and researchers with roles in the UN's climate panel IPCC. 11 experts from Norwegian academic communities have been invited to write three unique special reports and a report on methods in the period 2016-2019. In addition, 19 researchers from ten Norwegian institutions have been selected to participate in the author team for the climate panel's next main report (AR 6).

[25] *These are counted under the Belmont Forum projects (Table 5.2).*

In 2016, KLIMAFORSK earmarked funds for researchers to be able to write publications targeting the IPCC's 2018 Special Report aimed at limiting global warming to 1.5 ° C. Five projects were funded:

1. 261784 – Governance of Biomass-CCS
2. 261862 – Potential of bio-energy with carbon capture and storage limit warming to 1.5C
3. 261821 – Changed weather related risks by reducing global warming by half a degree: Supporting HAPPI by harvesting from competence and tools in EVA
4. 261728 – Kortlevde klimadrivere i en 1.5 graders verden (Short-Lived Climate Forcers in a 1,5 degree world)
5. 261603 – Empirical investigation of the effects of carbon pricing on emissions undercap-and-trade and taxation systems

All five projects submitted publications before the deadline set by the IPCC to be considered for the 1.5 ° C Special Report. Publications from one of the projects (261784) were not included in the IPCC SR 1.5-report but were used in IPCC's Special Report on Climate Change and Land. Publications stemming from the other projects were, as far as RCN has been able to trace, included. All projects were presented in a RCN report "Effekter av 1,5 grader global oppvarming: Fem norske prosjekter belyser temaet med ulik innfallsvinkel"[26].

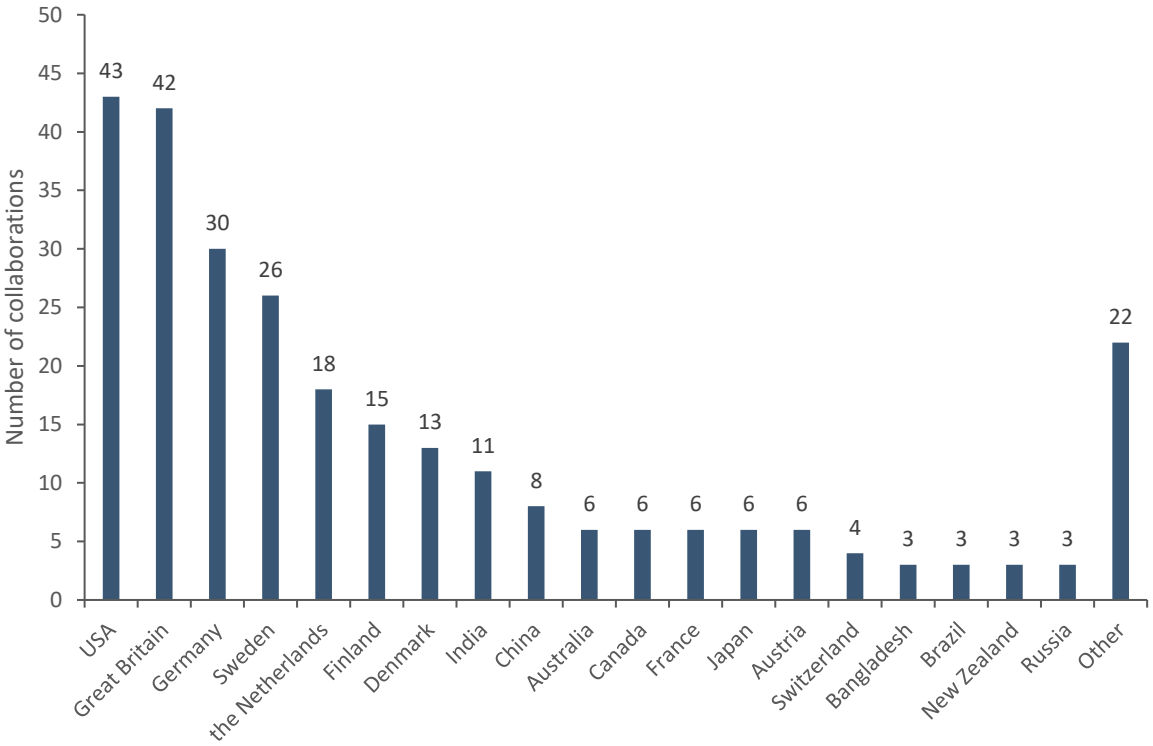
International collaboration in KLIMAFORSK projects

International collaboration has been encouraged or required in all KLIMAFORSK calls. In total 91 out of 114 Researcher and Collaboration projects (projects under international calls are excluded) involve collaborations with project partners from other countries. The projects involve collaboration with 274 foreign project partners. Figure 5.4 shows that most partners are in the USA (43), followed by United Kingdom (42) and Germany (30). Countries with two or fewer partnerships are grouped in "Other"[27].

[26] https://www.forskningsradet.no/siteassets/tall-og-statistikk-seksjonen/felles-blokker/effekteravmalomglobaloppvarming.pdf

[27] *"Other" include the following countries Indonesia, Iceland, Mongolia, Nepal, Portugal, Spain, South Korea, Thailand, Belgium, Estonia, Italy, Laos and Poland.*

Figure 5.4 International collaboration in projects from KLIMAFORSK calls in the period 2014-2020: number of project partners per country. Source: RCN



The bibliometric analysis undertaken by the RCN, shows that 66 percent of the publications involve collaboration with authors from other countries. The co-authors from other countries are predominantly from USA, UK and Germany.

5.3.3 Stakeholders' perspective: Results from survey and interviews

The general perspective among stakeholders is that KLIMAFORSK has enhanced international profile and contribution of Norwegian research groups.

The majority of project and centre leaders that have responded to the survey find that KLIMAFORSK has contributed to international research cooperation. Respondents expressed that projects funded by KLIMAFORSK have served as starting points for collaborations with researchers in Scandinavia, other parts of Europe and North America, particularly for projects funded by the EU and other international sources. Some respondents also highlight that knowledge from KLIMAFORSK projects has fared into Coupled Model Intercomparison Project (CMIP) Phase 5 and 6.

Several stakeholders also acknowledge KLIMAFORSK's cooperative work with Horizon 2020 and JPI Climate, which has resulted in increased presence of Norwegian researchers on the European 'climate scene'. KLIMAFORSK is also described as quick to respond to the international agenda, particularly in making available funds for research to contribute to the IPCC's (2018) 1,5 °C Special Report. One stakeholder argues that KLIMAFORSK should have contributed with more funds to international collaborative calls but was limited due to lack of funds.

There are mixed views on whether KLIMAFORSK has managed to *affect* international priorities. One stakeholder claims this to be the case. International research programmes, such as JPIs and Horizon 2020, have for instance focused on polar research and ocean currents in the north, topics of particular interest to Norway. Others question whether it is rather the opposite that has happened, that international priorities have affected national priorities, whereas several acknowledge that influence most likely goes both ways.

There are also critical voices. One respondent argues that KLIMAFORSK focuses too much on conditions in Norway, limiting how relevant the research is for the international research community. Another stakeholder questions whether KLIMAFORSK is too focused on being aligned with the EU programmes and ERC-type financial mechanisms and priorities, at the expense of national flexibility.

The stakeholders are also asked about the success of international collaborative calls. Some underline KLIMAFORSK's success in collaborating with international programmes, such as EU programmes. Others are less familiar with how KLIMAFORSK has collaborated internationally. One stakeholder also claimed that RCN should have more capacity to take part in international calls as this benefits the research community.

5.3.4 Assessment of the third structural objective

In accordance with the presented information above, KLIMAFORSK has contributed to the international profile and contribution of Norwegian research groups in climate research, among other things through joint calls with relevant national (Norwegian) and international programmes. Climate researchers from Norway have been successful in obtaining project grants in Horizon 2020 and in international calls under the JPI Climate and Belmont Forum. In particular, the earmarked funds for contributions to the IPCC 1.5°C report are an example of how KLIMAFORSK contributed to the representation of Norwegian climate research in the IPCC process. Investments in the development of NorESM has been instrumental to achieve this.

The Evaluation Committee has noticed with concern the limited Nordic coordination through targeted contribution to Nordic calls by KLIMAFORSK.

Based on the available data for this assessment, the Evaluation Committee cannot confirm any specific bilateral collaborations. This would have been valuable.

International collaboration enabled by KLIMAFORSK funding is also reflected by the high share of international collaboration in funded projects (91 out of 114). Also, 66 percent of the publications covered by the bibliometric analysis had international co-authors. The research collaborations were however only to a low degree with countries in the Global South, and the share of publications that are co-authored with researchers from low-income countries is low.

International collaboration is achieved in part through Belmont Forum and JPI Climate. While at one side facilitating international collaboration, this may also restrict the network building to the participating nations to some degree.

5.4 Foster the development of a new generation of climate researchers

5.4.1 Objective

KLIMAFORSK's fourth structural objective is to foster the development of a new generation of climate researchers. This is to be achieved by recruiting talented researchers and facilitating research training and enabling young researchers to be project or work-package managers. The programme also strives to achieve a satisfactory gender balance among project managers, according to the work programme (Research Council of Norway, 2019).

KLIMAFORSK's work programme identifies the following indicators to measure this: the number of doctoral and post-doctoral research fellowships awarded and the number of young project managers in projects funded under the programme (Research Council of Norway, 2019).

5.4.2 Activities undertaken by KLIMAFORSK

The objective to foster the development of a new generation of climate researchers has been pursued by facilitating that young researchers can become project and work package managers, and by aiming at gender balance among project managers. KLIMAFORSK has thus requested and/or demanded recruitment positions in the projects and encouraged young project managers (under 39 years) to apply in the calls.

Out of all projects (296) funded by KLIMAFORSK, 84 has a project manager[28] under 39 years (at the time of project start).

Further indicators for measuring the achievement of this structural objective are the number of doctoral and postdoctoral fellowships awarded and implemented, and the gender balance for these recruitment positions. KLIMAFORSK does only fund doctoral and postdoctoral fellowships as parts of larger projects, not as independent projects.

To date, KLIMAFORSK has financed 66 PhD fellows and 88 postdoc positions in projects. The average age of for PhD fellows is 30 years for men and 29 years for women (see Table 5.4)

Table 5.4 Number of PhD fellows in KLIMAFORSK and average age by gender. Source: RCN

Gender	Number of PhD fellows	Average age at project start
Man	23	30 years
Woman	26	29 years

*49 of a total of 66 PhD fellows are included in the table above. Those who are not included are not registered with personalia yet.

[28] *All projects: N=296. RCN does not have information on age of the project leader for four projects.*

The average age for project managers is higher. The average age for project managers in KLIMAFORSK projects (all) is 46 years for men and 44 years for women (see Table 5.5).

Table 5.5 Number of all KLIMAFORSK projects and average age of project manager at project start by gender. Source: RCN

Gender	Number of KLIMAFORSK projects	Average age at project start
Man	166	46 years
Woman	130	44 years

Research Stays Abroad

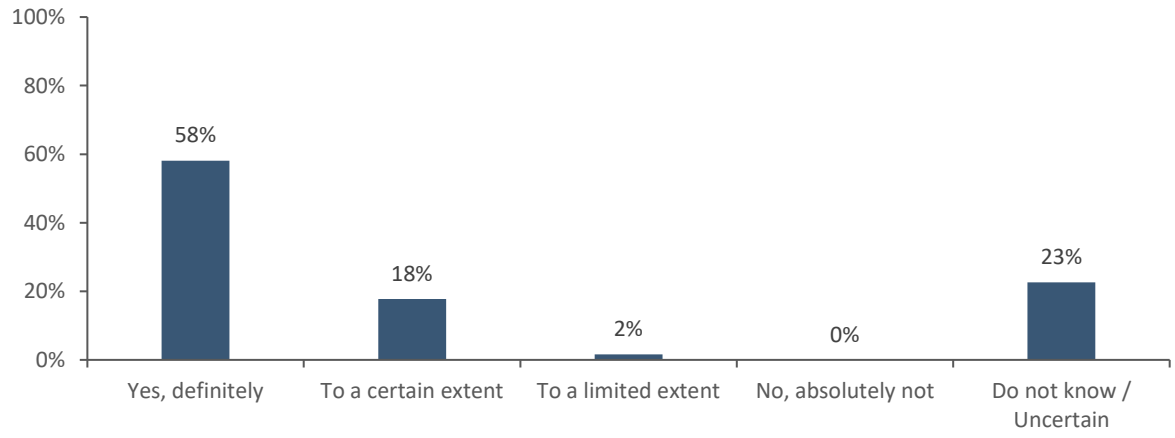
To promote mobility KLIMAFORSK has granted scholarships for stays abroad to participants in 66 projects (with departures from and including 2014). The scholarships for stays abroad may be granted to both to PhD-, postdoc - and established researchers. Some of the KLIMAFORSK projects have been granted more than one such scholarship. Some of the scholarships have not yet been completed. The stay abroad has a duration of a minimum of 3 and a maximum of 12 months.

5.4.3 Stakeholders' perspective: Results from survey and interviews

All survey respondents excepting those representing ministries and public agencies have been asked whether KLIMAFORSK has contributed to the recruitment of new climate researchers. The majority of respondents agree completely or partly with this statement (see Figure 5.5), as do the interviewees.

Several stakeholders comment that KLIMAFORSK both encouraged and allowed for including PhDs and post docs, and in part also master students, in projects. One stakeholder also highlights that KLIMAFORSK has managed to recruit established researchers in other fields, by facilitating interdisciplinary research. This is exemplified by a linguist studying the climate discourse.

Figure 5.5 Has KLIMAFORSK contributed to the recruitment of new climate researchers? N=62[29] Source: Survey to stakeholders



[29] *This question was not posed to respondents in the ministries and public agencies.*

5.4.4 Assessment of the fourth structural objective

KLIMAFORSK has contributed to fostering the development of a new generation of climate researchers. The Evaluation Committee finds that number of PhD- and postdoc-fellows, and the gender balance of the PhD fellows as well as project managers is satisfactory. The average age of project managers is relatively low; and the share of project managers under age 39 at the start of the project has been relatively high.

The allocation of KLIMAFORSK funds for stays abroad has also contributed to the training and development of a new generation of climate scientists, by promoting mobility and supporting research careers.

5.5 Expand expertise and applicable knowledge in society

5.5.1 Objective

KLIMAFORSK's fifth structural objective is to expand expertise and applicable knowledge in society. The sixth structural objective *Facilitate targeted communication and dissemination activities* is closely interlinked and may be seen as a way to achieve this objective.

According to the work programme, KLIMAFORSK seeks to increase the involvement and participation of the public and private sectors in projects, thereby expanding expertise and the utilisation of knowledge among these stakeholders. User participation is intended to enhance the benefit and relevance of the research and promote competence development in research groups and among user groups in public administration and the business sector. User participation is also expected to increase networking and knowledge sharing beyond the projects. The programme also seeks to fill knowledge needs to provide high-quality climate services in Norway (Research Council of Norway, 2019).

KLIMAFORSK's work programme identifies the following indicators to measure success in achieving the above: number of projects with user participation, and whether knowledge generated by the projects is put to use in society (Research Council of Norway, 2019).

5.5.2 Activities undertaken by KLIMAFORSK

Activities undertaken by KLIMAFORSK to achieve this structural objective include activities that are described under the sixth structural objective *Facilitate targeted communication and dissemination activities*. Activities related to mobilizing research applications prior to and during calls are also described here, as they contribute to spreading knowledge about research topics and research needs, and contribute to a broader supply of relevant research communities participating in the calls so that knowledge in society is increased both in scope and width. KLIMAFORSK has made an effort to increase involvement and participation from the public and private sectors in projects to expand expertise and the utilisation of knowledge among these stakeholders. Involvement of these stakeholders in projects has aimed to enhance the benefit and relevance of research in public administration and the business

sector. User participation is also expected to increase networking and knowledge sharing beyond the projects and develop competence in research groups on end user needs and perspectives.

User-involvement in projects

KLIMAFORSK-funded research is largely aimed at researchers in climate and other fields, the public administration, trade and industry, and the general public. User participation is a requirement for Collaborative Projects. Many of the 21 Collaborative Projects have user partners from the public administration (municipalities, etc.). In total there are 89 different user partners in the Collaborative Projects funded by KLIMAFORSK, 37 from the public sector, 35 from the private sector, and 17 NGOs. Researcher Projects may also involve users, although not include users as project partners. The Norwegian Environment Agency is a user that has a role in several Researcher Projects. This role includes participating in project reference groups, meetings with the project team, and similar dialogue. The Agency is then not a 'partner' in the formal sense but has contact with, gives input to and receives presentations and results from the projects.

Dialogue with public and private sector

The RCN dialogue with the Ministry of Climate and the Environment as well as with other government agencies and the representation of the Norwegian Environment Agency in the Programme board have been means for KLIMAFORSK in making the programme and its calls more relevant for the society. In addition, the dialogue increases the knowledge and expertise amongst government agencies which in turn will increase the use of the research. Also, in the framework of international collaboration, Horizon 2020 and JPI Climate, representatives from the government agencies and from RCN sit together in the relevant committees.

Through newsletters, fact sheets, seminars, conferences, user seminars, collaboration with relevant ministries and directorates, formal management dialogue with relevant ministries, participation in international arenas and expert groups (e.g. in JPI Climate), actors from research and public administration have participated together in expert groups and advisory groups etc., together with the RCN. Moreover, the RCN has participated in the programme committee of the EU framework programme within Climate and Environment, together with the Ministry of Climate and Environment.

One of the objectives of KLIMAFORSK is to involve the private sector. In 2017-2018, the KLIMAFORSK administration investigated the possibilities for increased business participation in the projects. Areas with potential for business participation were identified, for example climate services with themes such as hydropower, precipitation patterns, snow modelling and climate change. Through the process, the RCN found several reasons for the lack of business involvement in proposals submitted to KLIMAFORSK. One reason identified by the KLIMAFORSKs administration was that the business community was mainly interested in technical solutions when they participate in research projects, while KLIMAFORSK has excluded technology development from the calls for proposals.

One key conclusion from the investigation was that with the limited funds available, KLIMAFORSK would prioritize other applicants than the business community in its calls because the business community have other arenas for funding projects. In parallel, the programme administration decided

to work to influence more business-oriented programmes in the RCN to emphasize climate change more actively in their calls. This has been implemented, among other things, by assisting BIA (User-driven innovation arena) which funds business-oriented research, in their BIA-X-Sustainability call in 2018, where the objective was to strengthen industry's adaptability and competitiveness in a market that is increasingly demanding greener and more sustainable products and solutions. The BIA call was technology focused. Five projects were funded.[30]

Climate services

KLIMAFORSK work programme states: "The programme will work to fill knowledge needs to provide high-quality climate services in Norway".

The Norwegian Climate Service Center (KSS) provides a knowledge base for climate services and adaptation in Norway. This is done by sharing and disseminating climate and hydrological data for further use in climate adaptation and in research on the effect of climate change on nature and society. Seven KLIMAFORSK-funded projects are described as KSS projects (the criterion is that they involve at least two of the four partners in KSS). Other KLIMAFORSK projects use KSS as a dissemination platform for project results and project data, for example project 300608 Extreme windstorms and related damage.

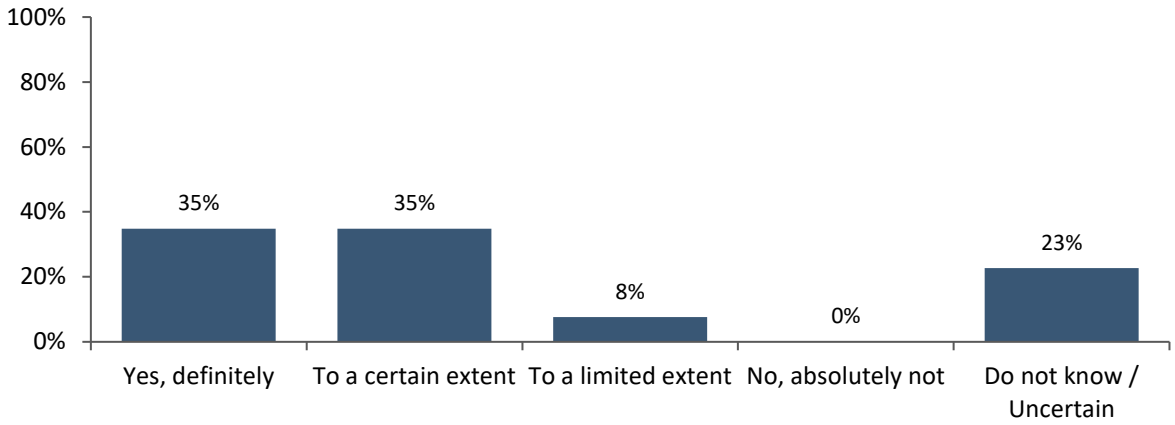
KLIMAFORSK arranged a full-day workshop on climate services in April 2016, in which stakeholders and researchers participated. Information was provided on climate services in national projects, the EU framework programme projects and JPI Climate projects (with Norwegian participation). KLIMAFORSK participates in the JPI Climate collaboration European Research Area for Climate Services (ERA4CS) with a number of other European countries and supported by Horizon 2020. In this collaboration, there is also an in-kind contribution in which the Norwegian Climate Service Center is participating. The competence in climate services has been high in KLIMAFORSK's Programme board and the RCN administration through the active participation in JPI Climate and the EU framework programmes, where climate services are high on the research and innovation agenda.

5.5.3 Stakeholders' perspective: Results from survey and interviews

Collaborative Projects require user participation. Stakeholders have different viewpoints on to what extent user participation in these projects resulted in relevant research for society. One third of the survey respondents agree completely with this statement, while the rest agree partly, are unsure or find that KLIMAFORSK to a limited extent has contributed with relevant knowledge (see Figure 5.6). These mixed viewpoints are also reflected in the interviews.

[30] Other business-oriented programmes than BIA also fund climate-relevant projects, for example the project 270733 Seasonal Forecast Engine led by NORCE and funded by IKTPLUSS. This project was further developed for the Centre for Research-based Innovation (SFI) 309562 – ClimateFuture, with broad business participation.

Figure 5.6 Have the Collaborative Projects under KLIMAFORSK, by requiring user participation, contributed to making the research relevant for the societal challenges? Source: Survey to stakeholders



Several stakeholders from KLIMAFORSK's administration/committee that are critical to the programme's success attribute this to the quality of the proposals received. The Collaborative Project proposals broadly received lower scores than other research projects. A couple of stakeholders claim the lower scores are a result of researchers' limited experience with writing such proposals. Another stakeholder highlights the need for more collaborative proposals with other representatives from the public and private sector.

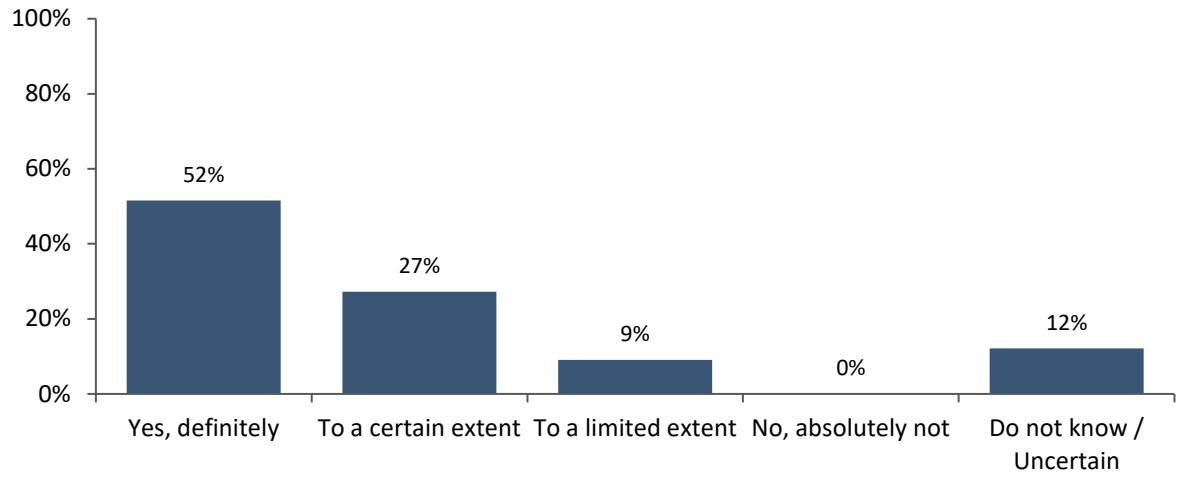
Collaborative Projects that did receive funding are to varying degrees described as successful. Stakeholders that find that these projects were successful, argue that user participation resulted in improved dissemination of research results and more insight into user needs. The latter has for instance resulted in development of tools that fine-tune model results into more user-relevant results. User participation has felt more like a "straitjacket" for other researchers. One argues that users may constrain the research, particularly within natural sciences.

The extent to which users have actually participated also seems to vary. In some projects, users seem to have actively participated, whereas in other projects the users were no more active than a reference group.

Lastly, several stakeholders question whether collaborative projects answer relevant research questions for *society*, and not just for the particular user that was involved in the project. One suggests that the need for relevant knowledge for *society* should be incorporated into the assessment criteria, ensuring higher transfer value to other potential knowledge users.

KLIMAFORSK may also have contributed to research-based knowledge beyond what was generated through collaborative projects. All respondents have been asked whether KLIMAFORSK has contributed to research-based knowledge. KLIMAFORSK is largely perceived to have contributed to the use of research-based knowledge (see Figure 5.7).

Figure 5.7 Has KLIMAFORSK contributed to the use of research-based knowledge? N=66. Source: Survey to stakeholders



Several stakeholders claim that results from KLIMAFORSK to an increasing extent is used at different levels in the environmental agencies/ministry, while others identify municipalities as end-users in their work on adaptation and mitigation.

The stakeholders that are sceptical of KLIMAFORSK's contribution to research-based knowledge provide a range of comments. One stakeholder suggests that the projects to a larger extent should be required to have an impact, with the aim of producing more targeted knowledge. Another suggests that the research projects focus more on solutions that may be useful for municipalities etc., such as nature-based solutions, whereas a third stakeholder acknowledges that researchers can improve their communication but that the decision-makers in public sector also have to become better at listening and inviting researchers to share knowledge.

Survey respondents are asked specifically about whether KLIMAFORSK has contributed to the development of climate services. About half of the respondents claim this to be the case, whereas the remaining are uncertain to what extent this has occurred.

Several respondents mention Norwegian Centre for Climate Services (KSS). KSS is a collaboration between Bjerknessenteret, the Norwegian Water Resources and Energy Directorate (NVE) and the Norwegian Meteorological Institute. The centre is not financed by KLIMAFORSK, and would have existed without KLIMAFORSK, but the partners have received funding for a number of projects that have increased the available knowledge through KSS. KLIMAFORSK has as such contributed to knowledge production on changes in storms, precipitation, permafrost etc. KSS also makes data available to researchers interested on the impact of climate.

Others exemplify climate services in terms of economic analyses, tools to predict changes and consequences from climate change, better warnings-systems, climate profiles for municipalities and county municipalities and improved weather predictions. Some of these climate services target populations in other countries, such as India.

KLIMAFORSK's call for projects that contribute to climate services is described as important in ensuring the above contributions.

Several stakeholders call for the need for more climate services, for example climate services that are combined with information on ecosystems and climate services related to economic questions related to adaptation. Others question to what extent existing climate services are actually used, and thus have an impact.

Another stakeholder claims that KLIMAFORSK to a limited degree has been policy relevant. This stakeholder claims that there is a lot of conflict and uncertainty related to climate-related measures, demanding need for more economic analysis (cost-benefit etc.) and a better understanding of terms such as climate risk.

5.5.4 Assessment of the fifth structural objective

The Evaluation Committee finds that KLIMAFORSK has partly succeeded in expanding expertise and applicable knowledge in society.

Concerning the involvement and participation of potential users, KLIMAFORSK has funded Collaborative Projects with user partners. There has been an increase in funding for Collaborative Projects over the period 2014-2020, and 21 projects are funded per 2020. The Collaborative Projects have expanded the number of actors involved in climate research, including from public sector, private sector, and NGOs.

In addition, Researcher Projects may involve users, although not as project partners. In particular the Norwegian Environment Agency, one of the mayor users of climate research, has a role in several Researcher Projects.

KLIMAFORSK has as also supported the provision of climate services through the funding of certain projects and through international collaboration.

KLIMAFORSK has not succeeded in engaging the business sector in projects funded by KLIMAFORSK. As described in chapter 5.5.2, RCN has attempted but not succeeded in engaging the business sector in projects financed by KLIMAFORSK. The bibliometric analysis shows that only one percent of the co-authors belong to the business or industrial sectors. The ambition in the work programme "…the KLIMAFORSK programme will increase the involvement and participation of the public and private sectors in research projects, thereby expanding expertise and the utilisation of knowledge among these stakeholders" is therefore only partly achieved. However, this result should be viewed considering the exclusion of technology development and innovation in the programme. There was in this sense a potential mismatch between the ambition to increase business participation and the design of programme.

The projects do not report on the structural objective of use and uptake of knowledge in society. Formal indicators and data that supports the analysis of use and uptake of knowledge are therefore limited. However, the balance of viewpoints from the stakeholder survey and interviews suggests that

the use of research-based knowledge has increased as a result of KLIMAFORSK, particularly in the public sector, from local to national level.

5.6 Facilitate targeted communication and dissemination activities

5.6.1 Objective

KLIMAFORSK's sixth structural objective is to facilitate targeted communication and dissemination activities.

According to the work programme, KLIMAFORSK should ensure that research-based knowledge is put to use. Communication activities under the programme may include collating knowledge and taking part in efforts involving national and international synthesis activities, management plans, reports and evaluations. Further, scholarly publication and participation at conferences and in other relevant fora are described as vital measures for fostering productive, interdisciplinary scientific dialogue between climate researchers. The programme intended to encourage researchers to take part in the public debate, to communicate via popular science channels and to share their knowledge with organisations, companies and government agencies.

The work programme identifies the following relevant indicators for measuring whether the dissemination objective is reached; dissemination via a number of different channels, such as meetings with key stakeholders, lectures, newspaper articles, teaching materials, videos, blogs, use of results in university courses, etc. (Research Council of Norway, 2019).

5.6.2 Activities undertaken by KLIMAFORSK

KLIMAFORSK requires dissemination efforts from all projects that are funded. In addition, KLIMAFORSK has issued a targeted call for Communication projects on climate research of NOK 3 million annually and has per 2020 funded 24 Communication projects with a total of around NOK 8,4 million.

Dissemination from KLIMAFORSK projects is done in several different channels, e.g. meetings with key players, lectures, newspaper articles, teaching materials, videos, blogs, etc. In the annual reporting to the RCN, project leaders are asked to report popular science dissemination in three categories: 1) Mass media coverage, 2) Popular science publications, and 3) Reports, notes, articles and lectures aimed at the target groups in the project. Table 5.6 shows accumulated figures from these reports in the period 2014-2020.

Table 5.6 Types of popular science dissemination from KLIMAFORSK-projects starting in >=2014-2019. Figures for >=2014-2020 are in parentheses since figures for 2020 are preliminary. Source: Annual reporting to RCN

Type of popular science dissemination	Total number
Mass media coverage, (newspapers, TV etc.)	1362 (1374)
Popular science publications (artikler/bøker, debattbøker/-artikler, høringer, utstillinger, skjønnlitteratur etc.)	477 (498)

A distribution of the Popular science publications according to Scientific objectives, gives the following numbers[31]:

- Scientific objective 1: 135
- Scientific objective 2: 134
- Scientific objective 3: 264

KLIMAFORSK projects have thus been active in dissemination of popular science, especially projects under SO3.

Example of dissemination from a Researcher Project

Climart (235223). The Climart project analyzed the effects of art related to climate change using new methods. In the project, climate artists collaborated with climate scientists and psychologists. After mapping 37 existing climate art projects, the project found that climate communication through art evokes emotional reactions that are an important driver of the motivation to change something. It also found that art exhibitions labelled "climate art" attract a very selected selection of people.

In 2016, Climart awarded an artist scholarship to Michael Pinsky, a well-known climate artist, following a selection process with more than 100 applicants from around the world. The artwork entitled "Pollution Pods" has attracted a great deal of international attention. In the six domes that make up the artwork, visitors can sniff in air from London, Trondheim, Sao Paolo, Cairo, Beijing, and New Delhi. The latter four have very high air pollution. The project can then study the psychological effects that arise in the encounter with climate art. Art can give an emotional reaction that leads to the desire to change action patterns.

Examples of Communication projects

The objective of the Communication projects is to support communication and dissemination projects that contribute to increased understanding and make it easier to apply research-based climate knowledge. Projects with clear target groups that can point to concrete plans to reach this / these target groups are prioritized. The main target group for the Communication call is the general public, but there is usually high interest from applicants that target children and young adults. KLIMAFORSK has funded several projects for these age groups, ranging from TV series and social media content; *Klimabesserwizzer - ein dokumentarserie for barn om klimaspørsmål*, *En framtid v.2*, *Klimaendringer - et undervsiningsprogram på viten.no*, *Is, Polhavet og klima: Lære fra nordpolarekspedisjoner*, *Klimaforsking The YouTube Way – frå sminkevideo til grønt engasjement*, to in school activities where children are active contributers; *Float Your Boat*, *15 klimaforedrag a 15 minutt*.

[31] *A project may be tagged with several scientific objectives, subsequently a popular science publication can count within more than one scientific objective. Therefore, the sum of publications according to scientific objectives exceeds the actual number of publications*

KLIMAFORSK has also funded projects targeting the general public on a wide variety of communication platforms such as:

- TV/Radio/web: TV-meteorologen som klimaformidler, *Visuell historiefortelling om ekstremvær i Norge i fremtiden*, *Vær og vegetasjon – 1700-tallet, i dag og i fremtiden*,
- museum, theater, exhibitions; *Talking in the rain: an entertaining show about the weather*, *FUTURUM: et museum om fremtiden*, *Farger i mørket – kaldtvannskorallrev i Norge*, *KlimaMatBordet*,
- book projects; *Frost, flom og tørke - sju historier om klimaet historie*,
- and information campaigns among researchers; *Polar Alien Hunters A science communication initiative to increase biosecurity education in Antarctica and in politics*
- and in politics; *Klimadult Norge rundt: En workshopturné for kunnskapsdeling og samskaping av beste praksis innen grønn nudging*

5.6.3 Stakeholders' perspective: Results from survey and interviews

Stakeholders have been asked whether they believe KLIMAFORSK has succeeded with dialogue, debate and making research results available for the programme's target groups: research communities, public sector, private sector and society at large.

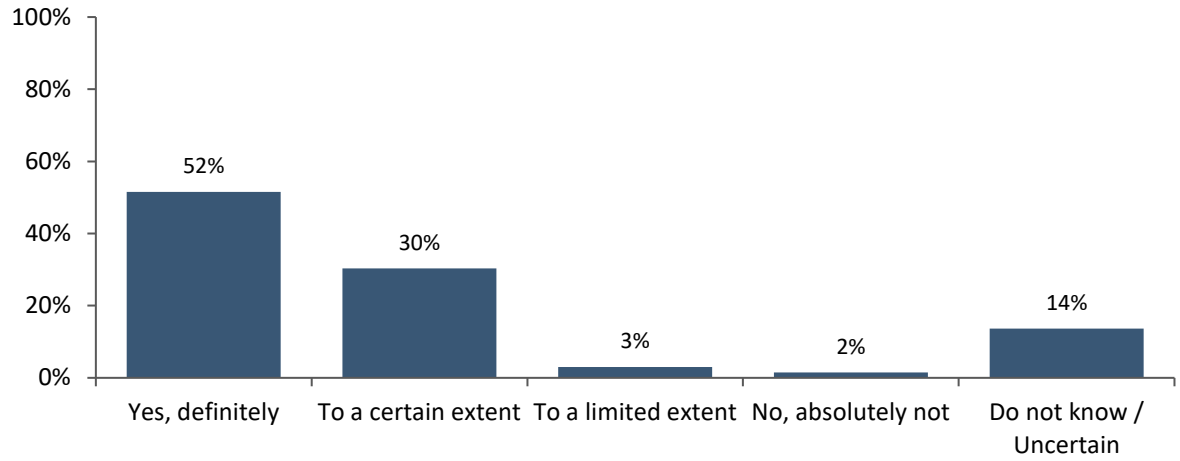
The survey respondents believe that KLIMAFORSK has succeeded in reaching the research communities to a larger extent than what is the case for the other three target groups (see Figure 5.8). Half of the respondents believe that KLIMAFORSK definitely has contributed with dialogue, debate and results for the research communities, whereas the remaining respondents agree to a certain extent or are uncertain. These mixed viewpoints are reflected in the interviews.

The stakeholders that believe KLIMAFORSK has been successful in dissemination towards the research communities, argue that there has been a lot of activity on conference arenas, for example after the torrential rains in Copenhagen, and that results are made available through Forskning.no, newsletters, seminars and fact sheets.

Others are uncertain to what extent KLIMAFORSK has facilitated meeting places for dialogue and debate between researchers and believes that KLIMAFORSK mainly has communicated with the research communities through the distribution of funds. Another stakeholder explains that many of the climate researchers are good at dissemination, and include dissemination activities in their proposals, but is uncertain to what extent this is something KLIMAFORSK has contributed to.

A couple of stakeholders argue that RCN took a larger role in communication and was better at dissemination some years back. One stakeholder attributes the limited dissemination activities to the reorganization into portfolio management and points at the absence of project fact sheets what were made previously.

Figure 5.8 Do you believe that KLIMAFORSK has succeeded in dialogue, debate and making research findings visible for research communities? N=66. Source: Survey to stakeholders



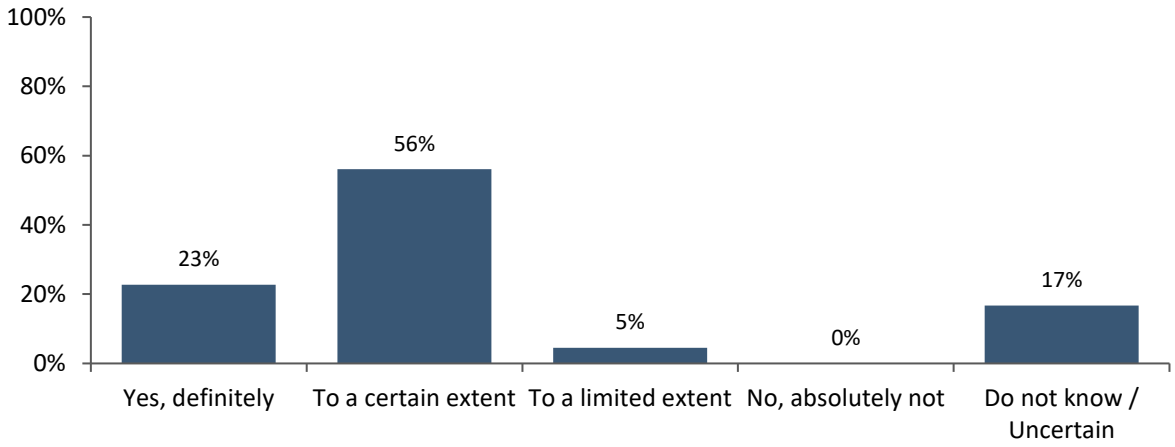
The stakeholders are less certain about whether KLIMAFORSK has succeeded in dissemination activities targeting the public sector (see Figure 5.9). Half of the survey respondents believe KLIMAFORSK to a certain extent has been successful, whereas less than one-fourth are certain this is the case. The remaining respondents are largely uncertain. The interviewees express the same range of responses.

Stakeholders that describe KLIMAFORSK as successful, argue that KLIMAFORSK has contributed to communication and dissemination, by for example establishing reference groups and trying to facilitate arenas where researchers and public sector representatives can meet. One stakeholder comments that results where shared internationally at a large conference. Several stakeholders argue that the collaborative calls and user participation requirement has increased dialogue between researchers and the public sector.

KLIMAFORSK is described as much more visible during calls than when research projects are finished, and results are available. Several call for the need for making results more easily available, and for ensuring that seminars etc. are perceived as relevant for the public sector. Others argue that KLIMAFORSK is visible to politicians and the public sector working directly with climate, but to a lesser extent for other parts of the public sector.

Representatives from the public administration are asked specifically whether they find that research and knowledge from KLIMAFORSK projects is used by the public administration and whether it covers their knowledge gap. One stakeholder comments that they to a limited degree know whether the results used emanate from KLIMAFORSK, whereas another comments that they largely use results pertaining to adaptation, yet that much of these results are of limited relevance to policymaking.

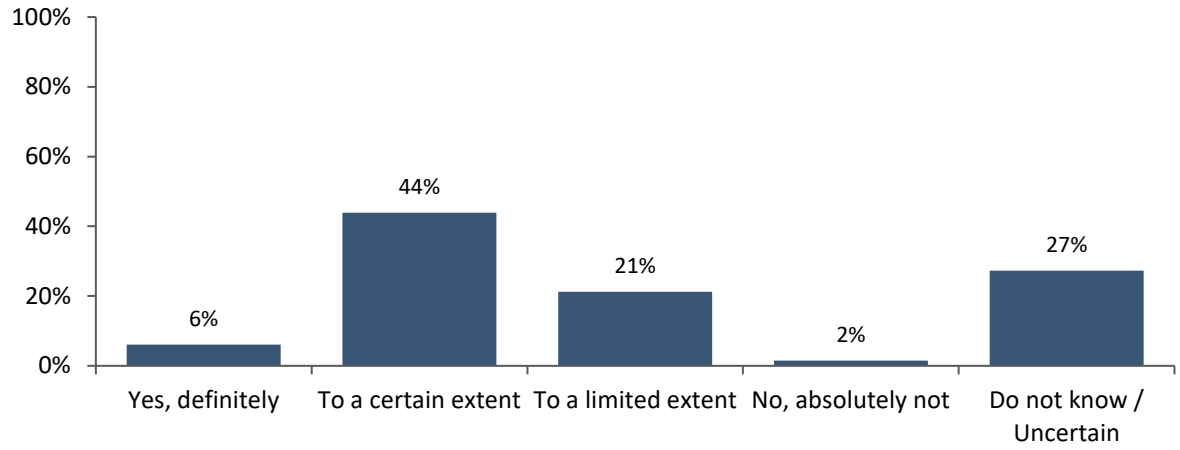
Figure 5.9 Do you believe that KLIMAFORSK has succeeded in dialogue, debate and making research findings visible for the public sector? N=66. Source: Survey to stakeholders



KLIMAFORSK is to an even lesser extent described as successful in targeting the private sector. The survey respondents either describe KLIMAFORSK as partly or to a limited degree successful in reaching the public sector or are uncertain to what extent the programme has reached this target group (see Figure 5.10). Only a few respondents are certain that the programme has been successful. The interviewees largely describe the programme as successful to a limited degree.

There are mixed views on whether and why KLIMAFORSK managed to reach the private sector. One of the interviewed stakeholders argues that KLIMAFORSK did not manage to reach the private sector. Others highlight instead the private sector's limited interest or capacity to apply research results. This is both attributed to the private sector's short-term planning, they plan in view of current regulations, and that the private sector is simply not used to applying research results. Another stakeholder describes the private sector as more than ready to transition to a low-emission society, whereas one posits that the research projects that result in user-relevant results will be more relevant to the private sector. More use of user participation requirements is by some stakeholders expected to increase the number of future dialogues.

Figure 5.10 Do you believe that KLIMAFORSK has succeeded in dialogue, debate and making research findings visible for the private sector? N=66. Source: Survey to stakeholders

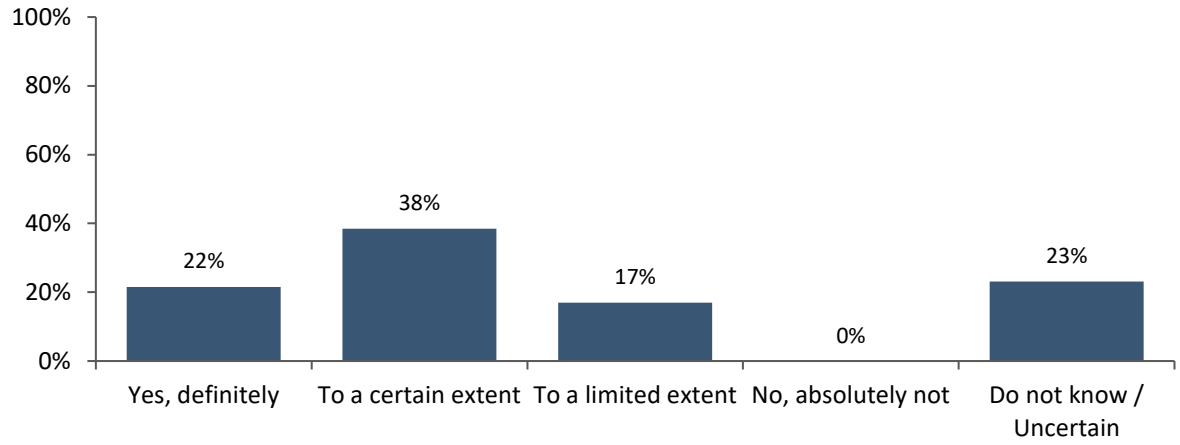


A comparison of responses indicates that the stakeholders believe that KLIMAFORSK has been more successful in reaching society at large (see Figure 5.11) than the private sector, albeit not as successful as in reaching research communities and the public sector (see Figures 5.8 – 5.10).

Stakeholders that are positive to KLIMAFORSK's work argue that the RCN and the programme have worked hard at disseminating knowledge, both by financing projects and through own activities. The EMERALD-project is raised as an example: the project has resulted in a traveling exhibition, starting at Klimahuset in Oslo (The Climate House, UiO), which will travel between museums in Norway, presenting KLIMAFORSK-results to among others school students. KLIMAFORSK has also participated at "climate days" and in media. Yet, one stakeholder argues that in order for these dissemination activities to be successful, the public also has to show interest and have some basic knowledge of the problems at hand.

Others describe the researchers as active participants in the public climate debate and the increased dissemination of climate research in the society in general but are uncertain to what extent this is a direct result of KLIMAFORSK. The programme is described as having encouraged researchers to undertake activities within popular science, but one stakeholder is uncertain about whether KLIMAFORSK has facilitated this other than through Communication projects.

Figure 5.11 Do you believe that KLIMAFORSK has succeeded in dialogue, debate and making research findings visible for the society at large? N=66. Source: Survey to stakeholders



5.6.4 Assessment of the sixth structural objective

KLIMAFORSK has to a large extent facilitated communication and dissemination activities in general. The programme has required dissemination activities from all funded projects and through Communication projects specifically. The findings in the survey indicate that dissemination activities have been most successful in reaching the research communities, and less successful in targeting the private sector.

Communication and dissemination activities may primarily be seen as means for achieving the other scientific and structural objectives, in particular the fifth structural objective *Expand Expertise and Applicable Knowledge in Society*. The programme has aspired both at dissemination aimed at the research communities and aimed at society at large. The tool of dissemination has been used actively, but the uptake in society at large is difficult to assess. Except for the survey, data supporting the analysis of use and uptake of knowledge in society has not been available. Compilation of knowledge through synthesis, as one of the communication objectives, has mainly been done through Norwegian researchers' contribution to the IPCC.

5.7 Increase the use of available data and research infrastructure

5.7.1 Objective

KLIMAFORSK's seventh structural objective is to increase the use of available data and research infrastructure.

The objective to increase the use of available data and research infrastructure is described in the work programme as follows: KLIMAFORSK will facilitate the utilisation and processing of time series and large data sets for use in research and management, and to improve the use of national research infrastructure in areas where Norway has special advantages, facilities or needs. The programme will comply with the Research Council's Policy on Open Access to Research Data. Projects awarded funding

under the programme are also expected to comply with the open access policy and work towards coordinated use of research infrastructure, when this is relevant.

The work programme acknowledges that Norway has a long tradition of collecting, processing and storing vast amounts of data. Norwegian research groups therefore have an advantage in terms of compiling a national research base and competing on the international arena.

The following indicators are identified in the work programme as relevant: proportion of research projects that are partially or entirely based on the reuse of existing data rather than on the collection of new data, proportion of research projects that make their data available for use by other researchers after project completion and use of relevant research infrastructure.

5.7.2 Activities undertaken by KLIMAFORSK

KLIMAFORSK has operationalized the objective by requesting the use of existing research infrastructure in certain calls. As an example, in the climate system calls in 2015 and 2018, it was stated that the Research Council will prioritize projects that:

- uses existing infrastructure and data
- uses existing national or international research infrastructure and observation systems to gain a better understanding of key processes and variability in Norwegian and polar areas and contributes to the coordination of available in-situ data, infrastructure, models and earth observation
- benefits from and at the same time contributes to the further development of infrastructure and existing observations and measurements that are carried out, among other things through established observation systems and research infrastructure

These priorities are not linked only to infrastructure and data funded by KLIMAFORSK.

Research infrastructure for climate research is mainly funded by the RCN initiative National Financing Initiative for Research Infrastructure (INFRASTRUKTUR), but also by KLIMAFORSK. INFRASTRUKTUR has so far had bi-annual calls funding research infrastructures within all subject fields and thematic areas. Funding for climate-relevant research infrastructures from INFRASTRUKTUR varies from year to year but has increased sharply from NOK 64 million in 2014 to NOK 253 million in 2019.

From 2007, the Norwegian earth system model NorESM has been built up into one of Europe's leading earth system models with funding from the RCN (KLIMAFORSK and Bjerknessenteret) and eventually KLD (Center for Climate Dynamics). After NORKLIMA and then KLIMAFORSK contributed with funding, especially through the projects 178246 NorClim - Climate of Norway and the Arctic in the 21st Century (2007-2010), 207711 EARTHCLIM - An Integrated Earth System Approach to Explore Natural Variability and Climate Sensitivity (2011-2014) and 229771 EVA - Earth system modeling of climate Variations in the Anthropocene (2014-2018), it became clear that competitive funding of NorESM and the maintenance of a state-of-the-art climate model and a national user environment could not depend on the funding from KLIMAFORSK alone. As the last contract came to an end, the Research Council

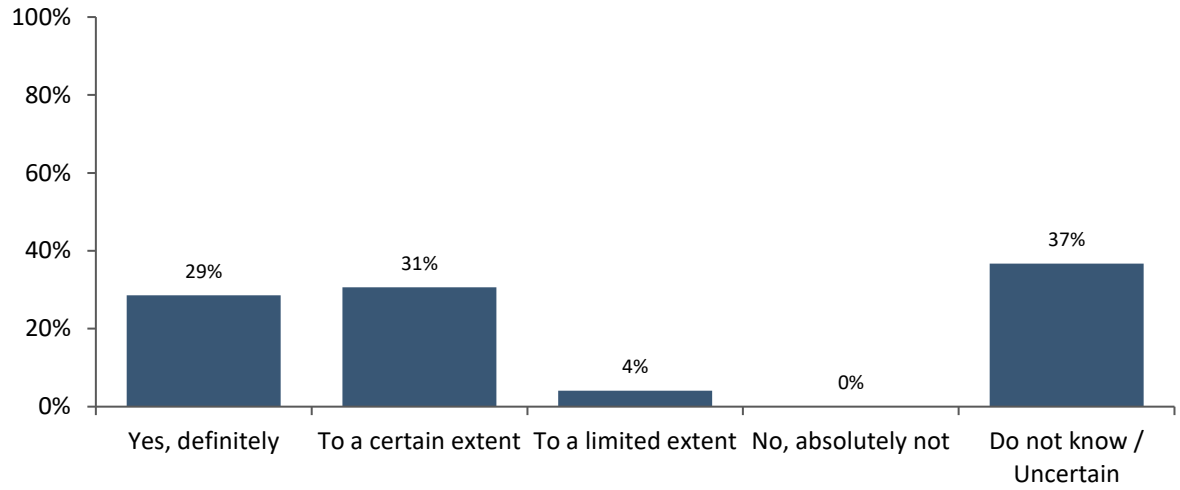
therefore informed the NorESM community that they had to apply to the Research Council's infrastructure scheme in 2016 to maintain the activity. This resulted in the national research infrastructure 270061 INES (Infrastructure for Norwegian Earth System modeling - 2018-2026), funded by INFRASTRUKTUR.

NorESM is well documented, implemented and made available on the national computing and storage resource NIRD under Sigma2 (National e-Infrastructure for Research Data), on NorESMHUB which is located on the international host service GitHUB (Microsoft), and model output data (CMIP) are available on the public US data distribution portal ESFG (Earth System Grid Federation). NorESM is used by a large number of (almost 50) national and international research projects, including ongoing H2020 projects (e.g. Blue-Action, Applicate INTAROS). National groups include CICERO, the Institute of Marine Research, the Nansen Center, MET, NORCE, NTNU, UiB and UiO. Researchers from UiB, NORCE and MET are the largest users. Climate projections from NorESM are also used by the Norwegian Climate Service Center (KSS). The large ongoing nationally integrated climate system projects 295046 KeyCLIM (Key Earth System processes to understand Arctic CLimate warming and Northern latitude Hydrological Cycle Changes) and EMERALD (Terrestrial ecosystem climate interactions of our EMERALD planet), are two of the major project users of NorESM. NorESM has also been integrated into a novel multi-model (super model) approach to reduce model biases. These projects are funded by POLARPROG and KLIMAFORSK, respectively, in a joint announcement. Both projects have as one of the goals to improve the process description in NorESM.

5.7.3 Stakeholders' perspective: Results from survey and interviews

Project leaders and research/centre leaders that have received KLIMAFORSK funding have been asked whether KLIMAFORSK has contributed to increase (re-)use of research data and existing research infrastructure. There are mixed views in terms of whether this is the case, around one-third are uncertain, one-third claim that this is partly the case whereas a bit less than one-third claim this to be the case (see Figure 5.12). The three interviewees that received the same question also respond differently.

Figure 5.12 Has KLIMAFORSK contributed to more use of research data and research infrastructure? N=49. Source: Survey to stakeholders



The survey respondents have further been asked to exemplify what type of data and infrastructure that has been used. A wide range of data and infrastructure is mentioned. Several stakeholders highlight NorESM as being key in ensuring comprehensive data sharing, in addition to UNINET Sigma 2's high performance computing (HPC) and mass storage systems.

Several stakeholders explain that they have sourced data from or made data available through Norwegian Centre for Climate Services (KSS), or accessed data from MET (on Climate Scenario RCP 4.5 and 8.5 and) or international sources.

One stakeholder explains that the programme in general has benefitted from increased access to satellite-based data and other internationally available data. They find, however, that they lack good infrastructure for data on land based Norwegian nature, which again inhibits larger systemic analyses.

5.7.4 Assessment of seventh structural objective

KLIMAFORSK has been a driving force for the development of a central research infrastructure for climate research, contributed with important projects as users of the infrastructure and contributed with project support of more than NOK 150 million to the development or use of NorESM including the technical expertise required (high performance computing, analysis and storage).

KLIMAFORSK has also contributed to Norwegian membership in the international data infrastructure ICOS (Integrated Carbon Observation System) and to building a Norwegian node in this infrastructure which is then financed by INFRASTRUKTUR. More than NOK 44 million has been allocated to projects that support or use ICOS. KLIMAFORSK projects also use other national infrastructures such as SIOS, COAT, EARTHLAB and FARLAB.

The Research Council's labelling system contains a separate label for data reuse. 22 KLIMAFORSK projects have been marked with this. There are good reasons to believe that far more projects exploit existing data infrastructures, for example related to grid-based meteorological / modelled climate data, weather data or other Earth observation assets such as satellite remote sensing of snow and sea

ice. This is particularly relevant for projects that are linked to or use IPCC scenarios and model predictions coordinated under CMIP and made available at data nodes (ESFG).

The material available for the Evaluation Committee on the reuse of data is too limited to make strong recommendations. However, it is concerning that 40 percent of survey respondents cannot clearly identify reuse of data and existing infrastructure as part of the funded research activities by KLIMAFORSK. Future, more general use of unique identifiers for datasets (e.g. DOI's) will help to better qualify this issue.

6 Overall conclusions and recommendations

6.1 Overall conclusions from the evaluation

KLIMAFORSK's primary objective is "to promote outstanding climate research and generate essential knowledge about the climate for the benefit of society". This objective is operationalized in three scientific and seven structural objectives. This evaluation considers whether the KLIMAFORSK's scientific and structural objectives are reached, and what factors have been central in goal achievement. Based on the evaluation results, the Evaluation Committee concludes that most of the scientific and structural goals are achieved, not by individual calls but through the 2-3 cycles of funding announcements, the FRIKLIM calls, contribution to joint national and international calls, and by contributing to and exploitation of new and existing research infrastructure.

The Evaluation Committee concludes that KLIMAFORSK has succeeded in building both an improved understanding of the climate system at process level and, in generating essential knowledge and data relevant for society on policy-relevant timescales. Research and development activities have been sufficiently coordinated and efforts targeted across the programme to deliver also increased confidence in climate projections and regional impacts. However, contributions from individual research activities are in general incremental. Outstanding scientific achievements are rare, still KLIMAFORSK has been instrumental in placing Norwegian climate research at the forefront of international efforts with a strong contribution to the IPCC (SROCC, AR6) and relevant research infrastructures.

KLIMAFORSK has worked to integrate climate issues in research into relevant programmes and topics and has succeeded in this through use of RCN and international collaborative calls. The significant number of publications within Environmental Science/Studies originating from KLIMAFORSK projects may well reflect the extensive collaboration with MILJØFORSK.

6.1.1 Scientific objectives

KLIMAFORSK's first scientific objective is to *increase knowledge about natural and anthropogenic climate change* (climate system) (Research Council of Norway, 2019). Based on the available data, the Evaluation Committee finds that the three identified research needs[32] are covered by the project portfolio. The projects cover a breadth of topics, focusing to a large degree on processes and systems of strategic relevance of concern to Norway. The projects have contributed to publications with more citations than Norwegian research not funded by KLIMAFORSK within the same subject area, including a number of publications in high impact journals. However, the Evaluation Committee points to a relatively low number of publications within oceanography, given the critical role of the ocean in the climate system.

[32] *Research needs under the first scientific objective: Observations and process understanding, Climate variability and change and Modelling climate evolution at the global and national level*

The second scientific objective of KLIMAFORSK is to *increase knowledge about the impacts of climate change on nature and societ*y (Research Council of Norway, 2019). KLIMAFORSK aims to focus particularly on four research needs. [33] The Evaluation Committee finds that the granted projects represent an impressive diversity of research on the impacts of climate change at high international standards. However, given the broad objective, important areas within the objective that are not adequately covered were identified. An overview of the project portfolio suggests for instance that only a minor share of the projects addressed impacts of climate change on society. The Evaluation Committee notes with satisfaction that the projects are likely to have contributed to publications within a broad range of subject areas, including environmental sciences (interdisciplinary) and ecology. However, since publications have not been sorted according to the scientific objective of the project in question, these publications may also contribute (instead) to knowledge production on the third scientific objective.

KLIMAFORSK's third and last scientific objective is to *increase knowledge about transition to a low-emission society and adaptation to climate change*.[34] The Evaluation Committee concludes that this objective is achieved. Research needs on adaptation and mitigation research are covered by the project portfolio. There is however less research on adaptation and projects that integrate adaptation and mitigation. The three targeted calls on societal transitions have increased the share of work within humanities and social sciences. The projects seem to have contributed to publications with an above average citation (CNCI) in the relevant subject areas.

6.1.2 Structural objectives

The seven structural objectives are meant to structure the research efforts under KLIMAFORSK. The structural objectives partly overlap. For instance, the first objective refers to collaboration in both national and international climate research, and the latter domain is also covered by the third structural objective (*Enhance the international profile and contribution of Norwegian research groups*). Further, the sixth structural objective (*Facilitate targeted communication and dissemination activities*) is closely interlinked to the fifth structural objective (*Expand expertise and applicable knowledge in society*). The Evaluation Committee focuses on the achievement of the sum of the structural objectives and, given the available data, finds that the structural objectives are reached to a large extent.

The KLIMAFORSK administration and Programme board have largely succeeded in *Promoting cooperation and task distribution in (national) climate research*, the first structural objective, by engaging with other RCN programmes. In total, 15 out of 45 calls totally or partly financed by KLIMAFORSK were funded in collaboration with other programmes. The majority of the funded projects involve collaborative constellations within one discipline area, such as "Mathematics and

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[33] Research needs under the second scientific objective: Impacts of climate change on the physical and chemical environment, Impacts of climate change on ecosystems, Interactions between drivers and feedback effects on the climate system and The consequences of climate change for infrastructure, trade and industry and living conditions

[34] Research needs under the third scientific objective: 1. Questions relating to both mitigation and adaptation. Questions relating to reducing GHG emissions and increasing carbon sequestration, Questions relating to adaptation and Questions relating to interactions between mitigation and adaptation

natural sciences" (72 percent of all active projects in 2020), whereas the remaining involve more than one discipline area. The categorization into these broad discipline areas is likely to mask new research networks and collaborations between subject areas within the discipline areas, suggesting greater success in achieving cooperation. In addition, 173 PhDs on climate-related topics are registered under other RCN programmes, almost three times the number of PhDs under KLIMAFORSK.

It is more difficult to assess the second structural objective, *Encourage boldness in scientific thinking and scientific innovation in research projects*. This is in part because it is unclear what boldness entails, and how and to what extent the review committees have considered boldness when assessing project proposals, including under FRIKLIM calls. The work programme defines boldness as innovative ideas that can contribute to expanding understanding beyond existing research fronts. This may take the form of research based on original scientific perspectives or research originating in innovative, interdisciplinary collaboration. While bibliometric means (number of publications, citations etc.) are suggested as possible indicators for goal achievement, these may not be precise measures for cutting edge research, which - in accordance with the RCNs own assessment, might include projects that risk not achieving their objectives. Further, some findings suggest that the review committees found it difficult to review interdisciplinary projects.

KLIMAFORSK is deemed to a large extent successful in achieving the third structural objective, *Enhancing the international profile and contribution of Norwegian research groups*. KLIMAFORSK has successfully facilitated joint funding announcements with national (see also first structural goal) and international programmes, yet the Evaluation Committee notes limited Nordic coordination through targeted contribution to Nordic calls by KLIMAFORSK. Norwegian research groups have been able to compete successfully in the international calls, successes that likely build on previous KLIMAFORSK projects. The majority of the KLIMAFORSK projects involve collaboration with international partners and has resulted in a high share of scientific publications with international collaborators. Splitting the collaborative partners into geographical entities, reveals that a large number of KLIMAFORSK projects involve collaboration primarily with US, UK, and Germany, and have also resulted in publications with co-authors from these countries. It is less evident to what extent the programme has paved the way for more research collaborations with countries in the Global South. RCN has also responded to specific demands on the international climate scene, specifically by ear-marking funds for Norwegian contributions to the IPCC 1.5°C report.

KLIMAFORSK has contributed to *fostering the development of a new generation of climate researchers*, the fourth structural objective. The number of PhD- and postdoc-fellows, and the gender balance of the PhD fellows as well as project managers is satisfactory. The average age of all project managers is relatively low; and the share of project managers under age 39 at the start of the project has been relatively high. The age of the work-package managers is not known. The funding of 66 KLIMAFORSK Scholarship for research stays abroad, has also contributed to the training and development of a new generation of climate scientists, by promoting mobility and supporting research careers.

KLIMAFORSK's fifth structural objective is to *expand expertise and applicable knowledge in society,* through the involvement and participation of the public and private sectors in projects and by

supporting climate services in Norway. The Evaluation Committee finds that this objective is partly achieved, as the programme has reached parts of the public sector but only to a very limited extent the private sector. The latter may partly result from the exclusion of technology development and innovation in the programme. There was, in this sense, a potential mismatch between the ambition to increase business participation and the design of programme. On the other hand, the programme has contributed to climate services that are in demand.

The sixth structural objective is to *facilitate targeted communication and dissemination activities*. The tool of dissemination has been used actively. The programme has required dissemination activities in all projects in addition to funding Communication and dissemination projects, and Support to events. Compilation of knowledge through synthesis has mainly taken place through Norwegian researchers' contribution to the IPCC. The programme does not seem to have collated knowledge from completed projects. The uptake in society at large is difficult to assess. Based on stakeholders' responses, the programme has been most successful in reaching research communities, in part successful in reaching the public sector and less successful with regards to the private sector.

KLIMAFORSK's seventh and last structural objective is to *increase the use of available data and research infrastructure*. Based on the available data, the Evaluation Committee concludes that the objective seems largely to have been achieved. KLIMAFORSK has both financed the development of research infrastructure for climate research and projects that use this infrastructure, both nationally (NorESM) and internationally (ICOS), and financed projects that use other national infrastructures (SIOS, COAT, EARTHLAB and FARLAB). According to the available data, the projects have to a lesser extent reused existing data (21 out of 132 Researcher Projects), yet this is likely to underestimate the use of for instance grid-based or modelled climate data. The Evaluation Committee does not have the required information to assess to what extent the projects have made their data available after project completion.

6.2 Recommendations

The KLIMAFORSK programme finds its place in the historic line of knowledge and research needs from the Report from the Brundtland Commission ("Our Common Future", 1987), through establishing the Intergovernmental Panel on Climate Change (IPPC) in 1988, and to the 2030 Agenda and the 17 Sustainable Development Goals (SDGs) decided by the UN in 2015.

As most of the SDG- initiated activities have been more visible and developing after the KLIMAFORSK programme began, it is due time to formulate both the 2030 Agenda and the SDGs as points of reference for future climate research.

All big global challenges, including climate change, require knowledge both from disciplinary as well as interdisciplinary and transdisciplinary research. There is, however, a need for better tools for enabling interdisciplinary research, and for collaboration between researchers and societal stakeholders. Further, it is necessary not only to facilitate research in each country, but also to succeed in regional and international collaboration.

KLIMAFORSK is now part of the Research Council of Norway's portfolio covering climate and polar research. To perform the best possible research, it is necessary to cross scientific and sectorial borders, for instance in RCN by cooperating with other portfolios. The SDG structure with 17 different goals gains its strength by seeing the totality, both in all goals together and in goal 17, "Partnership for the goals".

The recommendations from the Evaluation Committee follow along these lines. Even if the evaluation report is focused on the scientific and structural objectives, it is important to bear in mind that the primary objective of the KLIMAFORSK programme is to promote outstanding climate research and generate essential knowledge about the climate for the benefit of society. The programme's scientific and structural objectives will advance the achievement of its primary objective.

After a thorough study of the KLIMAFORSK programme, the Evaluation Committee has formulated a number of recommendations for future consideration. The recommendations are structured along three lines: research themes and focus areas, implementation and programming, and indicators, monitoring, and evaluation. The recommendations meet different levels in the research processes. However, the committee highlights the recommendations concerning the 2030 Agenda and the SDGs, and the recommendations concerning inter- and transdisciplinary research.

The Evaluation Committee leaves its assessments and recommendations to the RCN, anticipating that this can inspire and motivate to urgent ongoing and future excellent research.

6.2.1 Research themes and focus areas

- KLIMAFORSK lacks a clear research objective on sustainable development. A recommendation is therefore to formulate specific research objectives (needs) on climate science for sustainable development, using the 2030 Agenda and the 17 Sustainable Development Goals as a point of reference for all three scientific objectives. Points of reference are also the European Green Deal, IPPC (The Intergovernmental Panel on Climate Change) and IPBES (The Intergovernmental Platform on Biodiversity and Ecosystem Service).
- Emphasis on climate research connected to the ocean, including relating to earth system modelling, climate impact, mitigation, and adaptation, including policy relevant research related to these topics. The upcoming UN Decade of Ocean Science for Sustainable Development can, if implemented nationally, contribute to overcome the identified weaknesses.
- Emphasis on climate research related to forests, linking to Norway's international leadership on forests and climate change, but also Nordic forestry knowledge and practice. Thematic orientations can be connected to earth systems modelling, climate risk and impact, the role of forestry in mitigation and adaptation, and to bioeconomy and biodiversity issues.
- Increase the share of social science research under scientific objective 2 to meet the research needs on the consequences of climate change for infrastructure, trade and industry and living conditions.

- Ensure that the balance between local, regional, and global research can be justified. It is advisable to have clear priorities before taking on regional or local scale climate system research in regions remote to Norway.
- Increase the possibility of research collaboration with researchers and organizations in the Global South e.g., by means of directed calls.
- Improve the preconditions for inter-and transdisciplinary research (in particular for Scientific objective 2 and 3, and for FRIKLIM), e.g., by means of directed calls.
- Explore opportunities to increase collaboration with other relevant programs such as ENERGIX.
- Ensure a sustainable path for Norwegian climate research in the competitive field of climate modelling (and evaluate the impacts on Norwegian climate research if the Norwegian Earth System model NorESM developments are at some point discontinued).
- Increase the share of research focusing on climate adaptation and interactions between mitigation and adaptation and explore the possibilities of calls linking scientific objective 2 and 3 with focus on impacts on society and adaptation responses.
- To a larger extent provide synthesis relevant to the society, including the government administration.

6.2.2 Implementation and programming

- Strengthen the structures to enable inter- and transdisciplinary research to meet societal challenges for transformations towards a climate resilient and low-emission society.
- Seek new opportunities for enhanced Nordic cooperation on areas of mutual interests, for example around shared model systems, on the Arctic and interdisciplinary research into forestry, climate change and the green transition of society.
- Strengthen international research collaborations with researchers and research institutes in low-income countries/Global South.
- Continue the close alignment of calls with relevant parts of the EU's framework programme for research and innovation, Horizon Europe, including relevant missions and partnerships.
- Establish structures that ensure uptake of knowledge from individual projects and across projects in society, particularly in the programme's target groups.
- Establish structures ensuring ownership and uptake of climate research in relevant sectoral ministries and government agencies.
- Increase industrial collaboration by establishing scopes for broader integration of the industry sector, for example through predictive capacity on various timescales and focus on extreme weather and hydrology.

6.2.3 Indicators, monitoring and evaluation

- Establish a robust set of indicators for the entire programme and for projects that allow monitoring both during and after project implementation.
- Establish monitoring indicators and collect data for uptake and use in society, including prioritised target groups.

- Revise the objectives to separate more clearly between objectives, impacts and outcomes.
- Develop criteria for the assessment of boldness/innovation for finalized projects.
- Ensure reporting and project coding at "research need" level.
- Develop a set of indicators/criteria for interdisciplinarity (beyond the co-authoring of publications across disciplines).
- Monitor and quantify project data reuse through the use of unique open identifiers for datasets and further, facilitate reuse and work to limit data collection by implementing such requirements to generated data.

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Appendixes

Appendix A: Survey response rate

Table A.1 Survey response rate according to type of stakeholder

Rolle	Received	Responded	Response rate
RCN	4	3	75 %
Ministries	4	3	75 %
Directorates	4	3	75 %
Research/Centre leaders	6	5	83 %
Project leaders	86	45	52 %
Programme board 2013-2017	4	3	50 %
Programme board 2018-2019	5	4	60 %
Programme board 2013-2019	2	3	100 %
Total	**115**	**66**	**57 %**

Table A.2 Distribution of survey respondents according to type of stakeholder

What is your connection to KLIMAFORSK	Percent
Project leader on KLIMAFORSK project(s)	67 %
Researcher/Centre leader at institution that has received funding from KLIMAFORSK	9 %
Employed or has been employed at Norwegian Research Council	3 %
Member or previous member of the KLIMAFORSK board	15 %
Employed in ministry	5 %
Employed in directorate	2 %

Appendix B: Interview guide

Bakgrunnsinformasjon

Navn på intervjuobjekt	
Institusjon	
Hva er din forbindelse til KLIMAFORSK og på hvilken måte er KLIMAFORSK-programmet relevant for din virksomhet/institusjon? **Med forbindelse mener vi eksempelvis prosjektleder på et KLIMAFORSK-prosjekt, leder på et institutt som har mottatt støtte fra KLIMAFORSK, arbeider i administrasjonen til programmet osv.**	

I det følgende ønsker vi at du svarer på vegne av den institusjonen du representerer.

Måloppnåelse: de faglige delmålene

Under følger spørsmål knyttet til de tre faglige delmålene til KLIMAFORSK og hva man har oppnådd med forskningen. Vennligst gi en vurdering av programmet i sin helhet.

1. Under følger noen påstander om KLIMAFORSK og måloppnåelse knyttet til de faglige delmålene. **Utdyp gjerne med begrunnelse og eksempler dersom det er relevant. Eksempler kan være viktig kunnskap som programmet har bidratt til.**				
Faglig delmål 1 – Klimasystem: KLIMAFORSK gir økt kunnskap om naturlige og menneskeskapte klimaendringer				
Helt uenig	Delvis uenig	Delvis enig	Helt enig	Vet ikke
Faglig delmål 2 – Effekter: KLIMAFORSK gir økt kunnskap om effekter av klimaendringer på natur og samfunn				
Helt uenig	Delvis uenig	Delvis enig	Helt enig	Vet ikke
Faglig delmål 3 – Omstilling: KLIMAFORSK gir økt kunnskap om omstilling til et lavutslippssamfunn og tilpasning til klimaendringer				
Helt uenig	Delvis uenig	Delvis enig	Helt enig	Vet ikke
2. Hvilke virkninger og samfunnseffekter har KLIMAFORSK bidratt til – og på hvilken måte? **Virkninger kan omfatte endret adferd, ny politikk, endret forståelse for klimautfordringer, nye løsninger, nye synergier med andre prosjekter, osv.**				
3. Har KLIMAFORSK påvirket nasjonale og internasjonale forskningsprioriteringer? **Utdyp gjerne med begrunnelse og eksempler dersom det er relevant. For eksempel hvis ja, hvordan og i hvilken retning har programmet påvirket forskningsprioriteringer? Hvis nei, hva mener du er årsaken til at dette ikke har skjedd?**				
Nasjonale forskningsprioriteringer?				
Ja, helt klart	Til en viss grad	I liten grad	Nei, overhodet ikke	Vet ikke/Usikker
Internasjonale forskningsprioriteringer?				
Ja, helt klart	Til en viss grad	I liten grad	Nei, overhodet ikke	Vet ikke/Usikker

Måloppnåelse: de strukturelle delmålene

Videre følger spørsmål som skal bidra til å belyse ulike problemstillinger og temaer knyttet til de syv strukturelle delmålene til KLIMAFORSK. Vennligst gi en vurdering av programmet i sin helhet.

4. Har KLIMAFORSK bidratt til kompetanseheving og bruk av forskningsbasert klimakunnskap i samfunnet? **Utdyp gjerne med begrunnelse og eksempler dersom det er relevant. For eksempel hvis ja, på hvilken måte? Hvis nei eller i begrenset grad, hva tror du skal til for at KLIMAFORSK skal kunne bidra til kompetanseheving og forskningsbasert klimakunnskap i samfunnet?**				
Kompetanseheving?				
Ja, helt klart	Til en viss grad	I liten grad	Nei, overhodet ikke	Vet ikke/Usikker
Bruk av forskningsbasert klimakunnskap?				
Ja, helt klart	Til en viss grad	I liten grad	Nei, overhodet ikke	Vet ikke/Usikker

5. Har samarbeidsprosjektene i KLIMAFORSK-porteføljen gjennom krav til brukermedvirkning bidratt til å sikre at forskningen er relevant for samfunnsutfordringene? **Utdyp gjerne med begrunnelse og eksempler dersom det er relevant. For eksempel hvis ja, på hvilken måte? Hvis nei eller i begrenset grad, hva tror du skal til for å sikre dette?**				
Ja, helt klart	Til en viss grad	I liten grad	Nei, overhodet ikke	Vet ikke/Usikker
6. Har KLIMAFORSK fremmet dristighet og faglig fornyelse gjennom prosjektene? **Utdyp gjerne med begrunnelse og eksempler dersom det er relevant. For eksempel hvis ja, har programmet evnet å komme med innovative ideer, å ta opp i seg nye forskningsbehov og sørget for utvikling av forskningsprofilen til klimaforskningen i Norge? I så fall på hvilken måte? Hvis nei, kan du gi eksempler på nye forskningsbehov du mener ikke blir dekket i tilstrekkelig grad?**				
Ja, helt klart	Til en viss grad	I liten grad	Nei, overhodet ikke	Vet ikke/Usikker
7. KLIMAFORSK skal fremme målrettet kommunikasjon og formidling. Programmet har satt krav om kommunikasjon og resultatformidling til alle prosjekter som har mottatt støtte. Mener du at KLIMAFORSK har lykkes med dialog, debatt og synliggjøring av forskningsresultater? **Utdyp gjerne med begrunnelse og eksempler dersom det er relevant.**				
Målgruppe 1: Forskningsmiljøene?				
Ja, helt klart	Til en viss grad	I liten grad	Nei, overhodet ikke	Vet ikke/Usikker
Målgruppe 2: Forvaltningen?				
Ja, helt klart	Til en viss grad	I liten grad	Nei, overhodet ikke	Vet ikke/Usikker
Målgruppe 3: Næringslivet?				
Ja, helt klart	Til en viss grad	I liten grad	Nei, overhodet ikke	Vet ikke/Usikker
Målgruppe 4: Samfunnet for øvrig?				
Ja, helt klart	Til en viss grad	I liten grad	Nei, overhodet ikke	Vet ikke/Usikker
8. Har KLIMAFORSK bidratt å utvikle klimatjenester? Klimatjenester er tjenester basert på klimakunnskap som kan hjelpe samfunnet å tilpasse seg et endret klima **Hvis ja, på hvilken måte mener du at KLIMAFORSK har bidratt til å utvikle klimatjenester?** **MERK**: Med «klimatjenester» menes EUs definisjon av «climate services», som er følgende: *"In the context of the European Commission's climate services initiative, the term 'climate services' has a broad meaning: transforming climate-related data and other information into customised products such as projections, trends, economic analysis, advice on best practices, development and evaluation of solutions, and any other climate-related service liable to benefit that may be of use for the society. These services include data, information and knowledge that support adaptation, mitigation and disaster risk management."*				

Andre refleksjoner og innspill

9. Mener du at midlene som er tildelt gjennom KLIMAFORSK kunne vært anvendt på en annen måte som i større grad ville bidratt til fremragende forskning og relevant kunnskap knyttet til temaene klimasystem, effekter og omstilling? (programmets faglige delmål). Utdyp gjerne med begrunnelse og eksempler dersom det er relevant.				
Ja, helt klart	Til en viss grad	I liten grad	Nei, overhodet ikke	Vet ikke/Usikker
10. Har du forslag til endringer som gjør at KLIMAFORSK bedre kan tilpasses utfordringer og forskningsbehov i fremtiden? Eksempelvis endrede prioriteringer, osv.				
11. Har du noen andre refleksjoner eller innspill? **Eksempelvis tanker om hva som har fungert godt og hva som har vært utfordrende ved KLIMAFORSK.**				

Tilleggsspørsmål rettet mot tidligere/nåværende administrasjon (Forskningsrådet) og tidligere/nåværende styrerepresentanter

12. Hva ved forvaltningen av KLIMAFORSK er det som har fungert godt og hva er det som har vært utfordrende? Eksempelvis knyttet til organisering, saksbehandling, tildeling av midler osv.				
13. Har samarbeidet mellom KLIMAFORSK og andre programmer og aktiviteter i Forskningsrådet bidratt til mer og/eller bedre klimaforskning? Og har samarbeidet mellom KLIMAFORSK og andre internasjonale programmer bidratt til det samme?				
14. Har det vært en god og hensiktsmessig kobling til miljøforskning?				
15. Har målene og ambisjonene til KLIMAFORSK samsvart med den økonomiske innsatsen?				
16. Store programmer, som KLIMAFORSK, skulle ivareta koblingen mellom grunnforskning, anvendt forskning og innovasjon. Mener du KLIMAFORSK har lykkes med dette? Har du forslag til hvordan dette bedre kan oppnås framover?				
17. Har virkemiddelbruken (ulike prosjekttyper) i programmet vært hensiktsmessig ut fra programmets mål og samfunnets behov? Hvorfor/hvorfor ikke?				
18. Har KLIMAFORSK bidratt til å rekruttere nye forskere til klimaforskning? **Utdyp gjerne med begrunnelse og eksempler dersom det er relevant. Eksempelvis: Hvis ja, på hvilken måte? Hvis nei eller i liten grad, hva kan KLIMAFORSK gjøre for å oppfylle dette målet?**				
Ja, helt klart	Til en viss grad	I liten grad	Nei, overhodet ikke	Vet ikke/Usikker
19. Har de relevante miljøene (universiteter og høyskoler, forskningsinstitutter, offentlig sektor og bedrifter/næringsliv) deltatt som søkere til programmet? (Altså har programmet bidratt til riktig mobilisering?) **Utdyp gjerne med begrunnelse og eksempler dersom det er relevant.**				
Ja, helt klart	Til en viss grad	I liten grad	Nei, overhodet ikke	Vet ikke/Usikker

Tilleggsspørsmål rettet mot direktorater og departementer

20. Opplever du at KLIMAFORSK er et program det er bred oppslutning om i din virksomhet?				
21. Opplever du at forskning og kunnskap generert fra KLIMAFORSK-prosjekter brukes av forvaltningen og dekker forvaltningens kunnskapsbehov? **Brukes for eks. forskning og kunnskap fra KLIMAFORSK-prosjekter inn i arbeid med stortingsmeldinger, handlingsplaner, til politikkutvikling, til kunnskapsoppsummeringer og synteser som lages av forvaltingen selv? Utdyp gjerne med begrunnelse og eksempler dersom det er relevant.**				
Ja, helt klart	Til en viss grad	I liten grad	Nei, overhodet ikke	Vet ikke/Usikker
22. Opplever din institusjon at KLIMAFORSK er et sentralt program for å bidra til fremragende norsk klimaforskning (generelt)?				
23. Har målene og ambisjonene til KLIMAFORSK samsvart med den økonomiske innsatsen?				
24. Opplever din institusjon at virkemiddelbruken (ulike prosjekttyper) innad i programmet har vært hensiktsmessig ut fra programmets mål og samfunnets behov?				

Tilleggsspørsmål rettet mot aktører i det norske forskningssystemet

25. Hvilke av de tre faglige delmålene (klimasystem, effekter og omstilling) til KLIMAFORSK faller din virksomhet/organisasjons KLIMAFORSK-prosjekt inn under? **Utdyp gjerne med begrunnelse og eksempler dersom det er relevant.**		
Delmål 1) Klimasystem	Delmål 2) Effekter	Delmål 3) Omstilling
26. Har KLIMAFORSK bidratt til internasjonalt forskningssamarbeid? Hvis ja, hvilke effekter har dette medført? **Eksempel på virkninger er EU-samarbeid, annet internasjonalt samarbeid, internasjonal orientering på feltet.**		
27. Har det vært en god og hensiktsmessig kobling til miljøforskning?		
28. Har KLIMAFORSK bidratt til å rekruttere nye forskere til klimaforskning? **Utdyp gjerne med begrunnelse og eksempler dersom det er relevant. Eksempelvis: Hvis ja, på hvilken måte? Hvis nei eller i liten grad, hva kan KLIMAFORSK gjøre for å oppfylle dette målet?**		

Ja, helt klart	Til en viss grad	I liten grad	Nei, overhodet ikke	Vet ikke/Usikker
29. Har organiseringen med 3-årssykluser for de tematiske prioriteringene (klimasystem, effekter og omstilling) til KLIMAFORSK-programmet bidratt til å sikre forutsigbarhet for forskningsmiljøene? **Vennligst kryss av for det svaret du mener er mest riktig (NB: Kun ett kryss). Utdyp gjerne med begrunnelse og eksempler dersom det er relevant. For eks. dersom du er uenig, mener denne 3-årssyklusen er uhensiktsmessig: utdyp gjerne dette.**				
Ja, helt klart	Til en viss grad	I liten grad	Nei, overhodet ikke	Vet ikke/Usikker
30. Har KLIMAFORSK bidratt til mer bruk av forskningsdata og forskningsinfrastruktur? Og i så fall hvordan typer av data og infrastruktur er benyttet? Har KLIMAFORSK for eks. bidratt til at tidsserier og store datasett blir utnyttet og tilrettelagt for bruk i forskning og forvaltning, og for bedre utnyttelse av nasjonal forskningsinfrastruktur der Norge har spesielle fortrinn, fasiliteter eller behov? Har det blitt brukt klimaobservasjoner, klimadatasett osv. **Utdyp gjerne med begrunnelse og eksempler dersom det er relevant. Nevn for eks. her de datasett og datainfrastrukturer som er blitt benyttet.**				
Ja, helt klart	Til en viss grad	I liten grad	Nei, overhodet ikke	Vet ikke/Usikker
31. KLIMAFORSK gir støtte til tre ulike type prosjekter: 1) Forskerprosjekter, 2) Samarbeidsprosjekter og 3) Formidlingsprosjekter/Kommunikasjonsprosjekter **Mener du denne inndelingen er hensiktsmessig? Hva er mest relevant for din institusjon?** **Med samarbeidsprosjekter menes prosjekter med brukermedvirkning, hvor hensikten er å sikre at forskningen er relevant for samfunnsutfordringene.**				
32. KLIMAFORSK har etterspurt tverrfaglige prosjekter i utlysningene. Har din virksomhet mottatt midler fra KLIMAFORSK til gjennomføring av tverrfaglige prosjekter? Hvis ja, hva har din virksomhets erfaringer vært med å gjennomføre slike tverrfaglige prosjekter? Hvilke konsekvenser mener du dette har hatt for forskningen? **Med tverrfaglig menes for eksempel kombinasjon av samfunnsvitenskap og naturvitenskap i samme prosjekt, naturvitenskap og humaniora osv.**				
33. Har målene og ambisjonene til KLIMAFORSK samsvart med den økonomiske innsatsen?				

Appendix C: List of abbreviations

- BIONÆR – Research Programme on Sustainable Innovation in Food and Bio-based Industries,
- CMIP - Coupled Model Intercomparison Project
- COAT - Climate-ecological Observatory for Arctic Tundra
- EARTHLAB - Earth Surface Sedimentary Laboratory
- EUROPA – the Europe in Transition programme
- FARLAB - Facility for advanced isotopic research and monitoring of weather, climate and biogeochemical cycling
- FRINATEK – FRIPRO Natural sciences and technology
- FRIPRO – (Fri prosjektstøtte) Ground-breaking research
- IPCC – Intergovernmental Panel on Climate Change
- JPI Climate – Joint Programming Initiative Climate
- MARINFORSK –Research Programme on Marine resources and the Environment
- MILJØFORSK – Programme for Environmental Research for a Green Transition
- POLARPROG – Polar Research Programme
- SAMKUL – Programme on the Cultural Conditions Underlying Social Change
- SAMRISK – Research Programme on Societal Security and Safety
- SIOS – Svalbard Integrated Arctic Earth Observation System
- SROCC - Special Report on the Ocean and Cryosphere in a Changing Climate

Visiting address: Drammensveien 288
The Research Council of Norway
P.O.Box 564
NO-1327 Lysaker

Telephone: +47 22 03 70 00
Telefax: +47 22 03 70 01

post@rcn.no
www.rcn.no

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