The Research Council of Norway

The FRAM – High North Research Centre for Climate and the Environment

Evaluation Report

Evaluation
Division for Resource Industries and the Environment

The Research Council of Norway

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Executive Summary

Introduction

In 2018, the Research Council of Norway (RCN) established a committee to evaluate the FRAM - High North Research Centre for Climate and the Environment (FRAM Centre). The committee conducted its work from September 2018 to April 2019. In accordance with the evaluation mandate from the Ministry of Climate and Environment, the evaluation has mainly assessed how well the FRAM Centre delivers and communicates research-based knowledge for the Norwegian management of climate, environment and cultural/human resources in the High North.

The Evaluation Committee was not asked to conduct a comprehensive assessment of the scientific quality of the FRAM Centre related research. Scientific quality has nevertheless received a general appraisal, mainly based on the work and output of the FRAM core scientific activities: the Flagship programmes.

General assessment

Based on the interviews with FRAM researchers and Flagship leaders, the self-assessments provided by the Flagship programmes and member institutions, the views expressed by users of the FRAM research outcomes, as well as other documentation provided, the committee's assessment is generally very positive regarding all three FRAM Centre components, namely the FRAM Centre building, the FRAM Centre collaboration and the FRAM Centre support company. This positive impression is derived from assessing the functioning of the FRAM Centre in light of its two main objectives, as defined by the Ministry of Climate and Environment. These objectives are to:

- contribute with research-based knowledge that makes Norway an excellent manager of the environment and the natural and cultural resources in the High North, and
- further develop into an internationally leading centre in performing policy relevant research into the Arctic environment and climate.

The Evaluation Committee is of the view that the FRAM Centre has fulfilled these objectives to a large extent. The FRAM Centre provides excellent opportunities for knowledge development relevant for the High North by providing a structure for formal and informal collaboration between 21 Norwegian research institutions in very diverse research fields. The committee is impressed by the high quantity of research projects supported by the Flagship programmes and considers the output of all Flagships generally to be of high quality and relevance.

The FRAM Centre collaboration enables the development of multidisciplinary approaches that are necessary for understanding the developments and complex challenges for environmental protection and sustainable development in the High North. It particularly creates a research platform of relevance for developing ecosystem-based management and integrated sustainable use. It also plays an internationally acknowledged role within environmental monitoring, among others due to its important observation programmes in Norway's High North and in the Arctic. Several of the Flagship programmes have achieved this, while others still need to develop further.

The evaluation also states that the knowledge generated under the FRAM Centre cooperation, clearly is of high relevance both to Norwegian policy making in relation to its own High North territory and maritime zones, as well as to Norway's contribution to knowledge sharing and policy making at the international level (e.g., through the Arctic Council Working Groups and the UN

Environment in international conventions such as the Stockholm Convention on persistent organic pollutants and the Minamata Convention on mercury). The dialogue with stakeholders, however, in particular local communities, could yet be further improved.

The committee still is of the opinion that the functioning of the FRAM Centre could be further improved. The international recognition and the efficiency of the collaboration would benefit from a stronger leadership and a revised structure. The joint funding of the FRAM Centre Flagship programmes and collaboration is essential for ensuring cooperation, but the short timeframe of the funding (annual basis) creates challenges, particularly for the smaller FRAM Centre member institutions. While much effort is put into the promotion of interdisciplinarity, the assessment makes clear that truly interdisciplinary research projects are relatively rare. For instance, a substantial part of the projects within certain Flagship programmes are characterised by a specific, single-disciplinary scope, resulting in a rather limited contribution to a good understanding of ecosystem-based management. Furthermore, social sciences are underrepresented in the work of most Flagships. The committee notes that the branding of the FRAM Centre could be strengthened, with more priority given to acknowledging the FRAM Centre and its member institutions in international recognised research publications. The involvement of students in the Flagship programmes and its contribution to education, and the dialogue with stakeholders, could be further improved.

Recommendations

The Evaluation Committee offers the following recommendations for further strengthening the FRAM Centre in its scientific and managerial tasks:

- The leadership structure should be changed to provide an efficient leadership that also could adapt the FRAM Centre collaboration to a changing future. This involves an influence on the funding distribution to the Flagships.
- The FRAM Centre should in the future have a leader with clear scientific competence, a clear mandate and allocated time to lead. The leader should have its office in the FRAM Centre building. A merger of the FRAM Centre leadership and the current research leader group could be explored.
- Many of the FRAM member institutions have little or no continuous scientific participation in the FRAM Collaboration. The membership structure should be adapted accordingly. A new mixture of full and associated membership could be explored.
- The FRAM Centre Limited company should change its name in order to better reflect its supporting role, as well as making the important branding of the FRAM Centre less confusing and more consistent. This could be decided upon after the development of a clearer strategy for the collaboration.
- The FRAM Centre should develop a clear vision for the Centre as a whole and a strategy towards fulfilling the objectives set for the Centre. The strategy should include elements such as stakeholder engagement and branding.
- The Flagships should to a greater degree focus on those projects that require and could exploit the FRAM Centre collaboration by utilizing the competences of the relevant FRAM members.
- The Flagship programmes should concentrate more on strategic oriented science and more strongly support incentive research that specifically requires the FRAM Centre collaboration. More emphasis should be given to projects with science closely connected to societal challenges. Less support should be given to projects that are add-ons to already funded projects. It is also clear that long term strategic research will require development of new

technology. There should be a better balance between natural science, social sciences and technology.

- A process could be installed within the FRAM Centre collaboration to regularly revise and potentially change the content and lifetime of the different Flagship programmes, when necessary. This could also lead to a more homogenous broadness and better complementarity of the Flagship programmes.
- An increased transparency of the distribution of funds within the Flagships should be achieved.
- For projects with funding contributions or in-kind participation and support from industry, clear and transparent rules for research, work, publication and ownership must be established.
- The integration of social sciences and social scientists across all FRAM Flagship programmes and research projects should be supported and strengthened.
- All the FRAM members should clearly indicate the contribution from the FRAM Centre collaboration in their publications and reports.
- The integration of and funding for students into Flagship research should be strengthened and the FRAM Centre could develop common activities for students at all levels and projects.
- A transdisciplinary and iterative communication between researchers and stakeholders, and stakeholder engagement across all Flagship programmes and research projects, should be developed and encouraged.

More specific recommendations to the different parts of the FRAM Centre are given in the respective chapters.

Future perspective

In view of the strong characteristics and performance of the FRAM Centre, it is important to note that all FRAM member institutions, Flagships and stakeholders that have provided input for the Evaluation Committee's work, strongly agree that the FRAM Centre collaboration should continue to exist. The committee is of the view that the objectives set for the FRAM Centre are still extremely relevant and constitute a strong fundament for future cooperation. The committee sincerely hopes that its findings and recommendations may support the continued important role and further development of the FRAM Centre.

Acknowledgments

The committee would like to express its sincere appreciation of the cooperative, enthusiastic and open attitude of all persons who were so kind to provide information and share their views on the functioning of the FRAM Centre. The committee hopes that they recognise their input in this report. The committee would also like to thank the strong and effective support provided by the Research Council of Norway.

1 Introduction

1.1 Norwegian Arctic Policy and the FRAM Centre

The FRAM - High North Research Centre for Climate and the Environment (Framsenteret) – was established as an umbrella organisation for 21 different institutions in 2010, as an expression of a significant change in Norwegian Arctic policy. The modern history of Norwegian Arctic policy started with the FRAM expedition in 1893-96, with a new turn after the First World War, when Norway as a small and non-provocative power got jurisdiction over Svalbard, codified in the Svalbard Treaty of 1925.

The Cold War made political tension in the Arctic intrinsic to the Great Power contest, but the strategic and military significance of the Arctic faded during the 1990s. After the dissolution of the Soviet Union, geostrategic confrontation was replaced by an agenda of climate change, research cooperation and economic interests. Cooperation across national borders was institutionalised in the Arctic Council, the Conference of Parliamentarians of the Arctic region, the Northern Forum, and other interstate and non-state associations, including indigenous peoples' organisations. Regional collaboration mechanisms were established, notably the Barents Euro-Arctic Region (BEAR) and the EU Northern Dimension.

The geopolitics of the Arctic has changed from strategic confrontation to exploitation of natural resources, environmental issues, questions of jurisdiction, and prospects for new shipping routes, intensified with rising temperatures. The reduced tension after the Cold War has coincided with a shrinking and thinning sea-ice cover and technological improvements in resource extraction. The Arctic, therefore, has regained a prominent place on the political map within different geopolitical circumstances.

A topic for debate among strategic analysts and politicians is whether a scramble for the Arctic is underway or not. Most participants, not least in Norway, have concluded that a scramble outside the legal institutions is beyond the short to medium term horizon. There are prospects for new petroleum findings in the Arctic, but most of these will probably lie in areas where national jurisdiction is undisputed. Oil and gas deposits in what might remain of disputed areas are probably the least interesting commercially. Jurisdiction of the Arctic continental shelf is not yet finally established, but there is an on-going process under the UN of settling the outer limits of the continental shelf, to which all Arctic nations adhere and to which potentially strong non-Arctic actors, such as China, have declared that they will also adhere. The official Norwegian slogan for Arctic policies, developed a decade ago, still is "High North, Low Tension".

At the political level, there has been some debate about who should be the legitimate actors in international politics in the Arctic: the 'Arctic five' (the states bordering the Arctic Ocean), the 'Arctic eight' (the 'Arctic five' plus Finland, Iceland and Sweden). During the last many years, the Arctic Council with its eight member states, permanent participants and many observer states, has been the most important Arctic intergovernmental organisation. China and other Asian countries have gained permanent observer status in the Arctic Council. China is now planning for a Polar Belt and Road along the sea route to the north of Siberia, adding to the Belt and Road Initiative further south.

In 2006, when the Norwegian government announced its Strategy on the High North, the Arctic areas were declared to be a national priority, erasing the dividing line between foreign and national policies. The new strategy was many-stranded, covering challenges from climate change,

environmental protection and indigenous interests to petroleum extraction and other types of resource exploitation.

The second step in the new strategy was taken in 2009, with a policy document called New Building Blocks in the High North. While Norwegian policy during the Cold War and in the immediate aftermath had been concerned with Arctic issues in the waters north of Norway, the new strategy was more circumpolar and extensive. A major topic in the second step was the establishment of the FRAM Centre in 2010, signifying that the new High North policy and management should be knowledge based, on a broad scientific basis. Scientific insight should also be the basis for business development, resource extraction and multilateral agreements.

In this respect, the FRAM Centre is one of the core organisations in the Norwegian Arctic strategy that was declared a decade ago.

1.2 The evaluation of the FRAM Centre

As a basis for further development, the Research Council of Norway was tasked by the Ministry of Climate and Environment to perform an evaluation of the FRAM Centre in 2018. The evaluation should be based on the goals set for the centre by the Government in 2010, which clearly expressed that the FRAM Centre should contribute with the knowledge needed to make Norway the best manager of the natural- and cultural resources and the environment in the High North. The research communities participating in the FRAM Centre collaboration should develop into a leading international centre for climate and environmental research in the northern areas. The centre should provide research-based advice to Norwegian authorities, industry and the public as well as contributing to international political processes. Furthermore, it was expected that the centre should establish good networks nationally and internationally, actively communicate new knowledge and improve the general literacy of High North issues. The FRAM Centre should also successfully integrate new recruitment, education and research on the basis of multidisciplinary and interdisciplinary research, with close cooperation among science, technology and social science.

The Evaluation Mandate, which is enclosed in Annex 1, describes in the first part the overall framework for the evaluation as instructed by the Ministry of Climate and Environment. The following part, provided by the Research Council, specifies the implementation details and the relevant performance indicators that would be relevant for the Evaluation Committee. RCN provided secretarial support to the committee and used the FRAM Centre Limited Company as contact point at the FRAM Centre for all formal and practical aspects of the evaluation.

It is important to note that, according to the mandate, the evaluation should give primary weight on the assessment on how well the FRAM Centre delivers and communicates research-based and societal-relevant knowledge for the Norwegian management of climate, environment and cultural/human resources in the High North, as well as to what extent the knowledge is used. The assessment of scientific quality is, therefore, not the primary aim of this evaluation. However, a general appraisal of scientific quality and production is still included to the degree that it is judged to be a necessary basis for the FRAM Centre to deliver knowledge of high quality and relevance to Norwegian authorities and the society.

The ability to define the borders of the FRAM Centre has also been discussed by the committee. The evaluation has primarily assessed the knowledge production under the Flagship programmes as requested. It has been difficult to define and separate the knowledge production that originates from the Flagships and what is contributed by the individual member institutions themselves or other external funding to the members. The Evaluation Committee has relied on the background material

provided by each Flagship and member institution. To some extent the committee has judged in how far the results are attributable to the cooperation under the FRAM Centre Flagships and joint outreach activities.

The **main objectives** of the FRAM Centre are to:

- Contribute with research-based knowledge that makes Norway an excellent manager of the environment and the natural and cultural resources in the High North.
- Further develop into an internationally leading centre in performing policy relevant research into the Arctic environment and climate.

The **secondary objectives** set for the Centre are:

- The Centre will help analyse the challenges in the High North, both in terms of environmental and social consequences. The analyses will serve as a basis for policy design, to reduce risk and ensure that new activities are carried out in a sustainable manner.
- The Centre will have a focus on applied research and contribute to input to international processes.
- The Centre will contribute to enhanced multidisciplinary and interdisciplinary cooperation among institutions and researchers with scientific, technological and social sciences so that the overall challenges for the High North can be seen in context.
- The Centre will be an active intermediary of research results from climate and environmental research in the north to trade and industry, educational institutions, public authorities and the general public.
- The Centre will help strengthen education and contribute to PhD and master's degree education through cooperation with relevant institutions for higher education in climate and the environment.
- The Centre shall stimulate research collaboration between relevant national institutions, fill knowledge gaps, identify needs for new competence and produce national added value.
- The research communities participating in the Centre shall establish well-functioning networks nationally and internationally, as well as cooperation with other R&D communities in the region. Good teamwork and common identity are required as basis for the cooperation in research and education in the north and to make the most effective use of existing infrastructure and competence.

It is important to underline that the Evaluation Committee has been independent and has been allowed to provide recommendations that go beyond the framework of the evaluation. The committee has been free to forward relevant feedback and key messages provided by the participating institutions into the report.

2 Background and implementation

2.1 General remarks

The Evaluation Committee (Annex 2) was appointed to evaluate the “FRAM Centre” according to the attached mandate (Annex 1). It is essential to understand that in this context “FRAM Centre” means three different entities:

- The FRAM Centre building, hosting several research institutions in Tromsø;

- The FRAM Centre collaboration specific funding, from the Ministry of Climate and Environment, allocated to six separate Flagship programmes;
- The FRAM Centre Limited Company that has the responsibility to provide services to the two previously mentioned “FRAM Centres”.

In this evaluation it is of crucial importance to keep these components apart, but also to investigate their interrelation.

The committee expresses its thanks to the cooperative and open attitude that all the participants in these contacts have shown. All parties that the committee has interviewed clearly stated their positive attitude to the FRAM Centre collaboration, albeit from somewhat different perspectives. They also pointed out certain issues and suggestions for the improvements to the FRAM Centre structure and functioning.

2.2 Evaluation committee

The Evaluation Committee consisted of nine international and independent experts that together covered the research areas and scientific disciplines under the six FRAM Centre Flagship programmes. Consisting of senior professors, scientists, civil servants and research managers, the committee was chaired by a former director of a national agency with several roles in the scientific, economic and industrial development in the High North. The committee was gender balanced and international with members from Norway (2), Sweden (2), Denmark (1), Germany (2), The Netherlands (1) and Canada (1). Several committee members had previously been involved in other programme committee or evaluation work for the Research Council of Norway.

The RCN Division Board for Energy, Resources and Environment approved the following members of the Evaluation Committee:

- **Dr. Bo Andersen**, former Director General of the Norwegian Space Centre (**Chair**)
- **Prof. Dr. Karin Lochte**, Prof. Dr. in Biological Oceanography, former Director General of the Alfred-Wegener Institute, Germany
- **Dr. Björn Dahlbäck**, former Director of the Swedish Polar Research Secretariat, Sweden
- **Prof. Øyvind Østerud**, Professor of Political Science at the University of Oslo
- **Prof. Kees Bastmeijer**, Professor of Environmental and Water Law, University of Tilburg, The Netherlands
- **Dr. Magdalena Muir**, Res. Associate with the Arctic Institute of North America, University of Calgary, Canada
- **Senior Adviser Mikala Klint**, Head of Section, EU, International & Arctic Cooperation, Ministry for Environment & Food, Denmark
- **Prof. Göran Ericsson**, Professor in Wildlife Ecology, Swedish University of Agricultural Sciences, Sweden
- **Prof. Inga Monika Koszalka**, Junior professor in Physical Oceanography, GEOMAR, Germany

2.3 Background material

The background material that was made available to the Evaluation Committee prior to the site visit was provided by the FRAM Centre Limited Company, the member institutions, the Flagship leaders and RCN.

A final organisation and overview of the background material was prepared by the RCN (Annex 3). The material can be divided into the following categories:

1. Plans, reports and presentations of each of the member institutions
2. Research plans and annual reports of the Flagship programmes
3. Publication lists
4. Self-assessments, following a template from the RCN
5. Impact cases submitted by the Flagship programmes
6. National strategies and assessments

2.4 Organisation, committee conferences and site visit

The Research Council of Norway acted as secretariat for the evaluation. The secretariat assisted the committee in setting up the necessary meetings and the programme for the site visit. It also prepared the background material and the report template. The Evaluation Committee convened in one physical meeting (only) and total nine video-conferences. During the site visit in Tromsø the committee met with the FRAM Centre leadership, representatives from the six Flagship programmes, the FRAM Limited Company, and representatives of 15 of the member institutions. The committee also met several students connected to the FRAM Centre, as well as a group of relevant users of the research results and knowledge generated under the FRAM Centre. In Oslo, the committee met with representatives from the Ministry of Climate and Environment, the Ministry of Foreign Affairs, and the Ministry of Trade and Fisheries. The agenda of the site visit is provided in Annex 5, and a list of the people interviewed by the committee in Annex 5B.

2.5 Guiding considerations of the evaluation

The Evaluation Committee recognizes that Norway is one of the leading nations for research in the Arctic and in the northern areas. The political support at highest level for this research is very pronounced. It has during the last years (e.g. via the recent international evaluation of Norwegian polar research) become evident, that to further the science ambitions of Norway for the Arctic and the northern areas, coordination of research and adaptation of research to emerging questions have to be strengthened. The committee sees a unique opportunity for the FRAM Centre to be an international renowned science incubator for ground breaking and impact oriented polar research in Norway and to establish a model for high quality, solution-orientated research and policy. This model could later be expanded to other parts of Norway, and also stand as an international prototype and inspiration.

The Evaluation Committee sees the main success factors of an umbrella organisation like the FRAM Centre, with its background and objectives as:

- Focus on overall objectives
- Result oriented cross-disciplinary and cross-border collaboration
- Open and creative atmosphere
- High quality of science
- The necessity to collaborate on specific science topics within the collaboration
- An attractive workplace for employees, collaborators and funders
- A leadership with a clear mandate that is understood and accepted

The Evaluation Committee was guided by three questions addressing important issues for securing and develop the output from the FRAM Centre. In our viewpoint these issues relate to: WHY change (PROBLEM), HOW to change (STRATEGY), and the last WHERE to go (VISION).

- "Why" relates to addressing problems that can clearly be seen in our observations and assessments, i.e. background and rationale for changes.
- "How" is quite often and unfortunately not included in plans for the future of an organisation. "How" relates to the decisive processes to bring about needed changes.
- "Where" relates to giving direction to future developments and is a fundamental task that the Centre has to perform.

3 FRAM Centre Membership, Structure and Governance

3.1 Membership

The FRAM Centre as a collaboration consists today of 21 institutions capable of producing science and one associated member connected to outreach. These institutions vary in size and location of their activities. Two of them have their headquarters in the FRAM Centre building. Eight institutions have main offices outside Tromsø, but have units in the FRAM Centre building. Nine institutions have main offices or smaller groups elsewhere in Tromsø. The final two institutions are completely located outside Tromsø. Some details of the member organisations and their relation to the FRAM Centre are given in in the table 1 below.

The institutions vary from being commercial, through private and public institutes, to public institutions and governmental directorates. The Evaluation Committee sees this spread of organisations as giving an added value, but also that it can provide areas of organisational conflicts within the FRAM Collaboration. It can also create conflicts of interest for some of the FRAM members as well as questions regarding research ethics.

The Evaluation Committee received input from the majority of FRAM members, including self-assessments from Flagship programmes and member institutions. All members were given the opportunity to meet the Evaluation Committee during the site visit, and 15 of the member institutions used the opportunity to meet different parts of the committee.

This evaluation is not an assessment of the individual member institutions, but of the FRAM Collaboration itself. No general evaluation considerations are therefore given for each of the member institutions. Specific considerations related to the member organisations are mentioned when relevant for the FRAM Centre.

It is possible to divide the FRAM members into groups, in connection with size, location, involvement in FRAM Centre projects and how they relate to the FRAM Collaboration. The classification into groups will always imply some generalization but may give some indications on the development of the FRAM Collaboration.

Table 1. The FRAM Centre Member institutions

(The short form FRAM below means the FRAM Centre building. The information is extracted from self-assessment schemes, annual reports and websites. Shareowners equities in the company FRAM Centre AS in italics) .

Institution	**Type of institution**	**Staff total FTE's (researchers + advisers/ consultants**	**Turnover total** (Mill. NOK)	**Staff in the FRAM Centre or Tromsø (researchers + consultants/advisers)**	**Flagship contribution, (Lead in bold + contribution to projects)**
FRAM members with Main Office in FRAM					
APN - Akvaplan-niva (NIVA)	Company (non-profit)	136 (54+46)	173	**136** (100) 100 in FRAM	**Hazardous Fjord&Coast MIKON**
NPI - Norwegian Polar Institute (41%)	GOV INST/Agency	170 (73+29)	334	**150** (73+29)	**Arctic Ocean Ocean Acidification**
FRAM members with department offices in FRAM (Location of main office)					
Norwegian Radiation and Nuclear Safety Authority (0,82%)	GOV Agency (Oslo)	120 (10+80)	198	**6** (2+3)	Arctic Ocean
Norwegian Mapping Authority (11,5%)	GOV Agency (Hønefoss)	851	1300	9	
National Coastal Administration (11,5%)	GOV Agency (Ålesund)	965	2288	**15**	
IMR - Institute of Marine Research	GOV INST, (Bergen)	765 (232)	1088	**80**	**Ocean Acidification Fjord&Coast** Arctic Ocean MIKON
NIKU – Norwegian Institute for Cultural Heritage Research (3,3%)	Env INST, (Oslo)	117	137	**7** (6)	
NILU – Norwegian Institute for Air Research (11,5%)	Env INST, (Kjeller)	162 (104)	197	**13** (9)	**Hazardous** Mikon
NINA – Norwegian Institute for Nature Research (8,2%)	Env INST, (Trondheim)	245 (164)	385	**27** (19)	**Terrestrial MIKON Fjord&Coast**
Nofima – The Norwegian Institute of Food, Fisheries and Aquaculture Research	Prim INST (Tromsø)	370 (204)	595	3 (1)	Mikon
SINTEF Group	Tech INST, (Trondheim)	2000 (1400)	3200	17	**Arctic Ocean**
FRAM members localized in Tromsø but not in FRAM					
NIVA – Norwegian Institute for Water Research	Env INST, (Oslo)	210 (151)	320	3	Arctic Ocean

					Ocean Acidification Fjord&Coast Hazardous, MIKON
MET - Norwegian Meteorological Institute	GOV Agency (Oslo)	400 (105)	482	Tromsø dep.	Arctic Ocean Terrestrial
NORUT – Northern Research Institute	Tech INST, (Tromsø; Narvik)	130	134	Tromsø dep. 69	Terrestrial
NIBIO – Norwegian Institute for Bioeconomy Research	Prim INST, (Ås)	633	720	Tromsø dep.24	Mikon Terrestrial
UiT – The Arctic University of Norway – BFE-faculty	UNIVERSITY (Tromsø)	408 (286)		408 (286)	Arctic Ocean **Terrestrial** Arctic Ocean **Fjord&Coast**
National Veterinary Institute	Prim INST, Oslo	337 (159)	370	Tromsø dep. 3	Terrestrial
NGU – The Geological Survey of Norway (0,82%)	GOV Agency, (Trondheim)	200 (160)	247	2	
Polaria (Associated member)	OUTREACH (Tromsø)				
FRAM members localized other places in Norway*					
CICERO Centre for International Climate Research	Env INST, (Oslo)	65 (46)	94	0	Terrestrial
UNIS – The University Centre in Svalbard	UNIVERSITY (Longyearbyen)	149 (105)	147	0	Arctic Ocean Terrestrial

Company = Private research company
GOV INST = Governmental owned research institute
GOV Agency = Directorate or Agency under Ministry
Env/Tech/Prim INST = Research institute with basic funding from GOV/RCN
* The Norwegian University of Life Sciences (NMBU), was member from 2014-2017.

Comparing those members that have a significant amount of people in Tromsø or in the FRAM Centre building with those that do not have many people in Tromsø, leads to the conclusion that the strongest FRAM Centre participation in Flagships comes from the institutions in Tromsø.

If we compare FRAM members within Tromsø, the picture is also relatively clear. Apart from the University of Tromsø, the strongest involvement in the Flagships comes from those institutions located in the FRAM Centre building. The Evaluation Committee notes that all the Flagship leaders, except for the University of Tromsø, are located in the FRAM Centre building.

The Evaluation Committee observes that the reason for engagement in the FRAM Collaboration varies widely between the different member institutions and their participation in the different

Flagship programmes. For some of the Flagships and FRAM members the activities may be part of the institution's work plans, while for others it is merely a side activity helping to produce knowledge input to the authorities. Especially for smaller institutions, the scientific and financial opportunities offered by the FRAM Collaboration are of special importance.

There are very large differences in the engagement of the members in the FRAM Centre activities, including the Flagship programmes. Several members have little and intermittent participation in the activities. However, due to the important and specific competences in the relevant research areas, the Evaluation Committee believes their membership should be retained at some level, despite their current lower activity level.

The Evaluation Committee observes that the co-location of more than half of the FRAM members in the FRAM Centre building is clearly favourable for the collaboration. For the smaller members this co-location additionally gives an added value through closer cooperation with the other science fields, also located in the FRAM Centre building.

The Evaluation Committee does not see the different engagement levels as a problem for the FRAM Collaboration. It is, however, seen as a problem concerning an effective leadership and governance of the FRAM Centre. The different involvement of members could, therefore, be reflected in the governance structure of the FRAM Centre (elaborated further in the chapter Structure and Leadership).

Within the fields of natural sciences, the FRAM members have good competences that cover the broad scientific fields of the Flagship programmes. This of course is connected to the fact that the Flagships content is, at least partly, defined by some of the members. However, the Evaluation Committee observes that for some natural science areas and for social science in general the representation in the Flagships could be improved. Inclusion of these into the collaboration would strengthen the FRAM Centre research.

The Evaluation Committee observes that the current membership structure combined with the governance structure makes it difficult to react to change, both with respect to the scientific activities and who should be member of the collaboration. Concerning the membership, the Evaluation Committee observes that there are several members that currently have little or no participation in the Flagship programmes.

3.1.1 Recommendations

- The membership structure should be revised with the aim to streamline the governance processes (see below). A differentiation between strongly involved members and less involved ones could be considered. An alternative to the present setup could be having fewer full members and include associated members. All would have access to funding, while only full members would be involved in governing the collaboration.
- Better representation of social sciences in the Flagship research is recommended. This implies inclusion of groups from other departments or faculties at the Arctic University of Norway or further afield in Norway.
- The integration of laboratories and other facilities at the FRAM Centre could be strengthened through better coordination and planning.

3.2 Governance, Structure and Leadership of the FRAM Collaboration

The current governance of the FRAM Centre is unnecessarily complex and inefficient. There is the running of the FRAM Centre building which is the responsibility of the FRAM Centre Limited Company. The company supports some of the Flagships project selections. As a legal entity it can handle funding and distribute this to the Flagships, as well as providing support to varying outreach activities. Each of the Flagships has extensive independence on the internal utilization of its direct funding. At the same time the leadership of the FRAM Centre has no influence on the distribution of resources.

The leadership of the FRAM Collaboration is organised via the Centre Meetings. The committee sees this as an example of not so well-developed collective leadership. The meetings occur about every half-year and are attended by the responsible scientific and managerial leadership of the member institutions. A leader of the FRAM Centre is currently elected for a period of two years, with the possibility to be re-elected for one new period. Among other tasks, the FRAM Centre leader chairs the Centre Meetings.

The Evaluation Committee observes that the Centre Meetings, as governing structure, does not have a strong leadership capability. The member institutions have very different interests and involvement in the management of the FRAM Collaboration. This implies, since all decisions have to be made by consensus, that it will be difficult to find agreement on fundamental issues and strategic choices. An example of a difficult decision-making case would be to close down a Flagship programme or replacing it with another. The current Centre Meeting has no direct influence on the running of the Flagships nor on the Flagship funding. Several of the member institutions referred to the Centre Meetings as “interesting seminars”, but with little managerial impact. Also, several FRAM members expressed the opinion that the leaders of the member institutions did not have a strong enough “hands on” experience to set the scene for the further development of the FRAM Centre collaboration.

The scientific discussions are carried out within the Research Leader group. This group, however, does not have any formal role in the leadership of the FRAM Centre. It could be discussed if this structure should have a stronger leadership role and potentially be the leadership group of the FRAM Centre collaboration.

It also remains unclear who represents the FRAM Centre to the outside world. In the current setup the elected head of the FRAM Centre will at the same time be leader of his or her own institution, implying little time for scientific and strategic leadership of the FRAM Centre, and the potential for conflicts of interest is also present. The FRAM Centre Limited Company is only a support entity for the collaboration and does not govern nor represent the scientific collaboration.

For the above reasons the Evaluation Committee considers that the FRAM Centre presently does not have a well-functioning leadership that is able to both lead the running of the collaboration and to adapt the Centre to internal and external changes.

A real leadership should have an influence the flow of the funding. The current more or less fixed Flagship funding to the lead institutions does not encourage change or development of the Flagships. The FRAM Centre leadership should have influence on at least an adjustment of the Flagship funding from the Ministry of Climate and Environment.

The Evaluation Committee observes that there is a naming confusion and that the FRAM Centre Limited company should change its name. Alternatives for a name could be FRAM Support or FRAM Centre Support. It could also be considered if this company should have a supporting function in the selection process of the distribution of the Flagship funding, thus contributing to increase the transparency of this process.

3.2.1 Recommendations

The ineffective leadership stems from the current membership and governance structure. The Evaluation Committee strongly recommends that this has to be changed to ensure a continued ability to meet the goals of the FRAM Centre mandate and its continued positive development in response to the scientific and political developments in the High North. How this should be done, must be discussed between the Ministry of Climate and Environment and the current FRAM members. However, we see that the following aspects have to be considered in these discussions:

- The FRAM Centre should have a leader with scientific competence, a dedicated mandate and located in the FRAM Centre building.
- The new leadership structure could include an active Executive Board elected by all FRAM members.
- An integration of the roles of the Research Leader group with the Centre Meetings could be discussed.
- The leadership should have influence on the distribution of funds within the collaboration.
- The leadership should be responsible for the development of a "Vision" for the FRAM Centre as a whole and for the ways (strategy) to develop the FRAM Centre towards the vision.

4 Flagship programmes

4.1 Introduction

The main part of the scientific work within the FRAM Centre collaboration is organised in six different Flagship programmes, each with a specific leadership structure. Five of these Flagships were proposed by a working group of central institutions upon the commencement of the FRAM Centre. The proposed flagships were then assessed and chosen by the Ministry of Climate and Environment in 2010. The last Flagship, MIKON, was originally proposed as an independent programme, but was reduced in size and was established as a Flagship within the FRAM Centre collaboration in 2014.

RCN carried out a mid-term evaluation of the science plans for the five original Flagships in 2013/14. This external evaluation found that the scientific quality was good. According to the instructions the current evaluation does not go into detail in the evaluation of scientific quality, but rather focus on whether the science produced is relevant to the goals set up for the specific Flagships and the FRAM Centre mandate in general: that is to provide scientific results of great relevance to the Norwegian management of the High North.

The different Flagships are, on the basis of an annual application, financed directly by the Ministry of Climate and Environment. Several of the members noted that the effective funding timeline from March to November made it difficult for long-term planning and efficient use of the funding. This problem seems to be greatest for the smaller member institutions. In addition, it restricts in particular the employment of PhD students in the Flagship projects, as the funding for the time of the doctoral work cannot be guaranteed. In spite of the required annual funding lines, the Evaluation

Committee would encourage the Ministry to look into alternatives of the current funding structure. For the efficient running of the collaboration there should be a more direct involvement in the funding distribution for the Flagships by the leadership of the collaboration. Also, it varies strongly how the different Flagships interact with its stakeholders.

Institutions that have a significant presence in Tromsø lead all the Flagships, many of these are situated in the FRAM Centre building. The leadership institutions for each Flagship have not changed since 2010. There is also not set an end date for the Flagships. This seems to severely inhibit the dynamic development of the Flagships and the flexibility needed for securing the best quality of the science.

The Evaluation Committee observes that all of the Flagships have had a broad production of scientific papers that in different manners are important for a good scientific based management for the northern areas.

The Evaluation Committee observes that there are significant differences in how each Flagship is organising its work. We conclude that each Flagship should not necessarily be built on the same structure as their working format and science conducted is very different. We have the opinion that the transparency of the distribution of funding within the different Flagships should be improved as well as the process of project evaluation. Furthermore, the science plans should be followed closely by the Flagship projects and the funding of the activities within each of the Flagships should not be "a mini RCN". Within some of the Flagships there should be a stronger will to prioritize between the different projects. In fact, the Evaluation Committee considers that RCN could be used more frequently for scientific evaluations.

On a general basis, the scientific funding within the Flagships can be divided into three groups: (1) Strategic or infrastructure funding, (2) Incentive funding for new projects and (3) Additional project support funding for the existing projects. Specifically, the strategic funding goes into development of infrastructure and/or long-term projects. The incentive funding is a starting point for the work on what is deemed necessary future observations. The project support funding is in general an additional funding to bring an added value for the FRAM Collaboration from other fully financed projects.

We observe that the Flagship funding itself is more important for the smaller member institutions as means to enhance the scope of the research topics they undertake.

We observe that the integration of the different Flagships into the strategy of the respective lead institutions is varying. Some of the Flagships are closely interlinked with the priorities of their lead institutions and could possibly be carried out inside these institutions without the FRAM Collaboration. In other cases, the Flagships could content wise possibly be adjusted even more to the public and policy management needs. This specifically applies to the Arctic Ocean (AO) and Ocean Acidification (OA) Flagships. For the former the funding has been used to build up a much-needed mooring north of Svalbard, while for the second this has been focussed on building up competence on the field within IMR and NPI. This competence may be important for both institutions, but the Evaluation Committee cannot see that this building up of competence is central in the mandate of the FRAM Centre.

We observe that the broadness of the Flagships differs significantly and that the borders between them can sometimes be fuzzy. In addition, the evolution of the Flagships is not prominent as their fundamental structure has not changed significantly over up to eight years.

The Centre Meetings proposed a new Flagship on Plastic in the Arctic. In the current funding from the Ministry of Climate and Environment there are separate funds set aside for increased collaboration between the Flagships. These funds have been used to fund this project in a pre-Flagship period. There does not seem to have been a real discussion on how the funding for a new Flagship should be acquired if the Ministry does not come up with additional funding. Should this Flagship replace one of the others or should all or a few of the others have reduced funding? The Evaluation Committee has not gone in detail of the evaluation of this proposed Flagship, but observes that the connection to the High North is not yet clear and should possibly be strengthened.

The FRAM Centre provides the cooperation platform, but the projects in addition need the infrastructure of the member institutes. The FRAM Centre and its financing is essential as networking platform and "glue money" for the collaboration. This is particularly important for the smaller partners. There seems to be a lack of recognition of the FRAM Centre as a funding source. The Flagship leaders stated that it would be important to make the Flagship scientists proud of the FRAM Centre and to use the FRAM brand and logo more frequently. In fact, it seems important to develop a FRAM brand in order to become visible as an international leading institution.

4.2 Flagship Sea Ice in the Arctic Ocean, technology and agreements

4.2.1 Flagship characteristics

The flagship was established upon the onset of FRAM Centre in 2011 whereby the scientific programme was formulated by a group of expert scientists on request of the Ministry for Climate and Environment and subsequently re-formulated after the mid-term evaluation. The flagship is led by the NPI, SINTEF and UiT. The flagship programme is very broad regionally and spans natural sciences, social sciences and technology. A few themes within natural sciences themes have been prioritized reflecting research priorities of the leading institutions. The tendency to settle on institutional research areas and the mono-disciplinary aspect of the funded projects (rather than exploring the cross-disciplinarity of the posed research questions) has already been pointed out during the mid-term evaluation in 2013/2014.

Over the entire period (2011-2018), 16 flagship projects addressed issues related to monitoring, changes and impacts of the sea ice distribution (including ocean circulation and ecosystems), 8 projects addressed development of new industrial (mainly shipping) activities and 4 addressed Arctic governance.

Project funding range from pre-projects exploring a specific topic with an annual budget <1300k, medium projects with annual budget 1300-500k and large 3-year projects with budget up to 1Mio/year. Multi-year projects are only sent for external review at the initial submission. If project duration exceeds one year the projects are required to submit a progress report and are re-submitted annually for approval. As a strategic measure to comply fully with the Flagship scientific programme, there is annually a pre-selection ("invitation") for projects (10-15 per project call opens for proposals in selected topics based on the current portfolio of flagship projects with the aim of prioritizing research in the areas were the flagship has a lack of projects, or where projects are near completion. All medium-size and large projects are subject to expert peer-review and final selection based on ranking. The project selection procedure raises concerns among the FRAM members as unclear, this issue is addressed in more detail in the general recommendations to the Flagships.

By the construction, the Flagship collects natural, social and technological sciences under its umbrella. However, the individual projects within the Flagship are for most mono-disciplinary and not exploring the cross-disciplinary and synthetizing dimensions as already pointed during the mid-evaluation.

4.2.2 Science and Collaboration

The Flagship delivered a few large and successful projects, e.g., A-TWAIN (monitoring of warm Atlantic inflow to the Arctic, developed into a RCN/SIOS 10-year project), CASPER (monitoring of ice from space, continued within CIRFA, Centre for Integrated Remote Sensing and Forecasting for Arctic Operations), ModOIE (high-resolution mesoscale modelling of Arctic Ocean), A-LEX (shipping activities and governance) and (IfiSAW, impact of ice floes and waves on ships, which led to establishment of a SINTEF Ocean office in Tromsø).

A-TWAIN (Long-term variability of warm Atlantic Water inflow region) started in 2011 and consumed in total 10.1 million NOK from the flagship in addition to in-kind funding from the participating institutions. The project established and serviced a mooring system north of Svalbard (Kvitøya) aiming at monitoring inflow of the atlantic water into the Arctic. The warm atlantic inflow contributes to shrinking of the sea ice cover and impacts ocean circulation ("Atlantification of the Arctic") with consequences for the Arctic climate and its marine ecosystem. Data from the Kvitøya mooring array is combined with the mooring time series at the Eurasian Basin and with synoptic observations of turbulence and biological parameters for a holistic and interdisciplinary assessment of the atlantic inflow and its pan-Arctic impacts. The data is also used to evaluating regional modelling system (ModOIE, see below). A-TWAIN developed into a 10-year RCN/SIOS project procuring the continuation of the long-term mooring time series.

ModOIE (Mesoscale modelling of Ice, Ocean and Ecology of the Arctic Ocean) started in 2011 and consumed in total 7.6 million NOK from the Flagship in addition to the significant in-kind in form of researcher hours from participating institutions (core: APN, NPI, MET, IMR). The project delivered a high-resolution regional ocean-ice modelling system through coupling of the Regional Ocean Modelling System (ROMS) and ice model (CICE5). The model is used to interpret the moored observations from A-TWAIN in a broader regional context and to map the circulation and processes associated with the inflow. The developed model configuration will be also serving The Nansen Legacy project (Pioneering research beyond the present ice edge).

CASPER (Characterization of Arctic sea ice properties from remote sensing applications, 2011-2014, 4.6million NOK) was successful in improving satellite-based classification of sea ice from space through a collaboration between UiT, NPI, Norut and MET as well as KSAT and has spun 10+ publications reporting the developments). CASPER lay a foundation for, and is continued within CIRFA (Centre for Integrated Remote Sensing and Forecasting for Arctic Operations).

A-LEX (Regulating Arctic Shipping: Political, legal, technological and environmental challenges) run 2011-2015 (5.4 million NOK) was an interdisciplinary collaboration between SINTEF, APN and UiT addressing the increase in the shipping activities in the High North and associated opportunities and challenges in the realm of technology and marine security and rescue operations as well as impacts on the Arctic ecosystem. The research within the political science considered developing regulations of shipping activities in Polar waters.

IFiSAW (Ice floe interaction with ships and waves) started in late 2015 as a collaboration between SINTEF and UiT and consumed in total 2.8 million NOK from the Flagship. The project focused on mechanical and hydrodynamic interaction between ice-floes and marine structures (vessels,

moorings) when waves are present and the consequences these interactions have for marine operations close to the ice edge. The project developed an unique modelling tool to study these aspects and can be used for the design of vessels and marine structures.

Overall, the flagship reported 64 independent publications and multiple conference communications which we evaluate as a decent output considering the invested funding. Potentially high-impact publications from the long-term monitoring projects are still in preparation. Scientific data produced in the Flagship is stored in the institutional and/or national data bases (data.npolar.no, NIRD, this includes open access to modelling data from ModOIE and the model code is also available through GitHub).

4.2.3 Relevance for stakeholders

The Flagship has not been explicitly mentioned by the interviewed stakeholders. Nor has the Flagship been very explicit in defining its impact for stakeholders. The only direct pathway of knowledge to stakeholders is through a monolog of annual reports to the government which impact is hard to evaluate. However, the Flagship has influenced decision-making and developments in the region significantly through indirect pathways: annual reports, publications, conferences, advisory role of the NPI. It was pointed out as third relevant Flagship for the public sector in the user survey conducted by the RCN for the evaluation.

Data and understanding gained though the Flagship research on monitoring Atlantic water inflow and sea ice distribution are important sources of information for the Ministry of Climate and Environment on how and why the sea ice north of Svalbard is diminishing at an alarming rate with implications for marine transport, safety, rescue operations and fishing. The Flagship marine policy research outcomes are relevant for the development of shipping, fisheries, petroleum extraction and resource management in the Arctic–the Barents Sea, north of Svalbard and the Polar Basin. The Flagship has made long-term impact by seeding new collaborative research centres in Norway: CASPER was a building block of the RCN-funded Centre for Integrated Remote Sensing and Forecasting for Arctic Operations (CIRFA) and A-LEX contributed to the establishment of the Jebsen Centre for the Law of the Sea at UiT. Both CASPER and IFiSAW fostered collaboration and knowledge transfer between academic and research environments and industry, they strengthened integration of SINTEF to the FRAM Collaboration and led to the establishment of new research areas at the SINTEF-Ocean office in Tromsø.

The governance projects are relevant for the development of shipping, fisheries, petroleum extraction and resource management in the Arctic – the Barents Sea, north of Svalbard and the Polar Basin. The publications include 12 papers addressing governance and policy journals with potential impacts to stakeholders. The understanding of the ice conditions addressed in the Flagship also have a direct impact on the development of shipping, fisheries and potential petroleum extraction.

Under the flagship projects, collaborations with US (WHOI), UK (SAMS), France (L'Ocean/UPMC), Netherlands, Germany (AWI), Poland (IOPAS) have been established. A-TWAIN has been a partner to the US NSF project NABOS (Nansen and Amundsen Basins Observational System) and to the UK NERC project Arctic Prize. The Kvitøya mooring data (A-TWAIN) and the sea ice monitoring system (CASPER) save generated knowledge relevant to inter-governmental organisations (IPCC, Arctic Council) and integrated in their reporting and advisory activities.

With regard to education, recent Flagship activities have engaged about 10 Master and PhD students.

4.2.4 Recommendations to the Flagship

- More effort should be put into addressing the policy relevant issues holistically and synthetically by integrating natural, social science and technology within individual projects. The more synthetic/holistic approach might require deeper structural changes through collaborations with other flagships (e.g., Ocean Acidification, Hazardous Substances).
- The Flagship should try to establish transdisciplinary communication pathways with stakeholders in order to more specifically address management issues of the High North.

4.3 Flagship Ocean acidification and ecosystems effects in Northern waters

4.3.1 Flagship characteristics

The general objective is to understand ocean acidification variability, trends, and the biological effects and socioeconomically impact using a multidisciplinary approach. Since 2017, the sub-objectives have been to determine the variability of pH and CO_2 chemistry in the Barents Sea and Arctic Ocean, and to predict the resulting physiological and evolutionary effects in animal populations in these waters. The Flagship has, *de facto*, expanded into studying multiple stressors since most of the work includes CO_2-pH and at least one additional variable.

The leadership of the Flagship alternates every other year between NPI and IMR. From 2019 the flagship is led by a senior scientist at IMR and co-led by a senior scientist at NPI. The programme is built up around four work packages (WP1: studies the chemical change of the ocean; WP2: ecosystem effects using both species specific laboratory studies using multiple stressors as well as using natural analogues; WP3: concerns biogeochemical modelling to predict future pH/pCO_2 levels as well as advanced ecosystem modelling; WP4 is dedicated to social sciences emphasising the socioeconomic impact of OA (led by NIVA). Other partner institutions are APN, NINA, NORUT/SALT, UiT, UNIS and large international collaboration with Canada, USA, Japan, and Germany.

The funding from the Ministry to the Flagship programme is 6,45 million NOK in 2018. This is estimated to be about 50% of the total budget when considering in-kind contributions from mainly IMR and NPI.

The Flagship, which started in 2011/2012 by building capacity, competence and collaborations with already existing infrastructure at the partner institutions, is still in a competence and infrastructure build-up phase. The OA status and carbonate chemistry were investigated by adding these measurements onto existing research programmes/monitoring. In addition, the Flagship built up laboratory facilities to investigate Arctic organisms in temperature-controlled laboratories. These data contribute to national and international databases and are part of Global ocean acidification monitoring networks to bridge data gaps and increase the information on the Arctic Ocean acidification state and for initiating long-term observations in the Arctic Ocean that is necessary for studies regarding climate change and OA. Ecosystem studies have investigated effects of ocean acidification on key organisms, such as the arctic copepod *Calanus glacialis* and also the boreal counterpart *Calanus finmarchicus*. Copepods are generally robust against ocean acidification, but part of their life cycles have been found to be more sensitive than others.

Uncertainties are as such related to the whole scientific ocean acidification ecosystem effects and societal impact, but also to some extent related to uncertainties in the specific Arctic processes affecting the ocean CO_2 uptake.

The Evaluation Committee appreciates the very professional science competence built up for the objectives of the Flagship. It is clear that strategic decisions were made to recruit, to establish in the field, and to build up expertise on OA in Norway.

4.3.2 Science and Collaboration

The research activities contain a mix of field studies and data collection, simulations in laboratories, biogeochemical and ecosystem modelling and workshops with stakeholders. It includes analysis of impact of OA on polar specific species with relevance to society as well as on different oceanic Arctic ecosystem around Fram Strait.

The Evaluation Committee recognizes an impressive list of scientific publications and also some good examples of outreach activities.

The socio-economic assessments have not yet delivered because the previous pathway of socioeconomic cost-benefit analyses did not produce robust results. It is now suggested by this work package that future projects will work within post-normal science frameworks and explore how uncertainty and risk can be applied.

Collaboration with the other Flagships occurs especially with Arctic Ocean, Hazardous Substances and with Fjord and Coast. This concerns mainly sharing of infrastructure, observations, data and model developments to include the OA component. The FRAM Centre has provided the facility for the cross-Flagship collaboration. The Evaluation Committee sees potential for enhancing common work between the Flagships Arctic Ocean and Ocean Acidification even more.

The Flagship programme points to the importance of providing a-summary-for policy makers. The committee strongly supports this since it will create a solid basis for impact dialogues. At the same time, the committee sees it as a challenge for the management to bring about syntheses when the work is carried out in different work packages and at different institutions.

4.3.3 Relevance for stakeholders

The Flagship sees its impact for stakeholders through input on development plans of Norway in the oceanic realm of the High North. Impacts of OA on ecosystems and harvestable resources and their potential future changes are of great concern. The Flagship also provides input to e.g. the Arctic Council and its working group AMAP/AOA (Arctic Monitoring and Assessment Programme / Arctic Ocean Acidification) where several members contributed to both the 2013 and 2018 AOA report. In addition, the flagship scientists are involved in working groups within ICES (International Council for the Exploration of the Sea), OSPAR (Convention for the Protection of the Marine Environment of the North-East Atlantic) and WOA (World Ocean Atlas) to define indicator variables for both OA and multi-stressor effects.

OA is a global challenge and the Arctic Ocean is particularly sensitive to OA due to its natural chemistry and warming, sea ice processes and potentially increased meltwater, which will speed-up OA in the Arctic Ocean. The FRAM centre mission is to provide research-based knowledge in the High North and is thus highly relevant. The Norwegian data are very relevant in a Northern context and contribute to the further understanding of the unique complexity of parameters affecting the CO_2 uptake and impacts of multiple stressors on the ecosystems and its food chain in the Arctic Ocean. In addition, the Flagship is also motivated by the large Norwegian fisheries interest as fish stocks are

affected. The Evaluation Committee appreciates the international outreach obtained and identification of the potential impact especially to bodies such as AMAP, OSPAR and ICES. The Flagship formulates their Arctic and international cooperation in a convincing way. At the same time the committee feels that the Flagship should be able to even more concretely plan for an increased relevance for the stakeholders.

4.3.4 Recommendations to the Flagship

- In view of the suggestions to reorganize the Flagship structure it should be considered by the management of the FRAM Centre collaboration, if the ocean acidification Flagship still qualifies as an exclusive Flagship or whether it could be a part of a future broader Arctic Ocean Flagship.
- The Flagship is encouraged to further develop its activities in international bodies such as AMAP, OSPAR and ICES.
- The Evaluation Committee supports the work of preparing synthesis documents relevant for stakeholders involved in management and policy at international, national as well as at local level, and suggests to intensify the collaboration with other parts of the FRAM Centre and with other Flagships.
- It is recommended to the Flagship leadership to secure working procedures and funding that enables syntheses of the diverse work packages and also across Flagships.
- The work package on socio-economic assessment has not yet delivered satisfying conclusive results. The Evaluation Committee supports that this work package is developed further especially with the focus on developing socio-economic scenarios based on observations of the ecosystem changes including shelves and fish stocks.

4.4 Flagship Fjord and Coast

4.4.1 Flagship characteristics

The overall objective of the Fjord & Coast Flagship programme is to understand and differentiate among natural variability, effects of climate change, and impacts of other human activities in the coastal regions of northern Norway and Svalbard, such that ecosystems can be better managed and monitored.

The Flagship's investigations address very dynamic, heterogeneous ecosystems with a wide geographical range. The research is carried out in three sub-themes, one of these addresses specifically communication/outreach and management issues.

The Flagship is co-led by three scientists, one affiliated with IMR and the other with the Akvaplan-niva, while the third leading scientist representing social sciences was recently included as Flagship leader. In total, the Flagship research is carried out by scientists from more than 15 institutions. It cooperates well with many institutions that all seem to be contributing to the wide-ranging topics and provide necessary infrastructure.

The present approach is to investigate different aspects by many small projects that all contribute to the central aims of the Flagship. There are 25-30 proposals each year for flagship funding of which 15-19 are funded. The Flagship leaders pre-select the proposals whether they fit to FRAM Centre's mandate; external reviewers and science coordinator also evaluate the proposals. Often the projects are connected to already existing larger external projects with higher funding which increases the

scope and impact of the Flagship projects and gives the opportunity to hire PhD students and research staff.

4.4.2 Science and Collaboration

Although the financial support given via the FRAM Centre is small in comparison to the additional institutional funding, it is impressive how much work is done within these limits. The Flagship lists around 80 peer-reviewed publications since 2013. The themes addressed by the Flagship include migration routes and habitat use by seabirds, microalgae distribution and response to environmental stressors, fish populations along the coast, benthic community change, and zooplankton production and change. The articles are generally published in good journals. The scientific output of the projects is generally very good and, in some areas, internationally competitive. However, there are only very few publications related to socio-economic themes and there is lack of overarching publications that summarize a larger field of science.

In addition to the publication of articles, the Flagship has submitted a comprehensive list of presentations on scientific symposia etc. which shows that the scientists were very active in promoting the results in national and international meetings. Also, here we see only small contribution by social sciences or other fields of science.

Attempts are made to develop the scientific basis for ecosystem-based management, but apparently an agreed concept for ecosystem-based management in the context of the Flagship is still missing. It would be helpful to develop such concept. Climate change impacts on fjords and coast is an important part of the research of this Flagship. However, while there is some research on effects on species, it may be important to strengthen research on climate change impacts on ecosystems as a whole and on modelling to cover this aspect sufficiently. The Flagship is aware that there is a major challenge in closer integration of social sciences and humanities, since the topics of this Flagship have many relevant aspects for the society. It would be important to include the social science expertise of FRAM partner institutions or relevant external partners.

Due to the small scale of the projects the Flagship has the potential to adapt fast to emerging questions. However, there seems to be no mechanism to bring the individual contributions together in an overarching view or assessment of the ecosystem.

The scientific output of this Flagship is not entirely based on FRAM Centre funding. It draws on institutional support and on additional external funding. The Flagship has been very successful to secure substantial extra funding. Since 2011, the basic Flagship funding of 4.8 million NOK/year has been able to secure funding for large research projects totalling over 141 million NOK, largely from RCN. In addition, collaborations of several Flagships, including Fjord and Coast, have contributed to a 60 mill NOK project (SEATRACK). Therefore, the FRAM Centre funding was a nucleus to attract significantly larger amounts of external funding.

There are some overlaps with the MIKON Flagship, which should be addressed.

The FRAM Centre Limited is helping in science coordination; however, the Flagship considers the support of outreach activities by the FRAM Centre as not sufficient for the requirements. This could be achieved, if the central organisation would provide an effective service for common science coordination and outreach for all its members.

4.4.3 Relevance for stakeholders

The Flagship is aware of the importance of transfer of relevant scientific results into society and politics. There is an impressive list of news items, reports and educational contributions documenting

the active outreach activities. Different attempts are made to achieve a good transfer of scientific results to stakeholders (dialogue day, direct information to governmental agencies and information to the public). Especially the Dialogue Day, which includes business, local government, national management, and non-governmental groups, has received positive feedback from both scientists and managers. The Flagship is indeed making a great effort in transfer of scientific results to the public.

The presented projects with relevance for stakeholders are generally improving the scientific knowledge base for management of coastal and fjord ecosystems, but are still very much on the level of scientific research results. Potential impacts for fishing seem to be the most relevant contribution for stakeholders together with some technology developments for environmental monitoring.

It appears that the transfer is mostly a one-way process and science results are presented at the end of the research. The interaction with stakeholders or public is happening often on the level of the project members. In this context, the dialog day is an important event for exchange with stakeholders. However, there is no concept for the Flagship as a whole for joint transfer activities nor for co-designing of projects with potential users.

4.4.4 Recommendations to the Flagship

- Selection of regional areas of common interest should be strengthened where the efforts of several projects can be pulled together to arrive at a more holistic view of the ecosystem.
- Both Flagships, Fjord and Coast and MIKON, are dealing with coastal issues. It has to be discussed in how far they need to collaborate in order to address sustainable management of the coasts.
- Since the Flagship basically works with small projects, it is strongly recommended to strengthen synthesis and integration. This implies to allocate funding for cross-disciplinary synthesis projects and/or for a working group to develop an overarching concept for ecosystem-based management.

4.5 Flagship Hazardous substances - effects on ecosystems and health

4.5.1 Flagship characteristics

The overall objective of the Hazardous Substances Flagship programme is to investigate and understand the impacts of contaminants (Persistent Organics Pollutants, Poly Aromatic Hydrocarbons, heavy metals, radionuclides, mixtures) on Arctic ecosystems and human health with the aim to build knowledge for local and national environmental management and international agreements on pollution control.

The Flagship leader is NILU and APN is the deputy leader - both based at the FRAM Centre, and partners include NIVA, NPI, UiT, NINA, NGU, NMBU, NRPA, NORUT, and UNIS. The programme consists of four different work packages: 1) Human health & society; 2) Animal & Ecosystems; 3) Industry & urbanization; and 4) Risk governance. The first 3 packages have an environmental and human health focus while package 4 focuses on how communication from the research community is received and applied by stakeholders including the Ministry of Climate and Environment. The funding from the Ministry to the Flagship is 7.4 million NOK in 2018 and previous funding in the same range.

The research activities contain human health and environmental studies by field and laboratory studies (trends, biological and human health effects incl. multi stressor effects, epidemiological, non-target/target), modelling and risk analysis.

4.5.2 Science and Collaboration

The Flagship has clear overarching research goals, a strong leadership, four connected work packages with several relevant institutions engaged. The Evaluation Committee notes with appreciation that a professional science competence has been established on pollution impacts and changes on Arctic ecosystems and its populations. The Flagship is internationally recognized for its scientific contribution.

The four work packages are independent but are scientifically connected to each other. It is an advantage that the two leader institutions are present at the FRAM Centre in Tromsø. Though NILU has their main office in Oslo priorities are given to the Flagship and the centre. The Evaluation Committee notes from the consultations that the FRAM platform gives the locally based scientists a profound incentive for cooperation among institutions. However, cooperation with other national as well as international partners seems to get less priority.

The Flagship could be stronger in the integration of social sciences in several of its projects, both in the planning and in the implementation.

Data and publications have contributed to several scientific assessments of international bodies on legacy and emerging contaminants in Arctic ecosystems and human populations (Chemicals of Emerging Arctic Concern, AMAP 2016). Through many years the Flagship has focused on effects of contaminants in top predators including seabirds, and in recent years multi stressors including climate change have been addressed and presented in several publications.

4.5.3 Relevance for stakeholders

The Evaluation Committee notes with appreciation that the Flagship is a strong global player impacting and influencing chemical regulation, such as the UN Environment Programme, the Stockholm convention on candidate and legacy POPs, and the Minamata Convention on Mercury. Inclusion of the siloxanes (D4, D5, D6) in the Norwegian monitoring programme and focus on dioxins have provided data to NEA, and the EU Chemicals Agency ("ECHA") and resulted in potential EU regulation, but also to the AMAP assessments including the Chemicals of Emerging Arctic Concern assessment as well as national and local awareness on health care products.

In addition to the scientific publications on contaminant effects studies on top predators, contributions to national journals have been provided. The impact case study is limited in information on further outreach.

The Evaluation Committee acknowledges the review made by the Flagship for the Arctic Council: From Arctic Science to International Law: "The Road towards the Minamata Convention and the Role of the Arctic Council". This is clearly relevant for the governmental institutions, such as Ministry of Climate and Environment, the Environment Agency, Ministry of Health, Arctic Council and many other stakeholders.

The impact case study on food and health security at the High North borders documents the relevance of risk communication on human health and potential impacts due to contaminated local marine and terrestrial mammals from POPs, heavy metals and radionuclides. Interdisciplinary health and environmental cross border cooperation with Russian Federation and Finland have taken place

with dissemination of knowledge at various venues (schools, conferences, institution reports, seminars) as well as with the national health authorities.

The frequency of outreach activities also seems to be quite high by hosting yearly scientific sessions at the Arctic Frontiers and international chemical conferences. The Evaluation Committee notes with appreciation the work on risk governance, the focus on providing data to stakeholders and on how the data are received by stakeholders. During the committee site visit the Flagship leaders expressed a wish for enhanced communication with national regulatory stakeholders, e.g., agencies and ministries.

The committee notes other good examples on national public awareness and consumer awareness on products which include hazardous chemicals like parabens, brominated flame retardants, and a case study with citizens, students and schools on possible local radon exposure.

4.5.4 Recommendations to the Flagship

- This Flagship based in the High North is a unique platform for Arctic monitoring and research on global pollution and ecosystem changes. The Flagship and Norway has a great potential for influencing hazardous substance regulation at an international level. Human health seems to have a too little focus during the last years.
- Further synergy could be brought forward by enhanced cooperation among the work packages as well as the institutions.
- The Evaluation Committee supports enhanced communication with national management and policy stakeholders to strengthen the goal of the Flagship for more tailored science towards specific regulatory needs.
- The Evaluation Committee also recommends the Flagship leadership to focus on enhancing cooperation with international scientists and partners in order to ensure the best international science to take place at the FRAM Centre.
- The Flagship should continue and where relevant increase its engagement with international bodies such as AMAP, Arctic Council, WHO, OSPAR, and ICES.
- Contributions to local management do not seem to be a highly prioritized topic within the Flagship. However, as the MIKON Flagship covers parts of this aspect, an enhanced cooperation with the MIKON Flagship may cover this task.

4.6 Flagship Effects of climate change on terrestrial ecosystems, landscapes, society and indigenous peoples

4.6.1 Flagship Characteristics

The goal of the Flagship programme is to “advance and build on scientific competence and collaboration within the FRAM Centre in order to establish a dynamic programme that facilitates new knowledge concerning climate impacts on high-latitude socio-ecological systems” (cited from science plan). In practice, although interdisciplinary science has been included since its creation, the point of departure has been natural science with an increasing, but still minor, social science component in the Flagship the last years.

Terrestrial is one of the original Flagship established in 2010 by the FRAM Centre. The Flagship has very well followed the initial science plan with only minor departures. The initial plan was to start and develop the Flagship from persons, units and infrastructure present in the Tromsø region to

create a leading national and international unit. Since the start, there has been a clear progression as the Flagship has included more and more members, and more issues. Currently the Flagship shows a positive, adaptive evolution as we see an inclusion of broader issues and increasing interdisciplinarity compared to the initial natural science focus.

The funding from the Ministry to the Flagship is 6.445 million NOK in 2018. The strengths recognized by the Evaluation Committee for Flagship Terrestrial by being part of the FRAM Collaboration and its financial support is that FRAM offers a longer time horizon compared to e.g. the Research Council of Norway for exploring and nurturing new ideas. The FRAM support has contributed to initiate several new projects that later have developed into larger programmes with support from the Research Council of Norway and/or international funding bodies.

4.6.2 Science and Collaboration

The Terrestrial Flagship publishes excellent scientific quality in publications at high international level. Over time, we see a clear increase and evolution of journals with higher impact. Likewise, Flagship Terrestrial increasingly use the FRAM and other financial support to wisely integrate current and new members. The financial support provided via FRAM and distributed via the Flagship act as both initiation money for new projects and as glue for keeping the slowly growing Flagship together to bring added value. Thus, the strategy to use the money in several smaller portions, we believe is part of the success of good integration of its members, including those not based physically in Tromsø, with time.

The Flagship has had a clear leadership and has solidified the science plan and the consortia during its first eight years. The Flagship has brought international recognition to the terrestrial research to the Tromsø region. Furthermore, using the network provided the by Flagship members they have been successful in recruiting national and international leading scientists. Terrestrial has also been successful in landing competitive grants of the Research Council Norway and to some degree international funds. Currently there is a successful transfer of leadership of the Flagship. They are presently in the phase of revising and writing a new science plan to better accommodate for the changes needed.

4.6.3 Relevance for Stakeholders

The scientific output is of the highest international standard with an impressing collaboration; thus the impact is well beyond the Norwegian scientific community. The interviews revealed that the Flagship Terrestrial had had an impact on both national and international policy work. The Flagship as a whole has not until lately devoted outreach resources to further engage stakeholders and thus to have a more direct impact. Several ongoing projects have, however, an active dialogue and stakeholder involvement. Historically, the Flagship was extremely important for monitoring. This Flagship contributed significantly to the establishment of the COAT infrastructure in Northern Norway and on Svalbard. This is now mainly financed outside of the Flagship. COAT is important for the management of the northern landscape and provides crucial knowledge in the changing times we observe. Both in COAT and in other projects the Flagship provides important and relevant knowledge. The Tromsø co-location is particularly important for its member's aim to further integrate research, education and policy impact. Currently, Flagship Terrestrial has access to the wider Norwegian and International research communities given its members involvement in larger programmes. For the future, the Flagship has to continue to cooperate with international strong centres in Scandinavia, continental Europe, and North America. Right now, the size and current structure of the Flagship may make it vulnerable to changes in Norwegian funding policy.

It is obvious that the Terrestrial Flagship supports the FRAM Centre goals and vision. Besides being a recognized international unit, the Terrestrial Flagship produces knowledge that has national and international impact on the policy level. The Flagship should be acknowledged for their work to strengthen advanced education among its member institutions and, thus, put Tromsø on the map for being an international recognized educational unit.

Tromsø, the High North and FRAM are trademarks that may attract people from all over the world. Using those three in a positive combination provides a unique opportunity to attract and include more disciplines into Flagship Terrestrial; a major challenge for the Flagship is to become a truly interdisciplinary environment. To get there, the Flagship needs to work with international leaders of social science and humanities. Currently, this is a shortcoming. The ambition is there, but in order to achieve more policy impact and affect the policy of the northern areas in view of climate change impacts on the terrestrial environment, the Flagship has to move beyond the current disciplinary borders. Such a broadening would also result in more integrated supervision of e.g. students, which will increase both the international attractiveness of Tromsø as a hub for the Flagship and load the FRAM trademark with more positive values.

The Flagship contributes well to increased collaboration among FRAM Centre institutions. We are pleased to see that the Flagship has been successful in integrating non-Tromsø based units with time as well. With the inclusion of broader competences, the Flagship now much better, compared to the initial phase, contributes with interdisciplinary knowledge for sustainable development of the northern areas with respect to animal-plant-societal interaction.

A broader interdisciplinary focus will also lead to more active participation of local and regional stakeholders which currently is one of the weak points of the Flagship. Without an interdisciplinary broadening and better involvement of local and regional actors, the sustainability goals of FRAM are less likely to be met. The strong international impact on policy is a good start.

To maintain the national leading position for the Flagship, we suggest that Flagship Terrestrial continues to provide support for many small units e.g. those based in Tromsø and partners elsewhere. Physical co-location in Tromsø is important and will be important for future development. There has to be a strong central node in a successful network.

4.6.4 Recommendations to the Flagship

- The Flagship should continue the generation shift in order to safeguard its international recognized research.
- The research projects and research outputs are important to implement Norwegian policy and the Flagship should strive to support evidence for science-based sustainable management.
- The Flagship should increase the active participation from local and regional stakeholders.
- The Flagship should reinforce its research by working with international leaders of social science and humanities to move beyond the current disciplinary borders.

4.7 Flagship MIKON - Environmental Impacts of Industrial Development in the North

4.7.1 Flagship characteristics

The MIKON Flagship is the youngest Flagship established in 2015. It was initially thought as a larger and external programme. But with reductions of the budget and possibly at the instigation and request of the FRAM members it was made a Flagship within the FRAM Collaboration. It has the largest budget, and formal cooperation with all member institutions. Generally, the MIKON Flagship is very relevant for management of the High North. The Flagship was high priority with the Ministry and Norwegian government in supporting the FRAM Centre mandate for sustainable development of Norwegian High North. The MIKON Flagship management team is formed of eight members, and the Flagship funds collaborative research projects within the FRAM Centre. They have a call for proposals, evaluation of proposals and subsequent allocation of funds, while the costs of administration of the Flagship are low.

MIKON has a detailed science plan that outlines the research priorities. As for all the Flagships this plan was accepted by the Ministry for Climate and Environment. The Norwegian Environment Agency was consulted for defining research needs. The science plan outlines MIKON research priorities, and the plan was later evaluated by RCN. The Flagship has divided its work into three main themes. Theme 1: Knowledge base for ecosystem-based management. Theme 2: Impacts on organisms, habitats and ecosystems. Theme 3: Impacts on ecosystem services and social-ecological systems.

Except for the annual reports to the Ministry, MIKON has not provided any special reports to the government or other official bodies, though the MIKON impact report and interviews indicates that research results have been used by government.

Because funding is limited, MIKON encourages flagship projects in seeking additional funding outside the programme. In subsequent clarification, MIKON indicated that of its forty research projects, thirteen projects received additional funds from RCN or EU, four projects received additional funds from oil and gas companies, three projects received funds from the aquaculture industry and three projects received funding from governmental agencies.

The Evaluation Committee observes that the MIKON Flagship in some areas seems to follow an industry-focused problem-solving approach, where it examines possible negative impacts on ecosystems and environments, in order to analyse future potentially negative developments and assess possible regulation. In other areas, like the observation of whale sounds in the Fram Strait, the approach is more in the form of standard natural sciences. The Evaluation Committee observes that this broadness of approach is positive for this type of Flagship.

Currently, stakeholder and local community participation seems limited in some themes, while encouraged in other themes. For example, local participation and stakeholder engagement are central parts of Theme 3 where MIKON has funded several projects with extensive local and stakeholder participation including RConnected, OHiT, FIMITA, IndGov, ECCO, ReinLand and EIARein. In contrast, in Theme 2 the main goal is to investigate how different industrial activities affect habitats, organisms and ecosystems in the North, and there is currently less of a role for social sciences and local and stakeholder participation.

4.7.2 Science and Collaboration

The MIKON Flagship has produced 29 publications in the years 2015 to 2018, some of which in high impact journals. The scientists frequently participated in conferences, often in international meetings. They list 100 items of interaction with stakeholders between 2014 to 2018. This is seen as a general indication of good scientific performance.

Given the MIKON presentation, interview and subsequent discussions with the Evaluation Committee, one issue arises in how far this Flagship's projects and research represent purely academic research, applied government or industry research, or some form of hybrid type of projects and research. In turn, this characterization may affect evaluation and assessment of this Flagship and its projects.

From interviews, the Evaluation Committee was informed that specific projects within the science plan may arise from the needs of the authorities, or in response to issues raised by or experienced by the authorities, industry or public. In MIKON's project portfolio 25 projects (22 million NOK) are exclusively natural science, 5 projects (4 million NOK) are exclusively social science and 11 projects (13 million NOK) are interdisciplinary projects integrating natural and social sciences.

Particularly within Theme 2, which represents more than half of the Flagship project funding, issues and problems may get looked at from a primarily physical or technical perspective. This includes less ecosystemic issues, as well as the regulatory, policy and social context and framework. The Evaluation Committee observes that some projects in Theme 2 lack the broad and consistent involvement of social sciences.

The Evaluation Committee has the opinion that for a Flagship like MIKON that explicitly looks at environmental impact of industrial development, it is essential that the social science part must be stronger across all themes than what is currently done. While stakeholder engagement is adequate in MIKON projects of Theme 1 and 3, consideration of stakeholder issues across Theme 2 may be too limited.

For example, the evaluation committee observed that it may be problematic to conduct mainly natural sciences research in Theme 2 on economic development issues such as mining, aquaculture, hydrocarbons and pollution without adequately considering the wider policy, social, ethical and regulatory context as well as engagement of all concerned stakeholders. Research projects assessing the impacts of such industrial activities on marine ecosystems and species are of broad local, national and international interest. For instance, the deposits of mining tailings on fjords and sea beds is an industrial activity that may currently not even be permitted in several other nations.

The research on the environmental impact of these industrial activities is of general importance in the environmental management of the High North. These aspects are partly commented in the science plan and MIKON has indicated that all its projects are subject to ethical review. However, the Evaluation Committee has the opinion that the inclusion of the broader societal considerations could be strengthened even more.

4.7.3 Relevance for Stakeholders

Across the MIKON Flagship, there are several high impact publications with implications for international policy and governance, local and national decision makers. Integration with industry, and local and national decisionmakers varies with the theme and project. In a limited number of projects industry funds or participates in research. Research involvement of industry in some of the MIKON projects is important. In these cases, it is essential that the results are independently valid

and not inappropriately skewed towards industrial needs. The MIKON Flagship must be very aware of this possibility in designing and implementing the projects. The meaningful representation and participation of public interest and civil society organisations and local communities may be uneven across Theme 2 projects, and this deficiency needs to be addressed.

In a later communication, MIKON has confirmed that social science is an important part of MIKON's deliverables, science plan and project portfolio, and that interdisciplinary research integrating social and natural sciences has a high priority, especially under Theme 1 and Theme 3. However, MIKON acknowledges that the whole FRAM Collaboration must aim for more interdisciplinary projects. MIKON also indicated that it complies with standard procedures for ethical reviews similarly to other Flagships.

It has been observed that some of the concerns about impacts and nature of FRAM Centre and MIKON flagship projects may be addressed through consistent and greater participation and integration of social science and scientists across the Flagship, themes and projects particularly for Theme 2 projects, and including ethics, economic, legal and policy issues. Even if several projects include public interest or civil society organisations and local communities, the Evaluation Committee has the opinion that this should be strengthened across all themes and projects, especially for a Flagship like MIKON.

Since the MIKON Flagship, more than the other Flagships, gives science-based advice on issues of economic and societal relevance, the Evaluation Committee considers it important that all relevant implications need to be included in the research. Only such an approach will provide solid advice for decision makers. It should be considered in the relevant projects, whether ethical, economic, legal and policy issues are adequately addressed. This includes effects on traditional on-going activities together with the direct impact on the environment.

4.7.4 Recommendations to the Flagship

- The MIKON Flagship research projects and research outputs should be based on multi-disciplinary research and science and aimed at implementation of sustainable management of the northern areas.
- The MIKON Flagship projects with industry participation and co-funding must stress the ethical and legal implications of the research projects design and implementation before their approval.
- The integration of social science in the MIKON Flagship and across certain themes and projects should be increased to address ethical, economic, legal and policy issues.
- Public interest and civil society organisations and local communities should be provided with meaningful opportunities for participation in industry-oriented projects.

4.8 Plastic in the Arctic (proposal for a new Flagship)

After internal discussions, the FRAM Centre Meeting has proposed to the Ministry of Climate and Environment that a new Flagship called "Plastic in the Arctic" is to be established. In an initial phase this proposal is funded by resources set aside to increase collaboration between the current Flagship programmes. During the Evaluation Committee visit at the FRAM Centre, the plastic project was introduced by the Hazardous Substance Flagship leads. A call for proposals to the research programme 'Plastic in the Arctic' has been announced by the FRAM Centre in December 2018. The aim is to establish the state of plastic pollution in the Arctic, assess negative effects on ecosystems and inform decision makers about possible measures to reduce impacts.

The Evaluation Committee cannot evaluate this in the same manner as the other Flagships as it is not fully started and has no scientific results.

The rationale for a new Flagship is clear. The new scientific programme is based on the need to study the impacts of plastic in the Arctic specifically. The pollution of plastic occurs from the macro-scale with impacts on marine birds and mammals, to the micro- and nano-scale with potential impacts on the ocean food chain and food consumption where the impacts at all levels are poorly known. The largest sources of plastic in the Arctic are from outside the Arctic and they are transporte into the Arctic by the ocean currents. For larger size plastic the main local sources in the Norwegian Arctic may arrive specifically from the fishing industry, but also from aquaculture, local communities, with lack of proper waste and sewage handling etc. Within other parts of the Arctic, plastic sources are primarily transboundary with plastics now moving on Arctic ice and through the Arctic Oceans causing increased future risk for Norwegian waters. The balance between local and external sources is yet not known in detail for all the relevant scales, but most likely sources are primarily transboundary.

The proposed Flagship for Plastic in the Arctic is an important research initiative as few data are available on the levels and effects of plastic litter and microplastics in the Arctic. Some effects of plastics are not specific to the Arctic and should be understood in a global ocean context. In the argumentation for this proposed Flagship it is stated that the food chains in the cold Arctic waters are simpler with fewer species involved. In this context it could be argued that the Arctic is a good place to study the effects of microplastics and nanoplastics on the different elements of the food chain.

In addition, the Arctic Ocean and its ecosystems are especially vulnerable as other strong drivers as temperature increase, ocean acidification, eutrophication, and pollutions take place. It may be that these ecosystems are uniquely vulnerable to plastics, which will only be determined by further studies and focus on the Arctic.

The international and transboundary origin and transport of plastics into the Arctic is an important aspect supporting this proposed Flagship, and it has some parallels to the study of and international response to the role and vulnerability of the Arctic and its peoples to international and transboundary airborne pollutants. In this way, the Flagship could support Norway's contribution to the Arctic Council and its working groups, particularly AMAP and PAME, but also to the UN Environment Programme and the EU. In addition to species and ecosystem impacts, increasing levels of microplastics have been found in traditional food sources consumed by northerners. While it is yet not known, if microplastics have any effects on humans and ecosystems, contrary to global organic pollution with documented adverse effects, it is viewed as important to take a precautionary approach.

The last and particularly cogent reason to support this Flagship is the human and societal aspect, and the need to support focused socio-economic research and policy response for the impacts of plastics in the Arctic with focus on ecosystem services. It includes regulatory authorities, but also impacts on and engagement with indigenous people, local communities and residents of Norway.

4.8.1 Recommendations to the proposed Flagship

- The Evaluation Committee sees the need for studying the impacts of plastic in the Arctic.
- Only part of the relevant Norwegian institutions seems to be involved in the formulation of this Flagship. As many international institutions are already working with marine litter and plastics, international scientific cooperation is recommended to avoid overlap and

repetition of work, and to focus on unique aspects and added value for Norway's High North and Arctic.

- If the total funding for the FRAM Centre is not increased to accommodate this proposed Flagship, the essential parts of the work needed could be included in several of the other revised Flagships: Arctic Ocean, Hazardous substances or MIKON. Even if a separate Flagship is created there must be a close coordination with the above-mentioned Flagships. Emphasis should be given to a coherent coordination with the national and local policy stakeholders on data and possible mitigation measures, including the fishing and aquaculture industry.

4.9 Recommendations of relevance to all the Flagships

- The Evaluation Committee may consider several of the Flagships as programmes as they have been running with 5-year period and are repeated for the third time. A way of avoiding the Flagships merely to transform into a programme, but rather evolve as dynamic and flexible flagships, the committee recommends the leadership to consider seeking additional external funding for the Flagships.
- The leadership should be able to modify the Flagship programme to make it more dynamic and strategic with respect to the FRAM mandate so that the current issues and gaps in knowledge are always relevant for the management of the High North by the Norwegian government and internationally.
- The Evaluation Committee also recommends the Flagship leaderships to enhance cooperation with international scientists and partners in order to ensure the best international science to take place at the FRAM Centre.
- It appears that the Ministry or management agencies do not ask for specific scientific inputs nor do they give ample feedback to the Flagships. Hence, the Evaluation Committee considers that stakeholders could be even more included in the design and execution of projects when trying to make the research useful for the management of the High North.
- The interdisciplinary cooperation is appreciated by the Flagships, but is often observed to be deficient. There is room for improved cooperation between and among the different disciplines, and natural and social sciences. The Evaluation Committee considers that social science and humanities, legal matters or human health components should be encouraged, incentivized and mandated.
- All Flagships should assess their respective effectiveness in creating syntheses from results emerging from their different projects.
- It is essential that all projects concerning industrial co-funding are ethically coherent with that of the participating institutions.
- The FRAM Centre should be clearly acknowledged in publications.

4.10 Focus on Social Sciences

Multi-disciplinarity or cross-disciplinarity – in particular a combination of natural and social sciences – is stated to be a general aim of the FRAM Centre and of the Flagship research programmes, but is not consistently present in development and implementation of all projects, or consistently utilized in the outreach and communication of the resulting science and research.

The Evaluation Committee observes that the justification for inclusion of social sciences may not be perceived equally strong across all aspects of all the Flagships. *Ocean acidification,* has a small work

package dedicated to socioeconomical effects of ocean acidification and developed different methods to communicate between natural science and social science, while *Hazardous substances* has included some studies of community involvement, communication and popular reactions to information about health hazards. *Terrestrial* has a work package on the adaptive capacity in local communities and among indigenous peoples and a work package on adaptive management of ecosystem services. *Fjord and coast* has little emphasis on social sciences, and for the few attempts to include social sciences had little success, partly due to financial difficulties. *Arctic ocean* has included social sciences in their science plan, in their studies of governance, regulations, cooperative institutions, legal frameworks and information systems, even if not on a par with the strong presence of the natural sciences. The Evaluation Committee has the opinion that there are deficiencies of social sciences and scientists in the MIKON because of the special nature of this Flagship with its focus on effects of industrial development.

Finally, social sciences play a key role in education, communication and outreach across all Flagships, and needs to be integrated in all stages of the research.

The Flagship leaders more or less unanimously declared, in meetings with the Evaluation Committee, that they had not lived up to expectations of multi-disciplinary and cross-disciplinary research. They stated that including the social sciences in the Flagships was challenging. In some cases applications from social scientists have been too few. However, the Evaluation Committee does not view that as an adequate response as research project design needs to incorporate social sciences, versus separate applications.

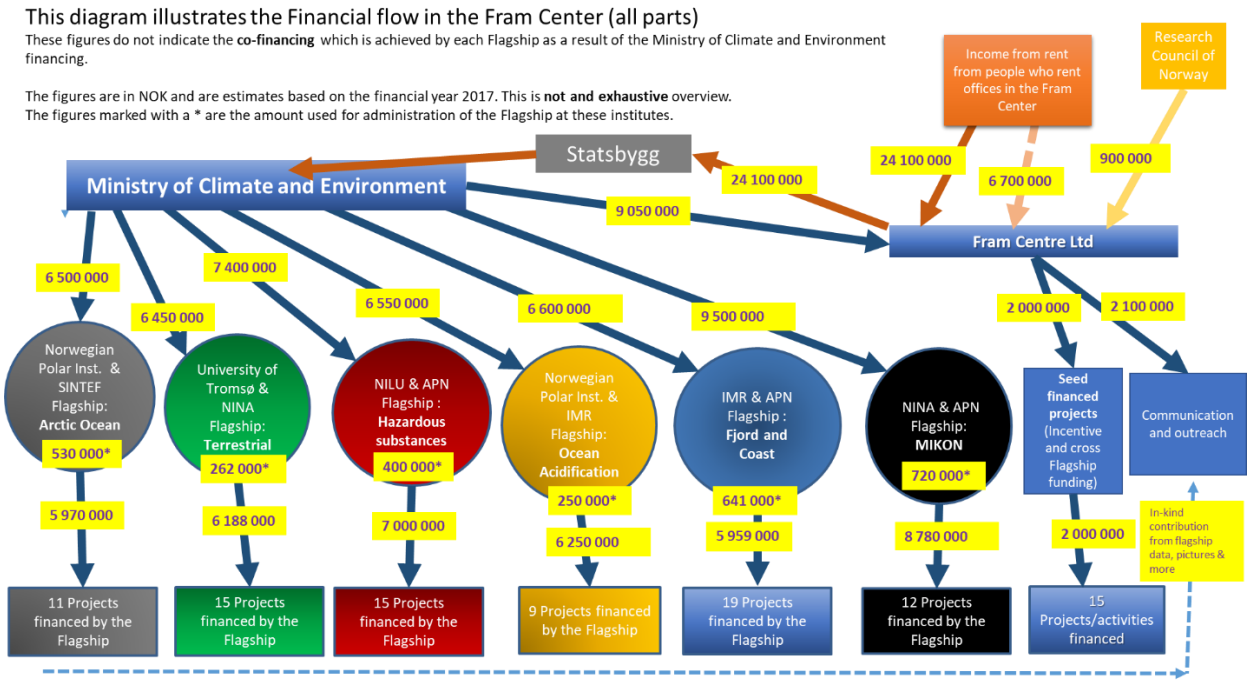
Nearly ten years after the establishment of the FRAM Centre, social science research is still a small part of the Flagship research portfolio. This is not only an expression of internal priorities within the FRAM Centre, but also of a result of too narrow recruitment efforts and role for social science research in the Norwegian High North. Social science is not included as leaders in nearly all Flagships, they are not sufficiently included in shaping of programmes and design of research questions. Social science does not answer natural science questions and this may lead to lower evaluation of social sciences.

The Evaluation Committee is of the view that the above described weak position of social sciences in the FRAM Centre's research is likely to affect the objectives of the FRAM Centre. If Norway is to be an excellent manager of the environment and the natural and cultural resources in the Norwegian High North and an international research leader, it will be important to take a more integrated approach. Scientific research to support sustainable economic development in the Norwegian High North will require a robust application and inclusion of social science in order to understand all implications of that economic development. Social sciences may help to identify gaps in knowledge in international and national management systems and this may be helpful in prioritizing natural science projects within the FRAM Flagship programmes. Social sciences may also help to strengthen the actual use of natural research outcomes in governing systems and overall governance. Furthermore, social sciences may help to get a better understanding of the causes of ecosystem degradation and possible approaches to address these causes and/or to enable ecosystem restoration. Such connections between natural sciences and social sciences may also help the FRAM Centre to further develop into an internationally leading centre in performing policy relevant research into the High North and Arctic environment and climate.

5 Funding and co-location

The FRAM Centre and the research under the Flagship programmes are financed by the Norwegian Government, mainly through the Ministry of Climate and Environment. The research budget is allocated to the Flagships on the basis of annual applications, which also results in annual rounds of applications for project funding under these Flagships. Over the last years the funding to each Flagship has been nearly constant.

Figure 1: The financial flows in the FRAM Centre (provided by the FRAM Centre Limited).



Within each Flagship programme, its management appears to have relative freedom in making decisions on how to use and divide the available budget. For instance, the budget available per project may be limited to a relatively small amount of money, resulting in the funding of a large number of smaller projects. Alternatively, Flagships may also set priorities and fund a small number of larger projects. Most Flagship programmes have adopted the first approach. But this does not necessarily result in only smaller projects as these may also receive substantial co-funding from other resources.

5.1 General observations

Since its creation, the FRAM Centre collaboration and the FRAM Centre Limited Company have received a total support of up to 440 million NOK, covering the 10-year period 2010-2019. The large majority of the funds has gone directly to the Flagship programmes.

Table 2: Funding provided by the Ministry of Climate and Environment to the FRAM Centre Flagships, Incentives, FRAM Centre Limited Company and Polaria, 2018

Description	Sum
Flagships (research including posts 6 flagships specified below)	**42 090 000**
Sea Ice in the Arctic Ocean, Technology and Governance (Arctic Ocean)	6 450 000
Effects of climate change on fjord and coastal ecosystems (Fjord and Coast)	6 000 000
Ocean acidification and ecosystems effects in Northern waters (Ocean Acidification)	6 450 000
Climate Effects on terrestrial Ecosystems, Landscapes, Societies and Indigenous people (Terrestrial)	6 400 000
Hazardous substances - effects on ecosystem and health (Hazardous Substances)	7 350 000
MIKON – Environmental Impacts of Industrial Development in the North	9 440 000
Incentive and cross Flagship funding	**2 000 000**
Outreach	1 500 000
Joint activities	500 000
Polaria	**300 000**
FRAM Centre Limited Company, operation	**7 355 000**
Total (Kap. 1474)	**51 745 000**

The funding for outreach and joint activities are at the disposal for the Centre Meeting to distribute. However, since the Centre Meeting is not a legal entity, the funding is given to the FRAM Centre Limited Company that functions as a bank account for the Centre Meeting. Similarly, the research coordinator and outreach coordinator are working for the Centre Meeting. Since the Centre Meeting cannot employ staff, the personal costs for these 2 positions are placed under the FRAM Centre Limited Company.

The Evaluation Committee is impressed by the high number of projects that have been funded under the various Flagship programmes. In view of the limited funding that is available per project in most Flagships and the fact that funding is limited to a one year time period (or less), the committee considers it very positive that so many member institutions and researchers have been active in applying and participating in the Flagships. In part, this may be explained by the seed money-effect: often FRAM funding is a fundament for additional funding from other sources. Furthermore, as noted elsewhere, the participation in Flagship programmes has also other advantages than funding, such as strengthening the connections within the Norwegian research community, strengthening education, and so on.

This relatively large freedom for budget decisions within the Flagship programmes appears to have advantages and disadvantages. For instance, an advantage may be that Flagship leaders have the space to ensure an adequate division of funding over different disciplines. This appears to be of high importance for ensuring interdisciplinary work within the Flagships.

The committee observes that there is no clear approach or funding mechanism for bringing the Flagship research outcomes together and for enabling overarching analyses of research outcomes within and across the Flagships. This appears to be a concern from the perspective of both main

objectives of the FRAM Centre. It increases the risk of fragmentation in the research, or in other words, limits the chances that interdisciplinary knowledge is provided that are useful for ecosystem-based management of the High North. Consequently, this may also limit to a certain extent the international reputation of FRAM-related research.

As noted above, the funding period of (effectively) less than one year is a challenge for long term planning and efficient use of the funding. It particularly restricts the employment of PhD students in the Flagships as the funding for the time of the doctoral work cannot be guaranteed. Generally, larger institutions can cope with this challenge by taking a certain risk by reserving and ensuring funding for the complete doctoral work, but particularly smaller institutions may not be in the position to take this approach.

5.1.1 Recommendations

The Evaluation Committee would like to provide the following recommendations in relation to funding issues:

- *Funding of overarching analysis:* The committee recommends that a funding mechanism is installed for bringing the Flagship research outcomes together and for enabling overarching analyses of research outcomes within Flagships as well as across Flagships.
- *Funding period:* The committee recommends discussing the short effective funding period and related concerns for particularly smaller institutions. The committee would encourage the Ministry to look into alternatives for the current one-year funding structure.
- Currently the funding of the Flagships comes directly from the Ministry of Climate and the Environment to the lead institution of the Flagship. This implies that the leadership of the FRAM Centre collaboration has no direct involvement. The Evaluation Committee recommends to explore, if this can be adjusted to create a stronger leadership.

6 Cooperation and Outreach

Cooperation with and outreach to the public and local communities is important to transfer research results into local or national management decisions, but also to make the work of the FRAM Centre Collaboration well known. This communication with public and local communities can help that stakeholders and policy recipients will understand and support the research and assist in the implementation of recommendations and policy outcomes. It will also work to build expertise, capacity and partnerships in the public sector and at a local community level, where the impacts and benefits will be most experienced. For controversial research projects, especially on economic developments, this engagement will assist in building social acceptance and social license for governmental policies and decisions. This is particularly important for the development and encouragement of renewable and non-renewable resource development in the Norwegian High North.

As a general observation, we found that cooperation and outreach is not sufficiently developed across the FRAM Centre research and Flagships. This may in part be rooted in the lack of a respective strategy of the FRAM Centre as well as in the limited support staff associated with the Centre. It also goes to the design and implementation of the research and science projects under the Flagship programmes. This is also an area where social science and scientists can play an important role. The Evaluation Committee suggests that there should be public engagement and input into the design and implementation of research and science programmes (co-design). A common concept for

communication and dissemination of research results and outcomes is also recommended. This would be useful across all projects, but essential for projects that consider and address human health, societal issues or sustainable development in the Norwegian High North, such as Fjords and Coasts, Hazardous Substances, MIKON, Terrestrial, and the proposed Flagship for Plastics in the Arctic.

The Evaluation Committee observes that there is not a consistent practice among the FRAM members to acknowledge the FRAM Centre collaboration in their scientific publications resulting from Flagship research. Primarily only the member institutions are referred to. This may signal that some of the members do not identify themselves with the FRAM Collaboration and don't see clearly an added value of it.

6.1 FRAM Centre collaboration to develop knowledge for input in international policy making

The interviews with the FRAM-related researchers and potential knowledge users show that the motivation for providing relevant knowledge is clearly related to the policy making by Norway nationally for the High North, as well as to Norway's role in international cooperation. Reference has particularly been made to the active participation of experts of the FRAM Centre institutions in the Arctic Council Working Groups as well as to the role of Norway in the Arctic Council and international convention systems with a specific importance for the High North.

During the interviews with the FRAM Flagships and member institutions, it was noted that the FRAM cooperation contributes at several levels to Circum-Arctic assessments via AMAP and CAFF by providing research-based knowledge, either through scientific assessments or peer reviewed academic articles, or direct participation in research networks. Information and improved knowledge on ecosystem-based management are also provided, which contribute to national management but also to the work of the Arctic Council working group Protection of the Arctic Marine Environment (PAME). Based on the scientific assessments the working groups prepare policy-based recommendations to the Arctic Council and its Foreign ministers. Data and relevant recommendations are also provided directly at national levels via ministries, agencies or other policy units relevant for the international UN treaty systems, such as the Stockholm Convention on persistent organic pollutants, the Minamata Convention on Mercury, the LRTAP Convention on long range transported air pollution, the Basel Convention on transboundary transport of hazardous waste including plastic, the Strategic Approach to International Chemicals Management (SAICM), the Convention on Biodiversity, Marpol etc. The knowledge transfer also covers inputs to other regional regulatory bodies, such as the EU chemical agency, ECHA, the chemical regulation under EU, REACH, and others.

This important role of developing knowledge as input for international policy making is and will be even further accomplished by the excellent research within the FRAM Flagships and its institutions. In addition, the FRAM Centre is an ideal platform for integrated observations and preparation of cross cutting data relevant for national and international policy instruments and other stakeholders. Several of the Flagships and member institutions have old or newly established monitoring stations; based on long term monitoring programmes scientific data trends are provided (on contaminant levels, acidification, changes in biodiversity). Although the FRAM Centre fosters and encourages multi- and trans-interdisciplinary scientific cooperation, this integration of knowledge and cross-Flagship analysis may be further strengthened.

The Evaluation Committee is of the view that the development of knowledge as input for international policy making, as briefly described above, is directly contributing to the objectives set for the FRAM Centre. Making Norway an excellent manager of the environment and the natural and cultural resources in the High North implies good cooperation in international governance frameworks. This cooperation as well as Norway's position in these frameworks may profit substantially from the research outcomes provided by FRAM institutions. Furthermore, particularly the use of FRAM related research outcomes in international policy making may help the Centre to further develop into an internationally leading centre in performing policy relevant research on Arctic environment and climate.

6.2 Educational aspects

Based on the provided background material and web search, the Evaluation Committee estimates that ~100 PhD and Master students participated in the FRAM Flagship activities. The students are usually linked to the University of Tromsø, the Arctic University of Norway (UiT), with several participating students from NTNU and UNIS and individual joint student projects with University of Bergen, University of Oslo and international universities (Poland, France, Iceland, the Netherlands). In most cases they are recruited from the natural sciences departments (majority from the Faculty of Biosciences, Fisheries and Economics at UiT) and there seems little engagement from the department of social sciences. The students are an important link to UiT as they also integrate the supervisors in the research of the Flagships. Only in a few cases students are paid directly by the Flagship programmes due to the short yearly funding cycles. Therefore, they are generally maintained by external funds. The *Terrestrial* and the *Fjords and Coasts* Flagships engage the largest participation of the students and the student engagement seems to be an important part of the strategy of these Flagships.

The students benefit from work in the Flagship programmes by using the laboratory facilities, by getting exposed to large research questions and interdisciplinary contacts. All participating students highlighted the valuable support from the FRAM Centre and the Flagships. At present there are some common activities for students in the FRAM Centre: AMINOR (for PhD students) and ARCTOS. Funding for these activities comes through the different Flagships, by UiT or by external funding. AMINOR is the Research School in Environmental Research of the FRAM Centre established in 2011. Until very recently, AMINOR was led by two members of the *Terrestrial* Flagship, and this Flagship has been most actively involved in the development of AMINOR so far. In 2018, AMINOR planned a drastic change in the structure to involve more members of the other Flagships. In the future, it will be led by members from most Flagships.

The ARCTOS student network (PhD & MSc) at the Faculty of Biosciences, Fisheries and Economics (UiT) is a partnership with NPI, UNIS, APN, IMR and Nord University with focus on research into marine arctic ecosystems. ARCTOS identifies NPI as a key partner, but does not refer directly to the FRAM Centre as an official partner.

The students expressed a strong wish to develop common activities further that link across all Flagships and that are supported directly by central FRAM Centre funding. They see great value in such common activities as it helps in networking across Flagships and developing interdisciplinary views on their research.

Surprisingly, the FRAM Centre, its facilities and opportunities are apparently not well known to students at UIT and UNIS. There is no common FRAM Centre web portal advertising MSc/PhD/internship student positions. Presently they learn about the opportunities through UiT, NPI

or personal communication. It would be advisable to inform especially younger students, but also early career scientists, about the possibilities to get involved in Flagship research. This way the FRAM Centre would develop closer links to UiT, acquire valuable student support in the Flagship projects, and also strive to involve more students of social sciences in the Flagship research.

6.3 Recommendations

- A joint concept for communication and dissemination of research results should be developed under the FRAM Centre.
- The role of FRAM-related research outcomes in national or international policy making should be made more visible and acknowledged.
- The integration of students into Flagship research could be strengthened and the FRAM Centre could develop common activities, amongst others an information platform for research opportunities for students of all levels.
- There should be encouragement and recruitment of students and early career scientists with interest and expertise in social sciences, public education and science communications to address the social science deficiencies and to build future expertise in the Norwegian High North.
- Funding for AMINOR should be included across all Flagship programmes to strengthen the connection between research and education.

7 Main findings

7.1 Broad general support among member institutions and potential users

There are currently 21 institutions that are members of the FRAM Centre collaboration. Two of these (Norwegian Polar Institute and Akvaplan-niva) have their dominant number of employees in the FRAM Centre building. Two institutions, Institute of Marine Research (IMR) and Norwegian Institute for Nature Research (NINA), have respectively about 70 and 27 people in the FRAM Centre building, while the large majority of employees are situated elsewhere in Norway. University of Tromsø, the Arctic University of Norway (UiT) does not have employees in the FRAM Centre building. Other member institutions have a few people, either in the FRAM Centre building or elsewhere in Tromsø and have the dominant number of employees located in other places in Norway.

The interviews, self-assessments and other sources of background material make clear that the value and importance of the FRAM Centre is broadly acknowledged among the representatives of member research institutions, Flagships and potential knowledge-users, including the Ministries. The two main objectives of the FRAM Centre were explicitly recognized in these motivations:

1. “contribute with research-based knowledge that makes Norway an excellent manager of the environment and the natural and cultural resources in the High North”, and
2. “further develop into an internationally leading centre in performing policy relevant research into the Arctic environment and climate.”

Positive views and support to the Centre were not only received from member-institutions that were actively participating in the research within the flagships. Also, those that were not currently involved in the Flagships considered the FRAM Centre valuable and expressed their ambition to get

more active in the FRAM cooperation. Positive assessments were also not specifically connected to either “protection” or “utilisation” perspectives. Both stakeholders who are mainly focusing on “protection” of ecological and social values in the High North, as well as stakeholders that are more involved in “utilisation” of the High North’s resources, do emphasise the important contributions from the FRAM Centre collaboration and its knowledge production.

7.1.1 Motivations for the broad support

This broad appreciation appears to be particularly based on consensus regarding the importance of solid scientific knowledge as a fundament for policy decisions and the added value of the cooperation between different research institutions to that end. However, the analysis of all interviews, self-assessments and other sources convey a much richer spectrum of motivations for considering the FRAM Centre important and valuable. Most of these motivations connect directly with the primary and secondary objectives that were defined for the FRAM Centre at the time of its establishment. While in respect of many of these motivations space for further improvement was identified, the main strong characteristics of the motivation may be summarised as follows:

Cooperation in multi-disciplinary research

A central added value of the FRAM Centre compared to individual research institutions is that the Centre connects 21 Norwegian institutions in very divers research fields and with research and management interests relating to the High North. By bringing this expertise together through joint meetings, Flagship programmes and concrete research projects, the FRAM Centre provides excellent opportunities for knowledge development that is less isolated and better connected to the ecological, social and economic challenges in the High North. As will be discussed below in more detail, separate joint funding of this cooperation programme is essential for ensuring that this cooperation is actually taking place, although – as also will be discussed – funding as such is not a guarantee to establish truly interdisciplinary research projects.

The FRAM Centre cooperation develops knowledge for ecosystem-based management and sustainable use, and thereby, of value from protection as well as utilisation perspectives. The interviews show that both, the protection and the utilisation perspectives, connect well with the FRAM Centre’s aim to contribute with research-based knowledge to enable Norway to become an excellent manager of the environment and the natural and cultural resources in the High North. The ambition of being the best manager implies the importance of developing scientific knowledge to ensure that utilisation is sustainable and truly in conformity with an ecosystem-based approach. This implies the importance of not only providing specific knowledge on the components of the ecosystem and the effects of specific human activities, but also generating integrated knowledge and more holistic approaches (ecosystem-based approaches) to the research. This is only possible through interdisciplinary work, which emphasizes the importance of the FRAM Centre as a unique framework for cooperation between the different research institutions.

FRAM Centre cooperation to develop knowledge for input in international policy making

The evaluation makes clear that the above motivations relate to Norwegian policy making in relation to its own High North territory and maritime zones (e.g., the fjords, coastal zones and Svalbard), but also to Norway’s role in international cooperation. Reference has particularly been made to the participation of experts of the FRAM Centre institutions in the Arctic Council Working Groups, as well as to the active information providing role and contribution of Norway’s Ministries in the Arctic Council and international convention systems with a specific importance for the High North (e.g., the Stockholm Convention on persistent organic pollutants).

FRAM Centre educational opportunities and training

Around 100 PhD and Master students participate in the FRAM Flagship activities. In most cases they are recruited from the natural science disciplines and there seems to be little engagement from the fields of social sciences. Only in a few cases students are paid directly by the Flagship programmes due to the short yearly funding cycles. The students benefit from participating in the Flagship programmes by using the laboratory facilities, by getting exposed to large research questions and interdisciplinary contacts. All participating students highlighted the valuable support from the FRAM Centre and the Flagships.

7.2 General findings on impact

The Evaluation Committee has put a lot of efforts and time to understand and assess how the researchers look upon the "impact of research" and what impact that can be seen as a result of the on-going joint research activities. The reasoning behind this focus on impact is that it is emphasised in the evaluation mandate and the importance of impact can also be seen from the main objectives of the FRAM Centre: *To contribute with research-based knowledge that makes Norway an excellent manager of the environment and the natural and cultural resources in the High North*.

In the background material delivered by the Flagships and member institutions to the Evaluation Committee, especially the requested examples of impact, and during the meetings with the Flagships, the committee paid extra attention to the issue of impact. The committee frequently challenged the researchers to elaborate on the purpose of impact and outreach and the difference between the two concepts.

An interesting finding was that quite often outreach was seen as the equivalent of impact, i.e. if you had published and disseminated the research results you had also created impact. The committee sees this as an oversimplification. Outreach does not necessarily create impact, but its activities eventually can lead to the sought and wanted impact. As a general recommendation, researchers and especially those in leading positions at the FRAM Centre need to develop and secure mechanisms and internal attitudes in order to increase the level of impact in different parts of the society. Everything to follow the objectives of the FRAM Centre.

Looking at the six Flagships the committee sees quite a broad range of impact initiatives. Some of them very ambitious with a clear impact. Others more difficult to assess whether the presented outreach has led to impact. Some of the Flagships have more inbuilt mechanisms for impact, partly due to the characteristics of the research, such as MIKON and Hazardous substances. In these two, impact is often inherent in the research questions. Others such as the Fjord and Coast and Terrestrial Flagships show examples of ambitious impact initiatives. The Ocean Acidification Flagship presents interesting plans for impact assessments, but it seems that building up the science first has been a necessary strategic choice.

The Ocean Acidification flagship has also created a specific work package for "Socioeconomic consequences and management options" which focusses on the effects on two model organisms. It would be interesting to discuss further why this work package narrowed down to the effects on only two organisms and did not take a broader scope on impacts of ocean acidification in the Arctic.

It is noteworthy that the one flagship, the Arctic Ocean, chose not to deliver any impact case studies because of too many other commitments.

A general recommendation from the Evaluation Committee on impact is that the proposed new and developed leadership should establish an internal discussion process and exchange experiences on

impact, in order to increase the impact from the research carried out under the FRAM Centre collaboration.

7.3 Structure and Membership

All member institutions express that the leadership structure of the FRAM Centre collaboration is too weak with respect to making necessary changes to the Flagship structure, organisation and funding in response to accumulated research findings, the international and national developments within Arctic policy and that of the High North. At present the need for associated changes in research priorities are addressed individually by the revised research plans of the Flagships. The members also clearly state that the FRAM organisational and funding structure itself seems too static and lacks sufficient ability to execute a dynamic response to the changing international and national research arena. The current leadership is in the form of the elected FRAM Centre Leader and the elected leaders of the Research Leader Group. The Evaluation Committee has the opinion that the FRAM Centre collaboration has no real leadership capability in the current setup with a consensus-based Centre Meeting with 21 members. The pre-assignment of the responsibility to specific institutions to lead the different Flagships does not encourage evolution of the Flagships nor their project content. The current structure also makes it unclear who shall represent the FRAM Centre collaboration outwards. A decision process to potentially change the current Flagships or propose a new Flagship is lacking. With a tentatively stable budget, increased activity in one field will require decrease in another. Currently this is impossible. The Centre Meetings have currently neither real control nor influence on the money flow to the Flagship programmes.

There is a very large difference among the member institutions, at what level they engage in the FRAM Centre collaboration. The lowest engagement is from members that do not have a significant presence in the FRAM Centre building specifically or elsewhere in Tromsø. Since the consensus-based decisions in the Centre Meetings have to take into account the opinions of all members equally, independent of their engagement in the FRAM Centre activities, this organisation is not optimal. The dysfunctional leadership is also demonstrated by the collaboration within the Flagships, where some of the members are clearly “sleeping members”, but still have influence in the Centre Meetings.

The Evaluation Committee, therefore, recommends that the structure of the leadership has to be revised to increase the ability and responsiveness to change. A new structure should manage to take care of the different engagement of the member institutions as well as taking care of updating the FRAM Centre mandate and create a unified vision for the collaboration.

It is also important to emphasize that the FRAM Centre is not an autonomous institute, but a collaborative structure. Both the leadership of this collaboration and what science is done under its auspices must be adapted to this.

7.4 FRAM Centre Limited Company

The FRAM Centre support company has three main duties:

- running of the FRAM Centre building,
- supporting the FRAM Centre collaboration
- supporting the outreach activities in the FRAM Centre projects.

The support company is also secretariat for the Centre Meetings of the FRAM Centre collaboration.

Several of the persons interviewed emphasized that the use of the FRAM Centre name both for the building and the support company created some confusion because people outside FRAM did not see

the difference. This misunderstanding could be reduced by changing the name of the support company. FRAM Support or FRAM Centre Support are potential alternatives.

It is clear that the company mainly has an administrative support function and does not directly contribute to the scientific production. There is a possibility that a slightly increased company could take over more of the administrative work in each of the Flagships or provide larger support for common outreach and "marketing" activities for the FRAM Centre brand.

7.5 Flagship programmes

Five of the six Flagships were proposed to the Ministry of Climate and Environment by a working group at the start of the FRAM Centre in 2010. This working group consisted of representatives of four to five institutions in the FRAM Centre. The last Flagship (MIKON) was proposed by the Ministry and commenced in 2014. The Centre Meeting has proposed a new Flagship concerning "Plastic in the Arctic". This is currently a smaller programme financed by the incentive funding which is provided for the collaboration within the FRAM Centre in addition to the Flagship funding. The disadvantage of using the incentive funding in this way is that it may further reduce the inter-Flagship collaboration.

The mandate for the FRAM Centre collaboration clearly states that the collaboration shall produce good science that is relevant to make the Norwegian management of the High North the best possible. The Flagships are the means of the FRAM Centre to provide the scientific added value. The Evaluation Committee finds that, to a larger or smaller extent, all the Flagships have delivered with relevance to the mandate they have been given. However, it is necessary to forward some critical comments concerning the organisation of the Flagships. There is a large difference in the broadness of the scope of the Flagships. There are also different timescales in the results and preparation of results of the different Flagships. Lastly, there is a difference in how the Flagships science is integrated into the main priorities of the institutions, specifically those that have the leadership of these Flagships. The participants also expressed that it was not very efficient to receive funds in March and having to report in November.

Assigning the Flagship responsibility to specific institutions from the start has not encouraged sufficient dynamic evolution of these Flagships. The science plans of the Flagships have been revised, but changes were limited due to the fixed financial and thematic scope. This lack of dynamics is also influenced by the fact that all the Flagships lack a specific end-date.

The different Flagships have used the yearly allocated funds quite differently. Some have used significant fractions of the funds to build up infrastructure (strategic support and investment for the future). Others have added funds to existing projects to incorporate the FRAM Centre (project support) while others use the funds to create projects that have good third-party funding prospects (incentive funding). All Flagships have all of these types of internal funding and some have clearly changed this during the life of the Flagships. In general, the Evaluation Committee is of the opinion that the balance of these types of funding should be looked into with the goal to assure the unique added value of FRAM. This implies greater emphasis on incentive funding, strategic infrastructure or other tasks that depend on the stability of the flagship funding. It is also clear that the incentive type of projects as well as long term strategic projects often requires the development of new technology. Overall the Evaluation Committee has the opinion that the technological side could be strengthened.

7.6 Integration and interdisciplinarity

The Evaluation Committee sees that there are several overlaps between the Flagships as well as significant differences in their broadness. The relatively constant scientific content assigned to the

Flagships should be looked at. There are two possibilities for ways forward. The Flagships could evolve towards even wider areas, e.g. ocean, coast and land. Each interdisciplinary unit could be programmes within these Flagships. Alternatively, the Flagships could remain the same and the project/programme content would be responsible for the development. Or all Flagships (and more) could be more programme oriented, thus narrower. This last alternative would require shorter lifetimes than the current Flagships.

We see that the integration of natural and social sciences varies significantly between the Flagships. In several cases the social science content seems to be "thrown in" at the end just to include it. For other projects the integration seems well thought of and included in the planning from the start. The Evaluation Committee has the opinion that for many projects where there is internal competence in social science, these should be promoted. This is specifically the case for the use of incentive type of funding to create a basis for new integrated projects. Also, there are several cases where a stronger collaboration with researchers outside the FRAM members should be encouraged.

8 General Recommendations

The recommendations here are a compilation of the more general recommendations by the Evaluation Committee. The more specific recommendations to each part are found in the respective chapters.

8.1 Leadership, Membership and Governance

The Evaluation Committee recommends establishing a stronger leadership structure that is more independent of the member institutions than it is today and has more power of decision. The head of the FRAM Centre should have a clear insight into the science of the FRAM Centre collaboration and should set aside about 50% of his or her work time for this task.

The Evaluation Committee recommends that the Ministry specifically asks the FRAM Centre to come up with alternative structures for the management of the collaboration. Several options may be considered, and the Evaluation Committee sees several possibilities for improving the governance structure.

The Evaluation Committee has the opinion that the number of governing members should be reduced. The membership could be limited to active members located in Tromsø. In addition, associated members with specific competences that are needed within the FRAM Centre collaboration and coming from different parts of Norway can be included. These associated members would have the same possibility to apply for funding and participate in projects, but they would have no responsibility towards the joint management of the FRAM Centre collaboration. New structures for membership and governance would have to be established in close collaboration with the Ministry of Climate and Environment.

In general, more focus should be paid to projects and activities that require the collaboration the FRAM Centre provides. Activities should be focussed more on issues none of the Members can do by themselves. The projects should not be an extension of the internal priorities of one or two members. This issue is directly related to the governance of the collaboration.

- A smaller steering group could be installed to enable more effective running of the FRAM Centre collaboration. The steering group should be appointed for a limited time-period. The

first steering group should have the specific task to look into structural issues that are required to increase the future dynamics and flexibility of the Centre.

- The head of the FRAM Centre collaboration should be a leading researcher from one of the institutions located in the FRAM Centre building. The head position could rotate every two years.
- The leadership of the FRAM Centre should have the responsibility of making proposals for strategic development and structural plans (with the support of the FRAM Centre Limited company).
- The membership could be grouped into core Members consisting of institutions with major presence in Tromsø. This includes the larger groups located in the FRAM Centre building and the University of Tromsø.
- The other members could be included as associated to the FRAM Centre with equal rights to get Flagship funding, but with smaller influence on the management of the collaboration.
- The current Centre Meetings could be replaced with an annual meeting of all Member institutions.
- The Evaluation Committee recommends that the FRAM Centre must have an updated view on why it exists and should develop a strategic plan for how to achieve its goals.
- The FRAM Centre Limited company should change its name to emphasize its supporting function.
- The use of the Research Council structures to evaluate the different projects should be considered as well as having more multi-year projects.

8.2 Flagship programmes

The specific recommendations connected to each specific Flagship is noted under the discussion of each Flagship.

- The Flagships must ensure that their scientific priorities require the collaboration the FRAM Centre provides. It must not be just an extension of the priorities of single member institutions.
- The Flagships must be able to adapt to the changing internal and external scientific environment and user needs.
- The selection process of scientific projects to be supported within each Flagship must be made more transparent and the supported projects should be prioritized clearly.
- The Flagship programmes should concentrate more on strategic oriented science and more strongly support incentive research that specifically requires the FRAM Centre collaboration. More emphasis should be given to projects with science closely connected to societal challenges. Less support should be given to projects that are add-ons to already funded projects.
- There should be a better balance between natural sciences, social sciences and technology.

8.3 Funding

- Discussions with the Ministry of Climate and Environment should be started with the aim to have full year funding cycles for the Flagships and projects.
- The restructured leadership should have influence on the distribution of funding to the Flagship programmes.

9 Statement

The Evaluation Committee is positive to the results achieved by the FRAM Centre collaboration. In total the science output has contributed to knowledge that is positive for a knowledge-based management of the High North by the Norwegian authorities. We have made observations and forwarded recommendations that we believe will improve the quality of the science output and adapt the results to the changing needs for knowledge and to meet the overall objectives of the Centre.

We clearly find that the governance and membership structure should be looked into by the partners and the Ministry of Climate and Environment. We have claimed that the FRAM Centre collaboration needs a change in its leadership, membership and governance and have made initial proposals. However, there may be alternatives to our proposals that have to be elaborated with the partners and the Ministry of Climate and Environment.

We observe that the Flagships need to evolve with the changing needs from the management of the High North as well as for scientific development. These needs have to be evaluated regularly by the members and users of the FRAM Centre.

This evaluation report is the consensus view of the evaluation committee based on the overall input of information provided. In general, it does not give the “truth”, but provides some guidelines where the Evaluation Committee believes the FRAM Centre could evolve. This evolution can only be done jointly by the member institutions and the Ministry of Climate and Environment.

Bo Andersen, 02.05.2019

10 Annexes

Annex 1: Evaluation Mandate

The Research Council of Norway was in 2018 asked by the Ministry of Climate and Environment to perform an evaluation of the organisation and scientific activity of the Fram Centre. The evaluation shall pay due attention to the goals set for the centre as formulated in the decision statement dated 02.07.2010. *The Norwegian version of this mandate is approved by the Ministry of Climate and Environment.*

Mandate for the Evaluation of the Fram Centre

1. Background

The Fram Centre was formally established in 2010 as one of the key measures in "New Building Blocks in the North, The next step in the Government's High North Strategy" (2009). The Ministry of Climate and Environment will conduct an evaluation of the Centre in 2018 as a basis for the further development of the Centre. The Research Council will play a central role in the evaluation. The evaluation will be based on the objectives of the Framsenteret set by the Norwegian government and described in the decision memorandum of 02.07.2010. Here, it is stated that the Fram Centre "*will contribute to making Norway the best manager of the environment and natural and cultural resources in the High North". The Centre will evolve into an international leading research centre on climate and environment in the High North. The Centre will provide advice to public authorities, trade and industry, and the public general and input to international political processes. Good research networks will be established nationally and internationally. Multidisciplinary / interdisciplinary research and close cooperation among science, technology and social science should be established. There will be active dissemination, and links to recruit recruitment, education and research."*

The **main objectives** of Framsenteret are to:

- contribute with research-based knowledge that makes Norway an excellent manager of the environment and the natural and cultural resources in the High North.
- further develop into an internationally leading centre in performing policy relevant research into the Arctic environment and climate.

The following **secondary objectives** set for the Centre are:

- The Centre will help analyse the challenges in the High North, both in terms of environmental and social consequences. The analyses will serve as a basis for policy design, to reduce risk and ensure that new activities are carried out in a sustainable manner.
- The Centre will have a focus on applied research and contribute to input to international processes.
- The Centre will contribute to enhanced multidisciplinary and interdisciplinary cooperation among institutions and researchers with scientific, technological and social sciences so that the overall challenges for the High North can be seen in context.
- The Centre will be an active intermediary of research results from climate and environmental research in the north to trade and industry, educational institutions, public authorities and the general public.

- The Centre will help strengthen education and contribute to PhD and master's degree education through cooperation with relevant institutions for higher education in climate and the environment.
- The Centre shall stimulate research collaboration between relevant national institutions, fill knowledge gaps, needs for new competence and produce give national added value.
- The research communities participating in the Centre shall establish well-functioning networks nationally and internationally, as well as cooperation with other R&D communities in the region. Good teamwork and common identity is required as basis for the cooperation in research and education in the north and to make the most effective use of existing infrastructure and competence.

2. The Fram Centre Organisation

The Fram Centre is organised as a research collaboration among the Centre members, on the basis of a binding scientifically based cooperation agreement. The Centre Meeting functions as the top governance level responsible for long term strategy development, strategic decisions concerning scientific considerations, overall monitoring and guidance of the Flagship programmes and outreach. The Centre Meeting allocates seed money and funding for core integrating activities on the basis of applications from the Centre members.

The Fram Centre is multidisciplinary, involves 21 institutions and the joint research activities are carried out within the framework of 6 defined priority areas / Flagship programmes (the first 5 established in 2010 with the 6th established in 2015). The following Flagship programmes are per 01.01.2018 running:

- Sea Ice in the Arctic Ocean, Technology and Governance (Arctic Ocean)
- Effects of climate change on fjord and coastal ecosystems (Fjord and Coast)
- Ocean acidification and ecosystems effects in Northern waters (Ocean Acidification)
- Climate Effects on terrestrial Ecosystems, Landscapes, Societies and Indigenous people (Terrestrial)
- Hazardous substances - effects on ecosystem and health (Hazardous Substances)
- MIKON – Environmental Impacts of Industrial Development in the North

The **leaders of the Flagship programmes** are specially selected among the member institutions. These are tasked to stimulate multidisciplinary and interdisciplinary cooperation, the coordination of member institutions, annual prioritisation of projects that fit within the framework of the Flagship programmes and their science plans. The member institutions appoint representatives as leader and co-leader for the Flagship programmes, and working groups are established in selected areas as found appropriate.

The company ***Framsenteret AS*** is owned by the Centre member institutions for the main purpose of solving common daily operational tasks for the members co-located in the Fram Centre building. The company functions as secretariat for the Centre Meeting and the Research Leader Group, but it does not participate in the scientific activity programme. It is also responsible for profiling the Centre as one jointly integrated centre of competence and provides administrative support and assistance to the research and planning under the Flagship programmes.

3. The Goal of the Evaluation

The goal of the evaluation is to consider how the Fram Centre contributes to the main and secondary objectives set for the Centre. The objectives shall not be evaluated as such.

The evaluation shall consider to what extent the objectives are met, especially with respect to the following points:

a. **Research relevance, quality and impact:**
   The research shall be assessed on the basis of how well the members deliver and communicate research based and relevant knowledge in a way that contribute to the objectives set for the Centre, with special consideration on the relevance of the research for the Norwegian management of the climate, environment and the natural and cultural resources in the High North, as well as the international impact of this research. The scientific quality and production will be included in the evaluation when it is considered relevant to meet the main and secondary objectives set for the Centre.

b. **Cooperation and outreach:**
   The evaluation shall assess how well the Centre contributes to improve the multidisciplinary and interdisciplinary research between natural sciences, technology and social sciences and cooperation with institutions outside the Fram Centre, and how the Centre communicates the research results to all user groups and stakeholders (industry, schools, public authorities and ministries, and the general public).

c. **Organisation:**
   The pros and cons of the current organisation and governance of the Fram Centre shall be assessed with respect to the main and secondary objectives set for the Centre, especially considering the organisational and operational aspects of the scientific cooperation at the Centre and the Mandate and effectiveness of the Centre Meeting. When it comes to the scientific cooperation, the evaluation shall give primary attention to the activities carried out under the framework of the Flagship programmes.

d. **Funding and co-location:**
   The impact of the flagship programme funding and the co-location in the Centre shall be assessed with regards to the objectives set for the Centre, especially considering how these contribute to improve the multidisciplinary and interdisciplinary cooperation among the Centre member institutions. (The funding model as such shall not be evaluated).

Appraisal on the scope:

The evaluation shall not assess the objectives and the funding model established for the Centre as such but shall judge to what extent the objectives are met, as well as consider the effects and added value of the Centre funding. The evaluation shall also consider if the Centre is organised in the best and most effective way to achieve its mission.

4. Detailed Mandate by the Research Council of Norway

15.10.2018

The Mandate (official version in Norwegian), provided by the Ministry of Climate and Environment, constitutes the overall framework for the evaluation. In this section the Research Council clarifies the implementation details and specifies relevant performance indicators to be used by the Evaluation Committee.

The Evaluation Committee must take into consideration the following questions in defining the framework set for the evaluation:

- **Assessment of scientific quality:** The evaluation shall give primary weight on the assessment on how well the Fram Centre delivers and communicates research-based and societal-relevant knowledge for the Norwegian management of climate, environment and cultural/human resources in the North, as well as to what extent the knowledge is used. The assessment of scientific quality is thus not the primary aim of the evaluation. However, an assessment of scientific quality and production is still included to the degree that it is judged to be a necessary basis for the Fram Centre to deliver knowledge of high quality and relevance to Norwegian authorities and the society.

- **Defining the borders of the Fram Centre:** The evaluation shall primarily assess the knowledge production under the Flagship programmes. To the degree that it can be difficult to define and separate the knowledge production that originates from the Fram Centre Flagship programmes and what comes out from the individual member institutions themselves, the Evaluation Committee needs to rely on the material provided by the Fram Centre. Nevertheless, the committee will need to judge to what extent the results are attributable to the cooperation under the Fagship programmes and the joint outreach activities under the Fram Centre.

The Evaluation Committee is independent and can, if it so wishes, provide recommendations that go beyond the framework of the evaluation, and is free to forward relevant feedback and key messages provided by the participating institutions. The Research Council shall also contribute its own administrative and professional comments to the evaluation report, on the basis of its role as main adviser and central player in the development of the Norwegian research system.

5. Evaluation questions and indicators

The Evaluation Committee must first consider the main aims and objectives of the centre, as well as a list of relevant quality parameters and performance indicators.

The evaluation shall consider pros and cons with respect to the organisation of the Flagship programmes and their governance, hereunder the dynamic relationship between the "Centre Meeting" and the "centre ledership", as well as the added value of the Fram Centre co-location, with regard to the implementation of the goals set for the centre.

The committee shall assess the following criteria, in accordance with the goals set for the evaluation (in chapter 3 of this mandate):

a. Research relevance, quality and impact:

The assessment shall consider to what extent the Fram Centre has developed into an internationally leading centre in the area. It is important that the research is of high quality and in areas of strategic

relevance for the Norwegian management of climate, environment and cultural resources in the North. The evaluation will assess the scientific quality and impact of the research that is the basis for the Fram centre activity programme, and the extent of the scientific production that the Fram centre gains from the cooperation under the Fram centre and its Flagship programmes. Special points to consider are:

- Is the knowledge production under the Fram centre relevant with respect to the goals set for the centre?
- Is the scientific production under the Fram centre, especially under the Flagship programmes and in the relevant fields of management and societal relevant climate and environmental research in the North, at an internationally leading level?
- Have the involved research communities in the Fram centre established excellent research networks and research cooperation nationally and internationally?
- Has the Fram centre established broad cooperation and links with the research and development communities in the region?
- Has the centre contributed to improved education at Master and PhD level in climate and environmental research?
- Has the centre been able to attract, develop and keep excellent national and international research talents and experienced scientists, including tools to improve gender balance?
- The Evaluation Committee is asked to identify the most important scientific contributions from the centre.

b. Cooperation and outreach:

The evaluation of cooperation and outreach will consider if the research at the Fram centre is organised in such a way that multi-disciplinarity in high north research is encouraged and improved. The evaluation will investigate to what extent the knowledge transfer and communication activities to the targeted user groups are jointly organised and of high quality, and to what extent the members of the Fram centre provide research-based and relevant knowledge to the Norwegian authorities in managing climate, environment and natural and cultural resources in the high north:

- How the scientific profile and organisation of the Flagship programmes have contributed to the analysis of multidisciplinary challenges in the high north.
- How research at the Fram centre has constituted an effective knowledge base for the decision-making process of Norwegian policy development and management in the High North, as well as contributed to reduce risks and assure sustainability in new activities.
- How the scientific profile and organisation of the Flagship programmes have contributed to applied research and international processes, including its roles in international assessment work (assessments under IPCC, ACIA, AMAP, etc).
- How well the research results originating from the Fram centre collaboration, in environmental and climate research, are communicated to industry, governmental authorities, the general public and educational institutions, and makes the centre a visible stakeholder in the high north?
- Does the international research cooperation at the Fram centre contribute to knowledge production relevant to Norwegian authorities?
- What effect does the position as outreach coordinator have on the joint knowledge communication from the Fram centre, and does the communication and outreach

activities at the Fram centre contribute to building identity and support as a jointly integrated centre, emphasising the trade mark "Framsenteret"?

c. Organisation, strategic leadership and governance structure:

The evaluation will investigate to what extent the mandate and tasks of the Centre Meeting (Sentermøtet) and the Research Leader Group (Forskningsledergruppen) contribute to the goals set for the centre. This includes an assessment of the positive and negative sides of the current organisation and governance structure (including the Centre Leadership, the Centre Meeting and Secretariat), as well as the organisation and effects of the Flagship programmes. A broad assessment of the strategic leadership will be performed (how new challenges, emerging research areas and knowledge needs by the authorities will be/are addressed), as well as the efforts invested in building a common identity (trade mark) based on the diverse expertise and complementarity of the member institutions. This needs to be judged, in addition, on the total economic framework provided for the joint activity programme of the centre. Relevant questions are:

- What are the pros and cons of the Centre organisation and governance model, as well as the Flagship model concerning the use and relevance for the authorities, industry and international processes?
- Is the administrative and technical support at the Fram centre sufficient to reach the goals set for the centre?
- Is the physical organisation of the Fram centre well-functioning? What are the main consequences of some members of the Fram centre located elsewhere than the centre?
- Does the Centre Meeting and the Research Leader Group (Forskningsledergruppen) contribute to high quality research leadership and relevant research?
- How does the Fram centre leadership work with strategy implementation?
- Does the strategic leadership at the centre encourage flexibility towards addressing new challenges, research areas or knowledge needs required by authorities?
- How relevant is the Fram centre strategy for the next five to ten years?
- How successful has the Fram centre been in strengthening the cooperation among the member institutions and researchers with natural science, technology and social science expertise, in an integrated way that addresses the full spectrum of challenges facing the northern areas?
- To what extent and how do the member institutions support the cooperation under the Fram centre, and what is the added value and possible disadvantages for the member institutions in participating in the centre?
- An appraisement will be done of the local, national and international cooperation structures and roles, including outside the framework of the Flagship programmes.

d. Funding:

The evaluation will investigate the impact and added value of the financial resources provided to the Centre for cooperation, as well as the effect of earmarked budgets distributed to the various scientific activities under the Flagship programmes. This will involve assessing to what extent the funding of the Flagship programmes has functioned as seed money for new ideas and research networks and as basis for successful proposals to win external funding from the Research Council, the EU and others. The evaluation shall also assess the added value and impact that the Fram centre funding has had on research results, recruitment, new activities and research areas, new projects etc. on the Fram centre itself. Important questions are:

- How is the Fram centre funding used to support the Flagship programmes for research coordination and leader positions, recruitment positions, long term strategic projects, smaller projects, visiting grants and guest researchers programmes etc)?
- What is the overall impact / added value of the centre funding on the Fram centre as a whole, in terms of scientific results, recruitment, integration, new activities and research areas, new projects etc.

6. Background material

Most of the material for the Evaluation Committee is expected to be supplied by the Fram centre AS and member institutions. Whenever the "Fram Centre" is mentioned below it concerns the Fram centre cooperation and the Fram Centre AS as the contact point for the evaluation. A final list of background material will be prepared by the Fram Centre and approved by the Research Council. The Evaluation Committee may also ask for additional information.

The following background material and sources will be included (responsible institution in parenthesis):

1. User survey among selected respondents (The Research Council)
2. Presentation of the Fram centre organisation, finances and cooperation (Fram centre AS)
3. Annual reports of the Fram centre AS, including economic reports, with an English resume if the reports are not in English, as well as partner institutions (Fram centre AS and member institutions)
4. Strategic plans for the Fram centre and member institutions from 2010 (Fram centre – centre meeting, and partner institutions)
5. Presentation of Flagship programmes (research plans) from 2010 (Fram centre – Flagship leaders)
6. Presentation of projects and results from 2010 (Fram Centre – Flagship leaders)
7. Self-assessments, following a template from the Research Council (Fram Centre, Flagship leaders and partner institutions)
8. Publication lists (Fram centre)
9. National strategies (Research Council)
10. Relevant assessments of scientific fields and sectors where the Fram centre is involved (Research Council)
11. Interviews with the Fram centre "Committee of institutional directors" and "Research heads' group" (Evaluation Committee)
12. Interviews with flagship leaders, and students (Evaluation Committee)

Self-assessment and background material from the Framcentre AS

The self-assessment must include

- Assessment of the role and importance of the Fram centre AS as secretary for the "Committee of institutional directors" and "Research heads' group"
- Examples of how the Fram centre AS has marketed the Fram centre as an integrated centre of expertise within its field.
- Examples of how the Fram centre AS has provided knowledge transfer to public management, the general public, and business communities or how knowledge that has been directly implemented in public management and policymaking.

- List of contributions regarding dissemination measures towards public management, schools, general public and business communities; including Polaria
- Contributions to joint reports, knowledge status, white papers etc.

In addition, it is expected that the Fram centre AS contributes the following information:

- Impact case studies – societal relevance of research conducted at the Fram centre
- Overview of multi- and cross-sectional projects and the proportion of such projects to the total number of projects; development since the Fram centre inception
- Overview of national and international cooperation and research networks
- Overview of PhD theses completed since 2010 within the scientific fields of the Fram centre.
- Overview of education activities connected to the Fram centre, including Master theses and university courses within the scientific fields of the Fram centre or supervised/taught by Fram centre employees.
- Overview of how the Fram centre has worked towards recruiting researchers, and instruments to secure gender balance and attract excellent research talents.
- Strategy- and activity plan for the coming 5-10 years, including the ability of the Fram centre to meet new or changing knowledge gaps within the fields of climate and the environment.

Self-assessment from each of the Flagships

The self-assessment must include:

- The Research Programme
- Examples of how the knowledge produced within the Flagship is disseminated to public management, the general public, and business communities or has been directly implemented in public management and policymaking.
- Five impact case studies – societal relevance of the research
- List of publications (peer-review, reports, conference presentations etc.) and dissemination measures
- Project portfolio, broken down into sources of financing and including project size; including the importance of seed grants for the grant acquisition
- Cooperative projects with educational institutions.
- Research cooperation, nationally and internationally, and networks including contact towards the R&D community in the region, within the framework of the Flagship.
- Strategy plan for the coming five years

Self-assessment for the institutions participating in the Fram centre

- Five most significant research contributions where the institution has had a significant part, and examples on how the research is put to use.
- Five most significant contributions (publications) within the framework of the Fram centre
- Five most significant contributions (publications) outside the framework of the Fram centre
- List/link to relevant publications (peer-review, reports, conference presentations etc.) and dissemination measures
- Description of what the institution considers the added value of the Fram centre cooperation, including the funding of the Centre, the Flagships and the value of (co)-location.
- An overview of cooperative projects with institutions of higher education within climate and the environment, including projects that have been part of university degrees
- The research cooperation within the Fram centre, both within and outside the framework of the Flagships.

- Number of positions, including source of funding, attached to the Fram centre.
- Economic report regarding funds used within the Fram centre and the Flagships
- Relationship between cooperation/synergy and competition for funds with the other institutions in the Fram centre

7. Composition of the Evaluation Committee

The Evaluation Committee will consist of 8-10 international and independent experts that together cover the scientific areas addressed by the 6 Flagship programmes. Each member will have broad expertise relevant to several of the multidisciplinary Flagships. It is important to include expertise in the management of climate, the environment and natural and cultural resources in the high north, as well as experts from environmental management, communication and leadership of research institutions and public agencies providing environmental synthesis and assessment work, for example from Scandinavia. It is also beneficial if the committee members have participated in previous evaluation work for the Research Council. The Research Council appoints the committee and the chair. The following expertise (examples) is needed in the committee:

- Effects of climate change on sea and coastal ecology in the north
    - Marin biology, oceanography, ecology, ocean management, fisheries,
- Sea ice in the Arctic Ocean, technology and agreements
    - Sea ice, cold climate technologies, international law, governance and conventions, maritime industry, climatology, earth system modelling,
- Ocean acidification and ecosystems effects in northern waters
    - Marine biogeochemistry, chemical oceanography, marine biology, physiology, lower trophic levels, fisheries management,
- Effects of climate change on terr. ecosystems, landscapes, society and indigenous peoples
    - Terrestrial biology, social science and geography, law, indigenous people, economy, public management, geoscience,
- Hazardous substances – effects on ecosystems and human health
    - Biology, environmental pollutants, toxicology, biomedicine, health, long range transport,
- Environmental impact of industrial development in the north
    - Marine technology, environmental management, petroleum industry, environmental pollution,

In addition, the evaluation requires expertise in the following areas:

- Management of research institutions providing synthesis and advise to the authorities
- Research leadership and organisation of large research groups/centres
- Communication, outreach and analysis (for the society and industry)
- Strategy work for research institutions or programmes
- Research based education and outreach
- Global/regional modelling, earth system modelling, prediction models
- Assessments, contributions to IPCC, AMAP, ACIA, UN Human development report, etc.
- Natural and anthropogenic climate variability with focus on the high north
- Prediction and predictability of Arctic climate change
- Carbon-exchange in the earth system

8. Organisation and working procedures

The Evaluation Committee will have several virtual/video meetings and one physical meeting (a site visit in Tromsø). The committee can, after its first meeting, suggest changes to the work plan, working procedures and organisation of the evaluation. The basis for the work is the following:

Assessment of a. Research relevance, quality and impact; and b. Cooperation and outreach

- The committee will assess the most important knowledge contributions relevant to the Norwegian authorities, the general society and industry, building on information provided to the committee from the user survey and self-assessments. The assessment will need to consider communication channels, cooperation structures and to what extent the knowledge is used (societal impact).
- The committee will then assess the scientific basis for the knowledge production, the quality of the research and to what extent the relevant research is a result of cooperation under the Fram centre.
- The Flagship programmes will be assessed separately, with respect to scientific quality and outreach/impact.
- The committee will interview the Flagship leaders, individual scientists and students.

Assessment of c. Organisation; and d. Funding and co-location

- The committee will consider the organisation, strategic leadership and governance, based on the presentation given by the Centre leader. This includes an assessment of the scientific cooperation at the Centre under the Flagship programmes, and to what extent and authority the Centre meeting (Sentermøtet) implements strategy, enables progress and meets the goals set for the Centre.
- The committee then will consider the impact of the direct funding channelled to the Flagship programmes and the impact of the physical co-location of the research groups under the Fram centre. This will include a closer look at the total knowledge production and publication output from individual member institutions and the added value of the Fram centre cooperation.
- The committee will carry out interviews with the Centre leadership and the research leader group, and will consider interviewing the top management level of individual member institutions at the Fram centre.

Secretariat, the site visit and elaboration of the evaluation report:

The Research Council will act as Secretariat and prepare the evaluation work in such a way that the Fram Centre will have sufficient time to deliver the background material and the committee will have sufficient time to study the material before the *site visit*. The Research Council will assist in carrying out a simple publication analysis from the Fram Centre (using the publication database Cristin and an assessment of impact from a simple citation analysis using ISI and scolare.google).

The committee will:

- Read the scientific programme plans for the Flagship programmes, the self-assessments and annual reports from the Fram Centre, as well as study other information and material from the Fram Centre available on websites, publication databases, journals etc.
- Develop a plan for the interviews and a list of questions for the Fram Centre. The Secretariat at the Research Council will prepare a detailed programme for the *site visit,* together with the committee. This will be sent to the Fram Centre in due time before the *site visit*. The committee is also free to ask other questions at the interviews.

- Carry out interviews and the *site visit*.
- Write a joint consensus-report. The Fram Centre will have the opportunity to *fact check* the report before the final report is handed over to the Research Council.

The Evaluation Committee is responsible for the writing of the evaluation report (in English), following a template proposed by the Research Council Secretariat. The Secretariat will assist in drafting the report. The Evaluation Committee is independent and allowed to provide advice that goes beyond the strict framework set by this mandate, as well as forward feedback and recommendation received from the institutions themselves. The Research Council will send the evaluation report to the Ministry of Climate and Environment and will have the opportunity to attach its own administrative and strategic opinion of the evaluation report, based on the Research Councils experience and role as main adviser and major actor in shaping the Norwegian research system. The report will be made public according to the Norwegian freedom of information act §7, nd will be published on the websites of the Research Council and the Fram Centre.

9. Schedule

The mandate and project plan are decided before summer 2018 and the Evaluation Committee appointed early autumn 2018 (September/October). The committee shall carry out its evaluation tasks during the period from September/October 2018 – January/February 2019. The final report will be delivered to the Ministry of Climate and Environment in March/April 2019. The site visit will take place in December 2018. The Research Council and the Evaluation Committee will draft a detailed plan for the implementation of the evaluation, in close cooperation with the Fram Centre.

Annex 2: Evaluation Committee

The Evaluation Committee consisted of **9 international and independent experts** that together covered the research areas and scientific disciplines under the six FRAM Centre Flagship programmes. Of key importance was also to include experts with intimate knowledge of the Norwegian Arctic Strategy and High North Policy, experience in environmental and resource management, as well as communication and leadership from research institutions or public agencies providing environmental synthesis work. In addition to this, a good overview of the Norwegian and international research landscape and cross-cutting themes such as global/regional earth system modelling, prediction and predictability of Arctic climate change, natural and anthropogenic climate variability, carbon exchange in the earth system, as well as research infrastructure, technology and logistics should be familiar to the committee. The committee should have strategic and operational experience in the management and organisation of large research groups and centres, as well as operation and strategy work, synthesis work, research education, communication and outreach.

The committee consisted of senior professors, scientists, civil servants and research managers, and was chaired by a former director of a national agency with several roles in the scientific, economic and industrial development in the High North, and was gender balanced. The committee was international with members from Norway (2), Sweden (2), Denmark (1), Germany (2), The Netherlands (1) and Canada (1). Several committee members had been involved in other programme committee or evaluation work for the Research Council of Norway.

The RCN Division Board for Energy, Resources and Environment approved the following members of the Evaluation Committee:

- **Dr. Bo Andersen**, former Director General of the Norwegian Space Centre (**Chair**)
- **Prof. Dr. Karin Lochte**, Prof. Dr. in marine biology, former Director General of the Alfred-Wegener Institute, Germany
- **Dr. Björn Dahlbäck**, former Director of the Swedish Polar Research Secretariat, Sweden
- **Prof. Øyvind Østerud**, Professor of political science at the University of Oslo
- **Prof. Kees Bastmeijer**, Professor of Environmental and Water Law, University of Tilburg, The Netherlands
- **Dr. Magdalena Muir**, Res. Associate with the Arctic Institute of North America, Univ. of Calgary, Canada
- **Mikala Klint**, Head of Section, EU, International & Arctic Cooperation, Ministry for Environment & Food, Denmark
- **Prof. Göran Ericsson**, Professor in Wildlife Ecology, Swedish Univ. of Agricultural Sciences, Sweden
- **Prof. Inga Monika Koszalka**, Junior professor in Physical Oceanography, GEOMAR, Germany

Evaluation Committee members and expertise

	Name	Profile and main expertise according to mandate	Position and appointments	Country	Sex
1	**Dr. Bo Andersen**	***Chair of Evaluation Committee*** **Research/Agency leadership and synthesis work.** **Management, organisation and strategy work** **Norwegian Arctic Strategy and High North Policy** **Norwegian and international polar research landscape** Research infrastructure and logistics Environmental impact of industrial development in the north	**Former director general of the Norwegian Space Centre (2006-2018).** Former member and leader of the **Norwegian National Committee for Polar Research** (Polarkomiteen) under RCN. Extensive experience in the scientific, economic and industrial development in the high north, on the basis that Norwegian space activities, supporting research, public-sector bodies and Norwegian interest in general, have a strong basis in both infrastructure development and knowledge communities in the high north and the Arctic. Several roles in the further development of Svalbard as a research platform, both in research infrastructure (SIOS) and in commercial activities (SvalSat). bo.andersen@spacecentre.no**;** https://www.romsenter.no/no/Aktuelt/Bilder-og-video/Norsk-Romsenter/Bo-Andersen	**Norway**	♂
2	**Prof. Dr. Karin Lochte**	**Effects of climate change on sea and coastal ecology in the north** Ocean acidification and ecosystems effects in Northern waters **Research/Agency leadership and synthesis work** **Communication to general public and industry** Contribution to assessments **Management, organisation and strategy work** Research-based education and communication Norwegian and international polar research landscape Natural and anthropogenic climate variability Research infrastructure and logistics	**Former director general of Alfred Wegener Institute (AWI) 2007-2017.** **Prof. Dr. in Biological Oceanography** with extensive experience in biogeochemistry, ocean acidification, marine biology, management of large research organisation, research expeditions, research infrastructure and logistics, as well as international collaboration. Karin.Lochte@awi.de https://www.awi.de/ueber-uns/organisation/mitarbeiter/karin-lochte.html	**Germany**	♀
3	**Dr. Björn Dahlbäck**	**Norwegian and international polar research landscape** **Management, organisation and strategy work** **Research infrastructure and logistics** Environmental and resource management Research/Agency leadership and synthesis work	**Former director of the Swedish Polar Research Secretariat.** **Member of Norwegian polar research evaluation committee,** previous research leader in University of Gothenburg and Chalmers. Swedish representative in the **European Polar Board**. Management of governmental polar policy, polar research expeditions and research infrastructure, polar strategy development. bjorn.dahlback@gmail.com http://polar.se/om-oss/medarbetare/; https://se.linkedin.com/in/björn-dahlbäck-44091221	**Sweden**	♂
4	**Prof. Øyvind Østerud**	*High North policy, globalization and political science.* **Norwegian Arctic Strategy and High North Policy** Sea ice in the Arctic Ocean, technology and agreements Effects of climate change on terrestrial ecosystems, landscapes, society and indigenous peoples	**Professor in political science at University of Oslo.** **Head of the FNI Board.** Published extensively on **geopolitics in the High North**. Research on globalization, war, peace, power, democracy as well as engaged in numerous national and international research programmes, and member of the board of several research institutes and scientific journals. oyvind.osterud@stv.uio.no; https://www.sv.uio.no/isv/personer/vit/stvoo1/	**Norway**	♂

5	**Prof. Kees Bastmeijer**	***Environmental management and nature conservation*** **Environmental and resource management** Sea ice in the Arctic Ocean, technology and agreements Natural and anthropogenic climate variability	**Professor at University of Tilburg (Netherlands)** **Member of EU-PolarNet White Paper Expert Group,** Professor of **Nature Conservation and Water Law** at Tilburg University (The Netherlands) and Visiting Professor at the School of Business, Economics and Law at the University of Gothenburg (Sweden; 2016-19). His research focuses on the role of international, European, and domestic law in protecting nature. He has a special interest in nature protection and other governance issues in the Polar Regions. As an advisor to the Dutch government, he has participated in the Antarctic Treaty Consultative Meetings since 1992. Kees is the founder of Legal Advice for Nature, through which he provides strategic legal advice on nature protection to governments, NGOs and companies. His most recent book resulted from a collaboration project of 30 experts on the legal protection of wilderness in Europe: Kees Bastmeijer (ed), Wilderness Protection in Europe: The Role of International, European and National Law (Cambridge University Press, 2016). c.j.bastmeijer@tilburguniversity.edu. https://www.tilburguniversity.edu/webwijs/show/c.j.bastmeijer.htm	**The Netherlands**	♂
6	**Dr. Magdalena Muir**	**Effects of climate change on sea and coastal ecology in the north and polar regions** **Environmental impact of industrial development in the north** Environmental and resources management Communication, advice and analysis Contribution to IPPC, European and North America climate scientific and socio-economic assessments Development of UN SDGs, particularly climate and oceans SDGs	**Research Associate with Arctic Institute of North America at the University of Calgary** **Member of EU-PolarNet White Paper Expert Group.** Research Associate with Arctic Institute of North America at the University of Calgary, collaboration with academic institutions, governments, industry and northern communities. Ongoing research collaboration with Arctic Research Centre, Aarhus University, where was visiting professor from 2012 to 2015. Completed regional socio economic assessments for Beaufort Sea Large Ocean Management Area and contributed to integrated coastal management regimes for western Hudson Bay. (Canada) in cooperation with Fisheries and Oceans Canada and industry, government and indigenous participants. Delivered modules on economic development, environmental and socio-cultural issues in the northern and circumpolar region for the Aboriginal Relations Leadership Certificate Programme. Advisory Board Member, Climate and Global Change with the Coastal and Marine Union (EUCC), leading engagement on climate impacts, adaptation and mitigation for Europe's coastal and marine areas, with a strategic focus on the Arctic and regional seas. mamuir@ucalgary.ca**;** magdalenaakmuir@gmail.com**.** https://arctic.ucalgary.ca/research-associate-magdalena-muir	**Canada**	♀
7	**Senior Adviser Mikala Klint**	***Natural science and env. Management*** **Ocean acidification and ecosystems effects in Northern waters** **Hazardous substances – effects on ecosystems and human health** **Environmental and resource management** Contribution to assessments	**Head of Section, EU, International & Arctic Cooperation, Ministry for Environment & Food, Denmark Head** of Delegation (Environment and health) **Arctic Monitoring Assessment Programme (AMAP),** Arctic Contaminants Action Programme (ACAP), **Member of Human Health Assessment Group,** Head of section at Miljøstyrelsen**.** mkl@mfvm.dk**;**	**Denmark**	♀
8	**Prof. Göran Ericsson**	**Effects of climate change on terrestrial ecosystems, landscapes, society and indigenous peoples**	**Professor in wildlife ecology, Swedish University of Agricultural Sciences (SLU),** Head of **d**epartment of Wildlife, fish and Environmental studies.	**Sweden**	♂

		Environmental and resource management **Research-based education and communication**	**Member of RCN MILJØFORSK Programme Board.** Expertise in ecology, human dimensions of fish and wildlife, outreach. Leader of research school ECOS – Ecology and society. goran.ericsson@slu.se https://www.slu.se/institutioner/vilt-fisk-miljo/moose-slu/personal/goran-ericsson/		
9	**Junior Prof. Inga Monika Koszalka**	***Natural sciences, Geoscience, Marine sciences, ocean circulation and young member:*** ***Natural sciences, Geoscience, Geology, sea ice*** **Sea ice in the Arctic Ocean, technology and agreements** Effects of climate change on sea and coastal ecology in the north Global/regional, earth system or prediction modelling, Prediction and predictability of Arctic climate change Natural and anthropogenic climate variability focusing on the high north Carbon exchange in the earth system Research-based education and communication	**Junior professor in physical oceanography at the GEOMAR Helmholtz Centre for Ocean Research, Kiel. ikoszalka@geomar.de, http://www.geomar.de/en/mitarbeiter/fb1/po/ikoszalka/** Member of the LAPCOD (Lagrangian Analysis and Prediction of Coastal and Ocean Dynamics) and ASOF (Arctic-Subarctic Ocean Fluxes) communities. Working with Lagrangian methods in ocean circulation and transport, subpolar North Atlantic circulation and its variability, ocean-glacier interactions, dense water overflows, stirring and mixing processes and their parametrization in models, mesoscale eddies, oceanographic data analysis and development of analysis methods.	**Germany**	♀

Committee conferences

The committee convened in total eight conferences:

- First (video) committee conference: 24 October 2018
- Second (video) committee conference: 9 November 2018
- Third (video) committee conference: 26 November 208
- Site visit: 2-6 December 2018
- Fourth (video) committee conference: 20 December 2018
- Fifth (video) committee conference: 18 January 2019
- Sixth (video) committee conference: 6 February 2019
- Seventh (video) committee conference: 21 March 2019
- Eight (video) committee conference: 5 April 2019
- Ninth (video) committee conference: 11 April 2019

Annex 3: Background material available for the Evaluation Committee

This list of background material is organised according to source unit or institution. Material from the Fram Centre covers the Fram Centre AS, its Flagships and member institutions, and most of this material has been collected and supplied by the Fram Centre AS. Parts of these documents (self-assessments and attachments/appendices) have been produced specifically for the evaluation. Some general documents and earlier evaluations regarding Norwegian research in polar areas etc. have been supplied by the Research Council of Norway.

Some additional and supplementary material has been available from the Fram centre website. This material is not mentioned here.

The Fram Centre AS

1. Self-assessment form including annexes
2. Presentation of the Fram Center organisation
3. Signed agreement on establishing the Fram centre, 2011.
4. Initial document regulating the Fram cooperation
5. Strategy plan revised 2017
6. Annual reports 2010-2017
7. Evaluation and strategy process (in Norwegian)
8. Suggested strategy process for the Fram Centre (in Norwegian)
9. Minutes Center meeting November 2017
10. Signed cooperation agreement 2011
11. Establishment document FRAM
12. Presentation of the Fram Centre organisation
13. Strategic plan Fram centre AS Revised 2809_2018 (In Norwegian)

Flagships

Documents regarding all Flagship programmes

1. Files providing an overview of all projects in the Fram Centre, for each year. Information contained: Research areas/Project titles; Project leader (s); Participating institutions; Flagship; E-mail project leader. One file for each year 2011-2017.
2. Excel files describe seed money funding for the different years, sorted by institution, project name, partners and grant.
3. Publication list covering the Fram Centre for 2011-2016 (not updated for 2017 and 2018)

Flagship Effects of climate change on terrestrial ecosystems, landscapes, society and indigenous peoples

1. Self-assessment form, including the following appendices:
    a. Science plan
    b. Knowledge communication

    c. Five impact case studies
    d. Peer-reviewed publications
    e. Conference contributions etc
    f. Outreach
    g. Reports
    h. Projects
    i. Cooperation with educational institutions
    j. Collaboration
2. Science plan 2012
3. Science plan 20016-2020
4. Annual reports 2012-2017
5. Science plan 2012
6. Science plan 2016-2020

Flagship Ocean acidification and ecosystems effects in Northern waters

1. Self-assessment form, including the following appendices
    a. Budget 2018 including in-kind
    b. Five impact case studies
    c. Research programme 2015-2017
    d. Science projects 2012, 2013 and 2014
    e. Publication list 2011-2018
2. Scientific progress report 2015-2017

Flagship Environmental impact of industrial development in the north (MIKON)

1. Self-assessment, including the following appendices
    a. Scientific programme
    b. Project portfolio
    c. Deliverables; including list of publications, conference contributions, dissemination to stakeholders and the public, externally funded projects originating from MIKON projects, International partners
    d. Five impact cases
2. Annual reports 2014-2017

Flagship Hazardous substances – effects on ecosystems and human health

1. Self-assessment, including the following appendices
    a. Publications 2011-2018
    b. Reports, conference contributions and outreach
    c. Projects 2017
    d. Five Impact case studies
    e. Students 2011-2017
    f. Scientific programme

    g. Updated scientific programme 2016-2020
2. Consortium agreements 2013-2018
3. Annual reports 2012-2017
4. Scientific programme
5. Updated scientific programme 2016-2020
6. Annual reports 2011, 2012, 2012 with attachments, 2013, 2014, 2015, 2016, 2017,
7. Publications 2011 –
8. Final reports 2013 – work packages 1-4

Flagship Effects of climate change on sea and coastal ecology in the north

1. Self-assessment including the following attachments, with content (a-f) and appendices (g-j)
    a. Science plan 2015
    b. Examples on knowledge dissemination to management, public, business or knowledge implementation for public management and policymaking
    c. Five impact case studies
    d. Peer-review publication
    e. Reports, conference contributions and dissemination measures
    f. Project portfolio partitioned by grant source, size of projects and importance of seed grants for project acquisition
    g. Case studies – Flagship projects with societal impacts
    h. Publication list
    i. Reports, presentations, outreach, students
    j. Project

2. Annual reports 2013-2017

Flagship Sea ice in the Arctic Ocean, technology and agreements

1. Self-assessment form
    a. Project overview 2011-2018
    b. Scientific programme 2011-2015
    c. Scientific programme 2016-2020
    d. Publications
    e. Annual report 2017
2. Scientific Programme 2011-2015
3. Scientific Programme 2016-2020
4. Annual reports 2011, 2012, 2013, 2014, 2015, 2016, 2017
5. Plan for activity 2010_Letter to the Ministry of Environment
6. Application to Ministry of Environment 2012

Flagship Plastic

1. Plastic in the Arctic Science plan 2018-2023

Member institutions

Akvaplan-niva / NIVA

1. Self-assessment form
2. NIVA strategy_English
3. NIVA strategi_norsk
4. AKVAPLAN NIVA strategy 2017
5. Board annual reports 2011-2017
6. NIVA annual reports 2011-2017

CICERO

1. Self-assessment form
2. Strategic Plan 2009-2014 (in Norwegian)
3. Strategic Plan 2013-2017 (English)
4. Strategic Plan 2015-2019 (in Norwegian)
5. Strategic Plan 2017-2021 (in Norwegian)
6. Annual reports 2010-2014
7. Board annual reports 2015, 2016

Norwegian Radiation and Nuclear Safety Authority

1. Strategic Plan 2012-2014
2. Strategic Plan 2015-2017
3. Strategic Plan 2018-2020
4. Annual reports 2010-2017

Institute of Marine Research

1. Self-assessment form
    a. Attachment: Five most significant contributions (publications) within the framework of the Fram centre, Five most significant contributions (publications) outside the framework of the Fram centre, List/link to relevant publications (peer-review, reports, conference presentations etc.) and dissemination measures, Description of what the institution considers the added value of the Fram centre cooperation, including the funding of the Centre, the Flagships and the value of (co)location, The research cooperation within the Fram centre, both within and outside the framework of the Flagships, Number of positions, including source of funding, attached to the Fram centre .
    b. Attachment Economy report and positions Flagship Sea and Coast
    c. Attachment Economy report and positions Flagship Ocean Acidification
2. Strategy 2013-2017 (in Norwegian)
3. Instruction for management of MRI from the Ministry 2018 (in Norwegian)
4. Grant letter to MRI 2018 (in Norwegian)

Kartverket (Norwegian Mapping Authority)

Norwegian Coastal Administration

1. Self-assessment form

Norwegian Meteorological Institute

NGU – Norges geologiske undersøkelse

1. Self-assessment form
2. Strategic Plan 2012-2015
3. Strategic Plan 2017-2020
4. Annual reports 2010-17

NIKU – Norwegian Institute for Cultural Heritage Research

1. Self-assessment form, with the following attachements
    a. The five most important knowledge contributions by the institution. Exemplify how the research has been put to use
    b. The five most important research contributions (publications) within the Fram Centre framework
    c. The five most important research contributions (publications) outside the Fram Centre framework
    d. Spreadsheet Publications in different categories, years and by author
    e. No content, refers to self-assessment form
    f. An overview of collaborative projects with higher educational institutions within the field of climate and environment, including an overview of PhD projects
    g. Research collaboration in the Fram centre within and outside the flagship frameworks
    h. Number of positions and the associated source of funds at the High North Department, Fram centre
    i. Financial report for funds spent within the Fram centre and flagships
    j. The relationship beween cooperation, syngergies and competition for funds with other institutions in Fram
2. NIKU Strategy 2008
3. NIKU Strategy 2015
4. NIKU Strategy 2018

NILU – Norwegian Institute for Air Research

1. Self-assessment form, including the following attachments
    a. Publications Environmental Contaminants
    b. Most important research
    c. Funding and publication in flagship
2. Strategy 2012 (in Norwegian)
3. Strategy 2018
4. Annual reports 2012-2017
5. Accounting reports 2011-2017
6. Annual magazines 2010-13

NINA – Norwegian Institute for Nature Research

1. Self-assessment form
2. NINA Tromsø publications 2011- (from Cristin database)
3. Goals 2008-2011
4. Goals 2012-2015 (in Norwegian)
5. Goals 2016-2020
6. Annual reports 2010-2014
7. English resumé 2017

Nofima - The Norwegian Institute of Food, Fisheries and Aquaculture Research

1. Self-assessment form, including
    a. Self-assessment – appendix: including important contributions to knowledge production, implementation of knowledge, five most important publications within and outside of Fram centre, projects and publications, economy report
2. NOFIMA – presentation_strategy 2018
3. Annual reports 2010-2017 (in Norwegian)

NORUT - Northern Research Institute

2. Self-assessment form

NIBIO – Norwegian Institute for Bioeconomy Research

Norwegian Polar Institute

1. Self-assessment form, including
    a. most important publications
2. Strategic plan 2019-2024

Norwegian Veterinary Institute

1. Self-assessment form
2. Strategic plan 2010-2015
3. Strategic plan 2016-2020 (in English and Norwegian)
4. Annual reports 2010-2017

The Arctic University

1. Strategic plan 2009-2013 (in Norwegian)
2. Strategic plan Developing the High North
3. Faculty of biosciences, Fisheries and Economics: Self-assessment form

SINTEF

1. Annual reports 2010, 2013, 2014, 2017

Research Council of Norway

Material for the Fram Centre evaluation

1. User survey with English summary
2. Template for self-assessment form for Fram Centre units
3. Fram Center Financial flows_overview prepared by the Fram Centre
4. Template Case studies_The societal impact of the research

Flagship evaluations

1. Note regarding Fram Centre Flagship evaluations
2. Note regarding evaluation of Flagship MIKON
3. Synthesis ASSESSMENT of MIKON Scientific program
4. Flagship Ocean Acidification
5. Flagship Terrestrial
6. Flagship Artic Ocean
7. Flagship Hazardous substances
8. Flagship Fjord and Coast

Evaluations of relevant research areas

1. Evaluation biology medicine healthresearch Norway
2. Evaluation Climate research in Norway
3. Evaluation Norwegian Polar Research
4. Evaluation Earth Sciences research in Norway

Other evaluations and strategy documents

1. Evaluation of Environmental Institutes
2. Evaluation of Environmental Institutes_examples of social impact (in Norwegian)
3. Evaluation of Environmental Institutes_fact sheet (in Norwegian)
4. Governmental High North Strategy
5. Norway's Arctic Strategy
6. Research strategy for Arctic and Northern Areas

Annex 4: Self-assessment template

Self-assessment form – the Fram Centre, Flagships and Member institutions

This self-assessment form is for three categories of respondents: The Fram Centre AS, each of its Flagships and all member institutions within the Fram centre.

This template shall be used. Where questions are better adapted to a certain category respondents, make the necessary adjustments. The term "unit" is used for all categories of respondents. For the member institutions within the Fram centre: this self-assessment form shall address only activity in areas of research that are of relevance for the Fram centre. The template partly follows the main points in the mandate for the Fram centre evaluation, and we ask that the respondents consider the evaluation questions posed in this mandate (5a-d), in their self-assessment. This self-assessment shall also include appendices (specific attachments for each category of respondents, listed in point 6 of the mandate for the evaluation of the Fram Centre). General questions addressed in the mandate should be included in point 7.

Deadline for submitting the self-evaluation is 15. November, 2018. All files must be submitted electronically to the evaluation secretariat, by e-mail to Jon Børre Ørbæk, jbo@forskningsradet.no.

Write concisely; the self-evaluation should not exceed 10 pages. Supplementary information and data could be included in an appendix.

1	**Unit – contact information**
	Unit: **Contact person:** **Phone:** **E-mail:**
2	**Distinctiveness, roles and tasks**
	a) What is the position and role of this unit in the national R&D system? b) What is the position and role of this unit in the Fram centre? c) Clarify the present professional profile of the unit today. List number of staff according to job category (administrative, technical and scientific – including adjunct positions).
3	**Relevance, quality and importance of research**

	a) In which fields (of relevance for the Fram centre) would the unit consider itself particularly strong in terms of - scientific quality - relevance for users For each of these terms, specify if you consider the unit to be in the forefront nationally or internationally.
	b) What are the advantages and disadvantages of being a member of the Fram centre, in terms of publication and project development and excellence in research?
	c) Has the professional profile of the unit changed significantly during the past 10 years as a consequence of its participation in the Fram centre?
	d) How many foreign researchers are presently employed by the unit? (number, and fraction of scientific staff) e) Which challenges, if any, does the unit face when recruiting for research positions and particular areas of research?
	f) Provide a short description of how societal needs influence the development of the research profile and research plans within the unit, and in the Fram centre.
	g) Which areas of research should, in the opinion of the unit, the Fram centre strengthen to meet the demands of its users?
	h) Other considerations?
4	**Cooperation and dissemination**
	a) Who are the most important scientific partners of the unit, within the Fram centre? - Specify if this cooperation takes place within the Flagships, Innovation projects, projects funded by the Research Council, projects within European commission framework programmes and/or in other international contexts. - Has the participation in the Fram centre specifically increased the cooperation with other units more than earlier cooperation with the same units? Give examples.
	b) Who are the most important competitors of the unit, nationally and internationally. - Specify if the competition takes place within the Flagships, or connected to acquisition of innovation projects, projects funded by the Research Council, projects within European commission framework programmes and/or in other international contexts.
	c) What are the advantages and disadvantages for the unit of being a member of the Fram centre?
	d) What are the most significant changes experienced by the unit during the last ten years, related to cooperating partners and competitors?
	e) To which other institutions are the unit connected, apart from the Fram centre, in formal cooperation agreements or similar? Which weight is given to these agreements, compared to the work within the Fram centre?
	f) Who are the units main users? What is the role of the users for the research of the unit, and how does the unit cooperate with different user groups (scientific and in terms of geography)? g) Has the utilization by public users and industry of results produced by the unit increased, due to the participation in the Fram centre?
	h) Which channels and arenas are most important for the unit in terms of dissemination and societal contact?
	i) Other considerations?

5	**The Fram centre organization, strategic leadership and management.**
	a) What are the central advantages and disadvantages, according to the unit, of the organisation and management model of the Fram centre?
	b) Does the Fram centre contribute to excellent research leadership and therefore relevant research?
	c) Is the strategy development within the Fram centre relevant, according to the unit, and are there areas where the Fram centre has the potential to be an internationally leading institution within a time frame of 5-10 years?
	d) From the point of view of the unit, is the administrative and technical support of the Fram centre AS expedient, good and sufficient to enable the unit to work efficiently within the Fram centre?
	e) Other considerations?
6	**Finanzing and co-location within the Fram centre**
	a) How are resources allocated to the Fram centre used to support the Flagship programmes, and what importance/added value do these resources have for the Fram centre as a whole?
	b) Has funding of the Fram centre / Flagships increased additional funding from EU, ERC or national (public and private) sources? Quantify if possible.
	c) To which degree does the resources allocated to the Fram centre foster strategic development and long-term competence building?
	d) Describe the positive or negative effects of the physical organization/location of the Fram centre for your institution.
	e) Other considerations?
7	**Other information of relevance for the Fram centre evaluation**
	Provide any other relevant information not covered above

Appendices

Please refer to the mandate for the evaluation of the Fram centre, according to each category if respondents.

Annex 5: Agenda for Site visit of the Evaluation Committee 2-6 December 2018

Monday 3 December

Venue: Fram Centre, Tromsø

08.30-10.00 Discussions in the committee, planning of interviews first day

10.00-13.00 Meetings with Fram Centre strategic and administrative leadership

10.00-11.30 Meeting with *Leader of Centre Anne Husebekk and Leader of Research leader group Anita Evenset*

11.30-12.00 Committee discussion / coffee break

12.00-12.45 Meeting with Framsenteret AS - *Centre Director Frode Kjersem, Research Coordinator Kathryn O. Donnelly and Outreach Coordinator Helge M. Markusson*

12.45-13.00 Committee discussion

13.00-14.00 Break

14.00-19.00 Two Flagships presents themselves for the committee (15 minutes presentation followed by questions and answers, committee discussion)

14.00-16.00 Flagship Effects of climate change on **Fjord and Coastal** ecosystems

14.00-14.15 Flagship presentation

14.15-15.15 Interview and discussion

15.15-16.00 Committee discussion and break

Presenters: *Paul Renaud (Akvaplan–niva) and Lis Lindal Jørgensen (IMR)*

16.00-18.00 Flagship Sea Ice in the **Arctic Ocean**, Technology and Governance (via Skype)

16.00-16.15 Flagship presentation

16.15-17.15 Interview and discussion

17.15-18.00 Committee discussion and break

Presenters: *Hans-Kristian Hernes, UiT, Karl Gunnar Aarsæther, Sintef Nord, Arild Sundfjord, NP (via telephopne*)

18.00-19.00 Committee discussion and planning of next day

Tuesday 4 December

Venue: Fram Centre, Tromsø

8.30-13.00 Four Flagships presents themselves for the committee (15 minutes presentation followed by questions and answers, committee discussion)

8.30-10.30 Flagship Climate Effects on **Terrestrial** Ecosystems, Landscapes, Societies and Indigenous people

08.30-08.45 Flagship presentation

08.45-09.45 Interview and discussion

09.45-10.30 Committee discussion and break

Presenters: *Rolf Anker Ims (UiT), Jarle Bjerke (NINA), Marius Warg Næss (NIKU), Dorothe Erich (UiT)*

10.30-12.30 Flagship **Hazardous substances** - effects on ecosystem and health

10.30-10.45 Flagship presentation

10.45-11.45 Interview and discussion

11.45-12.30 Committee discussion and break

Presenters: *Eldbjørg S. Heimstad (NILU), leader, Kjetil Sagerup (Akvaplan-niva), deputy leader, Louise K. Jensen (NRPA), Torkjel M. Sandanger UiT, on video), Geir Wing Gabrielsen (NP)*

12.30-13.00 Committee discussion

13.00-14.00 Break

14.00-16.00 Flagship **Ocean acidification** and ecosystems effects in Northern waters

14.00-14.15 Flagship presentation

14.15-15.15 Interview and discussion

15.15-16.00 Committee discussion and break

Presenters: *Melissa Chierici (UiT), Hakon Hop (NP)*

16.00-18.00 Flagship **MIKON**– Environmental Impacts of Industrial Development in the North

16.00-16.15 Flagship presentation

16.15-17.15 Interview and discussion

17.15-18.00 Committee discussion and break

Presenters: *Per Fauchald (NINA) and Jo Aarseth (NIBIO)*

18.00 – 18.30: Akvaplan–niva, *Salve Dahle*

Wednesday 5 December

Venue: Fram centre, Tromsø

8.30-09.00 Discussion in the committee, planning for interviews third day

09.00-12.00 Meetings with the Fram Centre member institutions

All member institutions that wish to meet (a sub-set of) the evaluation committee has been invited to do so.

	Room A	Room B	Room C
9.00-9.30	NILU / Eldbjørg Heimstad; Aasmund Vik; and Kari Nygaard (Nygaard via Skype)	NIKU / Alma Elizabeth Thuestad	
9.45-10.15	UiT / Rune Larsen; Jørgen Berge	CICERO / Camilla Schreiner	Norwegian Veterinary Institute / Torill Mørk Bo
10.30-11.00	IMR / Sissel Rogne Geir Lasse Taranger (via Skype)	Akvaplan-niva / Anita Evenset	
11.15-11.45	NPI / Ole Arve Misund and Nalan Koc	Norwegian Radiation Protection Authority/ Ole Harbitz	NORUT May Britt Ellingsen

12.00-13.00 Break

13.00-14.00 Meetings with a selection of students (PhD, Master).

Committee subgroups or individual committee members to meet selected students.

Organized in their home environment (at various locations in the Fram Centre).

14.00-15.00 Meetings with selected users of the Fram Centre.

Committee (subgroups) to meet selected users.

	Institution	Person
14.00-14.30	Norwegian Coastal Administration (Kystverket)	Øyvind Rinaldo
	Directorate of Fisheries (Fiskeridirektoratet)	Gunnstein Bakke (SKYPE)
	Institute of Marine Research - IMR	Per Arneberg
14:30-15:00	Arctic Monitoring and Assessment Programme / AMAP	Jan Rene Larsen, Lars Otto Reiersen (SKYPE)
	Arctic Council Secretariat	Nina Buvang Vaaja

Thursday 6 December

Venue: Thon Hotel Opera, Oslo

08.30-10.00 Committee meeting, sum up of key messages and conclusion from Site Visit

10.00–12.00 Meeting with funding Ministries, owners and key stakeholders

10.00-11.00 Ministry of Climate and Environment
Participants: Aud Ingvild Slettemoen, Svein Tore Halvorsen

11.00-12.00 Representatives of the other Ministries

Participants: Ministry of Foreign Affairs, Tommy Flakk and Ministry of Trade, Industry and Fisheries, Olav Rolstad

12.00-14.00 Final Committee discussion, sharing of tasks and responsibilities

Annex 6: Institutions and individuals interviewed during Site Visit

Institutions and individuals participating in presentations, interviews and discussions with the Evaluation Committee during the Site Visit.

Institution	Name(s)
Fram Centre and member institutions	
Akvaplan–niva	Salve Dahle Anita Evenset Paul Renaud Kjetil Sagerup
CICERO Center for International Climate Research	Camilla Schreiner
Directorate of Fisheries	Gunnstein Bakke (via telephone)
Fram Centre leadership	Anne Husebekk Anita Evenset
Fram Centre ltd	Frode Kjersem Kathryn O. Donnelly Helge M. Markusson
Institute of Marine Research (IMR)	Per Arneberg Lis Lindal Jørgensen Sissel Rogne (via telephone) Geir Lasse Taranger
NIBIO - Norwegian Institute of Bioeconomy Research	Jo Aarseth

NIKU – The Norwegian Institute for Cultural Heritage Research	Alma Elizabeth Thuestad Marius Warg Næss
NILU – Norwegian Institute for Air Research	Eldbjørg S. Heimstad Kari Nygaard (via telephone) Aasmund Vik
NINA – Norwegian Institute for Nature Research	Jarle Bjerke Per Fauchald
NORUT – Northern Research Institute	May Britt Ellingsen
Norwegian Coastal Administration	Øyvind Rinaldo
Norwegian Polar Institute	Geir Wing Gabrielsen Hakon Hop Nalan Koc Arve Misund Arild Sundfjord
Norwegian Radiation and Nuclear Safety Authority	Ole Harbitz Louise K. Jensen
Norwegian Veterinary Institute	Torill Mørk
Sintef	Karl Gunnar Aarsæther
University of Tromsø – The Arctic University of Norway	Jørgen Berge Melissa Chierici Dorothe Erich Hans-Kristian Hernes Anne Husebekk Rolf Anker Ims

	Rune Larsen Torkjel M. Sandanger (via telephone)
Master and ph.d. students affiliated with the Fram Centre	
Users and stakeholders	
Arctic Council Secretariat	Nina Buvang Vaaja
Arctic Monitoring and Assessment Programme (AMAP)	Jan Rene Larsen Lars Otto Reiersen (via telephone)
Ministry of Climate and the Environment	Aud Ingvild Slettemoen Svein Tore Halvorsen
Ministry of Foreign Affairs	Tommy Flakk
Ministry of Trade, Industry and Fisheries	Olav Rolstad

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