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Strategic Environmental Impact
Assessment of development of the Arctic

GAP ANALYSIS REPORT

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WP 1 EU Arctic Information Centre Feasibility Study

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G·R·I·D
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Chapter cover image: Iceberg on a volcanic black sand beach in Iceland.
Photo: GettyImages

EXECUTIVE SUMMARY

The Gap Analysis Report (GAR) is a deliverable within the Preparatory Action "Strategic Environmental Impact Assessment of development of the Arctic." The report evaluates existing Arctic information needs and exchange in order to help assess how an EU Arctic Information Centre could improve information provision and communication. The goals of the GAR are two-fold: First, it aims to identify and analyze the Arctic information needs of stakeholders and policy-makers. Second, the GAR endeavours to offer recommendations on ways to improve knowledge (reducing information gaps) and to improve two-way communication between information providers and users (reducing communication gaps). Recommendations are designed to reflect the role, or roles, of an EU Arctic Information Centre. Through meeting these objectives, the GAR ultimately supports the Preparatory Action's goals of evaluating a potential EU Arctic Information Centre and network.

The GAR looks at two types of information needs (also referred to as "gaps"): information gaps and communication gaps. "Information gaps" are defined within the framework of existing knowledge and are present where there is a lack of existing information to fill a user's need. In other cases, information needs can be traced back to insufficient knowledge transfer and failures to successfully exchange information between providers and users. These failures to convey existing information are considered as "communication gaps."

The primary information source for the GAR was a stakeholder survey developed to assess Arctic information needs. In order to analyze the information needs that were identified by survey respondents, the GAR groups them based on categories of human needs and thematic areas. The human needs, for which information is required, include Living in the Arctic, Investing in the Arctic, Working in the Arctic, Travelling in the Arctic, Governing the Arctic, and Understanding the Arctic. The thematic areas, according to which information gaps and communication gaps are further examined, are based on key mega-trends identified in the Preparatory Action EU Arctic Impact Assessment: Methodology Report: climate change; fisheries; land use; maritime transport; mining; oil and gas; and society and cultures. The report additionally analyzes the identified information and communication gaps according to stakeholder groups (community, government, industry, interest groups, NGOs, and researchers) and by regions, and also looks at major Arctic challenges identified by respondents and how these correspond to information needs.

The results of the survey offer a useful illustration of Arctic information needs as seen through the eyes of Arctic stakeholders. Results are derived from a small survey sampling and are not statistically representative, but are intended to be descriptive in nature. Nonetheless, the results serve to highlight certain types of information and communication gaps and major Arctic trends. Most importantly, for the GAR's stated purposes, the results provide a useful look at how an EU Arctic Information Centre and network could be used to meet Arctic information needs.

Generally, the information gaps identified pointed to a lack of knowledge on and understanding of the many widespread changes happening in the Arctic region. Climate change was a predominant theme, although all of the thematic areas (or mega-trends) were repeatedly referenced in both information and communication gaps, as well as major Arctic challenges. Social and cultural changes

in the Arctic region were also leading subjects. For information gaps, other common themes in respondents' answers included:

- a need for integrated and cumulative assessments of impacts,
- monitoring efforts and baseline studies,
- impacts of resource extraction,
- sustainable development alternatives,
- maritime transport,
- northern and indigenous cultures and lifestyles,
- demographic changes,
- land use,
- investment and employment opportunities, and
- policy gaps

Communication gaps described in the survey generally illustrated inefficiencies or confusion in gathering information from multiple sources, failures to communicate between stakeholders or governments, and a perceived lack of understanding about the Arctic region and its people. Themes within these responses included:

- a need for more centralized information,
- sharing information on indigenous peoples and Arctic cultures,
- discourse on the Arctic that fails to recognize regional variations and differences,
- failures to transmit information on training and preparedness,

- communication gaps between different stakeholders, and
- failure to communicate information between governments or government levels

Many needs and gaps were found to be overlapping, but in general, the breakdown by human need enabled a useful perspective on what information is needed and for what, as well as to categorize types of needs for subsequent discussion. Similarly, the division of information needs according to stakeholder groups and regions helped to examine the needs of different users, as well as help assess the reach of the survey and existing network. Not surprisingly, the types of responses from many stakeholder groups mirrored the backgrounds of the survey respondents. The human need of Understanding the Arctic received the largest number of responses, with a relatively even split between the sub-needs of natural sciences and social sciences. This is particularly interesting given the need's multi-purposed nature. However, the weight given to different needs or uses could be expected to change with a more comprehensive stakeholder network and alternative methods of engagement and communication, which may be seen as next steps for research. In the future, the mapping of responses will also enable network members to quickly access area-specific needs, to deepen the dialogue with relevant stakeholders, and to elaborate on targeted recommendations.

The supplemental information on main Arctic challenges enabled a wider perspective as to the priorities and needs of information users, including asking whether information needs are perhaps associated with major Arctic issues. In many cases they were, insinuating that better information and communication are related to meeting Arctic challenges. In other cases, there was a divergence between information needs and challenges, perhaps indicating that factors other than information and communication are more critical in relation to major Arctic challenges.

The GAR points to clear roles for an EU Arctic Information Centre in helping to meet information needs. Generally, the Centre could play a stronger part in reducing communication gaps, but could also facilitate the reduction of information gaps. The most striking opportunity for the Centre, based on respondents' replies, would be in serving as an information centre or hub. There were repeated answers, related to multiple issues and thematic areas, expressing difficulties in locating and using highly dispersed Arctic information sources.

Additionally, in order to reduce communication gaps, an EU Arctic Information Centre could:

- serve as an intermediary between information providers and users, and
- meet the communication preferences of multiple users and stakeholder groups,

For information gaps, an EU Arctic Information Centre could:

- enable research collaboration,
- help inform EU research agendas,
- provide a database for EU Arctic initiatives, and
- facilitate better exchange between stakeholder

When seeking to further investigate a specific thematic area is made, the GAR results will allow the network members to specifically target issues using the replies from relevant stakeholders and to supplement with additional, more detailed information retrieved from the network's contacts in order to quickly develop subject-specific, in-depth suggestions.

In conclusion, the GAR creates a useful picture of select Arctic information needs and demonstrates how an EU Arctic Information Centre could fill these, including through a variety of communication methods. While the scope of the GAR in the context of the Preparatory Action is limited, it can be seen as a building block for further research.

Chapter cover image: Humpback whale.
Photo: GettyImages

I. INTRODUCTION

The Gap Analysis Report (GAR) is a deliverable within the Preparatory Action "Strategic Environmental Impact Assessment of development of the Arctic," commissioned by the European Commission's Environment Directorate General. The Preparatory Action is designed to increase awareness about the Arctic and its changing political, economic, and environmental landscape, to enhance understanding of the impacts of European Union (EU) policies, and to test the effectiveness and sustainability of an EU Arctic Information Centre based on a network of Arctic research centres and universities within the EU and European Economic Area (EEA) and European Free Trade Association (EFTA). The project and prospective network are designed to support decision-making processes within the EU and to better address future Arctic challenges and opportunities.

I.1 PREPARATORY ACTION

The Preparatory Action project "Strategic Environmental Impact Assessment of development of the Arctic" was designed as a first step in strengthening communication and outreach within the EU and between the EU and the Arctic communities on EU contributions to addressing issues raised by rapid development of the Arctic region as a result of economic and climate change.

The idea of establishing an EU Arctic Information Centre was proposed with the intention of helping to support the EU's Arctic objectives and unifying existing Arctic information sources in order to ensure that policy-makers are well-informed and to support sustainable Arctic development benefiting Arctic states and local communities[1]. Following the Joint Statement on Progress since the 2008 Communication, the European Commission implemented a Preparatory Action to test the feasibility of an information platform consisting of a network of leading Arctic centres within the EU and EEA/EFTA, together with a strategic assessment of the impacts of development in the Arctic.

The Preparatory Action is lead by the Arctic Centre of the University of Lapland in Rovaniemi, Finland and is implemented by an international network of 19 Arctic research and outreach institutions based in 11 European states and EEA/EFTA countries. The Preparatory Action's objectives include:

- enhancing the use of impact assessments regarding the Arctic,
- assessing the impacts of EU policies on Arctic developments,
- assessing how Arctic developments and trends influence the EU,
- compiling scientific information on stakeholder knowledge,
- increasing awareness about the Arctic and its changing political, economic, and environmental landscape,
- increasing awareness about EU Arctic policies, and
- testing a network of polar communication and research centres as the basis of a possible future cooperation structure (an EU Arctic Information Centre) aimed at facilitating exchange between EU institutions, Arctic stakeholders, and the general public.

The Preparatory Action is designed to gauge the effectiveness and sustainability of the network of polar research centres and to test the workability of an EU Arctic Information Centre. This report, as part of the Preparatory Action, supports the assessment of how a potential EU Arctic Information Centre and network could facilitate better information exchange. The evaluation of existing information needs supports further assessment and understanding of how an EU Arctic Information Centre could fill these needs and improve information provision and communication.

I.2 OBJECTIVES

The goals of this report are two-fold: First, it aims to identify and analyze the Arctic information needs of stakeholders and policy-makers, as well as the wider public, where applicable. Second, the GAR endeavours to offer recommendations on ways to improve knowledge (reducing information gaps) and to improve two-way communication between information providers and users (reducing communication gaps). Recommendations are designed to reflect the potential role, or roles, of an EU Arctic Information Centre. Through meeting these objectives, the GAR ultimately supports the Preparatory Action's goals of evaluating a potential EU Arctic Information Centre and network.

I.3 METHODOLOGY

There is no generally accepted definition of the "Arctic," but the spatial scope considered in this report follows that of the Arctic Monitoring and Assessment Programme (AMAP) working group of the Arctic Council: areas north of the Arctic Circle (66°32'N), and north of 62°N in Asia and 60°N in North America, modified to include the marine areas north of the Aleutian chain, Hudson Bay, and parts

1. European Commission High Representative of the European Union for Foreign Affairs and Security Policy. Joint Communication to the European Parliament and the Council. Developing a European Union Policy towards the Arctic Region: progress since 2008 and next steps. Brussels, 26.6.2012. Available at *http://eeas.europa.eu/arctic_region/docs/join_2012_19.pdf*. See also Communication from the Commission to the European Parliament and the Council. The European Union and the Arctic Region. Brussels 20.11.2008. Available at *http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0763:FIN:EN:PDF*

of the North Atlantic Ocean, including the Labrador Sea. Figure 1 shows the AMAP area, as well as the borders of the Arctic according to the Arctic Circle (the parallel of latitude that runs approximately 66.56° north of the Equator), and to certain scientific parameters (10°C July isotherm, treeline, marine, and vegetation).

The GAR focuses primarily on the European Arctic, defined here as including Finland, Sweden, Norway, Iceland, Denmark, Greenland, and the Faroe Islands[2]. The non-European Arctic (i.e., Russia, Canada, and the United States) is also considered where relevant for the information needs of European Arctic stakeholders and policymakers and in order to better evaluate existing information, but is not the primary focus of analysis. The focus on the European Arctic, from Greenland to the Urals, is appropriate as this is where the influence of the EU is the most prominent[3].

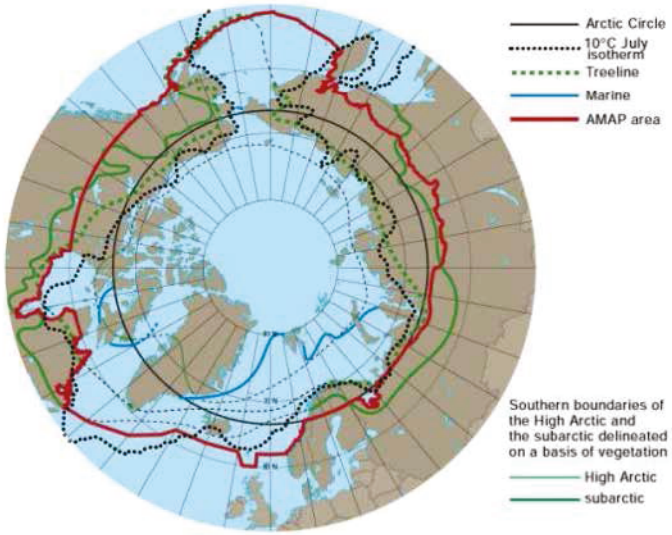

Figure 1. *Arctic boundaries*
Source: Arctic Monitoring and Assessment Programme. AMAP Assessment Report: Arctic Pollution Issues. Oslo: Arctic Council, 1997.

A "gap" usually refers to a (empty) space between (existing) things – a missing part[4]. "Information" is an organized set of knowledge that is used to produce added value in human activities, reduce uncertainty, and assist in decision-making[5]. Reasons for gaps can include a lack of actual information (e.g., additional research needs to be carried out), including a lack of sufficient quantity or quality of information. Alternatively, gaps can include synthesis gaps (e.g., information has not been used, interpreted, or understood correctly) or dissemination gaps (failure for information to reach the user). For communication of information to be successful, there must not only be a transfer of data, but also a transfer of meaning, so as to enable successful comprehension and application[6]. In some cases, successful dissemination and application of information requires the use of intermediaries in information systems[7]. This report does not distinguish between knowledge types; for instance, western science and traditional knowledge are considered equally relevant where applied to fill a user's information need.

The terms "needs" and "gaps" are used synonymously herein, with the understanding that a gap represents an unfulfilled need of an information user. The GAR focuses on two sides of these gaps or "information needs." The GAR looks first at "information gaps," information needs defined within the framework of existing knowledge where there is a lack of existing information to fill an information user's need. In other cases, information needs can be traced back to insufficient knowledge transfer and failures to successfully exchange or transfer information from providers to users. These failures to convey existing information are addressed in this report as "communication gaps."

Both information providers and information users are considered in the GAR. Information users are those who seek or obtain information for use in activities and decision-making. Users obtain information from information providers, who can range from direct

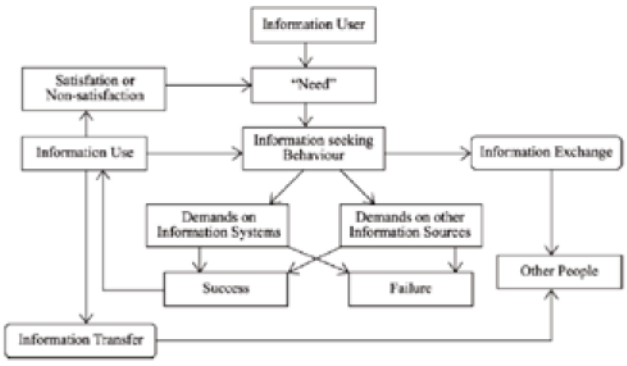

Figure 2. *Information users and needs*
Source: Wilson, T.D. "On User Studies and Information Needs." Journal of Documentation 37, no. 1 (1981): 3–15.

2. Denmark, Finland, and Sweden are Member States of the EU and Iceland and Norway are EEA/EFTA member states. Greenland and the Faroe Islands are not a part of the EU or EEA/EFTA (although Greenland is a member of the Overseas Countries and Territories Association), but are considered here as part of the Danish Realm.

3. See e.g., Adam Stepien et al., EU Arctic Impact Assessment: Methodology Report (Rovaniemi, Finland, April 30, 2013); Timo Koivurova et al., "EU Competencies Affecting the Arctic" (DG for External Policies, Oktober 2010); Sandra Cavalieri et al., "EU Arctic Footprint and Policy Assessment - Final Report," Dezember 2010, http://arctic-footprint.eu/sites/default/files/AFPA_Final_Report.pdf.

4. See, e.g., Merriam-Webster, "Gap," accessed October 8, 2013, *http://www.merriam-webster.com/dictionary/gap*.: "a space between two people or things; a hole or space where something is missing; a missing part."

5. Sylvia G. Faibisoff and Donald P. Ely, Information and Information Needs (ERIC Document Reproduction Service, 1974), 2; H.N. Prasad, Information Needs and Users (B.R. Publishing Corporation, 2012); Rice Knowledge Bank, "Concept 10: Information Gaps," accessed October 8, 2013, *http://www.knowledgebank.irri.org/ipm/concept-10-information-gaps.html*.

6. Faibisoff and Ely, Information and Information Needs, 4.

7. Ibid.

Human Need \ Thematic Area	Climate Change	Fisheries	Land Use	Maritime Transport	Mining	Oil and Gas	Society and Culture	Other
Living in the Arctic								
Investing in the Arctic								
Working in the Arctic								
Travelling in the Arctic								
Governing the Arctic								
Understanding the Arctic								

Table 1. *Arctic human needs and mega-trends*

sources of information to collectors and distributors of information. Stakeholders and policymakers, the main focus of the GAR, can be either users or providers of information, or in some cases can be both. Stakeholders are defined here as actors who have interests in Arctic developments or who are affected by Arctic policies[8]. This includes members of the public. Policy-makers also have interests in Arctic developments or may be affected by EU Arctic policies, but are distinguished here by having particular needs that pertain to Arctic governance.

For analysis of information needs, gaps are categorized based upon identified human needs: Living in the Arctic, Investing in the Arctic, Working in the Arctic; Travelling in the Arctic, Governing the Arctic; and Understanding the Arctic. Human needs are understood in the GAR within the context of information. They are not limited to cognitive needs, but also include other social, physiological, or affective needs for which users seek kinds of information[9]. Categories of needs with relevance for Arctic stakeholders were selected.

Next, information gaps and communication gaps are examined according to thematic areas. The thematic areas are based on seven key Arctic mega-trends identified in the Preparatory Action EU Arctic Impact Assessment: Methodology Report: climate change in the Arctic; changes in Arctic maritime transport, development of oil/gas exploitation in the Arctic; development of mining in the European Arctic; changing nature of Arctic fisheries; modernization of societies and cultures in the European Arctic; and European Arctic landscape under increase pressure from various forms of land use[10]. These thematic areas, based on the mega-trends, were chosen to further understand how Arctic changes and developments are related to the information needs of Arctic stakeholders.

The primary information source for the GAR was a questionnaire, developed based on the above methodology, used to assess information and communication gaps. The questionnaire (reproduced in Annex A) was shared with an extensive list of stakeholders and policy-makers based upon input from project partners. The list of recipients built upon stakeholder mapping and contacts used in previous work in the Preparatory Action which represents the following groups: local administration, conservation administration, indigenous peoples' organizations and institutions, industries (reindeer herding, fisheries, shipping, forestry, renewable energy, tourism, mining, hydrocarbon extraction, small and medium enterprises, IT), non-governmental organizations, research institutions, representatives of local residents, and EU policy-makers[11]. For the particular purposes of the GAR, partners contributed additional contacts from the targeted geographic range and based on roles as either information users or providers. An English-language questionnaire was sent out to a total of 898 individuals. In addition, a second version of the questionnaire in Russian was sent out to another 122 individuals. These results were gathered in separate databases so as to enable an easier distinction between regional information needs.

Survey participants were asked to select a human need for which information was desired. Next, they were asked to select which, if any, of the thematic areas the information need fell under. Finally, participants were asked to identify whether the need was either an information or communication gap and to provide further details regarding the particular gap. Participants could repeat the exercise multiple times, identifying multiple gaps. They were also asked to identify both the types if information sources used previously to fill information needs and their preferred methods of receiving additional information. Finally, at the survey's conclusion, respondents were asked to list what they viewed as the three main challenges or problems facing the Arctic, in order to further support understanding of information needs in the context of Arctic challenges and changes, The questionnaire was designed to take no longer than five minutes per identified gap.

8. For more on the methodology and selection of thematic areas (or mega-trends), see Stepien et al., EU Arctic Impact Assessment: Methodology Report, 25 et seq.

9. T.D. Wilson, "On User Studies and Information Needs," Journal of Documentation 37, no. 1 (1981): 663, 665.

10. Stepien et al., EU Arctic Impact Assessment: Methodology Report.

11. Ibid., 44 et seq.

The report and survey analysis are intended to be primarily qualitative and descriptive. The survey results are understood to be non-representative, as participants were drawn from stakeholders within the networks of Preparatory Action partners. As such, stakeholders were not selected with equal representation across various geographic locations, sectors, and interest groups and the survey does not represent a statistically valid sample across Arctic stakeholders, although this was sought to the extent possible within the limited scope of the GAR. Results should be read broadly to reveal certain trends, support recommendations for filling information needs, and inform the role of a prospective EU Arctic Information Centre.

Select secondary information sources were also used to support analysis, primarily the European Arctic Initiatives Compendium (AInC)[12]. The AInC, also a part of the Preparatory Action, presents certain flagship initiatives under¬taken in the Arctic region by states and actors operating within the EU or EEA/EFTA[13]. The description of Arctic knowledge-producing initiatives was undertaken by EU and EEA/EFTA member states (on a national, bilateral, or multilateral level) and is based on consultation of existing inventories and published materials and solicitation of input from partners. In the context of the larger goals of the Preparatory Action – to test the feasibility of an EU Arctic Information Centre and to strategically assess the impact of development of the Arctic – it focuses on initiatives with the following characteristics:

- Initiatives that are taking place on a country level, whether on a national, bilateral, multilateral, or non-governmental scale[14],
- Initiatives that are long-term, currently on-going, and high level within their given context[15],
- Initiatives that self-identify as Arctic, or have the Arctic region at their core, and
- Initiatives that fall within the framework of development of the Arctic.

Following analysis of Arctic information needs, this report offers recommendations for an EU Arctic Information Centre and for filling information gaps and communication gaps. When attempting to examine and deduct policy recommendations from the analysis of something non-existent – such as a gap – it is important to focus the viewing angle in advance. This enables the analysis to draw results with a cross-check for policy relevance. Here, a view to the EU's efforts on Arctic issues is a relevant factor in assessing whether a solution to filling an information need can be located within the EU's own competences.

12. Björn Dahlbäck et al., European Arctic Initiatives Compendium (Rovaniemi, Finland: Arctic Centre, University of Lapland., 2013).

13. A second updated edition of the AInC is being produced to supplement omissions in the original version, due to tight deadlines. However, this edition was not available prior to the completion of the GAR and this report refers to the first edition.

14. In other words, this does not exclude initiatives which have not been mandated by national governments and includes major industrial or business initiatives. The AInC does not discuss European Union-level initiatives per se as these have been documented in other sources, which are included in the litera¬ture review section of the compendium.

15. The AInC seeks to describe major initiatives undertaken in the respective countries. Given the diversity of European countries in terms of, for example, how research and development sectors are structured, this approach allows for the mention of comparatively major or influential initiatives undertaken in countries with different resource allocations.

Chapter cover image: Polar Expedition.
Photo: GettyImages

II. ARCTIC INFORMATION NEEDS

The Arctic information needs covered herein, based on survey results, encompass both information and communication gaps and are understood to be unfulfilled information needs of information users. Information users' needs cover a wide range of purposes, are structured and analyzed in this section according to the human needs set out in the methodology (see section 1.3) above. This approach allows for highlighting specific information and communication gaps associated with different needs, and in connection with certain thematic areas.

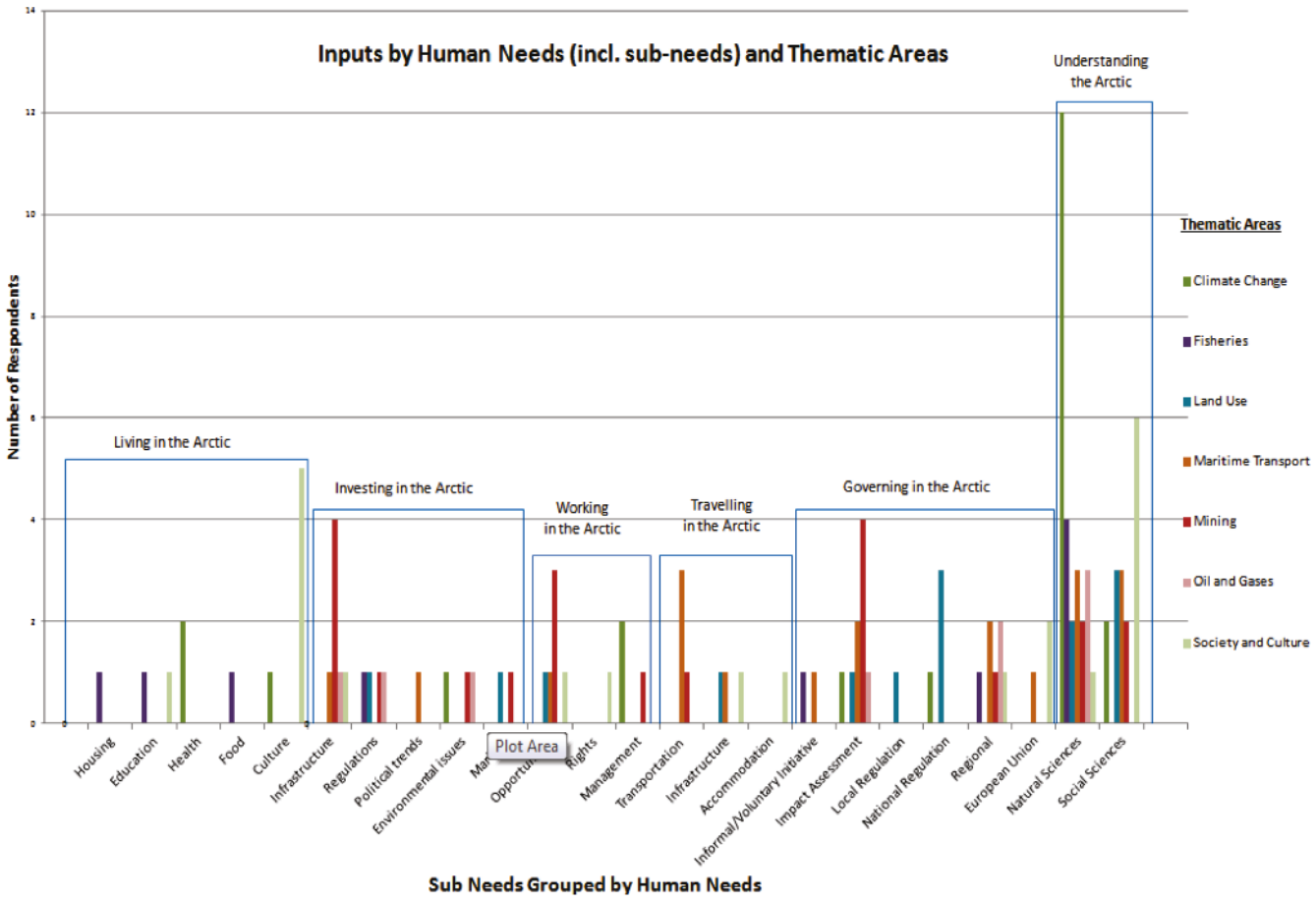

Figure 3. *Inputs by human needs (including sub-needs) and thematic areas*

II.1 LIVING IN THE ARCTIC

In total, 13 survey respondents (8.8%), and two from the Russian language survey, identified information needs for Living in the Arctic. Three of the respondents identifying needs in this category counted themselves to be part of an indigenous group. Survey replies for Living in the Arctic highlighted information needs centring on social and cultural topics and climate change, with a particular focus on development issues. Respondents focused on three primary thematic areas: society and culture, climate change, and fisheries.

Information gaps for Living the Arctic were tied to information deficits regarding local communities, particularly on changes in indigenous lifestyles and studies on Northern culture and education. Climate change information needs were seen from a local perspective, regarding health-related impacts such as changes to food security and the spread of disease: Climate and global changes, although universal in nature, can be interpreted as posing particular information needs for local communities in the Arctic. Other information needs included demographic information, environmental impacts, and the "lack of information in general."

Respondents found that there should not only be more information about communities in the Arctic, but also better exchange of information within and between Arctic communities. These communication gaps focused on cultural aspects as well as on awareness of Arctic communities and their interests from people and policy-makers living outside of the region. Within Arctic communities, one respondent stressed the need for better information distribution, while others pointed to the importance of sharing information on local culture.

II.2 INVESTING IN THE ARCTIC

Information needs for Investing in the Arctic were described by 19 respondents (12.8 %), and one from the Russian survey. Only one of these respondents counted

themselves as part of an indigenous group. Mining received the most replies within this need, followed by both oil and gas and land use.

Most of the replies related to investment focused on insufficient information for evaluating business opportunities in the Arctic. Based on the individual replies, it appeared that respondents were often not sure if the information existed (information gap) or if they were just unable to access it (communication gap).

Information gaps for Investing in the Arctic pertained to understanding environmental conditions and infrastructure. For example, one respondent noted that there was not enough information about climate change and mining or about the environmental impacts of mining. Another felt there was a lack of information for the oil and gas sector on ice conditions and permafrost. Land use issues also arose, including the need for information on areas such as mapping and occupancy studies.

Communication gaps, however, seemed to dominate investment information needs. Respondents for Investing in the Arctic demonstrated general concerns about the dispersal of information and inability to access it in one place. A need was raised for having a clearer picture on national and EU legislation requirements, particularly in order to attract and secure investors in the region. These needs were highlighted in the context of mining, maritime transport, and oil and gas exploitation. For oil and gas, one respondent stressed the need for communication between companies and communities, and between government, industry, and communities regarding regulations, international standards, and corporate sustainability. In the mining sector, several respondents felt there was confusion and difficulty in accessing information on differing regulatory requirements between countries and jurisdictions. For maritime transport, better operational and policy coordination were desired. Finally, for fisheries, one respondent suggested that an information hub on fisheries regulation and information was needed.

II.3 WORKING IN THE ARCTIC

In total, 10 respondents (6.8%) recorded needs for information in the area of Working in the Arctic. One respondent counted themselves as part of an indigenous group. The sub-topic of opportunities was chosen by 60% of the respondents, followed by both management and rights. The thematic area with the most interest was mining (40%), which was accompanied by society and culture, climate change, land use, and maritime transport. Entrepreneurship for foreigners in the Arctic came up several times. In general, more communication gaps than information gaps were described though unfortunately not all respondents provided details on the nature of the gaps.

Respondents selecting Working in the Arctic categorized information gaps within sub-needs of either management or rights. Further details were not provided, although one respondent selecting communication gaps described a need for "impacts of land use strategies on innovation and working opportunities in small and medium-sized firms of rural business."

Communication gaps in the area of Working in the Arctic recorded sub-needs of management or opportunities. One respondent described a need for more information and resources in English on business and employment issues in Finland in order to assist foreigners, particularly foreign entrepreneurs. Another respondent more generally described the need for a "shared information centre for Arctic issues" as "information is scattered and needs to be searched from various national sources."

II.4 TRAVELLING IN THE ARCTIC

In total, 8 respondents (5.4%), and one Russian language respondent, discussed information needs under Travelling in the Arctic. One participant counted themselves as part of an indigenous group. Under this need, survey replies focused on transportation – with a particular emphasis on maritime transport – and tourism.

Respondents discussing information gaps looked at needs regarding maritime transport and tourism. For maritime transport, navigational safety was the primary concern. Respondents highlighted the need for new strategies evaluating (and regulating) the environmental and socioeconomic risks and impacts of Arctic shipping. For tourism, a respondent discussed how tourism and hospitality are "peripheral" to Arctic research and consultation processes.

Comments regarding two of these "information gaps," as identified by respondents, were more oriented towards communication gaps. For maritime transport, one called for "warning against" cruise ships in Arctic waters that lack proper construction and crew training, and shared his own efforts to fill these gaps, including web articles and multimedia. On tourism, a respondent considered there to be a lack of understanding of the role of tourism and hospitality, which are "only understood as industries rather than societal functions" and suggested a stronger focus on the individuals living in the Arctic and working in the hospitality industry.

More respondents selecting Travelling in the Arctic identified communication gaps (than information gaps). Most of these did not provide details on the nature of the gap, but chose the thematic areas of maritime transport, societies and culture, land use, and mining. One respondent specifically wrote, regarding tourism, that there is a need to share information on tourism and travel opportunities in the Arctic. Another shared that the flow of information on social and cultural issues can be improved through activities such as EU-sponsored programs and building networks (e.g., culture, sport, youth work).

II.5 GOVERNING THE ARCTIC

Feedback on Governing the Arctic was drawn from all respondents that chose this particular human need, including policy-makers and individuals in governance positions, as well as those with other backgrounds, such as environmental advocacy, management, insurance, and so forth. Perspectives from stakeholders in government professions are highlighted below in section 3.6. In total, 27 respondents (18.2%) selected needs for information in the area of Governing the Arctic, as well as one respondent from the Russian language survey. Two participants from the Governing group counted themselves as part of an indigenous group.

Replies on Governing the Arctic showed a strong leaning towards maritime transport and resource-centred topics, with a particular focus on the terrestrial side (including mining and land use). Respondents under this human need focused on the thematic areas of maritime transport, land use, and mining. Additional input was given for oil and gas as well as for society and culture. For all of these areas, detailed input was provided, which is summarized and structured below. The only areas that were selected, but not described in further detail were climate change and fisheries. Responses were generally rather evenly distributed between information gaps and communication gaps.

A more detailed look into the information gaps under Governing the Arctic shows general concerns about a lack of information on the risks of resource extraction activities and the impacts of these activities on wildlife and local communities alike. In this context, one respondent stressed the need for information on governance structures for environmental risk prevention, and another specifically mentioned the lack of research on Arctic development without any extraction of fossil resources. From a number of respondents, a lack of information was mentioned for oil and gas activities and for how to address potential oil spills, including impact assessments on oil in ice. A related gap concerned the protection of wildlife and subsistence resources in the case of a spill. Similar concerns were described for mining and its impacts on indigenous livelihoods and traditional industry. For shipping, it was mentioned that there is a severe information deficit on the survival of invasive species in ballast water or on ship hulls on maritime routes through the Arctic Ocean.

For the social sciences, an Arctic-specific look on (and mapping of) issues such as urbanization, demographic shifts, and reasons for migrations out of and into the Arctic were all seen as missing. This also included research on particular governance aspects: Respondents mentioned research on local level governance and the democratic processes in the Arctic, the impact of current government policies (including the ability or inability to cooperate across borders), and regional development in the context of the international political economy.

Communication gaps in the area of land use were mentioned between different dialogue levels – on the international, national, and local levels. One rather generically described communication gap was a lack of international information on land use in the Arctic. Another respondent also mentioned that there seems to be insufficient information on EU activities related to impact assessments and mining. At the national level, a respondent stated that the permitting process for mining projects in other (neighbouring) countries is not well enough communicated, while a better understanding of risks and chances of these processes could help in national legislative processes. Also for mining, as an overarching gap, one respondent stated that it would be helpful to have “balanced” information on mining issues that is accepted by many stakeholders and allows for a better way of an independent understanding. The individual then suggested having a website that provides information from multiple perspectives and stakeholders.

At the local level, it was mentioned that decision-making can have serious impacts on certain aspects of traditional livelihoods, such as reindeer husbandry, which are not sufficiently included in decision-making processes.

Finally, with regards to shipping, the issue of search and rescue was highlighted in a number of related communication gaps. Respondents felt that it is unclear to what extent a shipping incident on the Northern Sea Route (NSR) could be managed and to what extent sufficient infrastructure (incident preparedness) exists along the route. A gap was also named with regard to the participation of foreign companies in response actions.

II.6 UNDERSTANDING THE ARCTIC

Information may be used for a variety of purposes and to meet a range of human needs, as considered in this section. While some information may be used for specific and particularized sub-needs and material purposes, other information may be used to meet cognitive needs, to support multiple or overarching purposes, or for more general purposes not yet identified. The category of Understanding the Arctic is intended to cover such information gaps, or for, communication gaps, where there is a failed transfer of meaning or lack of comprehension. Interestingly, Understanding the Arctic proved to be the leading category of information needs, with 48 respondents (32.4%) and two from the Russian language survey. For purposes of analysis, the category was split into two overarching sub-needs of natural sciences and social sciences, as discussed here.

II.6.1 NATURAL SCIENCES

For Understanding the Arctic, nineteen respondents (12.8%) selected natural sciences as a sub-need. Three of these identified as being from an indigenous group. For natural sciences, the need of Understanding the Arctic, focused largely on climate change and related, having better understanding the environmental and cumulative impacts of human activities expanding as a result of climate change (e.g., oil and gas exploitation, mining).

Most information needs for the natural sciences were for information gaps. As noted, for both information and communication gaps, the majority of these fell under climate change. Identified gaps covered a range of sub-topics, some being particularly specific, and included:

- Mapping of vulnerable species and habitats,
- Greenhouse gas and short-lived climate pollutant monitoring and inventories covering different Arctic environments and seasons,
- Coordinated long-range monitoring and observations, including of sea ice thickness and motion, and
- Improved information on natural variability and on present and past (geologic) climate changes.

Expressed purposes for this information (as volunteered by respondents) included both better understanding of past (geologic) climate changes and improving planning for climate change impacts, such as conservation planning to protect Arctic species.

A few respondents referenced the need for more natural sciences information in the areas of fisheries, although answers sought information about changes to fisheries in the context of climate change – needing more information to better understand how species and ecosystems may be affected by climatic changes and resulting increases in human activity. Similarly some, though not all, of the new information sought for the area of mining, was related to new threats and opportunities resulting from climate change. Other requests were related to better understanding the environmental impacts of mining and improving systematic linkages of data and impact information with other disciplinary areas such as indigenous interests, infrastructure development, resources, and hazards.

Other areas seen as requiring additional information included land use changes (tied also to socioeconomic changes in the Arctic), maritime transport (needing better data to understand both past and future Arctic marine traffic and inform related policy areas), and oil and gas (understanding the environmental and cumulative impacts of expanding oil and gas activity, particularly for comprehensive understanding the ecological effects of spills and of oil toxicity of oil in polar conditions).

Communication gaps were only identified for the thematic area of climate change. Respondents found that while a large amount of information is currently being collected by different groups, these are not easily located or synthesized in useful or timely ways. Likewise, "[w]hile new research and observations are and will remain essential, a more significant investment in improving the availability and flow of existing information should be a priority." Expressed purposes for improving the flow of communication included increasing awareness of climate change in the Arctic and bridging the science-policy interface by improving communication between scientists and policy-makers and the public.

II.6.2 SOCIAL SCIENCES

For social sciences, Understanding the Arctic was selected by approximately 14.2% of respondents. Half of these had backgrounds in the field of research. None of the participants counted themselves to be part of an Arctic indigenous group. Respondents identified needs primarily within the thematic areas of society and culture, maritime transport, land use, climate change, and mining.

About 43% of these respondents pointed to information gaps for society and culture, as well as the thematic areas of maritime transport, land use, climate change, and mining. About 22% referenced the need for more social science information in the area of land use in the context of management and the changing land use patterns. This included research on multiple and conflicting land uses (e.g., mining, tourism, forestry), stakeholder participation in land use planning, and policy and management instruments to manage cumulative development impacts. A need for integrated assessments and monitoring in the area of maritime transport was also listed.

Communication gaps were recorded for the areas of society and culture, maritime transport, and mining. A closer look at social sciences needs in this category shows a common struggle of respondents to actually define the "Arctic." Respondents expressed a need to better understand the subject of discussion when people refer to the "Arctic." For example, it was pointed out that the "Arctic" in international discourse is often presented as monolithic bloc, although significant regional differences exist in reality. Further, the respondent stated, there is little awareness that countries, such as Sweden, rarely use the term "Arctic" in domestic discourse about northern regions. Respondents emphasized that it is important to have a differentiated view of the Arctic. One also found that mass media discourse is usually built up on a single example or case and seldom provides comparison or consideration of development in different Arctic regions or compared to other parts in the world. A related gap, in terms of having limited understanding and perspective came from a respondent who stated that "social and cultural changes are still strongly led by perspectives of natural science and Arctic law and governance."

Chapter cover image: Polar Bears.
Photo: GettyImages

III. INFORMATION NEEDS OF ARCTIC STAKEHOLDERS

While section 2 focused on information needs as related to various human information needs, the feedback can also be structured and analyzed from the angle of the different stakeholder groups that participated in the survey. This aims not only for a better understanding of information users' needs, including regarding specific thematic areas, but also allows drawing of certain conclusions on possible overlaps or discrepancies between information users' occupations and their perception of issues in the Arctic. Finally, it supports analysis of how different types of users may seek or prefer to receive information, as discussed further below in section 7. Participants were asked to select their background from the below categories – which were left open for self-identification, rather than defined - or to specify an "other" option. It should be again emphasized that the survey did not explicitly link the gaps identified to respondents' individual needs; thus, the needs ascribed to stakeholder groups can be considered gaps that those groups are aware of, though not necessarily their own information needs.

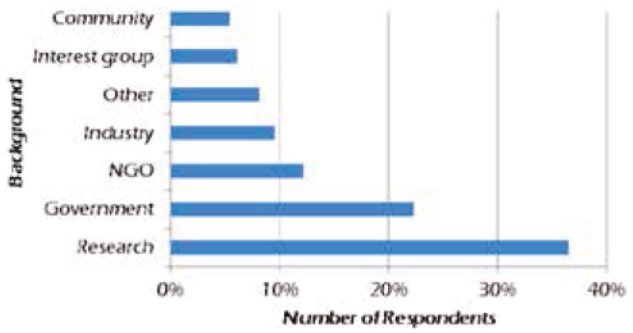

Figure 4. *Background of Respondents**
**Main survey results, not including Russian language survey.*

III.1 COMMUNITIES

Community respondents came mainly from Nordic countries. Many identified as being from professions related to municipalities, culture, politics, or as students. Gaps identified by respondents pertained primarily to Understanding the Arctic, and only one each respectively for Investing in the Arctic, Living in the Arctic, and Travelling in the Arctic.

Gaps from community respondents were primarily focused on communication gaps – although replies did not give a great deal of detail – and focused on culture, education, and business opportunities for foreigners. A specific gap, and proposal, was given for maritime transport, suggesting that a High Arctic operational centre is needed to meet safety and development needs.

III.2 GOVERNMENT

The views of government survey respondents revealed an interesting focus on two relevant human needs: Governing the Arctic and Understanding the Arctic. Looking further into the split among these sections, it can be seen that improved communication is particularly needed within the former, while additional information is needed within the latter. Further input on the other human needs was given for Investing in the Arctic, Travelling the Arctic, and Living in the Arctic.

The largest group of feedback on information gaps fell under the human need of Understanding the Arctic, with a particular focus on natural sciences. The lack of information did not always appear to be attributed to an absence of scientific efforts. For example, organizational factors – such as a perceived lack of coordinated observation and monitoring efforts and dissemination of data – can also impair the ability to gain new information.

With regards to marine transport, a need was described for additional information on historical data and to work on predictions for future development of marine traffic in the Arctic. Also, monitoring of developments in this sector in the Arctic was mentioned as an information gap, as was integrated assessments for the region.

Only two of the government respondents selected information gaps for Governing in the Arctic. These replies indicated gaps in the sub-needs of impact assessments (for land use) and regional governance (for maritime transport).

Additional information gaps were reported for the human needs of Investing in the Arctic and Living in the Arctic. These related broadly to the environmental and infrastructure aspects of mining. One respondent highlighted the lack of information in two aspects: climate change impacts on mining in the Arctic and also on the environment, while the other response showed a clear need for basic information on business opportunities in the Arctic, potential resources, and information regarding infrastructure. As some of this information could be provided via existing websites or materials, these inputs could be also seen as a communication gap. However, it could also insinuate that there are more specific aspects in infrastructure that respondents need information about, and which are not available yet. A continuous information exchange could identify these further needs and cater them.

The focus for communication gaps from government respondents turned towards Governing the Arctic, followed by Understanding the Arctic. Improvements in communication were also seen as necessary for Investing in the Arctic and Travelling in the Arctic. Governance aspects highlighted search and rescue capabilities and crisis response mechanisms as well as cross-border

operations (e.g., a better understanding of permitting processes in neighbouring countries). The mention of search and rescue can suggest two information needs – the lack of information on governance thereof (information gap) or the lack of (cross-border) communication of existing requirements (communication gap).

Reliable information on mining infrastructure in the region was also identified as a particular information need. This included relevant transportation routes and material flows as well as future investments and developing projects. "Green mining" was additionally mentioned by a respondent.

Development of oil and gas exploitation in the Arctic was mentioned for Understanding the Arctic, with respondents suggesting a need for better communication on potential threats resulting from resource development and on mitigation of natural hazards.

Another particular concern was voiced with regard to communication gaps in the area of society and culture. One respondent highlighted the cultural diversity of the Finnish Arctic region (mentioning the North Calotte area) that affects many aspects of life, yet is not well known in other parts of Finland or Europe.

III.3 INDUSTRY

Industry respondents came mainly from Nordic countries and Greenland, with a few from the United States and non-Arctic EU. Many identified as being from mining, oil and gas, shipping, or research sectors. Gaps identified by respondents were largely related to Governing the Arctic, followed by Investing in the Arctic, Travelling in the Arctic, and Working in the Arctic, and only one each respectively for Living in the Arctic and Understanding the Arctic.

Most information gaps described by industry respondents were related to information on business and investment opportunities and knowledge regarding various environmental, technological, and political factors. These also included information needs resulting from uncertainty about future regulation. For maritime transport, information was seen as wanting on handling shipping incidents, as well as coordination on logistics and resources – perhaps more of a communication gap.

Communication gaps by industry respondents covered a lack of clarity or difficulties in locating information on permitting and regulation. Respondents also expressed a need to communicate information to actors outside the Arctic on investment opportunities and Arctic industries, such as tourism.

III.4 INTEREST GROUPS

Only a small number of respondents chose interest groups as their background. All but one (from Russia) of the nine interest group respondents came from Nordic countries. Two respondents count themselves as indigenous persons. Those who chose to share more details on their background worked in native peoples' or regional governance organizations or in fishing or shipping groups.

A third of these respondents chose not to answer survey questions regarding information needs. For those who did, the most replies were for Living in the Arctic. Respondents selected information gaps for society and culture. One saw a "lack [of] information in general" for food and fisheries. Also listing broad categories, another saw a need for information on "environmental impacts" while a third, for Working in the Arctic, found an information gap on climate change.

Only one communication gap was cited: a respondent described a need for centralized fisheries information on management, regulation, training, and research exchange.

III.5 NGOS

Non-governmental organization (NGO) respondents came from across surveyed countries in a fairly even spread. Though professions were varied, many identified as being from environmental advocacy organizations. Most gaps identified by respondents pertained to Governing the Arctic, followed by Understanding the Arctic, and only one each respectively for Investing in the Arctic and Living in the Arctic.

Information gaps focused heavily on improving knowledge on the impacts of expanding Arctic activities, in order to inform better governance. For example, several respondents mentioned needing to understand the impacts of fossil fuel extraction and oil spill clean-up methods. Likewise, understanding the environmental impacts of mineral extraction and shipping were mentioned. Respondents linked these information needs to purposes such as informing protection of wildlife and subsistence resources, developing technologies and adopting governance structures for environmental protection, and for identifying more sustainable development and uses of Arctic natural resources. In terms of governance measures, NGO respondents looked to both the national and EU levels.

Additionally, several NGO respondents felt that better information was needed on societies and cultures and that this could bridge regional differences and challenges in working across nationalities and borders, including at the EU level.

There was less focus on communication gaps from NGO respondents and less detail in the replies. General topics identified in this area included land use, maritime transport, fisheries, societies, and culture. More specifically, several felt that better communication could

increase awareness of people living in the Arctic and their needs, and help them to better engage in national and international governance processes.

III.6 RESEARCH

The largest group of respondents (36.5%) identified as having a research background. These covered professionals working in both the natural and social sciences and in a wide range of positions that centred on academic and scientific researchers. The majority (50%) of these identified information needs for Understanding the Arctic.

Not surprisingly, the vast majority of information gaps pertained directly to research respondents' professional activities. While this may represent a bias in terms of objectively assessing priority information gaps and needs, it also, for the purposes of this report, showcases the value of an expert network for identifying needs for particular subjects and areas. The information gaps identified showcased a high level of specificity. Understanding the Arctic was the highest-selected need for information gaps for research respondents, with two thirds of these in the natural scientists and one third for social sciences. Thematically, climate change was the leading thematic area or trend. Otherwise, needs and subjects covered a range of areas.

For communication gaps, respondents in the research sector also tended to link needs to their areas of professional work and experience. Many observed that while a great deal of information existed or was being performed, these information sources were not necessarily easily accessible nor used in a synchronized manner. For example, one wrote that"[t]here are many types of information being collected by different groups, but there are not easily located or synthesized in useful or timely ways. While new research and observations are and will remain essential, a more significant investment in improving the availability and flow of existing information should be a priority." Likewise, another stated: "There are a number of organizations offering information (e.g., reports, projects, etc.), but it would be easier if the information is in one place." Many of these gaps were in the areas of natural sciences and focused on access to data and scientific results.

For the social sciences and for society and culture, communication gaps focused on the need for increased sharing within and between cultures and a need for increasing communicative efforts in these areas.

III.7 INDIGENOUS PARTICIPANTS

At the outset of the survey, participants were asked whether they consider themselves to be a part of an Arctic indigenous group. Only 9.9% of respondents indicated that they did. Indigenous respondents came mainly from Nordic countries. These respondents came from a variety of backgrounds and sectors, such as, inter alia, NGOs, reindeer herding, fisheries research, and governance. Gaps identified by respondents pertained to Governing the Arctic and Understanding the Arctic, followed by Living in the Arctic, and only individual each for Investing in the Arctic, Travelling in the Arctic, and Working in the Arctic.

Information gaps focused on research and information supporting better understanding of the political, environmental, and technological dimensions of increased development and resource exploration. This included understanding impacts on traditional livelihoods, from one respondent, and identifying non-resource-based alternatives for development, from another. A third expressed interest in meeting the information needs of Arctic investors. In general, it was expressed that there should be more information and knowledge about indigenous peoples and how various development projects affect Arctic indigenous communities and livelihoods.

Indigenous respondents found that there should be more information distribution between Arctic communities, as well as sharing information with others about Arctic communities, including, specifically, Arctic areas in Russia. Communication gaps suggested a lack of understanding between EU policy-makers and Arctic stakeholders and lack of dialogue and understanding between local, national, and international levels. Involving different local actors in decision-making processes was also seen as a challenge. One respondent wondered why EU policies should "interfere with the Arctic region."

Chapter cover image: Town in Greenland.
Photo: GettyImages

IV. REGIONAL INFORMATION NEEDS

In addition to analyzing the information needs of survey respondents by categories of human needs (section 2) and stakeholders (section 3), the following analysis aims to identify regional information needs. To better assess the information needs of different stakeholders and regions, and information exchange between the Arctic and EU, here we identify trends in information needs on a regional basis. For this purpose, this section groups the identified needs according to four regions:

- EU Arctic states[16]: Denmark (including Greenland[17]), Finland, and Sweden
- European (non-EU) Arctic states: Norway and Iceland
- North American Arctic states: Canada and the United States
- Eurasian Arctic: Russia
- EU Non-Arctic: Non-Arctic EU states and international organizations

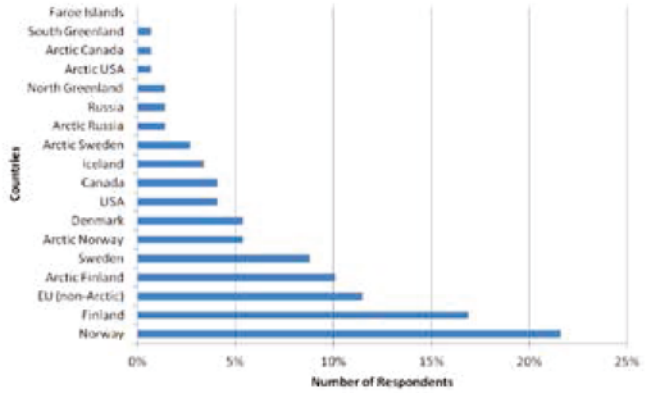

Figure 5. *Survey respondents by country**
**Not including Russian language survey.*

The majority of respondents came from Nordic countries. This is due both to the report's focus on the European Arctic (see section 1.3) and on the networks of Preparatory Action partners based in these countries, which formed the foundation for the survey's outreach.

IV.1 EU ARCTIC STATES

This subsection includes Arctic states that are also member states of the EU: Denmark (including Greenland), Finland, and Sweden. Responses from Greenland, which is not a part of the EU, but is an autonomous region of the Kingdom of Denmark – were included in this section to reflect Greenland's close and ongoing historical and economic ties to Denmark and the EU. Perhaps not surprisingly given the scope and network of the Preparatory Action, the greatest number of survey respondents came from EU Arctic states. The country with the highest number of respondents was Finland.

Information gaps

Related to Living in the Arctic, for which responses were fairly evenly distributed among the EU Arctic states, society and culture was the major area of interest, followed by climate change. Specific gaps covered demographic changes and health impacts of climate change.

All nations indicated needs for Investing in the Arctic. Mining was the dominant thematic area, although land use and oil and gas were also identified. Mining also arose under Governing the Arctic, where information gaps on EU involvement and the potential hazards of mineral extraction were highlighted. One individual from Greenland found that the varied environmental and socioeconomic impacts of increased resource extraction in Greenland are not yet understood. In general, and in regards to multiple types of needs (e.g., investing, governing, understanding) many respondents from the EU Arctic states expressed that there was a broad lack of information on the potential hazards of Arctic oil, gas, and mineral extraction. More information on sustainable natural resource use and investments such as green mining and sustainable forestry were also mentioned as needed.

Broadly, regarding investments, respondents found a general lack of information on investment opportunities available to businesses in the Arctic. Two respondents from EU Arctic states (and no others) were concerned about working opportunities for small and medium enterprises. Infrastructure to support Arctic businesses and investments also arose, as well as in the context of travel and transportation, to providing greater accessibility to the tourism industry and others. The majority of respondents citing needs for Travelling in the Arctic came from Sweden and most pointed to marine transport as the main thematic area to this topic.

Land use was a common theme under which information needs (for Working, Travelling, and Understanding) on mapping, occupancy studies, participatory practices in planning, and reconciliation of different uses were referenced. These respondents stated that new information about urban and non-indigenous populations is needed.

Information needs for Understanding the Arctic were somewhat evenly split between the natural and social sciences, with most answers pertaining to either climate

16. Arctic "states" are specifically referred to here, as the survey was shared with participants in those states from both Arctic and non-Arctic regions. In some cases, distinctions are made between non-Arctic and Arctic regions of states, though for general purposes they are considered together.

17. As stated in section 1, Greenland and the Faroe Islands (from which there were no survey respondents) are not a part of the EU or EEA/EFTA, but are considered here as part of the Danish Realm.

change and social and cultural issues. For climate change, needs were specific and geared towards both better understanding of the Arctic's role in global climate change and also towards protection for Arctic ecosystems and human health against climate change impacts.

Communication gaps

Responses from EU Arctic states indicated needs for better cultural education both within Arctic states as well as beyond national boundaries. Some respondents felt that Arctic histories and cultures are not well understood either within or outside of the Arctic. Specifically identified were the different histories among Arctic nations (e.g., specifically how Finland's history differs from other Arctic neighbours) and that these histories need to be understood to properly address problems in the region.

Investing needs related to understanding what national and EU legislation require and which authorities are responsible. Respondents found regulatory requirements to be confusing and to discourage investment. Also concerned with multiple governance levels – local, national, and EU – one respondent noted that these different levels made communication difficult and made it more difficult to effectively address issues such as reindeer husbandry.

Generally, many EU Arctic respondents felt that information on the Arctic is difficult to find and often spread out over various institutions, instigating communication gaps. Multiple respondents suggested that more centralized sources of information (such as, e.g., a website or information centre) could help lessen these gaps.

Like with information gaps, maritime transport also arose under communication gaps for EU Arctic states, in the context of training and preparation for Arctic cruise ships and tourism.

IV.2 EUROPEAN ARCTIC STATES

Norway and Iceland are considered separately here as European Arctic states that are not part of the EU, but are EEA/EFTA member states and have strong historical ties with the EU. The second largest number of survey respondents came from Norway, following Finland.

Information gaps

Maritime transport was a strong area of focus for respondents from the European Arctic states, arising in Investing, Travelling, Governing, and Understanding needs. This included insufficient information on assessment of risks and impacts on Arctic maritime routes, including historical data and future projections, as well as a lack of understanding (which can also be construed as a communication gap) about responses and policy priorities.

Many of the information needs were focused on the natural sciences, particularly for Understanding the Arctic and also for Governing the Arctic. Many of these were highly specific and pertained to better understanding of the (individual and cumulative) impacts of human activities (e.g., oil and minerals extraction, shipping) and establishing better baseline understanding of Arctic species and ecosystems.

For information gaps related to the social sciences, respondents addressed demographic shifts, regional development, and the social impacts of resource extraction. Several participants from Arctic Norway and Iceland indicated information needs for Living in the Arctic and for the thematic area of fisheries, but did not supply additional details. A few respondents referenced needs for information on sustainable development options and alternatives to fossil fuel extraction and energy.

Communication gaps

Gaps related to maritime transport included a lack of communication on logistics, search and rescue capabilities, and crisis response. There was a general perception of a lack of communication between actors throughout the region, and one respondent suggested developing a maritime Arctic operational centre in the High Arctic. A few European Arctic respondents identified communication gaps for Working in the Arctic, as related to maritime transport and mining, but failed to elaborate further.

European Arctic respondents found communication gaps between multiple stakeholders, including scientists, policy-makers, and the public. Likewise, they identified gaps in communication between governance levels and in democratic processes, particularly for indigenous peoples.

IV.3 NORTH AMERICAN ARCTIC STATES

Canada and the United States are considered together here as North American Arctic states. Respondents could distinguish between the Arctic and non-Arctic regions of these countries. Replies were relatively limited, in large part because of the report's focus on the European Arctic (see section 1.3)

Information gaps

The respondents from North America (from both within and outside of the Arctic) generally found that there is limited information on the needs and interests of people living in the Arctic and impacts of Arctic changes. Most information needs were related to social and cultural

aspects and the human needs of Living in the Arctic and Understanding the Arctic. More specific information gaps included a lack of information on land use patterns and current regulations and on the cumulative effects of development. Other main thematic areas identified included climate change, land use, and maritime transport.

Communication gaps

For communication gaps, too, society and culture were dominant themes. Communication gaps included a lack of government recognition for Arctic communities' needs and interests. Thematic areas included society and culture, climate change, and resource extraction. Other answers discussed methods for filling communication gaps: an information-sharing network and general efforts to improve availability, synthesis, and ease in locating information.

IV.4 RUSSIA

Russia is considered separately as part of the Eurasian Arctic and as neither a EU nor EEA/EFTA state. The results here include both the main (English) survey and the Russian translation that was distributed. Despite the additional outreach, participation from Russian respondents was still limited, though was not intended to be central focus of the report (see section 1.3).

Information gaps

The dominant theme for Russian respondents was society and culture. Many information gaps pertained to society and culture and on changes to culture and lifestyles. These included how indigenous peoples of the North have experienced changes in lifestyles as well as a need to preserve Arctic cultures in light of rapid social change.

Information gaps were selected for Investing in the Arctic, and for the thematic areas of fisheries and oil and gas, although no particulars were given. Gaps for Understanding the Arctic were selected for society and culture as well as mining, for which one respondent discussed an information gap related to technological and economic aspects of minerals exploration.

Communication gaps

Communication gaps from Russian respondents were selected for the human needs of Investing, Travelling, and Governing. Thematically, these addressed information on fisheries and on climate change (Arctic Russia). Respondents also offered suggestions for closing communication gaps, such as thematic mailings or a portal with management information.

IV.5 EU NON-ARCTIC

The survey also went out to participants from non-Arctic EU respondents outside of Arctic states to help assess the information needs of these stakeholders as well as exchange between the EU and Arctic. The survey was shared more widely, though actual respondents were limited to France, Germany, Italy, the United Kingdom, and EU institutions, as well as one respondent from an international intergovernmental organization. Most came from government and research, with two more from industry and NGO backgrounds.

Information gaps

For non-Arctic EU respondents, Governing the Arctic and Understanding the Arctic were the primary human needs. Needs for the thematic area of maritime transport arose multiple times, and a need was cited to improve risk assessment for environments and communities and develop new strategies. Policy impacts and understanding of cooperation, particularly in transboundary settings, in the area of societies and cultures were also referenced. Finally, for Understanding the Arctic, better information on climatic variability was listed as needed.

Communication gaps

There were relatively few responses for communication gaps for non-Arctic EU respondents and answers were general in nature. Investing in the Arctic came up repeatedly, including on understanding offshore oil and gas exploitation. Other communication gaps included international cooperation related to climate change and sharing observations on fisheries and marine science.

Chapter cover image: Jökulsárlón lagoon, Iceland.
Photo: GettyImages

V. PROBLEMS AND CHALLENGES IN THE ARCTIC

This section on main challenges provides additional background for the recommendations on information and communication gaps. It aims to provide an overview of the main trends in Arctic challenges perceived by respondents. This is intended to support recommendations, to provide another angle and larger context for analyzing responses on information needs, and to help highlight information-based approaches that could enable stakeholders and policy-makers to tackle (local, regional, or cross-border) Arctic challenges.

To retrieve this supplementary input, the survey included a final question (after participants already had provided input on information needs): "According to your experience, what are the three main problems / challenges that the Arctic faces today?"

Taking a different approach from the pre-structured reply path on information needs, this question allowed respondents to freely list major concerns regarding the Arctic. These inputs did not have to correlate to the information needs that respondents inserted earlier.

Due to the open approach of the question, the answers showed a wide variety of challenges, thematically as well as in the level of detail. This section first attempts to group and analyze the responses for all respondents (section 5.1), then splits the replies following the structure of sections 2 and 3 in human needs (section 5.2) and stakeholder groups (section 5.3) in order to analyze possible inter-dependencies and priorities of different groups.

V.1 OVERVIEW OF MAIN CHALLENGES FOR ALL RESPONDENTS

In total, 155 respondents provided 227 inputs for the question on main challenges in the Arctic. Answers were given in free text with no criteria or categories for guidance. For purposes of analysis, these answers were subsequently grouped into a total of ten overarching categories so as to provide a more coherent overview of the wide range of topics and to help recognize common trends and themes. Since participants used free text answers, answers were categorized ex post facto to best represent overarching issues that arose.

In many respects, the categories of answers that emerged mirrored the seven thematic areas used in the survey (see section 1.3), although, as explained, these were not overtly used as categories here. Two of the original thematic areas that were mirrored in the answers on main challenges, even without respondents being guided by the thematic areas, were "climate change" and "society and culture." Other categories were grouped differently, to reflect the variation in the free text replies. For example, the category of "resource use and extraction" covers multiple issues such as oil and gas, mining, and fisheries. The issue of land use (a thematic area) was included along with more general questions in the grouping of "land use and development." "Transportation and infrastructure" includes maritime transport (one of the thematic areas) as well as other modes of transportation and infrastructure-related issues.

To reflect some respondents' answers on "environmental impacts" (sometimes related to resource use and extraction or transportation), replies were grouped in a separate category. The distinction was drawn to reflect different nuances in the main challenges, for instance between concerns regarding industrial developments with their impacts on societies on one hand, and accidents in resource extraction with environmental impacts on the other.

Another category was created to include the "information and communication gaps" highlighted by the respondents. This group is particularly interesting as it shows that some respondents saw information acquisition and management as a more general, and important, concern for Arctic issues.

Further, overarching issues in governance structures, on the local, regional, and international level were summarized in "cooperation and governance." Issues related to the wider economic system (without a specific industry in mind) were grouped into "economic factors."

Answers on main challenges, in the categories as set out above, showed the following distribution:

- Climate change (15%)
- Information/communication gaps (13.7%)
- Information gaps (9.3%)
- Communication gaps (4.4%)
- Resource use and extraction (12.8%)
- Society and culture (11.5%)
- Infrastructure and transportation (11.5%)
- Cooperation and governance (11.5%)
- Cooperation (5.7%)
- Governance (5.7%)
- Environmental impacts (8.4%)
- Development and land use (6.2 %)
- Economic factors (5.3%)
- Other aspects (4.4%)

Figure 6. Main challenges in the Arctic

The distribution shows a clear, though not by a large margin, leaning towards the issue of climate change (15% of replies). Answers in this category tended to be rather general, often using climate change as more of a "keyword" than referring to different aspects and impacts specific to the Arctic. Only a small number of participants linked the issue of climate change back to particular impacts on the Arctic environment or biodiversity.

Participants were first asked questions of the survey on perceived information gaps or communication gaps, which may have inadvertently influenced the high number of responses on main challenges that listed challenges regarding these gaps. Still, the number of replies concerning these particular challenges shows the relevance of organizational efforts in increasing information generation and flow. Behind climate change, this was the second largest grouping of challenges (13.7%).

In the sub-group of information gaps (9.3%), three main themes emerged, the first two of which were distributed nearly evenly:

1. About half of responses mentioned a general lack of information about and knowledge of the Arctic,
2. Slightly under half of responses addressed challenges regarding knowledge about the changing environment on all stages of observation and management (baselines, physical and biological processes, effects of pollution on biota, lack of monitoring, lack of assessments, inadequate management instruments), and
3. Only a few responses focused on knowledge gaps centred around economic development in the Arctic, in general, and resource extraction, in particular (e.g., long-term project planning and the mining industry).

In this sub-group of communication gaps (4.4%), responses centred on issues of origin (risk of unbalanced information) and information flow (e.g., between communities and decision-makers).

The categories of resource use and extraction, society and culture, infrastructure and transportation, and cooperation and governance had relatively even shares of the responses.

For the category of resource use and extraction (12.8%), the interplay between resource exploration and environmentally-sound management was seen as one of the main challenges in the Arctic. Almost 60% of answers in this group referred to the general challenge of increased international interest on Arctic resources and associated environmental protection. The rest of the answers addressed specific challenges on oil and gas exploitation, mining, and fisheries, with oil and gas clearly leading and fisheries only mentioned once.

Society and culture (11.5%) saw two major groups of challenges: The first, maintaining indigenous livelihoods (including preservation of traditional occupations and culture), covered more than half of replies in this group. The second, demographic changes (including migration out of the region), was included in more than a quarter of replies. Additional issues mentioned were health issues and education in local communities.

In the category infrastructure and transportation, overall needs for new transportation routes and challenges related to increased traffic in the Arctic area provided the largest number of replies (over 42%), followed by infrastructure needs (27%). The additional aspect of shipping (mostly safety, as well as search and rescue) highlighted more specific components.

Both components of cooperation and governance (11.5%), showing crossovers and thus grouped together, had equal replies. The cooperation aspect includes cross-border exchange (up to the geopolitical level) as well as the inclusion of the local level in governmental decision-making processes. A similar range was also reflected in replies mentioning governance: International Arctic governance and insufficient interest by non-Arctic parties were highlighted on one hand, and on the other, a lack of detailed long-term planning on individual (smaller scale) topics. A lack of regional governance (and also lack of predictability thereof) was also mentioned by some of respondents. One also saw the involvement of the EU in the area as a challenge.

The category on environmental impacts (8.4%) included a number of general concerns on the Arctic (marine and terrestrial) environment, almost half of the replies. It also covered answers on specific environmental challenges, many of which were linked to other economic and development issues. For example, environmental impacts from pollution (mostly for oil, but one respondent also mentioned nuclear pollution) made up around one quarter of these replies. To a lesser extent, biodiversity issues (including loss and introduction of invasive species) and climate change issues (melting ice and ocean acidification) were highlighted as well.

Replies grouped in the category of development and land use (6.4%) showed a number of aspects and challenges, including social and sustainable development. While the answers of some respondents indicate that development is too rapid and does not allow for other sectors to adapt, one reply criticized the obstruction of regional development.

Economic factors (5.3%) reflected two angles on the (financial) development of the Arctic. One perspective, shared by two-thirds of these respondents, viewed the development in (and of) the North as a major economic challenge. The other third of replies called out the greed of mankind as major Arctic challenges, letting "money and investments take the centre stage." One reply specifically criticized developing a society "built on eternal growth."

Finally, the group of "other" aspects (4.4%) brought together some overarching replies that – for one reason or another – did not fit under another category. Many answers mentioned globalization or global changes (40%), while some singular remarks highlighted additional systemic challenges such as the use of sustainable energy or energy efficiency, as well as harsh natural conditions.

V.2 MAIN CHALLENGES (STRUCTURED BY HUMAN NEED)

The general overview in section 5.1 already provides a summary of the relevant topics perceived by survey respondents. However, as participation varied heavily among nationalities, stakeholder groups, and professional occupations, this presumably had an impact on the the results that distorts this (not statistically representative) overview to an extent.

Thus, this subsection takes a view towards the distribution of major issues along the lines of the human needs that participants responded to. It must again be emphasized that the question regarding main challenges was not dependent on the human needs or thematic areas previously chosen by individual respondent in the survey. This analysis is performed to better understand the relationships between information needs, Arctic challenges, and stakeholders.

V.2.1 LIVING IN THE ARCTIC

This particular human need suggests a rather local connection to Arctic issues, so the results of the question for main challenges do not appear very surprising. The most relevant challenges are seen in the impacts on society and culture by demographic changes and by changes in the local cultural integrity (over 29%). Categories on cooperation and governance, resource use and extraction, and climate change showed the second most replies (12.5%). While climate change was mostly used as a single key word; the other two categories covered a wide range of issues: With regard to governance challenges, respondents highlighted regional and international aspects, while the challenges in resource use and extraction mentioned oil as well as mining.

In comparison to the information and communication gaps identified by this group, it can be seen that the focus on the topics of society and culture as well as climate change remained. For the impacts of social and environmental changes on local communities, a need for action appeared to be correlated with a need for information.

V.2.2 INVESTING IN THE ARCTIC

Most respondents for Investing in the Arctic did list main challenges. It was striking that the most issues here were seen in the category of information and communication gaps (19.2%), including aspects such as data networks, information on the mining industry, and education. One particular comment criticized influence on Arctic discourse by the non-Arctic public and NGOs, such as seal hunting. The second largest category of challenges from these respondents was infrastructure and transportation (17.3%), mentioning the need for new transportation routes in the Arctic and also issues of safety development and navigation in the Arctic Ocean. Other clusters of challenges shared by this group were cooperation and governance as well as development and land use. Apart from the need of international cooperation, needs for research coordination were also mentioned. The category of development and land use covers a whole range of challenges, from a desire not to shut out Arctic development to concerns about non-sustainable development.

When compared to the information needs highlighted by this group of respondents, it appears that the selected information and communication gaps are considered as key challenges for future investments in the region.

V.2.3 WORKING IN THE ARCTIC

Under the human need of Working in the Arctic, responses showed an interesting tendency towards issues in the category of society and culture, focusing primarily on local influences and aspects. With more than 41% of replies, the demographic changes and potential conflict between the integration of foreigners and the existing indigenous livelihoods were seen as the most pressing issues. Following, major challenges were identified within infrastructure and transportation (over 25%). Two of the replies went into detail and highlight the lack of aviation routes in the region and a missing railway link from Finland to Norway. Finally, other challenges were related to climate change.

These main challenges showed a difference from feedback on information needs: While respondents' interests in information were primarily rooted in opportunities within the region, mostly referring to mining, the main challenges as set out here identified in social pressures related to demography and (foreign) workers.

V.2.4 TRAVELLING IN THE ARCTIC

From the nine respondents in the human need Travelling in the Arctic, only five answered the question regarding the main challenges in the Arctic. Infrastructure and transportation had the largest feedback of the respondents and put a clear focus on Arctic shipping, including concerns on sufficient security measures on ships, as well as search and rescue infrastructure. Another 20% mentioned environmental impacts (broadly), while society and culture and economic factors (with about 13% each) showed awareness of societal developments, for instance driven by economic growth.

The comparison of these main challenges with the identified information needs for Travelling in the Arctic showed relatively corresponding replies, highlighting the need for safety measures in Arctic transportation and improvements in social issues. However, due to the small number of respondents under this category, it is not advised to deduct larger patterns from this correlation.

V.2.5 GOVERNING THE ARCTIC

Major problems that were identified by these respondents focused, interestingly, on a range of Arctic-specific issues that went beyond the information and communication gaps mentioned for Governing the Arctic. For instance, the most highlighted areas for information and communication gaps in the survey – maritime transport, land use, and mining – were generally not seen as the most pressing issues in the list of challenges. Instead, the most relevant were seen as climate change (44.4%) and local and indigenous issues (40.7%).

The wording of the two questions – asking for the main challenges, as opposed to asking for more detail of distinct gaps – also seemed to have an influence on the level of detail in the respondents' reply. However, it is striking that the main challenge of climate change is named far more often than the (more diversified) governance aspects, while it does not play any role in the detailed information and communication gaps. The discrepancy between the two feedbacks could mean that while fundamental problems are well-identified and understood, particular governance information needs still arise (and should be addressed) in distinct, more specialized areas. Another interpretation, indicated by the lack of detail in some of the replies to the main challenges, could be that some of the global challenges with the greatest impact (such as climate change, which was often highlighted) are out of reach for governance from a single community, territory, or state.

V.2.6 UNDERSTANDING THE ARCTIC

Natural sciences

For respondents identifying natural sciences needs for Understanding the Arctic, climate change was viewed as the most prominent challenge (32.3%). Within the broad subject of climate change, more specific challenges referenced included adaptation, ice retreat, habitat loss of pagophilic animals, and understanding of offshore methane release, feedbacks associated with sea ice retreat, and enhanced rates of ice sheet melt. Other top challenges from respondents focused on environmental or resource-related challenges. Increased resource use and extraction were seen as general concerns, along with the sectors of oil and gas, shipping, and fisheries. Land use, and conflicts with other users, was also cited.

These correlated to some degree with information gaps identified under the natural sciences, which focused largely on climate change and better understanding of impacts and processes. Likewise, other information needs covered land use changes, shipping, fisheries, and oil and gas. Communication gaps under natural sciences, too, focused exclusively on climate change information.

Social sciences

The challenges most stressed by respondents who selected information needs on social sciences were found in cooperation and governance (23.1%). These covered all levels of governance: cooperation within Arctic states as well as the cooperation between countries and the domestic implications of international governance.

The other most frequent categories were climate change and resource use and extraction (15.4%). As under the other human needs, respondents did not elaborate much on the issue of climate change. Taking a social sciences perspective, the issues related to natural resources were kept at an overview level, covering natural resources, the extractive industry, or industrial activity in general terms.

Surprisingly, the respondents under this human need identified only a small number of challenges concerning society and culture (11.5%) while the information needs identified in section 2.6.2 showed the biggest part of the contributions in the parallel thematic area. This could be interpreted in a way that the wide range of social sciences are still in the process of understanding the issues and cultural interactions on the local level better while the biggest threats for Arctic societies appear to come from the governance level.

V.3 MAIN CHALLENGES (STRUCTURED BY STAKEHOLDER GROUPS)

In this section, the focus turns towards the various stakeholder groups that participated in the survey, attempting to show relationships and possible influences between backgrounds and perceived challenges. Comparisons can also be drawn to the information needs that the respective stakeholder group highlighted in section 3.

V.3.1 COMMUNITIES

As local stakeholders in the region and those most directly affected by Arctic changes, Arctic communities saw the biggest challenges for the Arctic in (local) infrastructure and transportation (35.7%), and in the category of society and culture (28.6%). They highlighted local needs for improvements in daily life, such as improvements on transportation routes or the merging of traditional livelihoods and mixed or formal economies.

A comparison to information needs from this group is limited: Due to a lack of details regarding information needs, it can be only highlighted that respondents focused on similarly local issues in the main challenges identified, such as infrastructure and societal developments.

V.3.2 GOVERNMENT

Government stakeholders presented the highest feedback and largest numbers of challenges of any stakeholder group. The replies showed major concern regarding information and communication gaps (18.8%), particularly on information sources and distribution. Other issues mentioned frequently by government stakeholders were climate change and cooperation and governance (16.7% each). The strong emphasis of information needs in this group could be seen as a trend that policy-makers still feel a lack of a sufficient basis for decision-making. This can also be read into some of the particular issues mentioned in the cooperation and governance category: Not only is a lack of understanding by decision-makers highlighted, but also an overly general approach to planning that discounts more specialized issues and needs.

In general, the main challenges mirrored the information needs of this particular stakeholder group, with a focus on further understanding in the Arctic and governance aspects.

V.3.3 INDUSTRY

Respondents with industry backgrounds highlighted challenges in cooperation and governance in the Arctic (25%), and on environmental impacts and resource use and extraction (16.7% each). These respondents showed coherent patterns in information needs and main challenges. Overall, governance aspects (such as local regulation) and knowledge on environmental issues and investment opportunities were common themes.

V.3.4 INTEREST GROUPS

Only a small number of respondents identified as having an interest group background (see section 3.4). Their main issues focused on the interplay between resource and extraction, infrastructure and transportation, and potential environmental impacts. This covered the mining, oil, and shipping industries. Due to the small numbers of participants, a comparison to the information needs of this stakeholder group does not bring additional aspects to the analysis.

V.3.5 NGOS

Top Arctic challenges identified by NGO respondents covered a wide range of subjects. Of these, climate change was the most common (21.9%) – with most respondents citing climate change generally, and one individual referring to "the threat of climate change to Arctic environment and biodiversity." Expanding resource development followed in second (15.6%), with a particular emphasis on resource development and exploitation without sufficient environmental protection measures in place (9.4%). General categories of resource-related activities such as mining, oil and gas, and shipping were referenced by respondents.

Correspondingly, NGO respondents' answers on information gaps focused heavily on information needs to improve understanding and governance of Arctic extractive industries. Challenges for Arctic communities were also featured, including livelihoods, poverty, education, and general well-being and development. Related, were challenges in understanding the Arctic and its people, which are seen as given overly simplistic views in Arctic discourse or focusing solely on resources. Finally, a number of governance challenges were identified by NGO respondents, which concerned a lack of input from local communities, need for cooperation, lack of regional governance, and "governing." Governance needs were the largest category of information needs that NGO respondents referred to.

V.3.6 RESEARCH

Respondents from research backgrounds listed a wide variety of "top challenges" for the Arctic. Climate change was the most frequent theme, covering 19.2% of replies. Most referred simply to "climate change," while others listed specific aspects of climate impacts or knowledge. Some climate change challenges were connected to impacts on Arctic species or to expanding industrial activities in the region. Rapid and poorly

managed resource exploration and extractive industries were also major concerns for research respondents. The industry seen to pose the largest challenges was the energy sector, followed by shipping. Challenges related to Arctic societies and cultures were the next largest overarching category. Demographic changes also came up repeatedly among researchers (6.1%), too. Concerns specifically about aspects of governance, from the local to international level, represented approximately 8% of replies. Other challenges related to infrastructure and transportation as well as development and land use. Other global challenges listed included variations on "greed," "competition," and "global change."

A number of other top challenges referred generally to lacking knowledge and understanding on aspects of the Arctic, particularly on baseline conditions, biophysical processes, and monitoring and observations. These answers may in part be linked to respondents' identified information gaps (see section 3.6) since some respondents selected the challenges that were connected to the information needs they had identified. A major portion of research respondents (50%) identified gaps for Understanding the Arctic. Thus, a comparison with the information needs of the stakeholder group shows an equally perceived importance of further research, particularly in the area of climate change. The correlation to the information needs of social sciences can be derived from the perceived importance of research in societal impacts.

V.3.7 INDIGENOUS PARTICIPANTS

Respondents had the (voluntary) option to include whether they counted themselves to an Arctic indigenous group (see section 3.7). These replies differed from the communities group and showed not only twice as many inputs, but also a more diverse range of priorities. The two major themes for indigenous participants were resource use and extraction and society and culture (19.2% each).

The latter showed similar concerns on indigenous rights and the influence of other cultural influences on the traditional livelihoods. However, while no respondent in the "communities" group saw information and communication gaps as a major challenge in the Arctic, more than 15% of the indigenous participants identified needs, mentioning, inter alia, the need for a better communication between governments and people in the region and reliable environmental assessments.

Chapter cover image: Wind turbines.
Photo: GettyImages

VI. DISCUSSION OF SURVEY RESULTS AND MAIN FINDINGS

As emphasized above, the results of the survey cannot be seen as statistically representative, but are rather anecdotal and serve to highlight certain trends, form a basis for recommendations, and contribute to an assessment of the role of an EU Arctic Information Centre. The results should be viewed as an illustrative snapshot of users' Arctic information needs from which to identify trends and draw conclusions on broad information and communication needs.

The main (English) survey received only a 16.5% response rate, while the Russian language survey received an even lower response rate at 5.7%. This may have been due in part to the timing of the survey, as well as the fact that other online questionnaires were being distributed around the same time by other Preparatory Action partners, potentially confusing recipients who responded to the other questionnaires. Nonetheless, the response rate does not invalidate the survey's responses since they are assessed qualitatively and anecdotally. Further, the online responses themselves are informative as to users' information preferences (see section 7) and for assessing the role of an EU Arctic Information Centre (see section 8).

As described, the survey led respondents through a series of choices regarding information needs and themes. Responses were undoubtedly influenced by the survey's pre-selected human needs and thematic areas, which guided respondents on a pre-determined path rather than allowing for wholly open choice, although respondents had the option of selecting "other" in most cases. The categories may have thus created certain artificial limits, but were ultimately useful in assessing the general trends to which respondents' broad and descriptive information needs corresponded. A few respondents found that the pre-selected options were not a suitable fit for their identified information needs, while others pointed to needs that clearly intersected across multiple trends. For example, climate change is related to expanding human activities and trends in maritime transport or oil and gas extraction. Needs may cover more than one category, too: e.g., where more information in the natural sciences is ultimately used for governance purposes. These linkages were evidenced from the responses, which exhibited cross-over between categories.

A total of 14.9% of respondents skipped the selection of a human need, which could indicate that the options did not fit respondents' individual information needs or could be a sign of survey fatigue. Only a small number of respondents (11.8%) chose to repeat questions and identify more than one type of information or communication gap. Additionally, not all respondents selected options or specified information for all fields. Most identified broad subjects and areas, rather than more detailed needs. As such, results should not be seen as prescribing a research agenda, but instead as informing needs and next steps.

Overall, the division between identified information gaps (50.4%) and communication gaps (49.6%) was evenly split. A number of respondents, however, didn't seem to understand or follow the distinction between information gaps and communication gaps. Another important aspect to consider is that respondents' might not have had sufficient information to evaluate whether gaps were information or communication-related. In other words, by not having access to information, one could be led to believe that it does not exist.

On the whole, the (qualitative) analysis of the content of the individual free text responses on specific gaps was given greater weight in analysis than the (quantitative) analysis of selected sub-needs and thematic areas, which did not always clearly correlate or may have covered multiple areas.

VI.1 INFORMATION GAPS

Across all categories of human needs, the information gaps showed a lack of knowledge on and understanding of the widespread changes occurring in the Arctic region. Climate change was a dominant theme, particularly for the natural sciences, and was also reflected in information gaps on Arctic industries that are expanding or predicted to expand in the face of climatic changes. Socioeconomic changes underlay many other information gaps regarding culture, business opportunities, and land use.

Given the high connectivity between many of these changes, it is perhaps not surprising that a number of information gaps highlighted a need for integrated and cumulative assessments of impacts. Detailed information needs were also shared regarding monitoring efforts and baseline studies. Generally, baseline information was sought for learning "about the current status of ecosystems as well as continuous monitoring to detect future changes." This included, under the thematic area of climate change, greenhouse gas inventories, monitoring of sea ice thickness and motion, better baseline data on present and past climatic changes, and surveillance of climate sensitive infections. Historical data on Arctic marine traffic was also mentioned, in order to better inform future projections and developments.

The greatest number of information gaps described by respondents focused on the impacts of resource extraction, such as oil, gas, and mining. Some of these information gaps were more specific, but most simply saw a general lack of information about the impacts of these industries and increasing activity, including on cumulative impacts. These primarily focused on environmental impacts, but also included socioeconomic

aspects, and several NGO and indigenous respondents pointed to both. Mining received the highest level of attention, with many gaps focusing on a lack of understanding of systematic impacts – especially in relation to climate change – and need for improved technological, geological, and economic information. NGO and indigenous respondents assessed gaps in understanding both the environmental and development impacts of mining. Often contrasted directly against natural resource extraction, a number of replies assessed information needs for sustainable development alternatives. Information was wanted on development options for the Arctic focusing on renewable energy and green technologies or industries.

Also related to expanding human activities in the Arctic, many information gaps were described for the thematic area of maritime transport. These focused on a lack of sufficient logistical information, as well as evaluations of related environmental, socioeconomic, and political risks.

Respondents saw needs for information on northern and indigenous cultures and lifestyles. There was interest in generally having more information in these areas, as well as particularly in light of changing cultures and lifestyles. Gaps were observed in understanding these changes and in documenting traditional cultures that were swiftly changing. Related to needs to better understand social and culture changes, several respondents cited information needs on demographic changes in the Arctic. These replies showcased needs for data on migration in and out of the Arctic and towards cities. Information gaps on demographic changes were identified by respondents in EU and European Arctic states.

Information gaps on land use were frequently referred to in survey replies. Respondents described needs for better mapping, and understanding of conflicting uses, changing patterns, regulations, and socioeconomic and environmental impacts. These information gaps were primarily highlighted by respondents from EU Arctic states, although from one North American respondent as well.

A range of information gaps were highlighted regarding investment and employment opportunities in the Arctic. These covered a general lack of information on investment and business opportunities and, from several respondents in EU Arctic states, information on small and medium enterprises.

Finally, although arguably more of a policy gap than an information gap, several respondents indentified areas that needed new governance measures. These included new instruments to manage the "cumulative effects from development," and to both minimize and assess shipping impacts.

VI.2 COMMUNICATION GAPS

Communication gaps described in the survey illustrated inefficiencies or confusion in gathering information from multiple sources, failures to communicate between stakeholders or governments, and a perceived lack of understanding about the Arctic region and its people.

A large number of respondents felt there was a need for more centralized information. They described that while there are many sources of Arctic information, on various topics, these are generally scattered and difficult to access without having a central hub or information centre. Respondents indicated that such a source could help both disseminate and collect information (thus filling both information and communication gaps) and ultimately promote better understanding of the region and regional impacts. For scientific research, a number of respondents indicated that centralizing and harmonizing information and data could improve research efforts and understanding. Specific areas of information seen as suffering from this type of communication gap included fisheries, mining, and monitoring and observation, though many referred more broadly to Arctic issues or information.

Some respondents felt that information on indigenous peoples and Arctic cultures should be better shared, both within and outside of the Arctic. This included cultural education, understanding Arctic lifestyles and histories, and generally sharing information to better understand indigenous peoples. Some of these were gaps in awareness of Arctic communities and their interests from parties outside of the Arctic. Within the Arctic, respondents discussed needs for better information distribution and cultural sharing. In addition to perceptions that outsiders have an incomplete understanding of Arctic communities and cultures, a more general sentiment was expressed that discourse on the Arctic fails to recognize regional variations and differences.

Another common theme under communication gaps was failures to transmit information on training and preparedness. This covered general needs for training and management of fisheries and natural resources. Several other responses saw gaps in preparedness for Arctic shipping. This included training on navigation, safety, search and rescue, and other operations for polar conditions. A number of respondents highlighted communication gaps between different stakeholders. They described failures to exchange or transfer information between communities and governments (including issues of participation and representation), between scientists and policy-makers, and, similarly, between researchers and managers. Likewise, a failure to communicate information between governments was described. Respondents saw breaks in communication between local, national, and international levels of governance, which impaired effective decision-making

Box 1. Communication gaps and the AInC

The AInC supports the GAR by examining the role of information on (existing) projects and contributes to the identification of communication gaps, as set out in the methodology above (section 1.3). The AInC focuses on the identification of relevant existing Arctic initiatives, aiming to show existing efforts undertaken by the EU and certain (mostly Arctic) states. The GAR, conversely, aims to show unmet information needs for Arctic stakeholders and policy-makers. The AInC does not state any information gaps itself. An identification of non-existent research in projects (i.e., information gaps) via the AInC is outside of the scope of the GAR given the vast range of material considered herein, large number of projects in the AInC, and lack of specific project-related criteria (e.g., finances, timeframes, participants, mandates, and more) by which to assess initiatives for "project gaps."

Nonetheless, understanding of communication gaps can be derived from the AInC and the outline of existing initiatives. First, the limitation of the scope of the AInC to certain initiatives was necessary to ensure a manageable information flow among an overwhelming range of possible entries. This was necessary within the given scope of the report, but in itself points to a need for a more systematic and accessible look towards initiatives than was available for or from the AInC. Some types of initiatives were excluded from the scope of the AInC, following certain criteria; these exclusion criteria not only draw the limits of the AInC, but may also hint towards areas of communication gaps. For instance, it is possible that a number of existing initiatives (that are, e.g., not centred on the Arctic or are not "high level" enough) are hidden in the shadow of larger initiatives or lacking the framing (i.e., "Arctic") or dissemination tools with which to be recognized and share information.

The AInC shows that a large number of initiatives are being undertaken, and that capacity is being built to launch these initiatives. It is also clear that Arctic initiatives do not necessarily operate exclusively in the Arctic, and that not all initiatives undertaken in the Arctic self-identify as "Arctic." Finally, it is clear that not all knowledge about the Arctic is produced via research projects: Although scientific research remains a central tenet in understanding the Arctic, there are many other, sometimes nebu¬lous, sometimes targeted, initiatives that affect understanding of the Arctic.

and management. There was also confusion in terms of which authorities had jurisdiction over issues and what regulations applied, particularly regarding the EU (including from EU respondents). Two respondents also found there to be a deficit of information on Russian policy priorities and strategies. For investment-related information needs, unclear information on regulatory requirements and jurisdictional purview arose repeatedly.

VI.3 MAIN ARCTIC CHALLENGES AND INFORMATION NEEDS

The main challenges identified by respondents offered insight on and further context for the analysis of information needs. To begin with, the thematic areas used in analysis of information and communication gaps were also reflected in the main challenges, although with certain distinctions. All of the thematic areas arose in the responses on Arctic challenges, particularly climate change and society and culture.

Survey respondents' answers identifying major Arctic challenges were not required (nor intended) to be based off of the information needs. However, because participants were first asked questions of the survey on perceived information gaps or communication gaps, this likely inadvertently influenced responses. Still, a large number of respondents highlighted challenges related to information and communication gaps in their responses. This shows that some respondents saw information generation and provision as principle concerns for the Arctic. Regarding a lack of information, about half of responses mentioned a general lack of knowledge on the Arctic or Arctic issues, while a nearly equal amount addressed challenges regarding knowledge about the changing environment on all stages of observation and management. Communication-related challenges were about information flow and reliability. Information and communication gaps were perhaps most prominent in challenges for respondents who also identified needs for Investing in the Arctic, who considered these gaps as key challenges for future investments in the region.

In looking at other challenges identified by respondents in relation to the information needs they named, there was overlap in some cases, and divergences in others. In the case of the latter, this may indicate that for some respondents, information is not what is seen as needed to meet major Arctic challenges.

For Living in the Arctic, challenges and needs showed significant overlap regarding social and environmental changes on local communities. Likewise, information needs and main challenges identified according to

Understanding the Arctic and natural sciences focused on climate change impacts and processes.

Respondents with Governing needs identified a range of Arctic-specific issues that went beyond the information and communication gaps mentioned for Governing the Arctic. Challenges focused primarily on climate change and local and indigenous issues. Climate change – the information need with the most responses overall, though not for Governing – was listed repeatedly as a main challenge. The discrepancy between the information and communication gaps and the main Arctic challenges here could be read to mean that while fundamental problems are relatively well- understood, more particularized information needs are priorities for governance purposes. An alternative interpretation could be that certain global issues (i.e., climate change) present challenges at the local, regional, or national level, but not necessarily direct information needs. For respondents identifying needs on Understanding the Arctic and social sciences, there was also some discrepancy, with respondents focusing more on cooperation and governance, climate change, and oil and gas in the main challenges, and less on society and culture, which were focuses of information needs, perhaps indicating greater threats at the international level than at the local.

When looking at the relationship between answers from various stakeholder groups, stronger correlations could be observed. Thus, for the most part, it appeared that certain groups of self-identified stakeholders saw information gaps and communication gaps for the same issues that they viewed as posting the greatest challenges to the Arctic.

Chapter cover image: Hot spring, Iceland.
Photo: GettyImages

VII. COMMUNICATION RECOMMENDATIONS AND PLANS

The aim of these recommendations for a communication plan is to develop an information structure, based upon the results of this report, that would support the activities of a potential EU Arctic Information Centre, promote communication among network partners, and be a vehicle of communication between the project and the "external world."

Information and communication gaps may not only impair decision-making, but can ultimately block effective governance and pose hurdles in the growth of people, organizations, and communities. As described above, a communication gap refers to a state where information is not communicated to users completely or properly. In order for communication to be efficacious and reach a significant or desired number of recipients, it is necessary to:

- Define the target: The starting point for any communication action is the definition of the intended objective. This will subsequently determine how, when, by what means, and how often to communicate.
- Identify the interests of the different parties: This can be done, for example, through results obtained from targeted surveys of information users, as was done for this report and to inform the suggestions herein.
- Identify the interactions between the various types of targets: There may be differing interactions and responses between audiences and targets. For example, the scientific community may be primarily interested in the study of climatic changes, while Arctic communities may be more interested in how climate change affects quality of life.
- Identify means of communication: Different modes of communication are useful for different targets. For example, stakeholders such as policy-makers, the general public, indigenous communities, and scientific researchers may all respond to (and require) different types of information products.

This section identifies means of communication and uses the feedback from the online survey to highlight relevant tools to successfully communicate with different groups of stakeholders. Based on the information sources used by respondents to fill information needs and their information preferences, certain conclusions can be drawn regarding information-seeking behaviour and interaction with information systems[18]. The implementation and use case for an EU Arctic Information Centre is further elaborated upon in section 8.

18. See Wilson, "On User Studies and Information Needs," 659.

VII.1 COMMUNICATION TOOLS

Information users have individual needs and information-seeking behaviour, which different types of communication tools and services can be used to meet[19]. For communication of information to be successful, there must not only be a transfer of data, but also a transfer of meaning. In some cases, successful communication may require the use of an intermediary information system[20].

Historically, prevailing technology guided the way "ideas" were conveyed, using verbal narrative, journals, art, music, photography, movies, radio, TV, computers, and the internet. Today, a plethora of methodologies and technologies are available for innovative communications, widening the range of options to transfer information and to target different user preferences and information-seeking behaviour. Below are some considerations on ways to improve knowledge and to develop better communication between providers and users, reducing information and communication gaps.

VII.1.1 ELECTRONIC INFORMATION STRUCTURES

Public website and portal

A website is one of several methods that can be used to both communicate existing information and to obtain information for use in activities and decision-making. The primary benefit of a website is to allow open and transparent dissemination of key information and results, and to explain how they were obtained and interpreted. A website can also serve a wide audience of interested parties. A web portal on the website could bring together and provide access to a variety of information and resources in a uniform way. To stay relevant and meet information users' needs, a website should be regularly updated.

The survey revealed data that highlighted the need to use web tools in promoting new or additional information, or rather, to improve the flow of information and communication. More than 50% of respondents indicated that they consulted websites to enhance knowledge and fill information needs. Respondents from European Arctic and non-Arctic countries indicated that they both used and had a general preference for (non-EU) internet web sites (see in Figure 7).

When splitting replies along the stakeholder groups, clear preferences arise as well: For the scientific community, there was prevalence (more than 30%) for receiving information from scientific journals. Some of the most commonly cited scientific journals included

19. Prasad, Information Needs and Users.

20. Faibisoff and Ely, Information and Information Needs, 4.

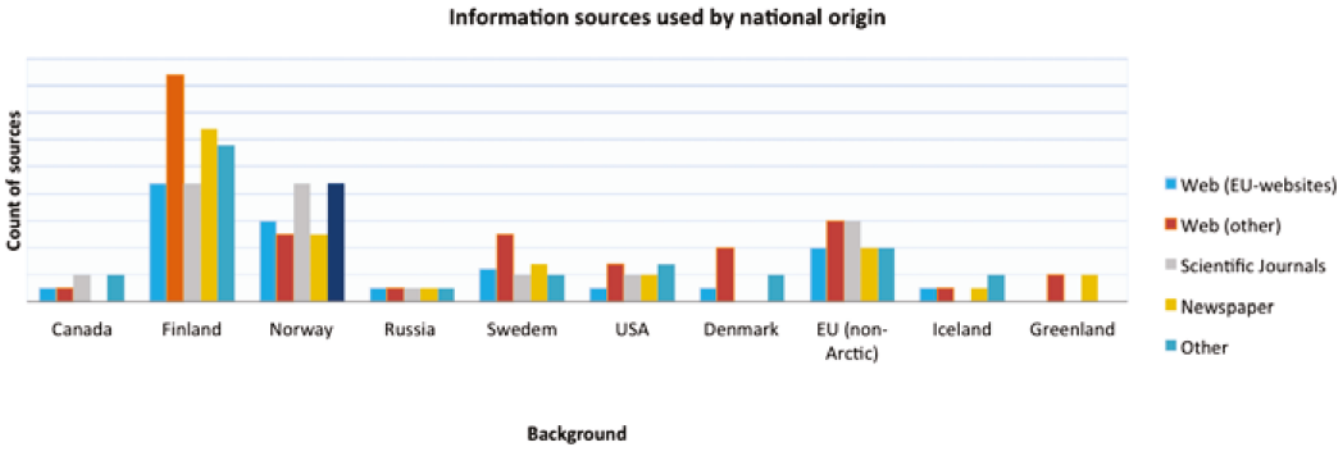

Figure 7. *Information sources used by national origin*

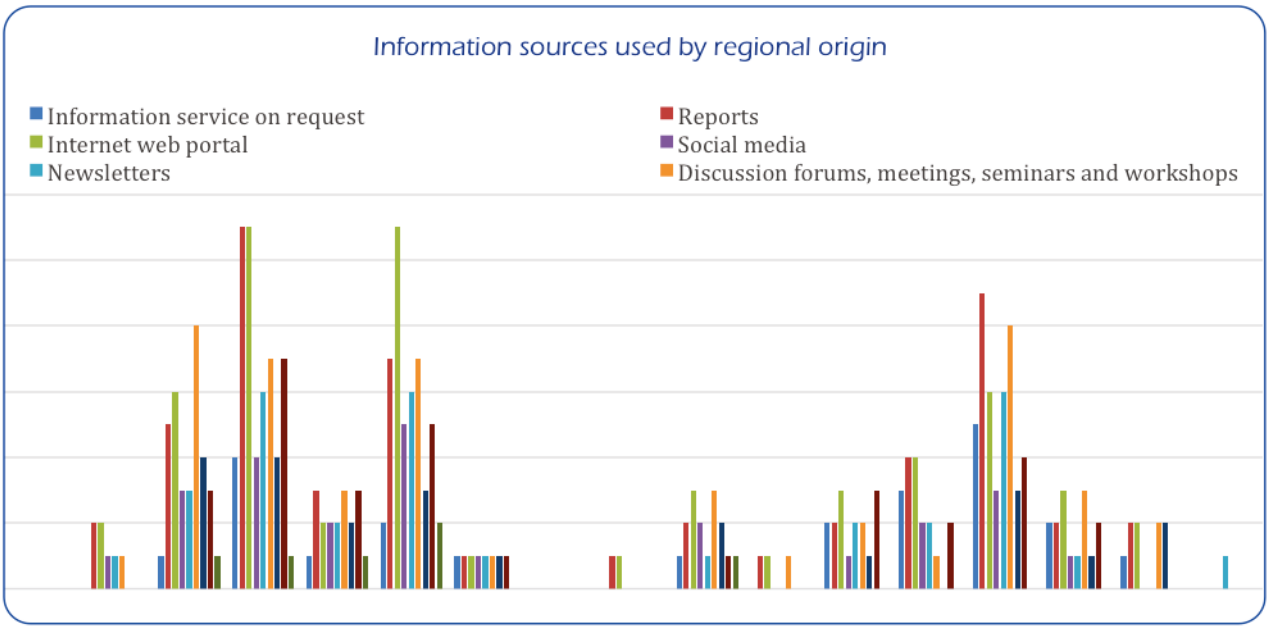

Figure 8. *Preferred information sources by region*

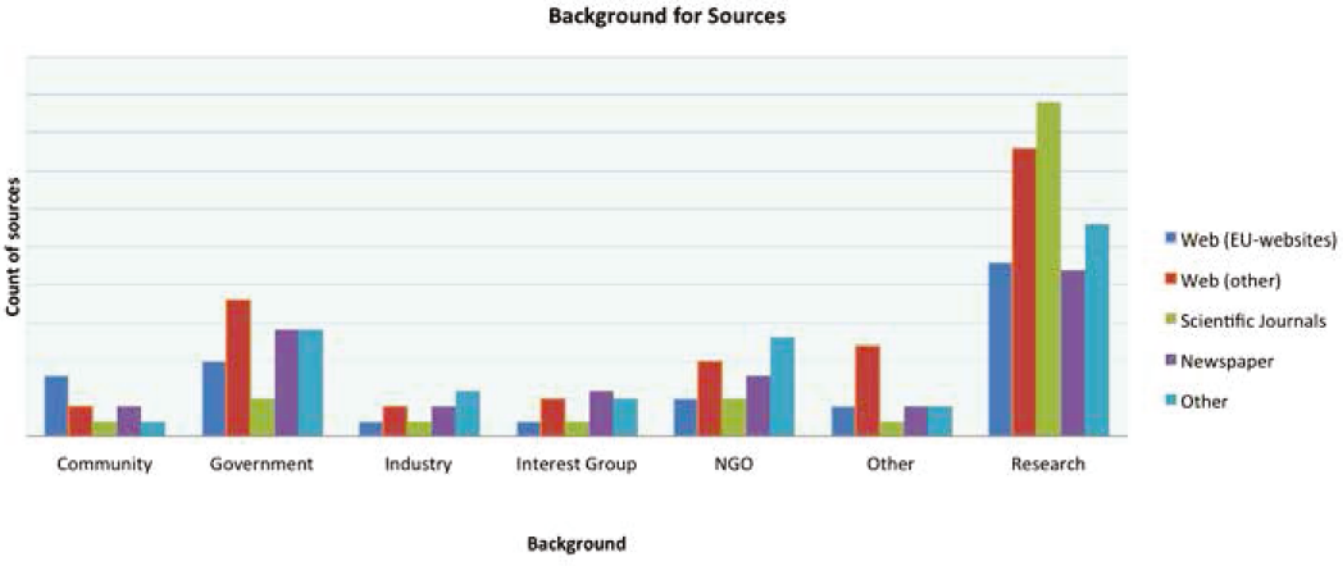

Figure 9. *Information sources used by stakeholder group*

Nature, Science, Polar Journal, and Arctic. Respondents from governance, NGO, and industry backgrounds cited general preferences for receiving information through websites and newspapers (see Figure9).

Internet integrating system

Internet integrating systems are tools that allow a simultaneous search of several databases. The amount of information and data collected on the Arctic region, and interest in accessing it, has increased in recent years and continues to grow rapidly. Therefore, new approaches must be provided to manage and share such information. In this context, many research groups are developing new infrastructure, built on web technologies, to implement resources (i.e., data, services, and documents) discovery, access, and visualization. According to such an approach, user and data providers are not asked to implement any specific interoperability technology, but to continue using their tools and publishing their resources according their standards (as much as possible).

Electronic/printed newsletter

A newsletter is a printed or electronic report of information and ideas that is distributed on a regular basis (e.g., monthly or semi-annually) to a group of interested people. This can be distributed either electronically ("e-newsletter") or in a printed version. A newsletter can serve many key purposes: keeping stakeholders up to date about new developments within the network; informing and educating the public about network developments; educating readers about other related Arctic news and developments; building a cohesive research network among members; and developing interest in projects, associations, research, and ideas. For an EU Arctic Information Centre, a newsletter should target key institutions and entities with an (actual or potential) interest on the activities of the project. A newsletter could be started at any time, although earlier is usually preferable, particularly when: large amounts of information need to be shared on a regular basis; there is a need to educate or inform impacted communities on relevant issues; there is a desire to attract new interested parties; and where there is a desire to build a sense of common purpose, motivation, or cohesion among network members. Given respondents' preferences for receiving information online, as well as gains in reaching greater numbers of recipients in a wider geographic range, and cost savings, an e-newsletter, using an email list or listserve, is the recommended approach.

Email lists

An email list – also called a listserve – refers to a group of people who communicate by email with one another through one single address. When people subscribe to (sign up for) a list, their email addresses are added and then, when anyone subscribed sends a message to the main email address, a copy of the message goes out to each person on the list. People can respond to the list address, entering into a group discussion, or they may wish to respond off-list or privately by emailing another list member directly without using that mailing list address. Email lists can serve many functions. They can serve as means to: quickly and inexpensively get information (including, e.g., an e-newsletter) out to a large number of people; create a forum for discussion of ideas and issues; encourage interested parties to engage and to offer support and assistance; and monitor the interests of subscribers.

Social media and networking services

A social networking service is a platform to build social networks or social relations among people who, for example, share interests, activities, backgrounds, or real-life connections. Social networking services are web-based services that allow individuals to create public profiles, to create a list of users with whom to

Box 2. Arctic Websites

From the small sample of replies specifying particular websites used to fill information needs, the following were most commonly cited:

- Arctic Centre – University of Lapland: www.arcticcentre.org
- Arctic Portal: www.arcticportal.org
- SAON – Sustaining Arctic Observing Networks: www.arcticobserving.org
- Strategic Environmental Impact Assessment of development of the Arctic: www.arcticinfo.eu
- Barentfsinfo.org Portal: www.barentsinfo.org

These include the Preparatory Action website, as well as websites maintened by the project lead, the Arctic Centre. While this may indicate successful dissemination of Prepartatory Action materials, it is also likely that there is a bias among respondents affiliated with project partners.

share connection, and to view and link the connections within the system. Approximately 30% of survey answers regarding respondents' preferences on receiving additional Arctic information showed a preference for social media. The Preparatory Action has already begun making use of Twitter to share project deliverables and network information, something that an EU Arctic Information could further promote. Another approach for an EU Arctic Information Centre to explore could be to create an open group on Facebook for reaching out to interested parties on Arctic challenges and information, sharing network information and projects, and connecting with stakeholders and network members.

VII.1.2 PRINTED MATERIALS

In accordance with the target audience and types of dissemination identified, a variety of printed materials – such as reports, printed newsletters, and brochures – are additional communication tools that are available and can supplement electronic outreach.

Reports

Reports are a fairly traditional modes of communicating information that can be shared either in a printed version or published online (e.g., on an EU Arctic Information Centre website). These could be used to share information on Arctic research as well as on the activities of the EU Arctic Information Centre and network.

Brochures and flyers

Brochures could perhaps best be used to explain the purpose and services offered by an EU Arctic Information Centre. For almost any situation where there is an opportunity to introduce the network, a brochure – usually a small printed paper piece typically 8.5" x 11" or 8.5" x 14" – can be a useful and accessible tool. Brochures, flyers, and similar materials can briefly explain the network's purpose, history, and where to find additional information.

Journal articles and publications

A number of respondents, particularly from research background, indicated a preference for receiving information in scientific journals. While the EU Arctic Information Centre would not seek to replace traditional scientific sources, it could help to increase access via a portal indexing existing research and sharing open access publications. Additionally, as a way to bring visibility to the network, members should be encouraged to reference the Centre and network in publications where they assisted research efforts.

VII.1.3 OTHER METHODS OF INFORMATION SHARING

In addition to more traditional dissemination methods, it can be useful to use less traditional strategies. For example, workshops, conferences, or online discussion lists can yield a higher level of engagement from stakeholders. A high number of respondents noted an interest in these types of information exchange activities (see Figure 10).

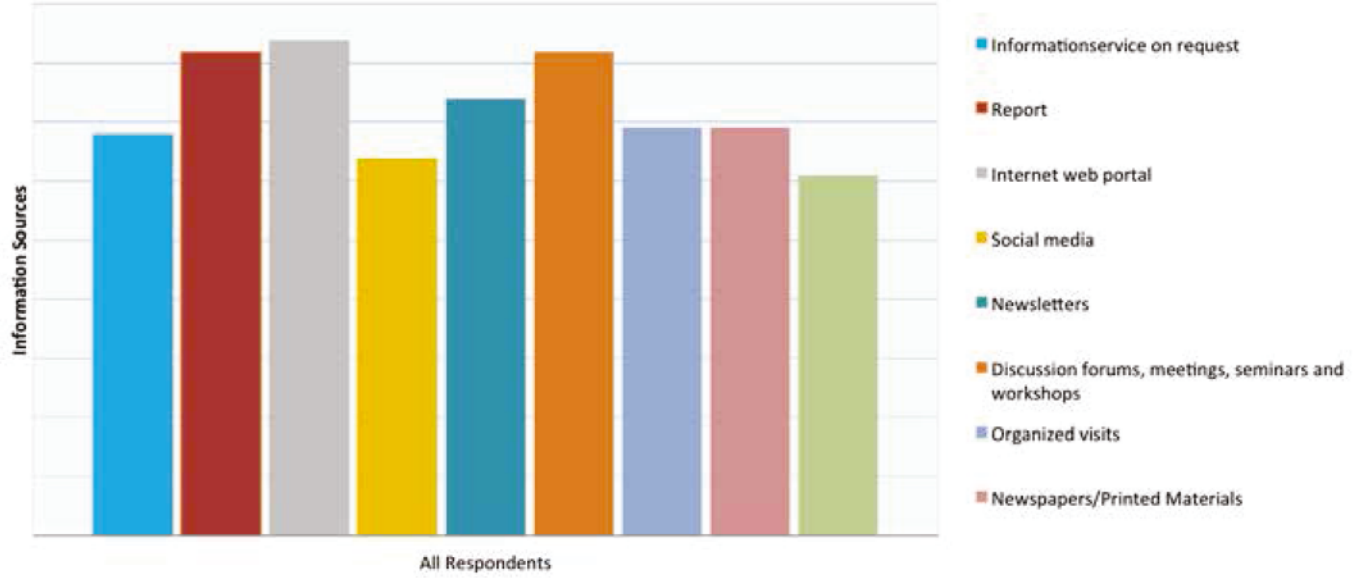

Figure 10. *Information preferences across all users*

VII.2 COMMUNICATION AND DISSEMINATION PLANS FOR THE NETWORK

"Dissemination" is a commonly used term that can carry different meanings for different audiences. Here, dissemination is understood to mean "delivering and receiving of a message." This can also be understood within the context of the GAR as communicating (or transferring) information (data and meaning).

Defining the purpose of dissemination is a first step to decide on the audience, message, method, and timing of the dissemination. All dissemination activities should have a purpose and should support or inform about project development. The purpose of the activity can be to, inter alia, share information, raise awareness (let others know what you are doing), educate (inform target communities or the general public), engage (get input or feedback from communities), and promote (share outputs and results).

When planning dissemination, it is important to decide when different dissemination activities will be most relevant. The ideal timing will depend on the progress of the project as well as on the agenda of the target audience. For instance, at the start of the project, it is best to focus on raising awareness; at the end on highlighting the achievements and deliverables. Like all other elements of a project, dissemination activities are targeted and can be more or less successful. To find out if the dissemination strategy was well chosen and well implemented, it is important to build an evaluation component into all major dissemination activities to monitor the quality and to see if they have achieved their aims. For example, the success of a website can be evaluated by checking usage logs; training sessions can be evaluated by asking participants to complete evaluation questionnaires; and publications can be evaluated by the number of citations.

While there are a wide variety of dissemination methods, it is important to select the right one(s) to get messages to the target audience and achieve the purpose. Each of these types of dissemination should be oriented to specific audiences in accordance to the aims of the EU Arctic Information Centre and network (see Figures 10 and 11.)

Means of dissemination	Purpose	Target Groups
Public website and portal	• Awareness • Information sharing • Education • Engagement • Promotion	• General public • Research • Government • NGOs • Industry • Interest groups
E-mail listserve	• Information sharing • Awareness	• Research • Government • NGOs • Interest groups
Newsletter	• Information sharing • Promotion	• Research • Government • NGOs • Interest groups
Social media	• Awareness • Information sharing • Promotion • Engagement	• Research • Government • NGOs • General public
Journals and publication	• Information sharing • Education • Promotion	• Research • Interest groups • Industry • Government
Workshops, meetings, and conferences	• Awareness • Engagement • Promotion • Information sharing	• Researchers • Government • NGOs • Interest groups • General public
Brochures and flyers	• Awareness • Promotion	• General Public • Interest groups

Figure 11. *Primary recommended means of dissemination*

Chapter cover image: Humpback whale.
Photo: GettyImages

VIII. ROLE OF AN EU ARCTIC INFORMATION CENTRE

The GAR's analysis makes clear that Arctic issues and challenges are marked by numerous information gaps and communication gaps. Respondents to the survey found that a great deal of information either did not exist to support users' information needs, or that existing information was not accessible or synthesized in an ideal manner. In light of these deficiencies, there are clear functions for an EU Arctic Information Centre to perform in helping to fill information needs and to meet the EU's Arctic objectives of promoting engagement and dialogue with Arctic States, indigenous peoples, and other partners[21]. Although a more prominent role for the Centre is evident for filling communication gaps, there are also ample opportunities for supporting the elimination of information gaps. Although a more prominent role for the Centre is evident for filling communication gaps, there are also ample opportunities for supporting the elimination of information gaps.

VIII.1 FILLING INFORMATION GAPS

To help fill gaps in information, where existing knowledge either does not exist or is inadequate, an EU Arctic Information Centre and network could facilitate information sharing and research collaboration between institutes. Survey respondents suggested that institutionalized international collaboration could help develop and execute long-range plans for data collection and sharing, particularly for monitoring and observations, helping to enable and improve knowledge creation. Serving as an information hub or clearinghouse, as discussed below, could potentially help guide researchers towards available data (e.g., through collection of metadata) and support enhanced research efforts. Coordinated research could also aid integrated analyses and regional impact assessments, which were named as gaps in survey responses. These functions would support the EU's Arctic objectives of supporting research and channelling knowledge, as well as international cooperation[22].

The EU Arctic Information Centre and network could also perform an important function in helping to inform EU research agendas. The majority of the research respondents identified highly-detailed information needs that corresponded with their individual areas of professional research. While this, on one hand, may create an element of bias in the relative importance of information needs, on the other, it points to richness in expertise within the network. Current Preparatory Action partners possess substantial multidisciplinary expertise on Arctic issues, and are connected to an even wider network of experts. In this way, the network could help connect researchers and policy-makers to identify information needs and areas for future EU research and funding. In addition to being able to recommend specialized information needs, many of the respondents surveyed were able to connect these to specific governance purposes. Having an EU Arctic Information Centre could help inform and support EU research agendas for the Arctic region, ultimately leading to the creation of new, essential knowledge for filling unmet Arctic information needs.

Support in filling information gaps is not only relevant for stakeholders in Arctic research but also for governments, as can be seen in the replies from government stakeholders (see section 3.2) where a large number of the information gaps hinted towards the need of a better science-policy interface.

VIII.2 FILLING COMMUNICATION GAPS

As described, many respondents experienced challenges in either accessing existing information or in synthesizing reports, data, and research from multiple and scattered sources. An EU Arctic Information Centre and network could help to improve the flow of information and reduce or eliminate communication gaps by connecting information users and providers to serve as an Arctic information hub. A large number of respondents, in what became a repeated theme, felt there was a need for centralized information. They described that while there are many sources of Arctic information, on various topics, these are generally scattered and difficult to access. The EU Arctic Information Centre could help to coordinate access to information sources from across partner organizations and across existing networks. The Arctic region spans eight countries and Arctic information needs – and sources – stretch far beyond, as demonstrated in the survey results. Moreover, important Arctic issues and trends span (and link between) disciplinary areas. To successfully work across borders, cultures, and disciplines, an intermediary between information providers and users may be needed. Information systems must often use intermediaries in order to achieve successful dissemination and application of information[23]. The Centre could serve as such an intermediary by being a central point of information exchange where information users could find sources and connect with providers. For example, one respondent wrote that "I've noted that the information is scattered and needs to be searched from various national sources, although the Arctic area seems to function as a regional cooperative beyond the

21. "Developing a European Union Policy towards the Arctic Region: progress since 2008 and next steps", EU Commission and High Representative of the European Union for Foreign Affairs and Security Policy, Joint Communication to the European Parliament and the Council, JOIN(2012)19 final, p. 4.

22. Ibid, pp. 6f. and 17f.

23. Faibisoff and Ely, Information and Information Needs, 4.

national borders." Stated another, "[t]here are a number of organizations offering information (e.g. reports, projects etc), but it would be easier if the information is on (sic) one place."

As described in section 7, the information sources used by and preferences of the respondents covered many forms of media (e.g., reports, a web portal, social media, etc.). An EU Arctic Information Centre could help to accommodate the communication preferences of multiple users and stakeholder groups by utilizing all or a number of the communication preferences and options.

Such a database could also be utilized to highlight the EU's own research and initiatives. The Community Research and Development Information Service (CORDIS) has a searchable database which details research output from EU-funded projects, including individual research projects as well as major multi-institution projects, like the programmes funded by the Seventh Framework Programme (FP 7). However, the CORDIS database only covers these types of EU-funded research programmes and not wider cooperation programs. The EU Arctic Information Centre could provide a single, accessible database of all (past and present) EU initiatives related to the Arctic.

By helping better distribute information, thus improving the flow of information, an EU Arctic Information Centre could help meet a number of purposes. First, the Centre could serve as a conduit through which to exchange information between policy-makers and Arctic communities. Multiple respondents noted that it was challenging for Arctic communities and local-level interests to be included in national, regional, or international decision-making processes. The network could serve as a central point of communication between these stakeholders and policy-makers, and help bridge geographic, language, and cultural barriers. Many respondents also remarked that they felt Arctic communities and their interests and needs are not well understood by those outside of the Arctic. Serving as an intermediary and platform for information exchange, with open and easy access to Arctic information, the network could help to improve information sharing from Arctic communities and transfers of meaning to non-Arctic groups. In addition to communication gaps between policy-makers and Arctic communities, or between Arctic communities and the public or NGOs, other respondents commented on a need for better communication between industry and communities, or between government and industry. In sum, an EU Arctic Information Centre could serve a much-desired function in facilitating better exchange between stakeholder groups. These functions also fit within the framework of other espoused goals of the Centre that have been advanced through the Preparatory Action and EUAIA in establishing long-term partnerships between Arctic stakeholders, EU policy-makers, and Arctic experts.

Better exchange between stakeholder groups and within governance proceeses would not only help meet the immediate goal of reducing communication gaps, but also long-term goals of promoting inter-regional sharing and cooperation and building a stronger foundation for Arctic cooperation and sustainable development.

Finally, improving the flow of information, and transfers of meaning as well as data, can help to improve cultural understanding and discourse. Many of the gaps identified by respondents described misunderstandings regarding the Arctic region and Arctic peoples, particularly from the public and interest groups outside of the region. Through better sharing and outreach to different stakeholders, policy-makers and the public, using methods such as those described in section 7, it is hoped that dialogue and awareness could be increased.

Chapter cover image: Common Guillemot.
Photo: GettyImages

IX. CONCLUSIONS AND RECOMMENDATIONS

The GAR offers a useful illustration of Arctic information needs as seen through the eyes of Arctic stakeholders. The results are not statistically representative, but serve to highlight certain types of information and communication gaps and trends regarding Arctic issues. Most importantly, for its purposes, the GAR provides a look at how an EU Arctic Information Centre and network could be used within the context of existing Arctic information and communication gaps.

Covering the whole range of thematic areas used by the EU Arctic Impact Assessment (EUAIA), the GAR shows information needs that need to be addressed and further assessed in every thematic area. To improve on specific information or communication gaps with limited resources, however, a (political) decision will be needed as to where to first focus efforts. From there, the GAR results can support network members in targeting specific issues using the replies from relevant stakeholders and supplementing with additional, more detailed information retrieved from the network's contacts, in order to quickly develop subject-specific, in-depth suggestions

IX.1 INFORMATION NEEDS AND CHALLENGES IN THE GAR

In general, the information gaps showed a lack of knowledge on and understanding of the widespread changes happening in the Arctic region. Climate change was a predominant theme, although all of the thematic areas (or mega-trends) – climate change, maritime transport, oil and gas exploitation, mining, changes to societies and cultures, and land use – were repeated themes in both information and communication gaps and the identification of major challenges for the Arctic. Social and cultural changes, too, were leading issues. For information gaps, other common themes in respondents' answers included:

- a need for integrated and cumulative assessments of impacts,
- monitoring efforts and baseline studies,
- impacts of resource extraction,
- sustainable development alternatives,
- maritime transport,
- northern and indigenous cultures and lifestyles,
- demographic changes,
- land use,
- investment and employment opportunities, and
- policy gaps

Communication gaps described in the survey generally illustrated inefficiencies or confusion in gathering information from multiple sources, failures to communicate between stakeholders or governments, and a perceived lack of understanding about the Arctic region and its people. Themes within these responses included:

- a need for more centralized information,
- sharing information on indigenous peoples and Arctic cultures,
- discourse on the Arctic that fails to recognize regional variations and differences,
- failures to transmit information on training and preparedness,
- communication gaps between different stakeholders, and
- failure to communicate information between governments or government levels

Many needs and gaps were found to be overlapping, but in general, the breakdown by human need enabled a useful perspective on what information is needed and for what, as well as to categorize types of needs for subsequent discussion. Similarly, the division of information needs according to stakeholder groups and regions helped to examine the needs of different users, as well as help assess the reach of the survey and existing network. Not surprisingly, the types of responses from many stakeholder groups mirrored the backgrounds of the survey respondents. The human need of Understanding the Arctic received the largest number of responses, with a relatively even split between the sub-needs of natural sciences and social sciences. This is particularly interesting given the need's multi-purposed nature. However, the weight given to different needs or uses could be expected to change with more a comprehensive stakeholder network and alternative methods of engagement and communication, which may be seen as next steps for research.

The supplemental information on main Arctic challenges enabled a wider perspective as to the priorities and needs of information users, including asking whether information needs are perhaps associated with major Arctic issues. In many cases they were, insinuating that better information and communication are related to meeting Arctic challenges. In other cases, there was a divergence between information needs and challenges, perhaps indicating that factors other than information and communication are more critical in relation to major Arctic challenges.

IX.2 AN EU ARCTIC INFORMATION CENTRE TO MEET INFORMATION NEEDS

The GAR demonstrates where there could be clear roles for an EU Arctic Information Centre in helping to meet information needs. Generally, these are stronger in the area of communication gaps, but the Centre could also facilitate the reduction of information gaps.

The most striking opportunity for the Centre, based on respondents' replies, would be in serving as an information centre or hub. There were repeated answers, covering multiple issues and thematic areas, expressing challenges in locating and using dispersed Arctic information sources.

Additionally, in order to reduce communication gaps, an EU Arctic Information Centre could:

- serve as an intermediary between information providers and users, and
- meet the communication preferences of multiple users and stakeholder groups,

For information gaps, an EU Arctic Information Centre could:

- enable research collaboration,
- help inform EU research agendas,
- provide a database for EU Arctic initiatives, and
- facilitate better exchange between stakeholder

The EU Arctic Information Centre Network Feasibility Assessment (NFA), which was produced alongside and independent of the GAR, similarly points out services and products that the Centre could provide and which would help to fill information and communications gaps[24]. For example, on promoting information access, the NFA suggests tools such as factsheets, serving as a clearinghouse about Arctic issues, information on request, expert commentaries, satellite imaging services, books and reports, and more. On two way dialogue and mediation, the NFA suggests tools for the Centre such as stakeholder workshops, online forums, seminars, Arctic Indigenous Peoples and Saami Dialogues, and impact assessments. Other ideas for outreach and communication, like many of those in section 7, included in the NFA are a website, social media, features, newsletters, publicity materials, and networking and media events. The NFA's additional, independent analysis further supports the GAR's conclusions regarding the role and usefulness of an EU Arctic Information Centre.

In conclusion, the GAR creates a useful picture of select Arctic information needs and demonstrates how an EU Arctic Information Centre could fill these, including through a variety of communication methods (section 7). Although the scope of the GAR in the context of the Preparatory Action is limited, it can also be seen as a building block for further research, such as:

- performing targeted assessments of information and communication gaps for specific issues and users that allows a more detailed examination and analysis,
- continuing to utilize the growing stakeholder networks being developed through the Preparatory Action and network, and
- better assessing gaps (whether truly information or communication gaps) via an improved AInC and other databases

24. Arctic Centre, University of Lapland, Network Feasibility Assessment, Paula Kankaanpää, Kamil Jagodziński, Preparatory Action, Strategic Environmental Impact Assessment of Development of the Arctic. (Rovaniemi, Finland, 2014), 49 et seq.

Chapter cover image: Fishing boat coming home.
Photo: GettyImages

ANNEXES

ANNEX 1: ONLINE QUESTIONNAIRE

Welcome to the **online questionnaire** for the Gap Analysis Report (GAR), a part of the EU Arctic Impact Assessment (EUAIA). This questionnaire attempts to identify issues that either correlate to potential **information gaps** (information is not gathered) or **gaps in communication** (information is not distributed). Please add your input **until 17.02.2014**.

We aim to include a wide range of views, so we encourage you to add information to several aspects. To fill out the questionnaire, it should take you **not more than 5 minutes per aspect**. The personal information at the beginning of the questionnaire only has to be filled out once.

Overall, we would like to ask to follow these **six steps**:

Pick a **specific topic** that you would like to contribute to (for instance "living in the Arctic") and pick one from several **sub-topics** (for instance "Health").

Choose the **thematic area** in which you see the need for improvement (for instance "Land Use")

Please enter your **input**

Specify **sources** that you used to fill the gap so far

Optional: Add **more input** on another issue

Rank your inputs according to your **priorities**

We respect your **privacy**. User data submitted to this survey will never be given/sold to third parties. E-mail addresses (if submitted) will be used only for receiving our final draft before publication.

Thank you very much for your participation and your valuable input!

Where are you from? (required)

[Select: Arctic USA, USA, Arctic Russia, Russia, Arctic Canada, Canada, Arctic Norway, Norway, Arctic Finland, Finland, Arctic Sweden, Sweden, Iceland, North Greenland, South Greenland, Faroe Islands, Denmark, EU (non-Arctic), Other (Non-EU and Non-Arctic/specify)]

What is your background?

[Select: community, government, industry, interest group, non-governmental organization, research, other]

You selected ____ as your background. Can you please specify?

[free text]

Do you count yourself to an indigenous group? (not required)

[Select: yes/no]

Gender (not required)

[Select: male/female]

What is your first name? (optional - answer will be kept confidential and will not be disclosed)

[free text]

What is your last name? (optional - answer will be kept confidential and will not be disclosed)

[free text]

At what email address would you like to be contacted? – If you provide us with a valid email address, you will receive our draft final report for feedback before it is published.

[free text]

Which of the following best describes your current occupation?

[Select: government; management; business and financial; computer and mathematical; architecture and engineering; life, physical, and social science; community and social service; legal; education, training, and library; arts, design, entertainment, sports, and media; healthcare practitioners and technical; healthcare support; protective service; food preparation and serving; building and grounds cleaning and maintenance; personal care and service; sales and related; office and administrative support; farming, fishing, and forestry; construction and extraction; installation, maintenance, and repair; production; transportation and materials moving; other/specify]

Please choose a topic where you see the need for additional information or better communication of information:

[Select: Living in the Arctic; Investing in the Arctic; Working in the Arctic; Travelling in the Arctic; Governing the Arctic; Understanding the Arctic]

Please select a sub-topic that you would like to contribute to:

Living in the Arctic - [Select: Housing; Education; Health; Food; Immigrant Support; Culture; Sports; Religion]

Investing in the Arctic - [Select: Costs; Bureaucracy; Reliability; Infrastructure; Regulations; Political Trends; Environmental Issues; Start-up; Market]

Working in the Arctic - [Select: Opportunities; Salary; Rights; Management]

Travelling in the Arctic - [Select: Transportation (Roads, Trains, Air, Sea); Infrastructure; Accommodation]

Governing the Arctic - [Select: Informal/Voluntary Initiative; Impact Assessment; White paper; Local Regulation; Sub-National Regulation; National Regulation; Regional; European Union]

Understanding the Arctic [Select: Natural Sciences; Social Sciences]

Please select now the thematic area you would like to address:

[Select: Climate Change; Fisheries; Land Use; Maritime Transport; Mining; Oil and Gas; Society and Culture]

Please enter if you see specific need for new/additional information or rather for the improved flow of information/ communication:

[Select: New/additional information; Improved flow of information/communication]

Please enter some details on your information need regarding _____:

[Free text]

Please specify your sources of information that you used to fill the information gap so far:

[Select: Web (EU-websites); Web (other); Scientific journals; Newspaper; Other]

Would you like to add additional input in another field or thematic area?

[Select: Yes; No]

Option to repeat questions 10 - 15

According to your experience, what are the three main problems / challenges that the Arctic faces today?

[Free text]

Which other stakeholders would you like us to share this survey yet? Please provide an email address.

[Free text]

How would you most like to receive additional information regarding the Arctic?

[Select: Information service on request, Reports; Internet web portal; Social media; Newsletters; Discussion forums, meetings, seminars, and workshops; Organized visits; newspapers; Other (please specify)]

ANNEX 2: SURVEY RESULTS

Overview of survey responses on human needs, sub-needs, and thematic areas

Human needs	Thematic Areas Sub needs	Climate Change	Fisheries	Land Use	Maritime Transport	Mining	Oil and Gas	Society and Culture	Others
Living in the Arctic	Housing	0	1	0	0	0	0	0	0
	Education	0	1	0	0	0	0	1	0
	Health	2	0	0	0	0	0	0	0
	Food	0	1	0	0	0	0	0	0
	Immigrant Support	0	0	0	0	0	0	0	0
	Culture	1	0	0	0	0	0	5	0
	Sports	0	0	0	0	0	0	0	0
	Religion	0	0	0	0	0	0	0	0
Investing in the Arctic	Costs	0	0	0	0	0	0	0	0
	Bureaucracy	0	0	0	0	0	0	0	0
	Reliability	0	0	0	0	0	0	0	0
	Infrastructure	0	0	0	1	4	1	1	0
	Regulations	0	1	1	0	1	1	0	0
	Political trends	0	0	0	1	0	0	0	0
	Environmental issues	1	0	0	0	1	1	0	0
	Start-up	0	0	0	0	0	0	0	0
	Markets	0	0	1	0	1	0	0	0

Human needs	Thematic Areas Sub needs	Climate Change	Fisheries	Land Use	Maritime Transport	Mining	Oil and Gas	Society and Culture	Others
Working in the Arctic	Opportunities	0	0	1	1	3	0	1	0
	Salary	0	0	0	0	0	0	0	0
	Rights	0	0	0	0	0	0	1	0
	Management	2	0	0	0	1	0	0	0
Travelling in the Arctic	Transportation (Roads, Trains, Air, Sea)	0	0	0	3	1	0	0	0
	Infrastructure	0	0	1	1	0	0	1	0
	Accommodation	0	0	0	0	0	0	1	0
Governing the Arctic	Informal/ Voluntary Initiative	0	1	0	1	0	0	0	0
	Impact Assessment	1	0	1	2	4	1	0	0
	White Paper	0	0	0	0	0	0	0	0
	Local Regulation	0	0	1	0	0	0	0	0
	Sub-National Regulation	0	0	0	0	0	0	0	0
	National Regulation	1	0	3	0	0	0	0	0
	Regional	0	1	0	2	1	2	1	0
	European Union	0	0	0	1	0	0	2	0
Understanding the Arctic	Natural Sciences	12	4	2	3	2	3	1	0
	Social Sciences	2	0	3	3	2	0	6	0