The Research Council of Norway

Midterm Evaluation of the Nansen Legacy project

Content

Preface

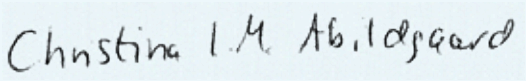
Major changes are taking place in the Arctic, and increased knowledge is more important than ever to ensure sustainable development. The Nansen Legacy project encompasses a wide thematic scope, and the research is expected to be of great importance for ocean management of the Barents Sea and adjacent Arctic Basin and the understanding of the impact of climate change that is taking place. The Nansen Legacy project is unique in many ways, it is one of the largest projects of this kind supported by the Research Council of Norway (RCN), it is a collaborative effort between ten of the most significant polar research institutions in Norway and is expected to be of great importance for recruitment of the next generation of polar researchers.

This evaluation report presents the midterm evaluation of the Nansen Legacy project and cover the period 2018-2020. The project is co-financed by the RCN, the Norwegian Ministry of Education and Research and the ten project partners.

The project has been evaluated by an expert panel consisting of four international experts and one national representative for stakeholders. The report from the evaluation committee has two main purposes:

- To assess if the Nansen Legacy project is on its way to reach its objectives, the quality of the research and collaboration, and the relevance for users of the project so far.
- To give recommendations on how to further develop the plans for activities in the final three-year period of the project.

The RCN wants to express a great appreciation to the committee and the committee secretary. A particular thanks to the Executive Director of Sentinel North, Martin Fortier for his engagement and leadership. The Covid-19 pandemic prevented the committee members to meet face-to-face, but thanks to good leadership and a positive attitude among the panel members this process has worked well. The committee has produced a report which will be of great value for preparing the final period of the Nansen Legacy project, but also for the RCN in administration of this project and similar future schemes.



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Executive summary

Officially launched in 2018 after six years of planning, the Nansen Legacy (NL) is a large-scale holistic Arctic research project aiming to increase our understanding of the ecosystems of the northern Barents Sea and adjacent Arctic Basin to provide the knowledge required for their sustainable management. Now at the midterm of its original funding period (2018-2023), the Research Council of Norway (RCN) commissioned an external evaluation of the project to assess its progress in reaching its core objectives and provide recommendations to inform the final 3-year phase.

Despite major unexpected challenges due to maintenance work on the RV *Kronprins Haakon* and the global COVID-19 pandemic, the NL project achieved significant progress and produced high quality research during its first phase, including the successful organisation and deployment of 14 oceanographic cruises. Ship-based data collection campaigns using complementary observing systems such as mooring arrays, autonomous under-water vehicles (AUV), and remote sensing have already resulted in major improvements in our understanding of the environmental conditions prevailing in the Barents Sea and beyond. A total of 75 peer-reviewed publications have already been published or submitted in topical journals.

One of the project highlights so far is the recruitment and training over 70 early career scientists (ECS) that benefit from a high-level multi-institutional training and research environment as well as access to ultra-modern research infrastructure and laboratory facilities in ten institutions across Norway. These conditions will produce a unique cohort of young multi-disciplinary researchers to renew and rejuvenate the aging Norwegian ocean research community.

A major achievement of the project has been to unite 10 of Norway's largest marine research organizations as part of a united and complementary national consortium that currently involves over 200 members. This national consortium already proves to be much stronger than the sum of its parts and will no doubt be a major legacy of the project for Norway.

The NL governance and Board of Directors is composed exclusively of consortium representatives. With user engagement and knowledge transfer priorities to be implemented in the second phase of the project, the project would benefit from opening its Board membership to allow for more arm's length, industry user representatives as voting members. Given the importance of ECS in the present and future initiatives of the NL project, the Board should also consider inviting an elected ECS representative as a voting member.

With the help of the UiT-based administration centre, the principal investigator Prof. Reigstad and her co-PIs Prof. Eldevik and Prof. Gerland, seem very efficient at coordinating this massive national endeavor. But the overall project would benefit from an improved project management framework supported by solid strategic and performance measurement plans to identify risks to expected outcomes, recommend corrective measures, and provide project governance and funding organisations with the performance indicators required to clearly illustrate progress and alignment with the project's strategic objectives.

The major focus and efforts during Phase 1 were placed on fieldwork, data collection, and training of ECS. Increased efforts will need to be deployed to improve user engagement and knowledge exchange during Phase 2 to ensure that results and impacts go beyond scientific publications and answer user needs and knowledge gaps identified in national strategies.

The visibility brought through the coordination of the nation's top Arctic researchers using a new state-of-the-art research icebreaker consolidates Norway's position as a world-leading Arctic research nation. One of the major challenge and task of the NL consortium in Phase 2 will be to continue to work with project funders and users to build a perennial project legacy beyond NL that will capitalize on the national synergy that is being built between institutions, end users and across disciplines.

Overall, the committee was extremely satisfied with the progress and expected impacts of the NL. The Committee strongly recommends that support for the project must be maintained for Phase 2. The committee also recommends that the project will take into consideration our recommendations to help them achieve their ambitious objective of contributing to the integrated scientific knowledge base required for the sustainable manage-ment of the environment and marine resources of the Barents Sea and adjacent Arctic Basin through the 21st century.

Photo: Andreas Wolden

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Introduction

1a. Midterm evaluation process

In January 2021, the Research Council of Norway (RCN) initiated an evaluation of the progress of the Nansen Legacy (NL) project as it reached the midterm of its original funding period (2018-2023). The purpose of the midterm evaluation is to assess the progress of the project in reaching its main objectives, the quality of the research and collaboration, and the relevance for users. The evaluation also provides recommendations on how to further develop plans in the final three-year period of the project.

An international review committee composed of high-level managers and scientists with experience in leading large-scale Arctic research initiatives was assembled by the RCN to conduct the evaluation (Appendix 1). Three of the 5 committee members, including the chair, were members of the committee that evaluated the original NL application for the RCN in 2017.

Committee members were provided with numerous documents, reports, and self-evaluations from project management and member institutions to feed their evaluation (Appendix 2). Given the pandemic situation, the committee met virtually on five occasions between March and November 2021 and was assisted by RCN staff and a committee secretary throughout the review process. As part of their review, the committee also met via videoconference with early career scientists (ECS), representatives of the Reference Group (RG) and the three project leaders (Appendix 3).

To make it more accessible for readers who are not familair with the NL project, the report also summarizes some of the information provided by the project management with regards to its governance, accomplishments on research, training, communications, and user engagement. The report is particularly relevant for RCN and the ministries that may use it to document impacts of the initiative and as quality assurance for funding the last three years. The consortium institutions and project leadership will also be able to use the evaluation as an external assessment of their activities so far and get input to inform the second phase of the project. Recommendations on the review process are also provided to inform future evaluations (Appendix 4).

1b. The Nansen Legacy

The Nansen Legacy is a large-scale holistic Arctic research project aiming to increase our understanding of the ecosystems of the northern Barents Sea and adjacent Arctic Basin and provide the knowledge required for their sustainable management. Officially launched in 2018 after six years of extensive planning, this major national initiative is led by a consortium of ten Norwegian public

and private partner institutions (Appendix 5) that employ a significant portion of the national expertise in marine research. The total budget of NOK 720 million is provided by the partner institutions themselves (50%, in-kind), the RCN (25%) and the Ministry of Education and Research (25 %, channeled through the RCN). One of the project's major research infrastructure is Norway's newly commissioned RV *Kronprins Haakon* research icebreaker.

The overall objective of the NL is to contribute to the integrated scientific knowledge base required for the sustainable management of the environment and marine resources of the Barents Sea and adjacent Arctic Basin through the 21st century.

The secondary objectives of the project are to:

1. Improve the scientific basis for sustainable management of natural resources beyond the present ice edge.

2. Characterize the main human impacts, physical drivers, and intrinsic operation of the changing Barents Sea ecosystems - past, present, and future.

3. Explore and exploit the prognostic mechanisms governing weather, climate, and ecosystem, including predictive capabilities and constraining uncertainties.

4. Optimize the use of emerging technologies, logistic capabilities, research recruitment and stakeholder interaction to explore and manage the emerging Arctic Ocean.

Recruit and train a new generation of highly educated marine scientists in a multidisciplinary and multi-institutional environment.

1c. Structure of the research project

The NL research project is organized and coordinated through four clearly defined Research Foci (RF) which are conducted and integrated through four crosscutting Research Activities (RA). The four RFs provide observations, experiments, and models for the Barents Sea to assess the physical state of the Barents Sea (RF1), determine specific human impacts (RF2), evaluate the ecosystem structure (RF3) and strengthen the predictive capabilities (RF4). The four RAs involve Data collection and infrastructure (RA-A), Data management and synthesis (RA-B), Technology and method development (RA-C), and Impact and legacy (RA-D).

1d. Project governance and management

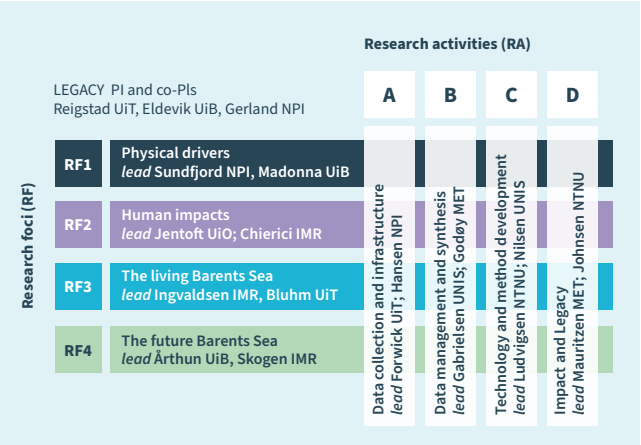
The NL governance is controlled by the 10 partner institutions that are also referred to as the consortium institutions or project owners. Their exclusive representation on the highest governance bodies of the project is justified by their 50% in-kind contribution to the overall project cost. A group composed of the rectors or directors of these institutions (owners group) is the top decision level in the NL project. Each partner institution also appoints a member to the NL Board, with the member from UiT The Arctic University of Norway (UiT, coordinating partner) acting as Chair. The board governs the project's strategic plans and finances.

Day-to-day project management, operations and coordination is led by the overall project PI (Marit Reigstad) with support from the staff of the administrative centre and the two co-PIs (Tor Eldevik at UiB & Sebastian Gerland at NPI). Prof. Reigstad and most of the administrative team are co-located at UiT. The leaders and co-leaders of the four RFs and four crosscutting RAs make up the Project Leader Team (PLT).

The early career scientists (ECS) have their own Recruit Forum and elect a chair and co-chair that meet with the PLT annually. ECS are not represented on the Board or other decision-making committees.

A Scientific Advisory Board (SAB) composed of high-level international Arctic scientists and managers provides scientific advice and links to international initiatives (Appendix 6). The SAB is not represented on the Board or other decision-making committees.

A Reference Group (RG) composed of representatives from key user sectors, including the maritime, petroleum, fisheries and biomarine industries, informs management about user needs. The group currently includes nine members from Norwegian industry, governing bodies, and international science organizations (Appendix 7). The group is coordinated by Akvaplan-niva, one of the NL partner organisations. No RG member is represented on the Board or other decision-making committees.



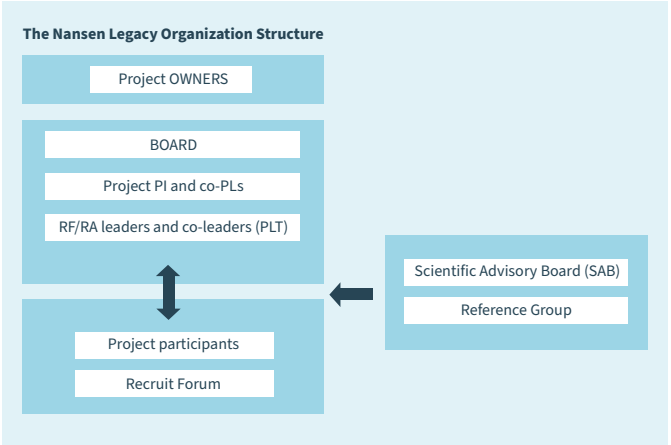


Photo: Andreas Wolden

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Research

During Phase 1, the NL project has been very productive in reaching its first objective of "*contributing to the integrated scientific knowledge base required for the sustainable management of the environment and marine resources of the Barents Sea and adjacent Arctic Basin*".

2a. Progress and quality of the research to date

Despite external challenges due to the delayed commissioning of the RV *Kronprins Haakon* and the COVID-19 global pandemic, significant progress was made in the deployment of most Research Activities (RA), especially on data collection and infrastructure (RA-A) and technology and method development (RA-C), as well as contributions towards a more comprehensive view of the Barents Sea climate and environment.

While some fieldwork in 2020 had to be postponed, actions were taken to minimize the impact on science, and intensive cruise activity has a been deployed in 2021, with an impressive 14 cruises already completed in th***e*** Barents Sea and surrounding waters.

New knowledge was produced at the frontier of several disciplines including ocean physics and biogeochemistry, marine ecology, and climate sciences. Standardized methodologies were developed and applied to field data across disciplines and institutions. Model developments are ongoing with significant improvements on key components of the atmosphere-ice-ocean system, some of them already being validated and exported to existing analysis or forecasting systems.

The data collected to date has been handled in a comprehensive way through the SIOS metadata portal and a unique identification system, even if some improvements are to be made on the inter-operability of the data between institutions which all have their own system. Data are meant to be FAIR (meeting principles of findability, accessibility, interoperability, and reusability) and openly accessible unless specific restrictions apply, e.g. in relation to PhD work. The data management plan is currently being further developed to support the NL needs.

2b. Major accomplishments and significant results

A major NL achievement is the collection of extensive datasets in areas and during seasons previously rarely sampled. These datasets are providing essential information on key physical, chemical, biological and geological research questions. The RF/RAs and the various components of the project have been at the forefront of marine research. A total of 55 peer-reviewed publications (including five in top ranked journals) have been published in topical journals, and 20 more have been submitted for peer-review. Numerous non-peer-reviewed publications have

been published according to the needs of various stakeholder groups.

The NL approach relies on a wealth of field campaigns on the new ice-class RV *Kronprins Haakon*, on cruises on other vessels, on long-term monitoring, on the use of satellite-based sensors, and on a collection of climate, sea-ice, ocean, and ecosystem models. A joint coordinated effort among the project partners in deploying instrumentation has been a major added value of NL. Successful data collection using complementary observing systems such as mooring arrays, autonomous underwater vehicles (AUV), remote sensing and ship-based measurements for process studies have been combined with existing historical data. Altogether, these different approaches have already resulted in improved understanding of the environmental conditions prevailing in the Barents Sea and beyond. Successful data collection including seasonal datasets are currently being processed and promising process studies are underway. These include data collected on trace metals, biogeochemistry, ecosystems and contaminants across habitats and trophic levels along the NL climate gradients. Sediment cores from the northern Barents Sea shelf region have also been successfully collected and their analysis and interpretation are in progress to reveal climate conditions through the Holocene.

The first phase of the NL project also included fieldwork that involved the development and the deployment of improved technology. These advances in technology include adaptive sampling by novel AUVs, which provide information on spatial scales of patchiness related to physical-biological interactions and structures and testing or preparation for under-ice operations with these AUVs. They are important steps forward to increase and improve the observational capability of combined biological and physical parameters. In addition, new satellite sea ice products have been developed taking advantage of multi-sensory information to produce high resolution sea ice estimates which are valuable inputs to marine services.

On the modelling side, the model developments and simulations have progressed as initially planned or with moderate adaptation based on the latest findings. The major achievements of the project so far include the estimate of the future Barents Sea and future Arctic sea-ice changes, as well as process modelling of the Atlantic water, sea ice and wind forcing to explain observed ice-melt rates in the Barents Sea. The importance of including an adequate representation of snow cover on Arctic sea-ice in weather forecast models has also been evaluated. Substantial breakthrough in sea ice modelling have been achieved with regards to explicit representation of fine scale features (leads and ridges) or improvements to existing models. Sensitivity studies have revealed the important role of these processes for improved forecasts. The climate-scale predictability of ocean biogeochemistry has also been integrated and coupled with ocean physics. In addition, an innovative model based on the principle of chance and necessity applied to the Barents Sea food web and production has been developed.

These initial findings emanating from the NL project illustrate how the understanding of the changing Barents Sea requires a broad geographical scope, involving both ocean and atmosphere research as envisaged in this interdisciplinary project. The specific RFs include important findings such as how the heat loss from the inflowing Atlantic water to the atmosphere is presently reduced in the southern Barents Sea, resulting in warmer water entering the adjacent Nansen Basin, hence weakening its stratification. These studies also provide new insight on the ongoing rapid melting of sea ice north of Svalbard explained by warm Atlantic inflow combined with increased mixing from storms in recently ice-free waters. New multiyear datasets collected during the project have provided novel information on the observed variability of the sea ice cover in the northern Barents Sea and the respective role of ice advection and Atlantic Water inflow in controlling it. Some observations also revealed unknown circulation patterns around Svalbard. It has also been found that winter cyclones reaching the Barents Sea are linked to large-scale atmospheric conditions rather than local sea ice conditions. These results, among others, are important steps forward in our understanding of the Barents Sea climate and its connection to the larger system.

On the ecosystem side, studies based on historical data have identified responses in the distribution of species to shifts in climate conditions. Analysis of the multidisciplinary datasets collected revealed the multiple roles of sea-ice for living resources way beyond the ice system itself, for biodiversity, primary production, carbon cycling and cryo-pelagic-benthic coupling. The enhanced Atlantic influence (*Atlantification*) increases the number of boreal species in the Arctic region of the Barents Sea. These boreal species change the structure as well as the interactions in the Arctic food webs. Also, timeseries of data show that increased water temperatures and reduced sea ice conditions in the Barents Sea increase individual growth for polar cod but weaken the overall recruitment to the early year classes resulting in reduced stock abundance. This contrasts the more boreal species that increase their recruitment under these conditions. An evaluation of the potential effect of using balanced harvesting as a new management tool in the Barents Sea has also shown that the existing harvest strategy is estimated to be close to optimal for our present target species. These results will provide important input to the food web models as well as evaluation of energy transfer through the system with implication for harvest potential.

2c. Impact of the COVID-19 pandemic

The COVID-19 pandemic and the unanticipated maintenance work on the RV *Kronprins Haakon* led to the cancellation of some marine campaigns in 2020. This has been recognized as a major problem for the overall project schedule considering that a substantial part of the research is being conducted by ECS with short-term grants and that field operations were initially planned to target specific distinct seasons. The current lack of data on seasonality remains an issue that will need to be addressed in Phase 2, demanding additional fieldwork. The work of many ECS involved in the NL project is particularly dependent on samples

from these field campaigns and was also impacted by closed laboratories and delayed analytical work. The project management has succeeded to adapt to this difficult situation in an exemplary way and found appropriate solutions to minimize the impact and hence maintained an excellent quality in the research. A collective and creative effort from all participants resulted in high scientific activity across the project, keeping it relatively well on track through alternative plans. Encouraged by the project management, participants took advantage of new working methods and tools and were able to meet and collaborate across scientific disciplines and national institutions through webinars, annual project meetings or internal meeting and to maintain good cooperation and joint efforts also on project cruises.

2d. Future plans

NL research will continue as indicated in the comprehensive and regularly updated NL *Implementation Plan* which serves as a guideline for project participants and as an important tool for management. It is appreciated that this *Implementation Plan* has been carefully updated with respect to change in personnel and to delays associated with the pandemic (see also Section 5). It is also reassuring that project leaders are convinced that, despite all the unexpected problems which slowed down some initiatives, the project will meet its objective on time. Reasons for this are mainly that ship time is secured, and resources could be reallocated in agreement with the updated implementation plan.

Photo: Marius Årthun, UiB

Photo: Christian Morel/christianmorel.net

2E. HIGHLIGHTS AND RECOMMENDATIONS

The NL project has already generated a wealth of new results regarding the physical and the living Barents Sea. A major added value of this large national project has been to coordinate partner organizations in leading interdisciplinary research, to ensure the continuity in research initiatives that facilitates interannual observations and data analysis, and to favor the development of common sampling campaigns or analytical techniques. It has already proven to be a huge learning opportunity for the various partners and a valuable experience for the community. Despite unique challenges with a new research vessel and a global pandemic in 2020-2021, the project achieved significant progress and produced high quality research during this first phase. Project leaders and all partners involved should be commended for such a success. Nevertheless, the committee had the following recommendations:

- Progress on data collection/analysis and modelling activities are clear during this first Phase of the project. A challenge for the next phase will be to ensure the interoperability and standardized cross-linking of the numerous datasets collected. It is also suggested to further enhance the synergy between modelling and observation initiatives, particularly among ECS as the project moves into Phase 2.
- Results obtained during the first phase of the project show great promise for assisting decisions on the future management of the Barents Sea. Close interaction with potential users of the project outcomes should be further developed to optimize the potential of the science deployed during Phase 2 to account for end user expectations and needs (See section 6)
- Besides the very positive developments on data management, some more work must be invested to establish a common level of interoperability at the data level among the institutional data center's (not all support OPeNDAP) and concerning the metadata, not all data are routinely tagged appropriately. Efforts also need to be invested to secure interoperability between data from the NL project and international databases.
- If not already done, a survey across all partner institutions should be conducted to get a precise assessment of the impact of the pandemic on planned initiatives, scientific productivity, ECS career development, and on the need for an extension of the NL project or of specific PhD theses & scholarships beyond the no cost 6-month extension period allocated by the RCN.

Photo: Christian Morel/christianmorel.net

3

Recruitment and training

The recruitment and training of a new generation of multi-disciplinary early career scientists (ECS) was identified as a core objective and legacy item of the NL project. The objective was to provide this emerging ECS community with a unique professional network, support for mobility, access to high-level research infrastructure and supervision across institutions and disciplines.

3a. Recruitment of early career scientists (ECS)
The NL project was successful at rapidly reaching and surpassing its original objective to support over 50 ECS (PhD students and postdoctoral fellows (PDFs)) over the course of the project. The core NL-supported ECS community is complemented by affiliated MSc students, PhD students and PDFs that are supported with external funding from partners that bring important leverage to the NL investment. The number of ECS grew from 19 in 2018 to 45 in 2019 and over 70 in 2020, with 28 PhD students, and 45 PDFs currently conducting or having completed their training as part of NL. The NL recruitment process also resulted in a very equitable, diversified, and inclusive multinational ECS community: Over 57% of ECS identify as women and ECS from 22 nationalities were recruited in 18 countries.

3b. Opportunities and value added for training and professional development
The NL project has developed and deployed numerous measures to provide their ECS community with opportunities and enhance their training experience. In addition to PhD courses and workshops, students are provided with mobility funds to participate in training activities across and outside Norway.

Many of the students are co-supervised by researchers from different research fields in different institutions and have access to funds to facilitate travel between institutions. In this sense, these ECS are often the conduit to develop and strengthen new or existing collaborations between institutions nationally or internationally. During their interviews, some ECS identified this mobility and co-supervision as a great advantage of their training, feeling as if they were getting the experience, contacts and benefits of 2 PDFs into one.

The NL project also develops and hosts interdisciplinary intensive course for PhD students and PDFs in which topics of interest to all ECS are addressed from different angles and fields of s cience. So far, a total of three PhD courses have been held and 54 students (including PDFs) have participated (Arctic Ocean

functioning, Arctic marine biogeochemistry, multi-factor experiments). These NL initiatives are meant to strengthen interdisciplinary exchanges among ECS and to encourage a collaborative spirit.

The project also held a 2-day annual Recruit Forum in 2018 and 2019 that allowed the ECS to set their own agenda and discuss topics of importance to them across institutions, educational level, and disciplines to strengthen the NL network and further develop their training experience. No Forum was held in 2020 because of the COVID-19 pandemic. The PhD schools, forum, webinars, and soft skills workshops were all cited as very positive and formative by the ECS interview group. The group highlighted that NL provided unique networking opportunities and that the excellent support from UiT's administrative centre was an important added value for them in the project.

The postponement of planned NL research cruises and the closing of laboratories for analytical work during the COVID-19 pandemic threatened the progress of PhD theses and PDFs.

This situation could have a significant impact on the career development of the ECS. In some institutions, and based on individual applications, PhD students have been allocated compensatory time (up to two months prolongation) for delays caused by the pandemic. This compensatory measure is however specific to the institutions and no general extension policy for PhD scholarships or PDFs contracts has been considered within the NL project. This could have resulted in possible inequalities among the project partners or among the various initiatives (e.g., modelling versus data analysis) in terms of career development of the ECS.

For the 50 PhDs and PDFs receiving NL scholarships, the security and stability provided by this funding was cited by the interview group as a major advantage, allowing them to focus on their research career instead of ways to find salary or funding.

3C. HIGHLIGHTS AND RECOMMENDATIONS

The NL project is reaching its goal of training a new cohort of highly qualified personnel that benefit from a multi-disciplinary and multi-institutional training and research environment, a high-level network of senior researchers and mentors, as well as access to ultra-modern research infrastructure such as the RV *Kronprins Haakon* and laboratory facilities in ten institutions across Norway. These unique tools and opportunities will no doubt result in a very strong pool of ECS to renew and rejuvenate the aging ocean research community in Norway and beyond. Beyond the datasets and knowledge gained from NL, this new ECS community, already closely networked, surely represents one of the most important legacies of the NL project. However, some recommendations emerged from our review:

- Given the importance of ECS in the present and future initiatives and legacy of the NL project, an elected representative of the ECS community should have a voting seat on the NL Board, in addition to representation on the PLT.
- Depending on their host institution, some ECS benefit from greater support than others (COVID support, access to berths on the vessels...). Efforts should be made to provide equal opportunities and benefits for all ECS across all 10 members institutions.
- The NL project has strengthened the interdisciplinary exchanges and collaborative work among the ECS. However, efforts are needed to ensure that this positive spirit exists among all NL partners and in all major project locations (institutions/cities). Noting that cruises and field work appear to work as efficient catalysts for strengthening collaborations between ECS and ECS access to new responsibilities, special attention may be paid to ECS working as modellers or located in smaller organisations as they cannot benefit from such opportunities and must rely on other collaborations.
- In addition to exchanges between academic institutions, ECS should be provided with opportunities/grants to pursue internships at some of the private and public sector RG organizations. Such internships would increase user involvement and communication within the project and better prepare some of the ECS for careers outside of academia, in the Norwegian private or public research sector.

Photo: Eva Therese Jenssen UNIS

4

Communications and knowledge transfer

As one of the largest and most comprehensive research initiatives ever funded by Norway, NL is a highly visible project with high expectations regarding its scientific impact and transfer of new knowledge to a diversity of stakeholders and to society in general.

4a. Communication Plan

> **"The Nansen Legacy will increase the general knowledge about Arctic marine systems, their specific nature, changes and, how they connect to society. The project aims to communicate with the general public, the scientific community, users to decision makers, both nationally and internationally."**
>
> - NL Vision and aim for communication

The project produced a communication plan in 2021 to set its vision and dissemination objectives to:

1. Share new knowledge about physical, chemical, and biological changes and the relevant processes in the northern Barents Sea.
2. Show how human activities impact the northern Barents Sea and adjacent Arctic Ocean.
3. Communicate scientific results on how past, current, and future changes have direct consequences and impacts for the society.
4. Contribute to and engage in a fact-based dialogue with stakeholder and decision makers about the use and management of the northern Barents Sea and adjacent Arctic Ocean.
5. Stimulate the interest for arctic research and the recruitment of future students.
6. Make Norwegian arctic research more visible and integrated with international research.

Photo: Hege Holen Paulsrud

Photo: Christian Morel/christianmorel.net

To meet these objectives, numerous tools that include various degree of scientific detail (Low, Medium, High) are proposed and being deployed to reach different target audiences ranging from school kids and the public to politicians, private sector users and research-oriented organizations.

One of NL's central communication tools is its comprehensive website that was updated in 2020/21. The website is well designed and provides up-to-date information on the project, participants, cruise reports, science, and outreach initiatives. The project is also active on social media through dedicated Twitter, Instagram, and Facebook pages as well as research blogs. Communication across the project community has not been disrupted by r estrictions on travelling, taking advantages of virtual workshops to optimize scientific exchanges. Among many tools being developed, we also note the production of a public exhibition about the project starting in late 2023 or early 2024 that will be circulated throughout Norway.

A dedicated full-time communications officer has been hired and is getting support from the administration office. Each partner organization also has a communication office that assures distribution of central NL communication material and produce their own NL related content.

As for other aspects of the project, the communication plan lists many intended initiatives and deliverables, but it does not provide a performance measurement plan to follow its progress, risks, and success in reaching its objectives. Some of the deliverables are highlighted in the implementation plan for RA-D, but as mentioned in section 5b below, this RA-D implementation plan is lacking clear timelines, metrics, and deliverables.

The communication plan also touches on the dissemination, exchange, and transfer of knowledge with the Reference Group (RG) and users as a key component of the NL strategy. Comments of this particularly important aspect of the project are addressed in Section 6 below.

4b. Nansen Legacy visibility and identity

The NL project makes very good use of the high-quality images (photos and videos) that illustrate the beauty, sense of adventure and aura surrounding Arctic research. The nations' new ultra-modern RV *Kronprins Haakon* (KH) research icebreaker is closely incorporated in the communications and identity of the NL project and adds to its impact.

Based on the interviews with ECS and stakeholders, the NL project has developed a very positive, well-received and recognized corporate identity or "brand". The ECS community has developed a strong identity and sense of belonging within the NL project, despite the institutional separation and reduced personal interaction due to COVID-19 restrictions. This sense of identity was particularly strong for ECS that can participate on cruises, especially onboard the KH. This "identify" was strongest for ECS located in the institutions such as UiT, where a larger group of participants was present. Annual events such as the Recruit Forum for ECS and annual meeting helps consolidate the NL identity and cohesiveness across all partner institutions.

In addition to the centralized communication efforts by the NL administration, NL scientists themselves act as major ambassadors of the project as they share results, experiences, and highlights of the project to a diverse audience, ranging from school kids to ministers. NL scientists and leaders appeared in media, contributed with several newspaper chronicles, a research blog on Forskning.no, and a variety of public talks.

Photo: Ellen Kathrine Bludd, UiT

4C. HIGHLIGHTS AND RECOMMENDATIONS

The visibility brought through the coordination of the nation's top Arctic researchers and institutions using the state-of-the-art icebreaker, named after Norway's crown prince, promotes a powerful and appealing image of national pride, and consolidates Norway's position as a world-leading Arctic research nation. This strategy will no doubt help the project reach its objectives of stimulating the interest for Arctic research and the recruitment of future students while increasing the visibility and reputation of Norwegian Arctic research on the international scene. But the project has set some ambitious communications objectives and it is difficult to see how communication initiatives are strategically planned and how success is evaluated. The committee had the following recommendations:

- The communication plan and associated RA-D plan would benefit from a performance evaluation plan with clearly identified metrics, targets and timelines. Among other things, the plan should clearly state how the impact and success of communication and outreach initiatives will be evaluated and measured regarding user engagement and addressing identified user needs (see also Section 6). This should be an integral section of an overall performance management plan for the project (see Section 5b)
.
- The ambitious communication plan and increasing focus on knowledge transfer, synthesis and outreach during Phase 2 will require a larger communications team, especially if this team is also responsible for interactions with knowledge users and stakeholder.
- It would be advisable that the NL project provide some meta-analysis about the usage and uptake of its published material, being it peer-reviewed or more public communication products.
- It would be of much value to learn more about the spin-off or footprint that NL-research and NL-output has provided to stimulate additional scientific projects or management activities from state agencies or the public sector.
- Given the high visibility of the NL/KH duo, it would also be of interest to assess the perception of the Norwegian public in general relative to NL and the KH.

Photo: Magne Velle, MET

5

Organization and management

5a. Leadership, governance, and management

The overall project leadership by Prof. Reigstad and the centralized UiT-based administration seems very efficient and nimble at coordinating this massive national endeavor. Based on the self-evaluation forms provided by partners institutions and the interviews conducted with ECS and RG representatives, the appreciation for project leadership and management was overwhelmingly positive. The recently added staff at UiT and at partner institutions shows a continued effort and investment in making sure that project management and administration stays efficient and productive. While very agile and efficient, the administration center will likely need additional staff and expertise in Phase 2 to address the increasing focus of knowledge transfer, user involvement, outreach, and legacy planning.

The NL project is governed by an owners group and a Board of Directors composed exclusively of high-ranking representatives from the 10 organizations that form the NL consortium. This select membership is justified by the fact that these institutions provide 50 % (in-kind) of the overall cost of the project. This exclusive owners group, where members "buy-in" their membership, is unusual in the publicly funded research world. The Board is currently dominated by representatives of research-focused organisations, including Akvaplan Niva, and the project governance would benefit from opening its membership to allow for more arm's length, industry RG member representatives as voting members. With user engagement and knowledge transfer priorities to be implemented in the second phase of the project, this direct representation of the user sector on the highest decision-making bodies of the project would be very beneficial. Given the major role of ECS in the delivery, success and legacy of the NL project, a voting ECS representative (elected by the ECS community) should also be added to the Board. The current indirect input of the ECS community, through an annual meeting with the PLT, is insufficient and does not reflect their essential contribution to the project. Having ECS directly involved in the governance of this major research project is also an extremely valuable training experience for future Norwegian science leaders.

5b. Strategic planning and performance measurement

The NL has developed a comprehensive Implementation Plan (the Plan) for the delivery of the research project that they describe as "*a guideline for the scientists and the main tool for the management of the Nansen Legacy project*". The Plan is accompanied by detailed lists of tasks and deliverables (publications, recruitments, data collections, workshop...) for each of the 8 RF/RAs that are presented in Gannt charts supported by milestones and justifications of delays or issues.


Photo: Christian Morel

In general, the detailed and regularly updated Plan is a comprehensive and valuable document that provides governance and all project members with a clear and transparent update on progress from all RF/RAs relative to their annual work plans. NL management and RF/RA co-leads should be commended for regularly maintaining such a comprehensive Plan up to date. The updated Plan also feeds the overall NL progress reports submitted annually to the RCN in January.

We do note however that the quality and level of information varies greatly between each RF/RAs. While most RF plans are quite detailed and provide clear measurable deliverables with identified milestones and progress justifications, some RA implementation plans are vague, with some sections not following the "template" format organized in Tasks or Deliverables (RA-B). This lack of clear and measurable deliverables and milestones is particularly striking for RA-D where milestones are all indicated as months 1 to 72 and it is pretty much impossible to know exactly what/when deliverables will be available relative to the workplan. Given the major strategic importance of RA-D (Impact and Legacy), it is difficult to see how the project will be able to measure success, risks, or deliverables. The 2021 NL communications strategy also support RA-D with details of the general communication objectives and types of activities, but it also lacks any metrics or indication on how progress or success will be measured (see also Section 4a).

While the Implementation Plan provides detailed updates for the different RF/RAs or individual components of the NL project, it does not allow the overall NL project to measure its performance in reaching its 5 core strategic objectives (see 1a). The review committee was not provided with an overall comprehensive strategic plan or performance measurement plan (with logic model, performance indicators, metrics and targets) for the NL as a whole. An informative SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis was developed by the project leaders in 2018 "*as a tool to guide strategic focus*". But the committee was not provided with an indication that the SWOT is actually being used by management or has been updated since 2018.

Many performance indicators could be developed by the NL project to highlight and follow the added value of this huge concerted national endeavor for the research community and society. The growing list of publications emanating from the project provides an opportunity for innovative bibliometric analyses that would help demonstrate the project's impact on the development of novel interdisciplinary, multidisciplinary, multi-institutional collaborative research. Beyond the number of peer-reviewed papers and co-authorships, metrics such as a citation distribution index or interdisciplinary/multidisciplinary scores can be followed over the duration of the project to demonstrate the added value of the NL compared to initial benchmark values or other similar projects internationally. Other metrics could also be used to follow the performance and impact of NL outreach and knowledge transfer activities or ECS performance (beyond the number of students recruited).

5c. Finances

NL management provides detailed annual financial statements to the RCN. The analysis of NL financial statements, expenses and budgets was not part of this midterm evaluation. The committee did have access to annual workplans and budget tables that presented very detailed budgets and expenses for each partners organisation. Unfortunately, no overall project budget with a clear indication of relative investments in each of the RFs, RAs and Project Administration was provided (nor requested by the RCN) to assess the relative amount of funding and investment dedicated to each major operational component of the project. Based only on tasks and deliverables to date, some RAs, such as RA-D, is likely underfunded relative the major outputs and outcomes it is expected to deliver in Phase 2. This is supported by some partner organisations stating that "*the budget for stakeholder involvement is quite limited and should have been prioritized".*

5D. HIGHLIGHTS AND RECOMMENDATIONS

Under the leadership of PI Marit Reigstad and co-PIs Tor Eldevik & Sebastian Gerland, the overall project management and relatively small UiT-based administrative centre have succeeded in implementing and delivering the first Phase of this complex and ambitious national project, even amidst unique logistical challenges and a global pandemic. The committee does see ways to improve overall project governance and performance management, especially as the project moves to Phase 2 where the focus will move towards modelling, synthesis, knowledge transfer and legacy planning.

- A national project of such magnitude and complexity demands a project management framework supported by solid strategic and performance measurement plans. The overall project and its communication plan would greatly benefit from setting clear and SMART (Specific, Measurable, Achievable, Relevant, and Time-Bound) objectives. Such plans and objectives are essential to identify risks to expected outcomes, recommend corrective measures, and provide NL governance and funding organisations with the information required to demonstrate progress and alignment with the project's strategic objectives.
- The project should regularly update its SWOT analysis and use its results to inform governance and the Phase 2 action plan.
- ECS and the RG (preferably from industry) should have a voting seat on the decision-making NL Board of Directors, especially during the project's second phase.
- A clear indication of how recommendations of the SAB and RG are considered in the management and planning of NL activities should be clarified.
- The project should invest in detailed and novel bibliometric analysis to highlight the numerous impacts of NL on the Norwegian Arctic research output.
- The committee could not find a clear engagement or plan to ensure that NL scientific publications will be available in Open access. If not already developed, a strategy (and associated funding) should be made available to allow NL teams to make their publication openly accessible, even if published in high impact subscription journals with high open access fees.
- The efficient UiT-based administration center will likely need additional staff to address the shift in project focus from Phase 1 to Phase 2. The qualifications required may not be the same.
- The workload and responsibilities placed on some key personnel involved in the NL project is large and may grow during Phase 2. Institutions should ensure that the key personnel do not get too engaged in other activities or are liberated from other duties during the NL project to ensure enough time for establishing new and creative collaborations within the project.
- A major risk in long-term, large-scale, academic-led research projects such as the NL is that most scientists, project leaders and students will gradually, and naturally, move on to the next exciting new project, expedition, job, or funding opportunity without fully delivering on their responsibilities towards the NL project (data archiving, publications, synthesis...). It is crucial that the core management and administrative team stay 100% dedicated to the NL until the end of the project (and beyond for some) to ensure that it delivers on its major objectives that go far beyond data collection, analysis, and publications.

Photo: Charlotte Stark, UiT

6

Knowledge transfer, relevance and utility for user groups

Optimizing stakeholder interaction to explore and manage the emerging Arctic Ocean is one of the 5 core objectives of the NL project (Section 1a) that is also reflected in its communication plan objective to "*Contribute to and engage in a fact-based dialogue with stakeholder and decision makers about the use and management of the northern Barents Sea and adjacent Arctic Ocean" (Section 4a).*

To help address these objectives, the project has set-up a Reference Group (RG) (Appendix 7) representing stakeholders and whose role is to inform management about user needs. The RG acts as the key arena for interaction in addition to the deployment of a series of initiatives aimed at facilitating effective communication and utilization of project-generated expertise, data, and results.

6a. Involvement of users in project management and planning

Dialogue meetings are one of the main activities deployed by the NL team to disseminate information to, and get input from, the RG. RG members are also invited to join the NL annual meeting, workshops, or panel discussion. During a first dialogue meeting held at the NL kick-off event, a set of principles and recommendations were identified to optimize dialogue between scientists and stakeholders/users and to define an efficient role of the RG in the implementation of the NL project. Some of the recommendations emanating from the meeting were to organize regular workshops with the RG, to provide regular and timely updates of the NL results in a synthesized form, including science products directly available for operational management, and to give users access to metadata as well as data sets. A major output of this first meeting was a list of overarching stakeholder needs. A second dialogue meeting was organized with the RG during which scientists presented their latest findings on topics relevant to these needs. Meetings with individual reference group members also took place. A scenario workshop was organized with RG members, using scenarios for cross-perspective discussions and to address the preparedness for these scenarios in the different user-groups.

During our interview session, RG members reported that these meetings were well-prepared with very professional presentations and following discussions. The presentations gave a good impression of the high scientific level of the NL research activities. RG members also stated that the project had an impressive diversity of expertise and high-quality state-of-the-art data. But several RG members stated that it was difficult for them and their organisations to see the direct application of the NL datasets due to the high level of detail and lack of data visualization or

translation needed to make it more accessible and relevant to users and their needs.

Most RG members have attended NL workshops and meetings and confirm that they have been given opportunities to discuss or answer topics or questions raised by the NL project team. They have however, not been involved in raising topics for discussion in the RG meetings, or in the follow-up of issues raised during meetings. RG representatives are not represented in the project management and decision-making structure. During their interviews, ECS also indicated that a greater participation of RG representatives in the NL management board would be valuable.

The interviews with various RG members also illustrated a very diverse sense of involvement between members. While some organizations seem to have been involved with the project leadership regularly, (e.g. AMAP), some industry representatives seem to have had a much less active role in the user group, acting more as "observers". Some groups missed a more direct interaction with the project while others seem to be satisfied of the current level of involvement.

The NL self-evaluation report mentions the will of NL to "*ensure relevance and utility for the user group by planning for more dialogue meetings, continue organizing side events on relevant topics, follow-up scenario workshop, and involving the Reference group further in project meetings/ webinars/ work.*" While this decision is certainly encouraged, it is difficult at this stage to measure what concrete actions will be deployed to support it. There is no evaluation of project achievements regarding the sound recommendations that have been established by the RG at the kick-off meeting. The committee did not see any concrete plan or deliverables that would make it possible to measure the success of increased stakeholder integration. Communication activities mainly took place through discussions between scientists and different user groups. It is unclear so far how much of these discussions contributed to actual transfer of knowledge toward end users, if specific actions were identified to favor further engagement of the end-users in the project, and to which extent the outreach events contributed to identification of end user expectations and to actual information of the scientific strategy of the project.

6b. Benefits to society and to Norway

While new results are just starting to emerge from the NL project, the NL team has been involved in activities to inform policy and the public. For example, the NL team contributed to the 2nd Arctic Science Ministerial (ASM2) meeting in Berlin in 2018 where they addressed the Arctic observational capacities and needs during the science plenary. NL members also met about one hundred 12–18-year-olds at their schools and invited them to their research laboratory during the National Research Days in Norway.

NL project members have also been active in national and international arenas discussing ecosystem-based research and management. This includes participation in relevant management/ stakeholder-related working groups, participation in international panel debates, and series of presentations and discussions. To bridge research and policy, project members have participated in international organizations/bodies to bring in new knowledge (AMAP, IPCC, ICES, SROCC, WMO, others). A scenario workshop "Barents Sea 2050" identifying potential scenarios, risks, and mitigation with input from scientists and different stakeholder groups has also been organised. In addition, presentation of results and fact-based information has been given to politicians and ministries related to the political discussions on the ice edge definition and in the preparatory phase for the white paper on the High North.

6C. HIGHLIGHTS AND RECOMMENDATIONS

Based on user group feedback and interviews with PIs, the evaluation committee recognizes that the NL leadership would like users to be informed of project results and are eager to see that results are being used beyond the academic world. The major focus and efforts during Phase 1 were placed on coordination and deployment of field-work, data collection, and recruitment/training of ECS, leaving little time to map user needs and to ensure involvement by users in project planning. As a result, there currently seems to be a weak link between user needs and research results. One specific example are the research needs stated in the Management Plan for Norwegian Sea Areas[1]. These knowledge gaps are important for the sustainable management of the environment and marine resources of the Barents Sea through the 21st century and should be addressed more clearly by the project. The further analysis and synthesis of data and NL results will no doubt help with this process. Nevertheless, the NL project team also acknowledges in its self-evaluation that increased efforts will be needed to engage users during Phase 2. To increase relevance and application of project results for users, the project should consider:

- An early involvement of the RG in the project planning and deliverables for Phase 2 of the project period. This should be real involvement by user group, including on the Board of Directors (Section 5), ensuring that relevant research questions are raised, that user group input has an impact on project prioritization and that data outputs are in a format that would facilitate access for users and meet user needs. The project to a larger extent could also consider add-on studies based on needs from user groups
- A clear stakeholder communication plan (see Section 4a) providing SMART objectives, initiatives and deliverables for NL interaction and knowledge transfer with the diverse user groups. Initiatives could include more thematic oriented meetings bringing together contrasting views of how to utilize the Arctic systems in the future by ensuring good environmental practice.
- According to the self-evaluation report, NL demonstrated substantial effort in public and society communication with relevant stakeholder groups. However, this communication could benefit from a more coordinated effort that would also include the cross-link communication between stakeholder groups. On site personal meetings, once COVID restrictions become more relaxed, might help to provide such forum.

1 https://www.regjeringen.no/en/aktuelt/norway-presents-revised-marine-management-plans/id2699315/

Photo: Christian Morel/christianmorel.net

7

National and international collaboration

"The Nansen Legacy is the collective answer of the Norwegian research community to the outstanding changes witnessed in the Barents Sea and the Arctic as a whole."
NL website

7a. National collaboration outside the consortium

At the national level, the project coordination managed to implement several tools to foster cooperation with institutions outside the core consortium despite a highly constrained budget. PhD and PDF funding from other sources than NL supported the creation of a status of "affiliated" personnel. NL cooperates with nine non-NL institutions on different aspects ranging from collaborative use of infrastructure (for field work), data sharing, sampling, recruitment program and co-supervision. However, despite the nature of the project which fosters external collaboration, the high level of collaboration and wide spectrum of expertise already existing within the project tend to minimize partner needs for expanding their collaborations beyond the project consortium. Globally this is a kind of recognition of the project gathering all the necessary expertise and being inclusive. Some partners do indicate useful collaboration outside the project consortium through, e.g., joint participation on cruises (yet dependent on berth availability) or industry partners, sometime not beyond the individual level. Yet, others highlight the difficulty of finding the additional funding needed for such collaborations.

Besides institutional partnerships, NL managed to activate numerous collaborations by reaching out to several national projects (22 so far) which are bringing complementary expertise on a variety of topics and disciplines. National exchanges of r esearchers, with a large majority of PhD students, have been numerous and facilitated by an easy-to-use application for mobility. Yet, these mainly concern project partners. Shared PDF employments were also organized between partner institutions, with the idea to strengthen collaboration, increase knowledge exchange to both the candidates and between institutions, and expand and strengthen the candidate´s network to relevant science groups over longer time spans than traditional mobility. Note that the overall exchange activity may have suffered from the pandemic conditions.

7b. International cooperation

The NL project gathers many scientists with internationally recognized expertise in their research field. International collaboration around the project therefore arises in part as a natural consequence of the project science reputation. Natural links with large international initiatives such as MOSAIC, YOPP, SAS, DBO or other national programs (UK Changing Arctic Ocean) have also been established. The project has linked with 16 international projects or initiatives. The level of cooperation and the benefits for the different partners vary, with actions ranging from joint meetings to co-supervising students, researcher exchange, harmonization of field work protocols, joint sample analysis or building new networks. Some long-lasting cooperation already existed and therefore are not necessarily to be attributed to new project efforts, but the cooperation level was strengthened and extended to more scientists and fields of research thanks to NL, which have led to exchange of expertise, personnel (including co-supervision of students), and shared access to infrastructures. A concrete illustration of international collaboration within the project is the fact that half of NL publications so far include international partners from 20 different countries and 64 different research institutions outside of Norway as co-authors. In total, over 80% of the NL publications include authors from two or more national and international institutions.

International cooperation within the NL project also had a leveraging effect by helping some partners to successfully apply to other sources of funding. In some circumstances, the project was instrumental in the establishment of new international collaborative efforts.

Photo: Sebastian Gerland, NPI

7C. HIGHLIGHTS AND RECOMMENDATIONS

One of the major achievements of the NL project has been to unite Norway's largest marine research organizations as part of a single extremely solid and complementary national consortium of eight national public institutions and two private research organisations that currently involves over 200 members. The national consortium already proves to be much stronger than the sum of its parts and is likely to be a major legacy of the NL project. The consortium also actively collaborates with external Norwegian and international institutions and researchers.

- NL puts forward its specificity as a solid "national" project. As such, it is important that the consortium be opened to the contribution and inclusion of Norwegian research organisations that are not yet in the project but may contribute to NL or future consortium-led research.
- As the consortium grows and new ECS get established, it will be important to assess the expertise gaps still present in the Norwegian Arctic research community to inform future recruitments and prioritize the needs for specific complementary international partners and collaborators.

Photo: Sebastian Gerland, NPI

8

Conclusion and overall recommendations

Despite external challenges due to the delayed commissioning of the RV *Kronprins Haakon* and the COVID-19 pandemic, the NL project achieved significant progress and produced high quality research during its first Phase (2018-2020). With the successful organisation and deployment of 14 oceanographic cruises, the recruitment of more than 70 early career researchers now involved in the project and over 55 peer-reviewed publications to date, the NL has already reached some of its ambitious core objectives.

The UiT-based project leadership and administration centre is highly efficient and appreciated by partners and project participants. Beyond a very operational implementation plan, the project seems to lack formal strategic and performance management plans that make it difficult to evaluate progress and performance against SMART objectives and metrics. This will be particularly important during Phase 2 where the project focus will move away from field work towards modelling, synthesis, knowledge transfer, outreach, and user involvement.

Increased efforts will need to be deployed to improve user engagement and knowledge exchange during Phase 2 to ensure that results and impacts go beyond scientific publications and answer user needs and knowledge gaps identified in national strategies.

One of the major challenge and task of the NL consortium and owners in Phase 2 will be to ensure that the consortium continue to work with project funders and users to build a project legacy beyond the NL that will capitalize on the national synergy that is being built between institutions, end users and across disciplines. Beyond the new knowledge and understanding of the Barents Sea ecosystem, the new generation of interdisciplinary Arctic scientists being trained within the project and working together within a concerted national research consortium will be the true lasting legacy of the NL.

Overall, the committee was extremely satisfied with the progress and expected impacts of the NL. The Committee strongly recommends that support for the project must be maintained for Phase 2. The committee also recommends that the project will take into consideration our recommendations to help them achieve their ambitious objective of contributing to the integrated scientific knowledge base required for the sustainable management of the environment and marine resources of the Barents Sea and adjacent Arctic Basin through the 21st century.

Appendix

Photo: Christian Morel

APPENDIX 1.
Composition of the midterm evaluation committee

- **Dr. Martin Fortier (chair)**
  Executive Director, Sentinel North and Assistant to the vice-rector research and innovation, Université Laval, Canada
- **Prof. Ulrich Bathmann**
  Director, Leibniz-Institute for Baltic Sea Research Warnemünde (IOW), Germany
- **Dr. Didier Hauglustaine**
  Laboratoire des Sciences du Climat et de l'Environnement, France
- **Dr. Toril Inga Røe Utvik**
  Manager, Northern Area Unit, Equinor, Norway
- **Dr. Marie-Noelle Houssais**
  Laboratoire d'Océanographie et du Climat, Expérimentation et Approches Numériques (LOCEAN), France
- **Dr. Catherine Lalande**
  (committee secretary), Université Laval, Canada

APPENDIX 2.
Documentation provided to the evaluation committee

The committee was provided with over 1100 pages of information in the following documents to help with their evaluation:

- 2017 evaluation panel assessment and response to recommendations (25 pages)
- Annual Report 2018 (32 pages)
- Annual Report 2019 (40 pages)
- Annual Report 2020 (48 pages)
- Communication plan (14 pages)
- Data Management Plan (56 pages)
- Data Policy (4 pages)
- Fact sheet Nansen Legacy Midterm evaluation (164 pages)
- Nansen Legacy 2017 project description (48 pages)
- Progress report 2018 (in Norwegian) (27 pages)
- Progress report 2019 (in Norwegian) (143 pages)
- Progress report 2020 (in Norwegian) (165 pages)
- Report from stakeholder workshops and user groups interactions (42 pages)
- Research plan 2021-23 and Implementation plan (158 pages)
- Self-evaluation from Nansen Legacy project 2021 (7 pages)
- Self-evaluation reports from 10 member institutions (88 pages)
- Workplan 2019 and budget tables (26 pages)
- Workplan 2020 and budget tables (26 pages)
- Workplan 2021 and budget tables (34 pages)

APPENDIX 3.
List of interview participants

As part of their review, the evaluation committee met via videoconference with NL ECS, RG representatives and the three project leaders. Each group met separately with the committee for an interview period ranging from 45 to 90 minutes.

Early career scientist (ECS):
Johanna Aarflort (IMR)
Jakob Dörr (UiB)
Snorre Flo (UNIS)
Anjali Gopakumar (UiO)
Zoé König (UiB/NPI)
Natalie Summers (NTNU)

Reference Group representatives:
Eva Degré (Norwegian Environment Agency)
Line Kjelstrup (Biotech North)
Stig-Morten Knutsen (Norwegian Petroleum Directorate)
Einar Lystad (Norwegian Oil & Gas Association)
Øyvind Rinaldo (The Norwegian Coastal Administration)
Rolf Rødven (Arctic Monitoring and Assessment Program)

Nansen Legacy project leader and co-project leaders:
Marit Reigstad (UiT The Arctic University of Norway)
Tor Eldevik (UiB)
Sebastian Gerland (NPI)

APPENDIX 4.
Comments on the evaluation process

The midterm evaluation of the Nansen Legacy project was conducted during the global COVID-19 pandemic situation that prevented committee members to meet face-to-face. Committee members were not able to conduct a site-visit of the research facilities and of the host institution at UiT that would have normally been required for a project of such magnitude. The committee believes that they nevertheless were able to conduct a proper review of the project's progress and achievements based on the extensive documentation provided. The following recommendations could inform future reviews:

- The committee was provided with many documents (27) representing over 1100 pages of information for their review (Appendix 2). The overall statistics to date (# of ECS, articles, list of participants...) were provided in a 156-pages fact sheet, but no formal 3-year synthesis mid-term progress report was requested from the project by the RCN. Such a report, with precise questions on progress and challenges so far, would have greatly helped the committee who had to navigate numerous documents and annual reports to find and synthesize information. The only 3-year synthesis provided by the project leadership was in the form of a short 7-page overly positive self-evaluation form.

- ECS interviews were conducted with a group of ECS suggested by the project leaders. The interviews could have been complemented by an anonymous survey of all ECSs in the project to get a more comprehensive and impartial view of the ECS experience within the NL project.

- No overall strategic or performance measurement plan for the NL project is requested by the RCN or provided by the NL project. Such plans, with clear progress and metrics on deliverables and objectives would be of great value for future reviews.

- No interviews were conducted with the RA/RF leaders or any PIs except for the three NL co-leaders. Interviews could have been conducted and supplemented by an anonymous survey of all PIs in the project to get more comprehensive view of the PI experience within the NL project.

- Most of the material provided to the committee focused on the positive results and project highlights, with very little information on the risks, difficulties or challenges naturally encountered by such an ambitious project. Future evaluations should request the project to provide a summary of the key problems/challenges, risks and mitigation strategies that they have adopted.

APPENDIX 5.
Nansen legacy partner/consortium institutions

The NL consortium or partners include eight public Norwegian research institutions and two private research institutes with expertise in Arctic marine science.

- UiT The Arctic University of Norway (host of the NL administration center)
- University of Oslo
- University of Bergen
- The University Centre in Svalbard
- The Norwegian Meteorological Institute
- Institute of Marine Research
- Norwegian Polar Institute
- Norwegian University of Science and Technology
- Nansen Environmental and Remote Sensing Center
- Akvaplan-niva

APPENDIX 6.
Nansen Legacy scientific advisory board composition

A Scientific Advisory Board (SAB) composed of high-level international Arctic scientists and managers provides scientific advice and links to international initiatives.

- Antje Boetius, Alfred Wegener Institute, Germany
- CJ Mundy, University of Manitoba, Canada
- Derek Muir, Environment and Climate Change Canada, Canada
- Jacqueline Grebmeier, University of Maryland, USA
- Julienne Stroeve, University College London/ University of Manitoba, UK/ Canada
- Michael Karcher, Alfred Wegener Institute, Germany
- Søren Rysgaard, Aarhus University/ Greenland Institute of Natural Resources, Denmark/Greenland
- Timo Vihma, Finnish Meteorological Institute, Finland

APPENDIX 7.
Nansen legacy reference group organisation

A Reference Group composed of representatives from key user sector organisations, including the maritime, petroleum, fisheries and biomarine industries, informs management about user needs.

- Norwegian Environment Agency
- Norwegian Oil and Gas Association
- Troms County Municipality
- Norwegian Directorate of Fisheries
- Arctic Monitoring and Assessment Program (AMAP)
- Norwegian Petroleum Directorate
- Norwegian Coastal Administration
- International Council for the Exploration of the Sea (ICES)
- The biomarine innovation cluster Biotech North

APPENDIX 8.
List of acronyms

AMAP	Arctic Monitoring and Assessment Program
DBO	Distributed Biological Observatory
ECS	Early career scientist
ICES	International Council for the Exploration of the Sea
IMR	Institute of Marine Research
IPCC	Intergovernmental Panel on Climate Change
MOSAiC	Multidisciplinary drifting Observatory for the Study of Arctic Climate
NERSC	Nansen Environmental and Remote Sensing Center
NL	Nansen Legacy
NMI	The Norwegian Meteorological Institute
NPI	Norwegian Polar Institute
NTNU	Norwegian University of Science and Technology
PDF	Postdoctoral fellow
PI	Principal investigator
PLT	Project Leader Team
PMP	Performance measurement plan
RA	Research Activity
RCN	The Research Council of Norway
RF	Research Foci
RG	Reference Group
SAB	Scientific Advisory Board
SAS	Synoptic Arctic Survey
SROCC	Special Report on the Ocean and Cryosphere in a Changing Climate
UiB	University of Bergen
UiO	University of Oslo
UiT	UiT The Arctic University of Norway
UNIS	The University Centre in Svalbard
WMO	World Meteorological Organization |
YOPP	Year of Polar Prediction

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