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The Canada – Inuit Nunangat – United Kingdom Arctic Research Programme

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ABSTRACT

Arctic and Northern research does not always have a positive legacy with northern communities, from early colonial exploitation through contemporary practices that may not leave positive benefits for communities. In Canada, the Arctic and Northern Policy Framework and the National Inuit Strategy on Research (NISR) provide guidance for how research may enable Inuit-led priorities, and lead to greater Inuit self-determination in research. This paper highlights the principles under which the Canada – Inuit Nunangat – United Kingdom Arctic Research Programme (CINUK) was formed, championing different ways of convening and conducting research in alignment with this guidance. The paper then introduces some of the successful projects funded under CINUK's Mitigations and Adaptations for Resilience thematic area that have relevance to Arctic coasts and oceans; how were these collaborative relationships formed and what are some of the key lessons-learned for developing this type of collaborative research in an engineering context? CINUK endeavors to demonstrate how impactful research can be carried out under a new lens, with Inuit-led research at the centre of Arctic studies.

KEY WORDS: Arctic; Inuit; Research; Collaboration

INTRODUCTION

In a research context, there are a number of programmes and academic- and government-led projects that, for many years, have nurtured partnerships with northern and Indigenous organizations, governments and communities. More recently, many of those partnerships have moved towards Indigenous-led research. Examples of these include numerous community-led environmental monitoring initiatives such as the Northwest Territories Cumulative Impact Monitoring Program, the Inuit Qaujisarnirmut Pilirijjutit Inuit-led research programme funded through ArcticNet, and research activities that have morphed into non-profit social enterprises such as the Indigenous-led SmartICE (see Bibliography for sources). Such activities intentionally enable Indigenous participation from the outset, in the research design, delivery and dissemination. They include the development of research capacity in a variety of disciplines. And they braid Indigenous knowledge systems with western methodologies. The research lens for many of these projects, initiatives and programmes is one of natural, social, physical or health sciences; there are limited examples of applied science and engineering research moving towards an Indigenous-led approach from which other researchers may learn by example. Dimayuga et al. (2023) examined the research practices of engineering, energy and infrastructure projects, and highlighted the gap between Indigenous scholars' expectations and whether those expectations were met through technical

collaborations. In other fields, as well as government publications, these expectations are already more prevalent, and outline paths forward for respectful collaboration (see, for example, Wong et al. 2020, and selected examples in bibliography).

A new collaborative research programme can provide such applied science and engineering examples. The Canada – Inuit Nunangat – United Kingdom Arctic Research Programme (CINUK, Figure 1) was launched in 2021. Research conducted under this programme is supporting key themes connected to climate-driven changes to the terrestrial, coastal and near-shore marine environments in Inuit Nunangat, as well as impacts on Inuit and community health and well-being. One of the principal approaches incorporated into the design, development and delivery of CINUK is that research can support impactful international, ethical and diverse partnerships, advancing Inuit self-determination in research.

Inuit disproportionately experience a range of challenges that negatively impact social determinants of health including food security, housing, and mental wellness, many of which will be exacerbated by rapid changes to the environment. As the current and future economic, social, cultural, environmental and health implications of environmental changes for Inuit communities are critical, the CINUK thematic areas will support research to examine these implications. Ensuring that Inuit are not just involved, but leading research directions, will result in research that more concretely addresses these challenges.

There are two thematic areas within the CINUK programme. Theme 1, *Arctic ecosystems and their impact on Inuit communities*, explores research related to understanding dynamic Arctic ecosystems in the context of rapid change, and the impact of this change on Inuit health and well-being. Theme 2, *Mitigations and adaptations for resilience*, explores research related to innovative, practical and ethical mitigation and adaptation tools and technological solutions derived from understanding the impacts of environmental change on housing, health, food and water in Inuit Nunangat. Projects must also address at least 2 of 3 cross-cutting areas: economics of Arctic change; resilience and sustainability; and Inuit community health and well-being. It can be seen that the two themes are inter-related. Theme 1 addresses research questions within the natural, health, social and physical sciences, while Theme 2 advances engineering and applied science research and development, enabling uptake of the other science disciplines, moving research into policy, regulatory, commercial or community use.

This paper will focus upon introducing the collaborative programme's guiding principles, and some of the projects underway in Theme 2: Mitigations and adaptations for resilience, highlighting the building of teams, project management and delivery plans. An article in development will provide more in-depth information about the programme's creation. It is hoped that by providing examples of how these projects are thinking differently about applied science and engineering research collaboration, others may similarly initiate collaborative research design, led or co-led by northern Indigenous organizations.

GUIDING PRINCIPLES

Before the call for proposals was launched for CINUK, the programme partners (United Kingdom Research and Innovation (UKRI), Fonds de recherche du Quebec, Inuit Tapiriit Kanatami (ITK), the National Research Council of Canada (NRC), Parks Canada and Polar Knowledge Canada) established both a Memorandum of Understanding (MOU) as well as a Partnering Agreement. Combined, these two documents, one non-binding, the other a legal funding agreement, strive to advance the five pillars of the National Inuit Strategy on Research

and its implementation plan (Inuit Tapiriit Kanatami, 2018a and 2018b – see Figure 3), as well as Canada's Arctic and Northern Policy Framework, a document that outlines how Canada will advance and prioritize Arctic and northern interests (Figure 3, Government of Canada, 2019).

Figure 1 The CINUK logo (www.cinuk.org)

Figure 2. The five priority areas of the National Inuit Strategy on Research (Inuit Tapiriit Kanatami, 2018).

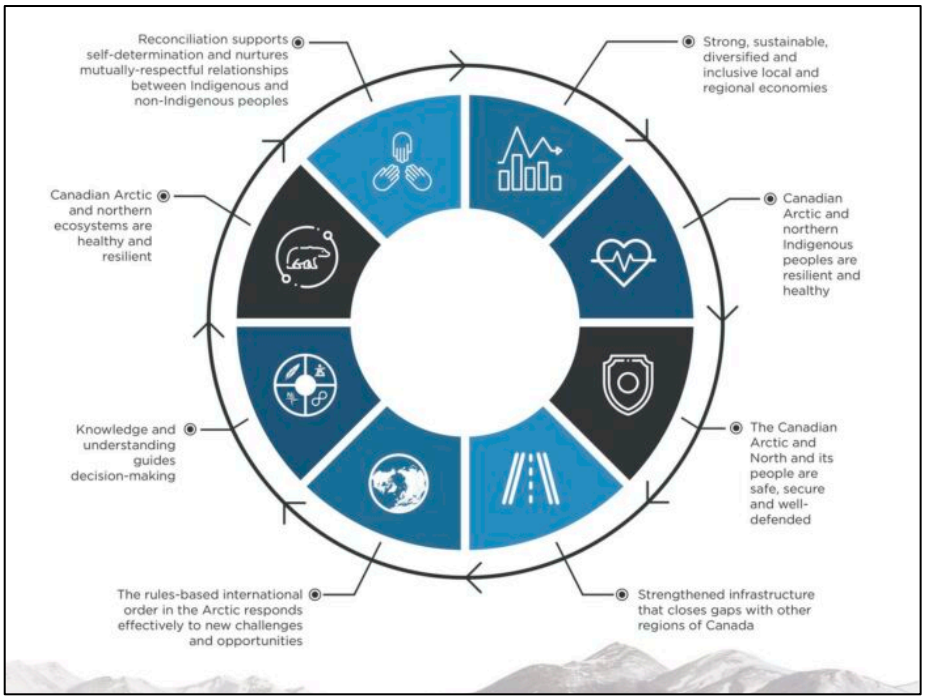

Figure 3. The 8 goals of the Government of Canada's Arctic and Northern Policy Framework (2019)

The MOU largely sets out the guiding principles under which the programme is to be carried out. This includes the shared expectations for the programme, to advance its development and delivery, co-developed by all of the partners and designed to support a constructive working relationship based on mutual respect. The guiding principles of the MOU include:

- **Respect and support for Inuit self-determination in research -** Working in good-faith to co-develop and implement a program that respects and supports Inuit self-determination in research, wherein Inuit representative organizations are engaged as leaders and partners in setting the research agenda in Inuit Nunangat, have equitable opportunities to access funding for Inuit-led research, and are engaged in the design, implementation, and dissemination of research.
- **Joint responsibilities in establishing programme research priorities -** Defining the priorities through full and equal partnership, as well as all call documents and reporting.
- **Supporting capacity-building among Inuit -** Including provision of funds to ITK and Inuit Land Claims Organizations to enable participation in the development and implementation of the Programme, as well as advancement of Programme research priorities. Inuit-directed research includes research conducted by Inuit and/or conducted or supported by Inuit Tapiriit Kanatami, Inuvialuit Regional Corporation, Nunavut Tunngavik Inc., Makivik Corporation, or the Nunatsiavut Government.
- **Establishing a joint selection process for proposals –** Developing a protocol for adjudicating and awarding proposals for successful applicants. For CINUK, this included two research tables, one of which was Inuit-led, that then came together to determine the final rankings of proposals in each thematic area. It also included consensus-based approaches at a number of stages within the review process, as well as evaluation criteria that explicitly evaluated data management, community dissemination, northern capacity building plans and anticipated impacts for communities within Inuit Nunangat.
- **Establishing a data management plan -** Developing a data management plan that provides Inuit access to and control over data that is collected under the Programme's projects within Inuit Nunangat or about Inuit.
- **Ensuring the ethical conduct of research -** Adhering to Canadian standards and guidelines for conducting ethical research (e.g., Government of Canada, 2022), researchers operating under the Programme will respect Inuit-specific ethical concerns related to their project and follow Inuit-specific guidelines for conducting ethical research.

While the MOU is a non-binding agreement, it was, and continues to be, important that all subsequent documents were / are in alignment with, and reflect the spirit and terms of, the MOU. It is important to note that this document took many months to develop, given the number of partners involved and the attention to detail ascribed to each aspect within it.

The strategic priorities of the programme mentioned in the Introduction, as well as further details about the development of the programme's initiation, thematic development, funding approach, and other areas of interest, will be documented at a later date. Here, it is sufficient to know that they were developed through a broad collection of engagement and outreach. These included an extensive, Polar Knowledge Canada-led survey and set of engagement sessions, a UK-led workshop with ITK participation to share Inuit priorities, examination of ITK's National Inuit Strategy on Climate Change, background research and subsequent

engagement sessions to develop NRC's Arctic and Northern Challenge Program and more (see selected bibliography).

DEVELOPING COLLABORATIVE RESEARCH PROJECTS

The previous section of this paper shared the guiding principles for the CINUK organizations to come together to support collaborative research and development within Inuit Nunangat. But what about at a project level? What do applied science and engineering projects look like under this lens? How do engineering research projects, often carried out in collaboration but with industries and municipalities, engage with Inuit? How do Indigenous Knowledge methodologies come together with engineering? Using four of the six Theme 2 research projects as examples (ones that have a coastal and/or ocean focus), we will step through some of these questions by examining these projects through the following six areas: making connections and enabling participation; developing research relevance to region(s); Indigenous Knowledge; project management; data and Intellectual Property (IP) management; building northern research capacity. These considerations have been chosen due to their relevance to the guiding principles of the CINUK programme, their relationship to the five pillars of the National Inuit Strategy on Research (2018) and to the objectives of Goal 4 of the Arctic and Northern Policy Framework (2019), *Knowledge and understanding guides decision-making*.

There are some important considerations to present prior to this examination. The CINUK call for proposals was a two-stage process, where letters of intent were followed by invitations to submit a full proposal. When the call was opened, a networking session was developed, to bring people together virtually to support making connections, given the limitations imposed by the ongoing COVID-19 pandemic. The time-frame between launch and the due date for the letters of intent was short – 8 weeks. The full proposals were due 12 weeks later. This timing was chosen to have proposals submitted before the summer, and to accommodate funding deadlines. Further, the project teams in Theme 2 must include researchers from the NRC, providing their research expertise in-kind, due to the terms and conditions of the available funding. Each project team is led by a Canadian and a United Kingdom Principal Investigator, and may be supported by funded Co-Investigators and unfunded Collaborators. Further information about the projects, and the project teams, may be found through the CINUK webpage, www.cinuk.org. As the website will be accessible for a limited time post-programme, short descriptions of the four projects follow.

NSAR - Search and Rescue, community resilience

The aim of the project is to strengthen the whole-of-society search-and-rescue (SAR) system in the Canadian territory of Nunavut through capacity and skill building, and by creating a decision support model for planning, preparation, and infrastructure development.

Nuna - Changing ground conditions, Community resilience, technological solutions

The Nuna (Inuvialuktun for 'land', 'country' and 'soil') project will co-produce regionally appropriate new tools and solutions to prevent, mitigate, and adapt to prioritized coastal climate change impacts. Nuna will equip and train community climate monitors to develop more accurate predictions of future erosion rates to know when to relocate and to assess and monitor ground conditions at potential relocation sites to ensure resilient development strategies. New low-cost monitoring technologies will provide early warning for preventative action and assess the success of nature-based solutions to ground instability and its wider threats and impacts.

REMIROCaN - Building Integrated Renewable Energy

Communities across Inuit Nunangat are heavily dependent on fossil fuels to support nearly all their heat and electricity loads. However, there is a strong desire to develop renewable energy sources to decrease the dependence on fossil fuels, mitigate climate change impacts and improve resiliency. This project will integrate Inuit values, needs and interests with renewable energy technology evaluations and deploymen. Remedies to barriers of renewable energy adoption will be developed in accordance with Inuit Quajimajatuqangit (for a definition: https://www.nirb.ca/inuit-qaujimajatuqangit#:~:text=Guiding%20Inuit).

Sikuttiaq- Sea ice travel safety, Inuit Qaujimajatuqangit, sea ice monitoring
Sea-ice roughness, thickness and slush are key characteristics that determine safe and efficient ice travel for Inuit. The changing climate is negatively affecting these characteristics, impacting mental health, food security and cultural practices. The Inuit-led project team will combine satellite and drone sensor data, with Inuit Qaujimajatuqangit to generate new data layers for community ice travel safety maps.

Making Connections and Enabling Participation
How did these research teams come together? Had they worked together in the past on research projects in the north? How did the team composition and its expertise get established?

NSAR	NRC actively sought connections, in this case for an expression of interest that had been proposed. A brainstorming activity followed, with NRC facilitating connections. Leveraging existing UK connections, individuals were brought together who in turn pulled in co-investigators across the region of interest. *Key northern investigator(s): Co-Investigators; municipal governments; not project manager*
Nuna	NRC had prior research projects with another Government of Canada department, Natural Resources Canada, which was central to the establishment of the research relationships. That organization had been in community for many years, with good relationships, and had also been working with UK partners through other projects. Complimentary skills were central to the team and project design. *Key northern investigator(s): Principal Investigator; municipality; not project manager*
Remirocan	NRC had existing UK relationships in the area of renewable energy and an existing research relationship with Qikiqtaaluk Corporation. NRC had recently established a dialogue with Qikiqtaaluk Corporation's new subsidiary, Nunavut Nukkiksautiit Corporation (NNC) about renewable energy systems. The creation of NNC was critical for enabling northern participation, due to the hiring of 3 individuals within the company. The team highlighted the important aspect of leveraging existing connections due to limited time. NRC played a central role to bring complimentary expertise together. *Key northern investigator(s): Principal Investigator; corporation; contracted out project management*
Sikuttiaq	The non-profit that led the development of this project has existed for many years, and is globally-recognized for its activities in communities. The non-profit was approached by many people to be part of a proposal. In response, the organization went back to the communities' established priorities, and the organization could then examine who had identified interests that aligned with those priorities in order to create a community-relevant project and a balanced team. A key challenge highlighted is the time it takes to develop relationships – e.g., 2-3 years before a research project gets underway, which is longer than

	the lifetime of most funding opportunities. *Key northern investigator(s): Principal Investigator; non-profit organization; project manager*

Research Relevance to Region(s)

How did these teams establish the importance of the research to the region(s) in which it they are focused?

NSAR	The team brainstormed ideas, as the Canadian Principal Investigator had extensive northern connections, with awareness of existing priorities. Another similar project in this area was also already underway, and the team could leverage priority areas for the proposal.
Nuna	The Canadian Principal Investigator, through the municipality that it represents, has long-established priorities around the protection of its shoreline, mitigation and adaptation planning needs.
Remirocan	The Canadian Principal Investigator drove the priority areas based on lessons learned from partnerships with several Arctic-based collaborators, as they already have large-scale industrial projects underway. With its corporate priorities established, NNC was able to be specific about what area(s) of research aligned with the organization's interests, in this case, solar and hydrokinetic energy.
Sikuttiaq	Community Management Committees establish the research priorities from which the Canadian Principal Investigator, a non-profit organization, is exclusively guided.

Indigenous Knowledge

How are the teams working with Indigenous Knowledge holders in the project?

NSAR	The individuals who are part of northern SAR organizations hold this knowledge. Two compensated northern partners will be in this role to provide information and feedback.
Nuna	The United Kingdom Principal Investigator has developed community engagement workshops where Indigenous Knowledge will be sought, should the community choose to provide this information.
Remirocan	The team indicated that working with Indigenous Knowledge methodologies can be challenging with engineering projects, not because it is separate, but because technology in the north is disconnected from Indigenous knowledge for historical reasons. Knowledge holders will be compensated for their expertise. The team will also engage with Inuit not part of the core project team, to connect directly with individuals who can bring Indigenous knowledge to the project; for example, specific use cases of how off-grid cabins are used, their value to way of life, shelter, energy connections, location and use of land.
Sikuttiaq	The Canadian Principal Investigator's non-profit organizations has Indigenous employees and uses community workshops as a basis for requirements capture and associated system design. Indigenous knowledge is a key input into the system, with established protocols and processes developed via community workshops, as well as defining the output of the product. Communities have flagged that technology should not replace Indigenous Knowledge, rather it should augment it.

Project Management

How has the project management been structured? Is it led by the north? If not, was it a collective decision that a southern-based organization would lead? What were the drivers for either type of project management?

Nuna	A collaborator on the project team, another Government of Canada department, is the main project manager, supporting the Principal Investigator, the local municipality, for funding management. This arrangement works as the collaborator has been working with the municipality for many years. The United Kingdom Principal Investigator leads the organizational aspect of performing the research.
NSAR	The northern Co-Investigators did not want to lead a research project, as their day-to-day responsibilities are operationally focused. However, they wanted to provide regular input, and so took on the co-investigator role. A southern-based academic Canadian Principal Investigator is managing the project.
Remirocan	The Canadian Principal Investigator, an Inuit corporation, hired a consultant to manage the research project due to capacity challenges, as the corporation already has large-scale industrial projects underway. Taking on research versus commercial priorities can be difficult for such an organization. However, small-scale research and development can be beneficial, as the company develops a portfolio of projects. NRC played a central role to co-ordinate the proposal and co-ordinates communications between the team members. With NRC's history working with the Canadian Principal Investigator and in this region in Inuit Nunangat, it plays an enabling role in conjunction with NNC staff and their consultants.
Sikuttiaq	The Canadian Principal Investigator is the overall project manager, mentoring its northern employees to take on the research project management aspects. The non-profit organization's management committees provide input for the locations where the project is based; each committee decides if they are to be remunerated for their involvement.

Building Northern Research Capacity

NSAR	As well as the establishment of information for improving search and rescue capabilities in Nunavut, the project will strengthen linkages between community response and Government response. The project will also provide testing of equipment for evaluation and feedback to communities. The models developed will be transferred (with training) to communities.
Nuna	From the outset, the project team has integrated training for northerners to take over data collection, for ongoing monitoring post-project. It is also field testing lower-tech tools that could be deployed on community boats etc. The project team has noted that applied science provides tools that are beneficial to communities, by moving monitoring through to technology development, in order to impact the community's response abilities.
Remirocan	The Canadian Principal Investigator has hired junior staff, gaining experience on research, including an Inuk staff member. An Inuk Ph.D. is conducting their thesis research project in collaboration with the project and intends to work for a northern-based organization following completion of their degree. Amongst other plans, the project's outputs will include providing information to communities about ongoing needs for maintenance, parts, labour etc. for small-scale renewable energy technologies.

Sikuttiaq	The project team highlights that it is essential to consider the sustainability of the work post-project. How will the services and products created continue to be funded and delivered when the research is complete? What are the maintenance/parts/effort requirements? From the outset, there is a need to bring in local operators for involvement in the path forward. For this project, the team has defined training for UAV pilots, certified at end of the project. Technology instruction and auxiliary training such as first aid instruction, and using a train-the-trainers model, has been beneficial in the past, and will continue here.

Data and Intellectual Property (IP) Management

NSAR	The background IP was defined in a collaborative research agreement. The team has established that reports will follow principles that support Inuit data sovereignty. A data management plan is in place with northern partners.
Nuna	The background IP was defined in a collaborative research agreement. The project team is investigating how to balance IP with sharing data with other communities for their benefit.
Remirocan	The background IP was defined in a collaborative research agreement. Going forward, the Canadian Principal Investigator will hold all project data, for which the team is deciding how to implement.
Sikuttiaq	The background IP was defined in a collaborative research agreement. The non-profit's management committees decide how data is held and owned, generally as derived data. Drone sensor data that is collected will be owned by partner communities.

OBSERVATIONS

Some observations are provided here about these four projects and what perhaps enabled them to respond to and be successful in the CINUK call for proposals process, outside of the scientific merits of the proposed research. These commonalities are highlighted in Figure 4.

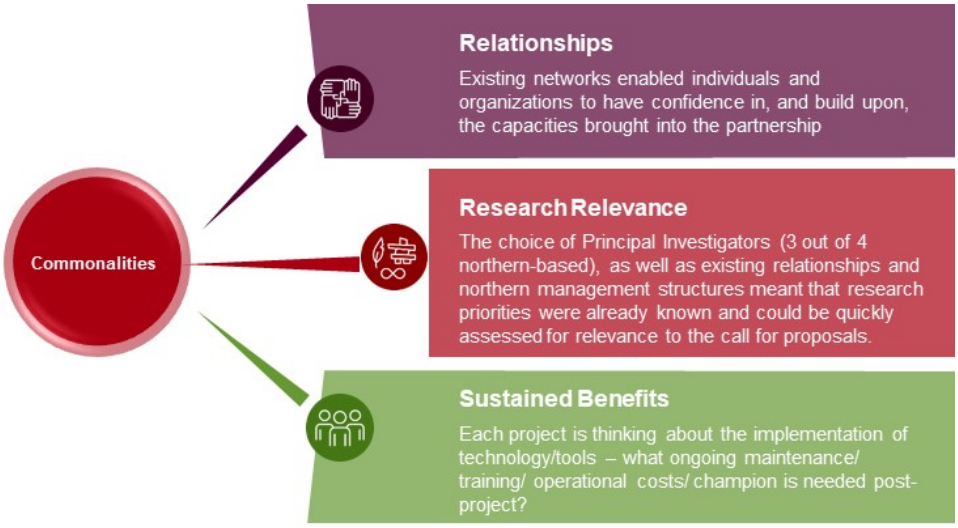

Figure 4 Common aspects of the four CINUK research projects highlighted in this paper.

Relationships

Each of the four projects had a foundation of existing networks – both from the north of Canada to the south, and from Canada to the United Kingdom. These networks enabled existing relationships to come together relatively quickly for collaboration purposes. With such a short

time frame for the development of the letters of intent, this was critical. It would be difficult, although not impossible, to form brand-new research relationships within such a short time-frame, especially through the months of June and July – key times for people to be on the land within Inuit Nunangat. These relationships enabled individuals and organizations to have confidence in—and build upon—the capacities brought into the partnership. One consequence, potentially, is that known teams may tend to focus upon incremental research, rather than riskier, new research ideas. That being said, there is a strong need for incremental research in many northern regions of Canada; just because a tool or technology or product is commercially available in southern regions does not mean it will function similarly in the north, and incremental research also plays a role in expanding research across regions, to enable research needs that are distinct to a particular region. Another potential consequence to the reliance on existing networks is that it can be difficult for northern-based organizations and individuals to step into research for the first time, as the connections to research organizations do not yet exist. This could have implications for equity, diversity and inclusion, with more limited introduction of new ideas for innovative engineering research as well as having research concentrated in communities where long-term relationships already exist. On the other hand, existing relationships may also foster equity, diversity and inclusion, by removing barriers and providing flexibility in research participation and management. For example, enabling research collaboration but without the responsibility of research management by a northern-based organization that is just starting to carry out engineering research.

Research relevance

Likely because of the existing north-south networks and the requirement that each proposal must have a funded co-investigator or Principal Investigator from an Inuit Nunangat organization, northern research priorities were known by these teams ahead of the launch of the call for proposals. That is, when the call came out, they were able to rapidly assess the relevance of their own northern research priorities to CINUK's, to assess alignment and to quickly develop the high-level letter of intent.

Sustained benefits

Each of these four projects has been and are currently developing their approach to the creation of positive and lasting environmental, social and economic benefits. This could be through training initiatives for organizations to take over the tools developed, or opportunities for more coordinated responses to climate change-induced engineering issues by facilitating the establishment of new networks. The key aspect for each project, in the author's opinion, is that those sustained benefits are being co-developed; it is not a case of southern-based researchers dictating what the benefits of the research will be to northern partners.

It is noted that these three elements, common across each of these four projects, were also key aspects of the reviewing committees' evaluation rubric, and directly tie back to the guiding principles of the programme. So, while the research quality of the proposal was clearly important and central to the overall project assessment, these elements, successfully defined by the project teams, led to subsequent success of the proposals.

Differences and Challenges

The Canadian Principal Investigators' organizations for the highlighted projects vary, with a municipality, an Inuit corporation, a non-profit social enterprise and a southern academic organization. These differences drive differing project management approaches, based on the needs of the largely-northern-based leadership; from contracting out, to relying on trusted

partners, to in-house management. No one approach is best; flexibility is required in order to both accommodate and build applied science research and research management capacity.

All of the projects have a data management and intellectual property plan, partly due to NRC's requirements that a collaborative research agreement be put into place prior to funding being made available. Another requirement of the call was to have considered braiding Indigenous Knowledge with their projects. Approaches for these differ due to the nature of the research being carried out. In the case of projects where technologies are being developed with potential licensing opportunities, those considerations have required longer deliberations, more legal advice, and critically, an openness to examine how benefits can be derived for the northern partners. Indigenous Knowledge, in the context of, for example, renewable energy technologies, or permafrost protection for building foundations and coastlines, requires an openness on the part of co-investigators, to first learn about Indigenous Knowledge as a knowledge system, one that can be part of the project alongside western scientific methodologies, and then to work to improve project outputs based on both systems together.

The project teams indicated that two of the biggest challenges to responding to this call for proposals were:

- How to find out who is doing what with respect to research? This included within organizations, within Canada, and within the UK. Pulling together teams quickly meant relying upon existing networks. Some were already strong, others were less developed, but all played a key role. This has implications when designing funding calls. How can new-to-research northern organizations get involved, if they do not have pre-existing research connections? How do new communities get involved, if research organizations focus upon existing relationships extensively or exclusively?
- How to establish research priorities that align with the themes in this call? This is interesting, as it was flagged despite existing relationships that meant a quicker turnaround to be able to match northern research priorities to this call. In a CINUK matchmaking exercise, many northern organizations came with specific ideas, which made matching up priorities quicker. Where others came with no pre-determined priorities, these were much more difficult to match with partners, as brainstorming needed more time.

CONCLUSIONS

The CINUK programme has been described as unique, as a research programme on an international scale that is bringing together Inuit, Canadian and United Kingdom researchers to conduct climate change–related research that enables and implements the National Inuit Strategy on Research. However, the CINUK partners do not want this programme to be unique. Rather, they seek to enable others to reproduce the framework, so that impactful collaborative research can be carried out by others as well in this context. It is in this spirit that this paper has presented some of the applied science projects underway, so that others may read about project design elements that enabled these projects to be successful. These foundational design elements are critical – leading-edge technological solutions that do not consider community impacts, and the social, health and economic implications of those technologies, will likely not be implemented.

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