

ICARP II – SCIENCE PLAN 1

ARCTIC ECONOMIES AND SUSTAINABLE DEVELOPMENT



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PREFACE

The Second International Conference on Arctic Research Planning (ICARP II) was held in Copenhagen, Denmark from 10 November through 12 November 2005 and brought together over 450 scientists, policy makers, research managers, indigenous peoples, and others interested in and concerned about the future of arctic research. Through plenary sessions, breakout sessions and informal discussions, conference participants addressed long-term research planning challenges documented in twelve draft research plans. Following the conference drafting groups modified the plans to reflect input from the conference discussions and input from the ICARP II web site. This science plan is the culmination of the process.

ICARP II Science Plans

Science Plan 1	Arctic Economies and Sustainable Development
Science Plan 2	Indigenous Peoples and Change in the Arctic: Adaptation, Adjustment and Empowerment
Science Plan 3	Arctic Coastal Processes
Science Plan 4	Deep Central Basin of the Arctic Ocean
Science Plan 5	Arctic Margins and Gateways
Science Plan 6	Arctic Shelf Seas
Science Plan 7	Terrestrial Cryospheric & Hydrologic Processes and Systems
Science Plan 8	Terrestrial and Freshwater Biosphere and Biodiversity
Science Plan 9	Modeling and Predicting Arctic Weather and Climate
Science Plan 10	A Research Plan for the Study of Rapid Change, Resilience and Vulnerability in Social-Ecological Systems of the Arctic
Science Plan 11	Arctic Science in the Public Interest
Background Document	Contaminants

1.1. Introduction

Sustainable development, as defined by the World Commission on Environment and Development (1987), is “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” Inherent in this definition is the need to balance competing interests and to track multiple indicators to evaluate success (Kates and Parris, 2003; Parris and Kates, 2003). Thus it may be said that *sustainable development requires the ability to set and achieve multiple social and environmental objectives in the context of change, through the management of human behavior*. Such a statement merely opens the door to the many implications of sustainable development for society. Long-term sustainable development requires political support, which means that environmental sustainability must be matched with social and economic sustainability to ensure continued support for the actions that are required. To date, the concept of sustainable development has received considerable attention from researchers globally (e.g., Berkes, 1989; Trzyna, 1995) and in the Arctic (e.g., Caulfield, 1997; Sejersen, 2002; AHDR, 2004).

For the Arctic, sustainable development offers a compelling vision and a host of practical and intellectual questions. Due to recent influxes of immigrants and industrial-scale development of oil and gas, minerals, and fish stocks, new economic bases have been created in the public and service sectors as well as in resource extraction (AHDR, 2004). Arctic peoples are involved in these recent changes to varying degrees around the region, but the impacts on arctic communities and indigenous cultures have been profound (e.g., Minority Rights Group, 1994).

Today, sustainable development as a concept appears to offer useful guidance for arctic societies and economies. At the same time, sustainable development may imply something very different to different individuals or groups, for example to those involved in extractive industries versus those providing social services, or when examined from the local versus the national perspective. Similarly, the Arctic as a region covers a diverse array of environmental and societal characteristics. The different concepts of sustainable development have to be tested and compared.

Economic development in general can be defined in terms of freedom of choice and access to opportunities (e.g., Sen, 1999). While economic growth is a necessary condition for achieving economic development it is not a sufficient condition. Economic development implies more, and also must take into account distributional issues as well as other concerns. Besides access to resources and the distribution of income and wealth and individual capabilities as suggested in Sen’s capability theorem, it is of importance to address the question of socio-economic systems and system impact on growth and development. Several economic systems were or are prevalent in arctic regional economies, which suggests that institutional factors are at play when assessing causalities of growth and development. Research should be formulated to investigate the association between economic growth and human and economic development, including the link between economic development and human development in the Arctic. This question especially stresses the human dimension of economies and economic development. How do people match economic strategies with community maintenance and quality of life? And who benefits from economic development?

The United Nations’ Human Development Report (UNDP, 1996) analyzed the link between human development and economic growth. The report argued that there is no automatic link between growth and human development, and that more attention must go to the structure and quality of growth – to ensure that it is directed to supporting human development, reducing poverty, protecting the environment, and ensuring sustainability. In this view, the focus of development should not be on the quantity of economic growth, but rather on the quality of that growth (e.g., Vanek, 1970; Lutz and Lux, 1988; UNDP, 1996). For example, participatory ownership of companies has been shown to improve worker morale and productivity (Levine and Tyson, 1990; Conte and Svejnar, 1990; Winther, 1995; Winther and Marens, 2003), although little such research in the Arctic has taken place (e.g., Winther and Duhaime, 2002). If such an approach better matches arctic indigenous cultural values, research could be done to examine how this model of ownership and management compares with

conventional models. Such research would help illuminate the links between human development and economic development.

This ICARP II science plan begins with a focal question stressing the complex problem of linking arctic economies to sustainable development. Seven key scientific questions are then explored under three main headings:

- The meaning of sustainable development
- Influences on sustainable development
- What sustainable development implies

The questions are intended to challenge common assumptions about the Arctic and about sustainable development, leading to a better understanding of if and how the concept of sustainable development can be usefully applied in the Arctic. Next, there is a reflection on the significance of research into sustainable development, from the point of view of an indigenous arctic resident in the working group. Finally, the science plan describes how this vision for a research program links to other work underway in the Arctic, what outcomes it is likely to produce, how it can be carried out, and in general terms what funding is required.

1.2. Focal Question

How do arctic economies work and how are they linked to issues related to sustainable development in general and to human development of arctic residents and communities in particular?

There are many potential starting points for considering sustainable development in the Arctic. The selection of arctic residents and communities as the initial focus in this ICARP II science plan serves two purposes. First, it underscores that arctic peoples are the ones most dependent on the future of the Arctic. Cultures found only in the Arctic simply have no feasible alternatives to their homelands if they are to sustain their cultures. They are thus the most vulnerable members of society with respect to events in the Arctic. Second, arctic communities and residents are closely linked to their environments and to the economic, political, and social development of their regions. They are thus centrally located in the conceptual space of sustainable development, tied to the various strands that connect the various elements of the Arctic that are involved in the examination of sustainable development.

At the same time, the quest for sustainable development in the Arctic is hardly limited to indigenous and other local communities. All the key scientific questions discussed in this report can be applied to all arctic residents as well as to those who live elsewhere but work, do business with, or interact with the Arctic in other ways. For example, the majority of arctic residents live in cities, with interests and needs that are distinct from those of people living in small villages or in the countryside. Sustainable development cannot be achieved for only a portion of a society, and thus consideration of the topic must address all those who have a stake in the future of the Arctic.

The focal question also implies a purpose to the research described below. While that research has inherent interest and value, it also has implications for arctic peoples, and as such should be careful to include consideration of its impacts for good or ill to arctic residents. It is not suggested, of course, that research into sustainable development should aim to promote a particular outcome, nor that it should turn into advocacy for a particular group or point of view. Instead, research should seek to provide objective understanding that will support sound decision-making with clear recognition of the costs and benefits associated with a particular action. Research into sustainable development cannot avoid becoming part of the quest for sustainable development, and thus the researchers must recognize their roles and responsibilities in a dynamic system (e.g., ICSU, 2002).

1.3. Key Scientific Questions

1.3.1. The Meaning of Sustainable Development

Definitions

Questions

How do the concept and the evaluation of sustainable development vary with cultural and societal context and across spatial and temporal scales?

- *What does sustainable development mean in different cultures, settings, languages?*
- *How do goals of sustainable development differ?*
- *How do the different perceptions of sustainable development relate to the original definition?*
- *Can “sustainable development” be rigorously defined (i.e., with quantitative measures to allow evaluation of the degree to which an activity or a society is sustainable), at least with respect to the Arctic?*

Discussion

The term “sustainable development” has different translations and shades of meaning in different languages or in political versus economic contexts. For example, sustainable development in Russian is translated as *ustoichivoe razvitie* which, translated back to English, means “stable development,” and carries a different meaning. Clearly, assessment of sustainable development will depend on precisely how the term is understood. There is an urgent need to examine and compare how the term and its synonyms are used and understood, not just at the national level, but also locally and particularly for indigenous communities.

What kinds of activities can be considered “sustainable” also depends on the scale being considered. For a multi-national corporation, sustainable development may mean spreading activities around the globe, with less concern about a particular mine or oil field. At the local level, however, what happens at that particular site is crucial. Similarly, communities with high immigration and emigration may have shorter time horizons than communities with a more stable population and thus different perspectives on the time span over which sustainable development should be evaluated.

Different institutions will approach sustainable development differently, and the specific aspects of sustainable development may support or conflict with one another. Private sector and public sector goals may differ. The legal regime may support one approach, whereas popular political action may promote a different approach and seek to change the legal regime accordingly. A cautious approach to fish quotas may make environmental sense, but not be economically or politically viable for the long term. Understanding and assessing these perspectives is vital to recognizing the many influences that affect sustainable development and thus the question of combining long-term economic growth with human development and environmental protection.

Scientific Approaches

This set of questions is inherently comparative. Several lines of inquiry can be pursued, including:

- Compilation of, with commentary on, the terms equivalent to “sustainable development” in various public documents, policy papers, and arctic languages and locations. This approach would require literature review and, most likely, fieldwork to interview members of various ethnic and other groups in different occupational and other social roles around the Arctic. The result would be a comparative assessment of the basic terms used, pointing to further research to compare and contrast groups and places with various perspectives on sustainable development.

- Assessment of the goals of sustainable development in various contexts. Terminology is a useful start, but determining what specific goals are recognized as part of, or consistent with, sustainable development will add depth to understanding similarities and differences across regions, cultures, and contexts. This approach would also require literature review followed by interviews, supported by in-depth case studies to get beyond superficial statements of aspiration or intent, and instead to examine actual practices and experiences.
- Comparison of perspectives and roles of various actors. In addition to comparisons across locations, cultures, and spatial scales, further comparisons can be made of the ways in which sustainable development is framed and sought by the various actors within each area. This approach would require a series of case studies, ideally set up from the beginning to foster comparison and to identify common themes and patterns.
- Evaluation of the various forces affecting sustainable development. Case studies can also help identify the interplay between economic, social, environmental, political, legal, cultural, and other forces that influence sustainable development. Comparisons among the case studies may identify themes and patterns as well as lessons in how potentially conflicting forces and perspectives can be reconciled or managed.
- Development of a rigorous definition of sustainable development. Such a definition should be quantitative, in that it should be possible to assess the degree to which a given activity or society is sustainable. Developing such a definition will almost certainly require a great deal of testing and refinement, but in the end can help overcome problems of vagueness and subjectivity that often plague discussions of the topic. Elements of this definition are addressed in the following section on Indicators.

In all cases, the studies will require an interdisciplinary character to ensure that the various perspectives on sustainable development are captured adequately. Theoretical development to facilitate effective interdisciplinary investigation of these questions is also highly desirable.

Indicators

Questions

What factors are most important in achieving sustainable development in different cultural and societal contexts and at different spatial and temporal scales?

- *What are the key, relevant indicators?*
- *How can these indicators be measured and monitored?*
- *How can indicators capture the complexity of sustainable development in the Arctic?*
- *How can a suite of measures and indicators be turned into qualitative, quantitative, narrative, or other models and scenarios?*

Discussion

Sustainable development requires consideration of multiple environmental and social parameters, but not all parameters will have equal significance in each case. Indicators have been developed or sought for many aspects of societal and environmental well-being (AHDR, 2004; Meyerson et al., 2005), but the interplay among them requires more study (Kates and Parris, 2003). Identification of indicators is also only a first step. To be useful, it must be possible to gather reliable data on them and to use those data in analysis and modeling.

The development of indicators for the Arctic will require a more complete understanding of how arctic economies work. In broad terms, arctic economies are characterized by large-scale resource exploitation, the export of resources to markets outside the region, and the control of those resources

by outside sources of capital where often only a fraction of income and profits remain within the Arctic. Furthermore, the size of spin-off effects from resource exploitation and economic consequences varies considerably across and within regions, ranging from virtually no impacts to sizable impacts, positive or negative for local and regional economies. Aside from economic impacts, large-scale resource exploitation has considerable impact on the local natural and human environment (AHDR, 2004).

A particular challenge of developing a suite of indicators is achieving robustness without losing the ability to address specific circumstances. Indicators that are useful only for particular regions, issues, or conditions cannot be readily applied elsewhere, preventing a common definition and assessment of sustainable development. Indicators that are too general may miss particular characteristics of a community, region, or industry that are major influences on sustainable development. For example, the strength of social networks is hard to assess and its significance varies greatly from place to place. Nonetheless, the presence of resilient social networks can greatly enhance a community's ability to provide for itself reliably through time.

Similarly, indicators may vary in relevance and applicability over spatial scales. Aggregate data for an entire region may show general trends and indicate the potential role of regional government, but may not capture local variation and the role of local businesses, institutions, and individuals. Trends in gross domestic product or regional employment, for instance, may mask much wider variation at the local level. Balancing perspectives and feasibility of data collection is a significant challenge in the creation of indicators of sustainable development.

Scientific Approaches

- Comparison and analysis of widely available data, such as those collected in national and economic censuses. It would be worthwhile compiling a list of regularly collected data for various regions, to see what is readily available and to analyze the results to determine how effective those data would be for answering questions related to sustainable development. Such analysis should consider how well available data address sustainable development at various spatial scales. Additional data gathering must be pursued to strengthen the overall analysis.
- Case studies to determine which data are relevant to assessing sustainable development. In many places in the Arctic, sustainable development is an explicit policy goal for economic development or environmental management. An examination of how that goal is defined, measured, and pursued would indicate the potential for various indicators. Furthermore, such an assessment should consider whether standard definitions, such as “unemployment” which typically requires that the individual has sought work recently, accurately capture what is occurring in arctic communities. Comparative analyses across case studies would indicate the robustness of various sets of indicators and thus their suitability for broader application, again considering multiple spatial scales.
- Modeling to assess utility of indicators for planning and prediction. Sustainable development is ultimately a matter of planning, which in turn requires reliable projections of the implications of various decisions. If a set or sets of indicators can be used effectively in modeling of this kind, they will have immense utility in the policy arena as well as in further scientific research.
- Comparison and analysis of available data to analyze the nature of large-scale resource exploitation, its impact on regional and local economies, and research on the actual net outflows (a comparison of outflows in the form of profits and rents and inflows in the form of transfer payments).

1.3.2. Influences on Sustainable Development

Determinants

Questions

What are the determinants of sustainable development in arctic contexts?

- *How do arctic economies work?*
- *What is the role of communities?*
- *What is the role of industries and large-scale resource use?*
- *What are the roles of government policies and their implementation?*
- *What is the role of environmental change, including climate change?*
- *What is the role of economic systems?*
- *What is the role of globalization?*
- *What is the role of infrastructure and technology?*
- *What is the role of subsistence?*

Discussion

Arctic communities and industries vary in their ability to influence and promote particular policies, practices, and discourses on economies and sustainable development. Much depends on the rights of a given community, industry, or people: their level of power within local, regional, and national government; their ability to effectively exercise that power; what laws exist and how they are enforced to protect the long-term environmental, cultural, political tenacity of arctic communities; and the psychological climate within the local communities and regional power structures to work together towards these goals. The variance across arctic communities can be seen in struggles over rights to resources (including land, e.g., Young, 1992; Osherenko, 2001), both on a subsistence and a profit level, over the proper protection of the environment, over the control to live according to certain cultural prescriptions (self-determination), and over decision-making processes (self-government). The policies of national, regional, and local governments, and the ways those policies are implemented, may be the key constraints on the quest for sustainable development (Tishkov, 2004).

Across the circumpolar north there is increasing activity towards sustainable community development via resource governance and widening involvement in the global economy (AHDR, 2004: 132). Community viability can be enhanced through partnerships with outside actors in developing natural resources, job creation and training, and accessing international markets (AHDR, 2004: 139). Economic growth is thus pursued to strengthen communities and to support human development. However, sometimes local communities have and exercise their rights but those rights are not fully attended to in negotiations (e.g., diamond mining in the Northwest Territories; see Bielawski, 2003). This calls into question the balance of power and the viability of indigenous self-determination and self-government. Additionally, the colonial legacy of the north has affected local people's psychology, creating in some times and places a paternalistic relationship with the state that impedes a move towards self-determination, while also solidifying stereotypes that perpetuate the lack of knowledge and responsibility among governmental and power structures to facilitate local empowerment.

The nature, workings and structures of arctic economies are also determined by larger “outside” influences. Global environmental change compromises the viability of subsistence economies, most notably the recently documented effects of global warming (ACIA, 2005) and the accumulating effects of transboundary air and water pollutants. Globalization similarly poses challenges to, and creates opportunities for sustainable development in the Arctic on at least two levels: (1) its cultural “disembedding” effect that works to transform the orientation of arctic residents, especially youth, from local subsistence-based to western consumer-oriented values as it constitutes new networks and cultural points of orientation and priorities; and (2) its increased pressure on local resources for use in distant places, the development of which brings many changes to northern communities in the process

of accessing, exploiting, and producing goods for the south (e.g., Pika and Bogoyavlensky, 1995; Nellemann et al., 2000). The change from self-sustained nation building towards an open economy with the emphasis on globalization and international cooperation challenges the basic demarcation of arctic economies as such.

The production of goods and services in the Arctic takes place under a variety of institutional, governmental, and resource conditions. The arctic economy comprises three parts all of which are linked to the Arctic's resources. The industrial economy produces resources primarily for sale outside the region. The traditional economy produces goods and services for local consumption from the region's resources. The transfer sector of the arctic economy represents the flow of funds between governments and citizens of the region and higher levels of government. These sectors have their own economic geography with different implications for scale in the production of these goods. Around the north economies operate in a wide variety of resource, institutional, and governmental situations that provide data for understanding how these economies respond to changes in important factors. Understanding the economies' response to changes must be central to any attempt to implement new policies in the Arctic.

In terms of linkages or input-output relations an important question is whether local resources like labor, real capital, financial capital, human capital, and technology could utilize the derived demand from large-scale resource exploitation. In essence it is a question of backward and forward linkages in relation to large-scale oil and gas production and mining. A worst-case scenario could imply that imported technology and factors of production substitute local resources. A development strategy based on self-reliance and increasing economic independence from centers in the south may suffer from dependence that constitutes monetary flows out of the regional economy instead of creation of value added within the region. This directs attention to income flows, capital movements, and overall regional current accounts.

While large-scale resource exploitation is a central characteristic of the formal economy, subsistence, in the form of customary harvesting, continues to play an important role, although the extent of this practice varies between and within regions of the Arctic. Customary harvesting makes an important contribution to food production and consumption, just as it is embedded into the modern world (AHDR, 2004: 74).

Macroeconomic analysis of the open-trade economy suggests the importance of structural distortions due to a booming sector based on large-scale exploitation of natural resources. The so-called "Dutch Disease" phenomenon paints a picture of a sector of tradables squeezed due to extraction of labor moving to the boom sector. Moreover labor is attracted to the sector of non-tradables enjoying an increase in aggregate demand due to the booming sector's activities. Both the resource mobilization effect and the spending effect may make large-scale exploitation of natural resources a mixed blessing. A de-industrialization effect could imply an economy experiencing inflation, lower exports, and a booming resource sector at the same time (Winther, 2003). The phenomenon was first experienced in the years after the natural gas finds at the Schlochteren fields in 1969 in the Netherlands and the subsequent establishment of a large-scale production of natural gas. The evidence on the phenomenon is mixed, and it seems that enforced savings in large-scale funds like in Norway (Petroleumsfonden) and in Alaska (the Permanent Fund) may impose a constraint on the de-industrialization process.

The successful application of technological advances can be counted as one of many success stories in the Arctic: "Evidence from the Arctic demonstrates both the feasibility and the desirability of applying advanced technologies to address social problems" (AHDR, 2004: 237). The Arctic has become a global leader in terms of the successful application and adaptation of emerging technologies to local circumstances.

The unique character of the Arctic has often been emphasized, and it is in this regard that globalization might be seen as a challenge or even threat to the region (Nuttall, 2005: 754). Natural resource development in the Arctic is typically conducted on a large scale, to overcome the high costs of access

and infrastructure in a harsh climate remote from markets. This helps explain the involvement of multi-national corporations, which are more likely to have the capacity to undertake development on such a scale. Globalization in the Arctic gives rise to a variety of environmental, social, and other costs, which have tended to be borne predominantly by marginalized native populations of the Arctic. At the same time, those living outside the Arctic have often been those reaping the benefits of globalization of the region (Nuttall, 2005: 756). The Arctic has a range of options in terms of how to deal with potential negative consequences of globalization. In particular, it has been argued that one solution would be to participate more actively in globalization, which would increase the chance of the region somehow neutralizing the negative implications of the process, just as it would help create further opportunities for the region (Nuttall, 2005).

So-called globalization has been scrutinized by Hirst and Thompson (2002), who question whether mankind is witnessing something that has not been seen before? Assuming that we are in the era of globalization, the economic paradigms advocated by supranational institutions like the International Monetary Fund (IMF), the World Bank, the Organization for Economic Cooperation and Development (OECD), and the World Trade Organization (WTO) become important. The overarching question is whether arctic regional economies will suffer the same consequences of neo-liberalism as seen in developing economies. Recent economic reforms in Greenland put an end to the uniform price system on freight, water and energy. The redistribution of real income due to these reforms cannot yet be fully appraised, nonetheless future reforms of liberalization in arctic economies needs analysis regarding socio-economic and distributional consequences.

Lastly, there has been some preliminary research into what constitutes community-level sustainable development (Crate, no date; Habeck, 2003; Nuttall, 1998; Sirina, 2005; Wilson, 1999). What constitutes and what determines sustainable development on a community level is diverse, due to the varying environmental, political, and cultural contexts in the Arctic. Russia is an especially stark example of a context where local communities lack many of the land and resource rights, civic experience and involvement, and political power necessary to secure the impact and benefit agreements and other consensual elements of northern resource development witnessed in other arctic areas (e.g., Crate, 2002). To some extent these barriers seem insurmountable, particularly if they require major political decisions such as the recognition of aboriginal land rights (e.g., Fondahl et al., 2001).

Scientific Approaches

- Characterize and model all aspects of arctic economies. The modern economy, based on flows of goods, services, and cash, does not capture the full extent of arctic economic activity. Traditional activities, such as hunting and fishing, contribute to local livelihoods without being captured in standard economic statistics. In addition, the factors influencing industrial development, the role and distribution of transfer payments, and the functioning of labor markets around the Arctic all need further investigation, in themselves and also as they are connected to one another.
- Conduct a pan-Arctic, comparative project investigating the determinants of sustainable development at the community or industry level. Inquiry would focus on how communities of industries define sustainable development and what factors determine whether or not they realize those ideas. Inquiry would also survey the regional, national, and other interests that are driving resource development in community areas to assess the extent to which they are / are not operating in sustainable ways. What are the drivers of both sustainable and unsustainable practices? Another component of the project would be to assess the effects of globalization on local communities and the extent to which this interplays with sustainable arctic economies.
- Conduct a pan-Arctic, comparative project investigating the interplay of local and regional/national governance. A common assumption is that local governance is most suited to achieving locally beneficial outcomes of economic, resource, and environmental management.

This assumption should be examined carefully, in particular by assessing the role of economic systems, national standards, national-level funding, and associated requirements in facilitating or constraining local management actions and their implications for sustainable development.

- Examine how economic opportunities are taken. From government service to resource extraction, there are many professional-level or other relatively high-paying jobs in arctic regions. Similarly, there are many possibilities for economic development through extraction, tourism, and so on. A comparison of opportunities across regions together with an evaluation of who takes advantage of those opportunities would help illuminate some of the structural supports and barriers facing arctic residents. This study should include a study of barriers and their implications on local and indigenous business interests.
- An analysis of outflows and transfers in relation to arctic resources. Analysis of large-scale resource exploitation, its impact on the regional and local economies, and its impact on outflows and transfers.
- Describe the arctic economy across regions and countries. How important are each of the sectors? How does the regional and local “GDP” vary? How do they interact with each other? How big are they?

Institutions and Regimes

Questions

How do local, national, and international institutions and regimes organize and run economies in the Arctic, and to what extent have those that exist been effective in achieving sustainable development?

- *What are the relationships among various institutions (governments, businesses, non-governmental organizations, etc.) in terms of influencing economies at various levels and scales?*
- *How do global and other international regimes influence and interplay with economies in the Arctic?*
- *What is the role of distribution of power, ownership and rights, with respect to the effective organization of economies and the achievement of sustainable development?*
- *How do limited capacities and the level of education constrain the abilities of communities to manage various and disparate efforts to promote their perspectives on sustainable development?*
- *To what extent have institutions and regimes been effective in achieving their aims of economic growth and human development?*
- *Do new government approaches allow a more encompassing approach to the design of models for economic development, resource management and human development?*
- *What is the current institutional system in the Arctic, and what are the consequences of recent institutional change?*
- *How are new institutions different in different regions of the Arctic?*
- *What has been the history of institutions in the north? What are the changes, and how did the changes come about?*

Discussion

Institutions and regimes play the major role in defining the balance between the environmental, social and cultural costs and human benefits of economic development as well as the distribution of benefits and wealth. As benefits and trade-offs of economic development are neither given, automatic nor unidirectional these institutions and regimes constitute one of the arenas where negotiations over resource control, ownership, rights, access, disposition and use take place. In this problem-complex the state takes on an important role as mediator between private interests and civil society.

Increasingly, the political systems in the Arctic recognize the unique position of indigenous peoples and have introduced political reforms and developed a multitude of structures (i.e., self-government, regional self-government, co-management) to take account of the rights and perspectives of indigenous peoples and the local non-indigenous population. Additionally, they have set up structures to attract and support economic development as well as environmental impact assessments. The degree of political and economic integration of local peoples constitutes in addition to increased integration in global political, legal, and economic systems some of the future challenges of arctic institutions and regimes.

Thus, institutions and regimes constitute one of the primary keys as well as a major barrier to implementing the social, cultural, economic and ecological goals of sustainable development (e.g., Forbes et al., 2004). Understanding the dynamics and effects of institutions and regimes are vital in order to assess and discuss the future direction of economic and human development in the Arctic.

Institutions define the rules of the game for an economy; property rights, laws, and traditional relationships define the economy's institutions. In some arctic nations the north has a different institutional structure than the rest of the nation. The most important factor is the significance of government in the northern economy. The government acts in its traditional role as rule maker and enforcer of these rules. It also participates in the economy as an owner of resources and patron of the significant transfer sector. The north has also seen much institutional change in the recent time period. Major changes in economic and political institutions at the national level as well as changes in ownership and control of resources locally affect the production of northern resources and the northern economy. Approaches to institutional change vary across the north and provide data for comparative studies of the role of institutions in the economy.

Privatization is a general trend that also applies to the Arctic. This trend in itself will not alter the Arctic's economic structure, but is most likely to affect the forms of economic development taking place (AHDR, 2004: 80). Globalization and neo-liberalism may impose a certain development path based on the idea of privatization, liberalization and outsourcing to private companies. In this context the discussion regarding alternative ownership structures, such as communalism, participatory ownership and empowerment may constitute an alternative model of privatization. Beside regional corporations, locally owned businesses and suppliers, and consumers' and workers' cooperatives can also be found in the North. If these ownership models pertain to indigenous peoples' values and at the same time have potentials in terms of growth and development further research on these companies is imperative, before northern communities move into traditional neo-liberal projects.

Scientific Approaches

- Compilation of the different legal structures that organize, control, and influence large-scale and small-scale economies. As some matters normally falling under local, regional and national control are now subject to binding international agreements or global limitations the approach must integrate all scales of the global political set-up. Of special importance is the establishment of criteria for a demarcation of the control and influence local peoples have in all aspects of economic development and priority setting.
- Assessment of the relationships between various institutions and regimes (international organizations such as the Arctic Council, European Union, World Trade Organization, national and local governments, indigenous organizations and governments, corporations and businesses, non-government organizations, etc.) in terms of influencing the direction of economic development at various levels and scales. The approach requires political and legal research but also interviews with actors on their roles in, experiences with and perceptions of the structures and systems. Additionally, the educational background and requirements of actors should be assessed.

- Comparison of how different systems have dealt with large- and small-scale economic development (including transfer of rights to indigenous peoples and/or private interests) and related these practices to the problem complexes associated with sustainable development. This study of dynamics of resource governance should be seen in the context of past and present political, social, economic, cultural and environmental changes in order to understand problems and reforms to their full extent.
- Research on the trend in privatization and the impact of privatization on economic structures at various levels, development and sustainability.
- Evaluation of what constitutes effective and sustainable resource governance and economies. Part of this research question includes the study of the flexibility and speed institutions may apply to respond to rapid changes and community viability. Additionally, the link between self-government and the effectiveness of establishing and running sustainable economies should be studied. Furthermore, the need for competence building in institutions and among actors should be evaluated. Part of this approach requires studies into how institutions have integrated local social and cultural values (e.g., customary law).
- Analysis of the role of property rights and who defines these, including an assessment of how private ownership is limited in the region, and how significant government rules are for limiting or promoting economic development.
- Analysis of whether local owners produce more resources, and whether they are more concerned with the conflict between the traditional and industrial economies.

Demographics

Questions

How will changing populations and population distribution affect the goals and achievement of sustainable development?

- *What will be the effects of urbanization and migration?*
- *What will be the effects of population growth and decline?*
- *What will be the effects of changing age distribution in the population?*
- *What will be the effects of gender disparities?*
- *What will be the effects of trends in ethnic proportions?*
- *What will be the effects of changes in educational and professional attainment?*
- *How does migration vary across the north, and how does migration affect the demographic structure of communities?*
- *How do relative community economic opportunities affect migration? How does this effect differ by type of community (traditional village or resource production community)? What role does access to traditional activities play in determining migration behavior?*
- *What explains the gender differences in migration, and how does migration vary across other socio-economic and demographic characteristics?*

Discussion

There are a wide variety of population profiles throughout the diverse regions of the Arctic, reflecting the fact that the Arctic's demographic and population dimensions are variable and dynamic. This is highlighted by population data that show significant differences between northern regions in population density, population growth rates, and the share of indigenous populations. For example, total population and total population density are higher in the European Arctic than in the North American Arctic and the Russian Arctic, while the North American Arctic accounts for a relatively small share of the total arctic population. Population density not only varies between arctic countries,

but within countries as well. For example parts of the Russian Arctic and Alaska are relatively densely settled, while large areas are sparsely inhabited.

Since the 1960s, most of the population growth in the Arctic occurred in urban centers tied to industrial activities or public administration, partly accounting for why population density remains relatively low in rural areas across the Arctic. There has been a marked change in this pattern of growth since the early 1990s. Growth has slowed in North America and Greenland, and population has declined in northern Fennoscandia and particularly in Russia. Although the indigenous population has grown at a rate of about 1.5% annually, its share of total population has declined. Indigenous peoples have become ethnic minorities in all arctic regional government jurisdictions except Greenland and parts of Canada (Nunavut and the Northwest Territories). Non-indigenous population growth in the Northwest Territories could make indigenous peoples a minority there, too, within a decade (Chapin et al., 2006).

Population movement has a significant place in most traditional economies of the Arctic; populations moved to pursue game, other subsistence resources, or herds. Policy actions of many governments provided social services by relocating the regions' populations; larger communities provided the scale necessary for provision of these services. Population movements continue today and are more significant in some regions of the north than in others. Migration between rural communities and the urban centers of the Arctic and the south continues as a response to employment opportunities, education, and changes in lifestyle. People also migrate to improve their quality of life, which is affected by the characteristics of place. An understanding of the pattern, causes, and consequences of migration in the north will provide useful information about potential population response to changes in policies. The different behavior across the north provides an opportunity to test a variety of hypotheses about migration.

Scientific Approaches

- A comprehensive assessment of recent and projected demographic change, together with assessments of regional and local population profiles. Such an assessment is necessary for providing baseline data for any discussion of sustainable economies. For example, the prospect of large-scale development (such as the Mackenzie Valley Pipeline in Canada or the Eastern Siberian Taishet-Perevoznaya pipeline in Russia) and resulting in-migration is a major factor in the course of future directions and possibilities of sustainable development. At the other extreme, the population of most of the Russian Arctic has declined sharply since the early 1990s (Crate and Nuttall, 2003), with consequent social and economic impacts. One of the greatest challenges for research on demography and population is how to enhance our understanding of the diversity and complexity of human societies in the Arctic today, and what consequences and implications this has for views about appropriate forms of sustainable development.
- Modeling of population changes and drivers over time, to support analysis of the implications of demographic change. Current understanding of demographic trends is an important factor in assessing and planning for sustainable development, although inaccurate projects may undermine efforts that are made. During the twentieth century, northern population growth rates varied significantly, both between and within northern regions, and, importantly, between indigenous and non-indigenous populations. Based on what is known, and on present trends, is it possible to construct sophisticated demographic models and to suggest several scenarios for how the population of the Arctic may look in ten, twenty, fifty years' time?
- An assessment of the interplay of various demographic trends. The trends in well-being of arctic residents are regionally variable. How far do growth rates of indigenous populations reflect improvements in health care and living conditions, if at all?

- A comparative assessment of the causes and effects of urbanization and migration to and from the Arctic. What will be the effects of urbanization and migration? And what lessons can be learned from an assessment of historical trends and processes of urbanization in the Arctic? For example, urban life remains one of the distinctive characteristics of Russia's settlement pattern in its north, with nearly 80% of the country's northern population living in urban environments (Nord, 2005). Other countries exhibit similar trends, often with sharp disparities by age and gender (e.g., Hamilton and Seyfrit, 1994). With these demographic transitions in mind, what are the contemporary challenges and conditions for northern populations, both indigenous and non-indigenous?
- Assessment of the importance of migration in the overall population growth of these places, how migration affects the demographic structure of communities, and the demographic structure of migration in the various types of communities and regions.
- Evaluation of what the pattern of migration tells us about the well-being of people in communities of the north, and what community characteristics are important to which part of the population.

1.3.3. What Sustainable Development Implies

Social and Economic Costs

Questions

What are the opportunity costs of sustainable development?

- *What are the economic costs?*
- *What are the social costs?*
- *What does it cost to maintain other options?*
- *What constitutes an optimal economy under arctic conditions of marginality, uncertainty, etc.?*
- *What are the trade-offs between diversification and specialization?*
- *What is the role of dependence on government subsidies, distant markets, and other forces beyond local control?*
- *What is the link between economic growth and human development in the Arctic?*

Discussion

Achieving sustainable development requires making changes from current practices. Such changes involve costs and benefits, just as current practices do. Assessing the short- and long-term costs and benefits of sustainable development will help identify the primary obstacles to and opportunities from such changes. In general terms, sustainable development involves a process of trade-offs among the various goals of biological, economic, and social systems (e.g., Barbier, 1987). Overall, the costs of sustainable development will vary among sectors, regions, and communities and be related to the current state of development, and so forth, just as costs will depend on the timing of implementation of sustainability practices.

In general, there are many potential economic costs associated with achieving sustainable development. That said, however, current economies also incur costs (e.g., social and environmental impacts [Rasmussen and Koroleva, 2003; Forbes, 2004]) when they engage in practices where sustainable development is not a key goal. The economic costs of sustainable development are potentially large and will vary between sectors, regions and communities, and will depend on when and how practices linked to sustainable development are implemented. Some of the costs may be associated with the movement of resources from one sector to another, or changes in methods of production from labor intensive to capital-intensive production or vice versa. Also, the removal of subsidies, the implementation of quota systems, restructuring, for example, may have negative impacts on groups and individuals.

Many communities also face the dilemma that minimization of economic costs in the long term may come at a cost in the short term. Northern communities are often faced with a lack of financial resources and a high level of economic dependency, and hence in the short term economic hardship may create incentives for the over-utilization of a resource, while at the same time sustainability in the use of resources is the least-cost option for the community in the long term.

Arctic economic systems are often narrowly based and therefore highly vulnerable to both market fluctuations and political interventions. Individual communities in the Arctic suffer significantly when resources are exhausted, experience sharp decline, or are affected by bans or boycotts. A major challenge is to devise ways for arctic economic systems to diversify and to protect themselves from the effects of actions taken by outside actors who may be ignorant of the consequences of their actions for human development in the Arctic (AHDR, 2004: 232).

In terms of efficiency it is often claimed as a self-evident truth that concentration of people in larger towns is a better solution to development issues than keeping the settlement patterns as they are today. To date, there has been little empirical evidence to support this statement. Further research in terms of cost-effectiveness and cost benefit analysis is imperative. The cost of the exodus from settlements to larger towns may in the long run require considerable government cost due to construction, housing, infrastructure, and establishment of health and educational institutions. Also, the social costs due to the alienation connected with a shift in living conditions from a hunting community to a job in a town factory may prove very costly owing to social complaints, addiction to drugs and alcohol, and psychological disorders, all of which may cause illness, require extensive care, and result in loss of productivity in the workplace.

In addition to economic costs, sustainable development may give rise to social costs, and these costs will vary across the region and depend on many factors, including the level of power and participation in decision-making processes and the ability to exercise that power. The social costs of sustainable development may include changes in people's livelihoods, perhaps as production changes from labor intensive to capital intensive or vice versa, or as subsidies are eliminated in fisheries and farming, or from changes that may be associated with the transition from more traditional livelihoods. Social costs will vary between regions and may depend on the flexibility and mobility of regional and community resources (human and capital resources) as well as the ability of peoples and individuals to adjust. Research is needed on the social costs of sustainable development across regions.

Scientific Approaches

- Evaluation of the economic and social costs of sustainable development. This would require a literature review of existing studies on the economic and social costs of sustainable development. It would be valuable to analyze a variety of case studies across the Arctic on this issue, where the costs are analyzed over a period of time to evaluate how and when costs of sustainable development change, from the start of implementing sustainable development practices and onward. The analysis could also include interviews of groups and individuals to assess how the size and impact of these costs are experienced.
- An analysis of what constitutes an optimal economy. This would require a literature review on the subject. It would also require an analysis of several case studies across the Arctic to evaluate and assess what constitutes optimality, and what has increased efficiency under various constraints in the Arctic. Research could also include economic model building to provide a framework for thinking systematically about issues of optimality in the Arctic.
- An assessment of the trade-offs between diversification and specialization. This would require a literature review on the subjects of diversification and specialization. It would also require an analysis of case studies at the national, regional and community levels to evaluate the trade-offs between diversification and specialization. It would be valuable to track trade-offs over time.

Research would also be needed to formulate models to project future trade-offs, which would then be followed by an evaluation of these tradeoffs.

- An analysis of the role of dependence on government subsidies, distant markets, and other forces beyond local control. This would require a literature review on the role of dependence. Further, it would require the analysis of case studies across the Arctic at the national, regional and community levels to assess the role and impact of dependence on government subsidies, distant markets, and other forces beyond local control in terms of the impact on efficiency and sustainable development. These studies should be cast within a time-series context to make it possible to track the impacts over time. Research could also include interviews of groups and individuals across the region and at various levels of government.

Economic Equity

Questions

What is the relationship between equity and sustainable development?

- *What is the role of economic opportunity?*
- *What is the role of access to power and decision-making, and the effectiveness of representation in the institutions where power and decision-making authority reside?*
- *Have efforts to achieve sustainable development increased or decreased equity, and why?*
- *Have efforts to achieve equity increased or decreased sustainable development and why?*
- *What constitutes effective participation in the decision-making process?*

Discussion

Inequalities in people's access to resources and the resultant ways in which they use them constitute great challenges for sustainable development. Inequality in access to resources can threaten the prospects for sustainable development in various ways. It may lead to increased poverty, which may also mean that people are left with no other option but to overuse the resource base on which their livelihood depends. At the same time, inequalities allow a minority of people to overuse and exploit resources. Arctic communities are often subject to environmental and social impact of natural resource development. It is often the case that relatively little of the wealth created in connection with large-scale resource exploitation will benefit or improve the economic and social well-being of the people from whose region the resources were extracted.

Economic opportunities are vital to achieving sustainable development in the Arctic. Often economic opportunities are absent in the Arctic, which creates impediments to achieving sustainable development and a greater degree of independence and autonomy. And yet at other times, economic opportunities arise but communities may be ill equipped to take advantage of them, in part because of a lack of ability to mobilize human and financial resources. Research is needed to determine the link between the availability of economic opportunities, the ability to take those opportunities, and sustainable development across regions.

An important aspect of economic opportunity, and thus of equity and sustainable development, is participation in the decision-making process. Examining such participation and its effectiveness across regions should help illuminate the connections between power structure, equity, and sustainable development. For example, a recent report on fisheries in the Nordic region (TemaNord, 2003) examined the integration of environmental concerns into fisheries, noting that such a step involves many and diverse interests and requires effective mechanisms for conflict resolution. The legitimacy of management and conflict resolution will depend on the involvement of the peoples and individuals. The findings of the report showed that the integration of environmental concerns into fisheries management has proven particularly effective where decisions are delegated to the local level and where decisions at that level are focused on dealing with the problem at hand.

It is also likely that the definition and nature of effective participation will depend in part on the type of community, region, or nation that is being considered, and is therefore likely to vary over time and space (see Forbes et al., 2006).

Scientific Approaches

- An analysis of the role of economic opportunity. This would require a literature review on the subject, as well as national and community-based studies to evaluate the role of various economic opportunities and their impact on equity and sustainable development. This might also include some projections of the impact of alternative opportunities. Also, the analysis and evaluation could include interviews of groups and individuals at the national, regional, and community levels, and at various levels of government.
- An analysis of the role of access to power and decision-making, and the effectiveness of representation in the institutions where power and decision-making authority reside. This would require a literature review, as well as case studies across the Arctic designed to evaluate the role of access to power and decision-making. It would also require the analysis of data gathered through interviews of groups and individuals at the national, regional, and community levels, and at various levels of government. Also, diachronic studies should be included to allow us to capture the effects and the dynamics of changes in access to power and decision-making over time.
- An evaluation of whether efforts to achieve sustainable development have increased or decreased equity, and why. This would require a literature review on the subject, as well as case studies at the regional, national and community level where practices supporting sustainable development are in place. This would include an analysis of the level of equity before and after the implementation of various practices of sustainable development, as well as comparison among communities, regions and countries. Research might also look into formulating indicators of the level of equity that would allow the level of equity to be tracked over time, throughout a process of implementing sustainable development.
- An evaluation of whether efforts to achieve equity have increased or decreased sustainable development, and why. This would require a literature review of the association between equity and sustainable development, as well as case studies of the link between equity and sustainable development at the national, regional and community level where sustainability practices are in place. Also, it could be valuable to formulate a time-series study to analyze the impact of changes in equity over time on the level of sustainable development.
- An evaluation of what constitutes effective participation in the decision-making process. This would require a literature review on the subject, and the evaluation of data from case studies of various forms of decision-making processes. It would also require the evaluation of data collected through interviews of groups and individuals engaged in decision-making processes. Comparisons should be made throughout the arctic regions.
- An evaluation of whether efforts to achieve economic development have improved human development and the quality of life in arctic societies.

1.4. An Indigenous Person's Perspective on Sustainable Development and Research

The question of sustainability, especially research on sustainable development, leads quickly to questions about how that research and its results relate to arctic residents. Adelheid Herrmann, a member of the working group that drew up this ICARP II science plan, is an Athabaskan from Bristol Bay, Alaska. A commercial fisherman, she has also served in the Alaska Legislature, and participates in many initiatives concerning rural Alaska and Alaska Natives. Her reflections on the significance

and challenges of arctic research are a powerful, personal statement. In addition to her own experiences, Adelheid has drawn on ideas from several sources, including *Decolonizing Methodologies* (Smith, 1999), *Leadership on the Line* (Heifetz and Linsky, 2002), and the *Arctic Human Development Report* (AHDR, 2004).

As stated in the Arctic Human Development Report the Arctic has long served as a magnet for researchers, ranging from physical scientists interested in glaciers and the earth's climate system to cultural anthropologists seeking to reconstruct the peopling of the new world and to understand the cultures of Indigenous Peoples whose lives are focused on herding, hunting, fishing or gathering. I believe there is benefit to all the academic research being done in the Arctic but there is much room for improvement on how it is conducted. Answers to the many questions facing the Arctic will not come from just one group of people, but many collaborating with common interests at heart.

I have observed over the years that when Indigenous and non-Indigenous Peoples come together to discuss issues such as research, sustainable development, sustaining healthy ecosystems, and so on, the forum can take many shapes. Open communication and dialogue is the key to many of these forums' success. When communication is open and the balance of power is equal, then oftentimes the group can move forward working on common goals and issues. Full partnerships have to be just that, full partnerships, and acknowledgement has to be made that communication barriers are real. The basic premise of mutual respect has to be given to each party and there has to be an understanding that all issues are treated as important and not discounted because of lack of understanding.

An important consideration in research is ownership. Communities need to develop the agenda defining which questions they want answers to. Communities need to educate their own people in research methods. It should be up to the community to determine how this is done. There are instances of this happening in the State of Alaska yet there is no one central place to go to find out what is going on. Oftentimes the only exposure to these community driven research efforts is done at conferences. There are many tribes taking matters into their own hands and building natural resource programs that include developing their own resource programs or projects. There are more and more success stories and good examples of models that can be adopted by others. We need better communication to share the positive examples with one another.

Overall, those of us involved in arctic research, from whatever perspective, need to make what Heifetz and Linsky (2002) call "adaptive changes." This is distinct from "technical change," in which the challenge is to apply what is already known, and the work is typically done by those in positions of authority. In adaptive change, new understanding is needed, and the work must be done by all of those involved in the situation. Treating adaptive challenges as technical problems is the single most common source of leadership failure, as the leaders are incapable of resolving things on their own, even if people look to them for answers.

I noticed this disconnect in Bristol Bay when there was a downturn in fisheries. The people looked to the government to solve their problem, expecting the government to provide easy answers and to protect them. But the government didn't know how to solve the problem, nor did the people know how to come up with a local coordinated response to help the government realize what they needed to do. During this time of coping with change for these communities only one study focused on the economics of this region from a local perspective.

If we are to make the adaptive changes we need to make, research on sustainable development, on communities, and on ecosystems needs to be done collaboratively with Arctic Peoples, and Arctic Peoples must be willing to take responsibility, too. Collaborative research can extend beyond the confines of a particular hypothesis or topic, and take part in the broader dialogue in which Arctic Peoples are involved as active participants, helping shape the Arctic of the future.

1.5. Education and Outreach

Studying economies and sustainable development cannot be done in isolation, nor should the results be limited to an academic audience. The involvement of participants in all sectors of the economy and from institutional and other connections to sustainable development should be involved in research in this area. The precise role in a given study depends, of course, on the nature of the study, the characteristics of the region or community in question, and so on. Nonetheless, the success of the overall research program will depend in large part on the degree to which it is able to entrain those outside the academic community and to which the results of research are communicated effectively to those whose actions and decisions can benefit. The section on implementation (section 1.8) suggests the creation of a network, which should include participants from industries, governments, communities, and so on. This section also calls for an extensive education and outreach effort.

1.6. Linkages

The study of sustainable development in the Arctic and of arctic economies should be connected to various initiatives at various levels. Recent international reports such as the *Arctic Human Development Report* (AHDR, 2004) and the *Arctic Climate Impact Assessment* (ACIA, 2005) address many aspects of the societies of the Arctic and the factors that influence them. Further research is expected in both areas, and will be highly relevant to many of the ideas presented in this ICARP II science plan. Other activities conducted under the auspices of the *Arctic Council* are likely to address the ideas in this science plan as well. Plans are developing for the forthcoming *International Polar Year* (<http://www.ipy.org>) and include several potential programs and studies related to sustainable development, resource management, rapid social transitions, and similar topics. Other studies, such as the *Survey of Living Conditions in the Arctic* (http://www.iser.uaa.alaska.edu/projects/Living_Conditions/index.htm) and the *Institutional Dimensions of Global Environmental Change* (<http://fiesta.bren.ucsb.edu/~idgce/>) are also highly relevant. At the national level, censuses provide a great deal of relevant data, research programs address many aspects of economies and sustainable development, and many institutions promote or have a strong interest in the aims of sustainable development. Locally, the number of relevant links is likely to be greater, but will vary in detail from place to place. A crucial aspect of sustainable development research is connection to stakeholders. Asking the right questions and interpreting data correctly require a detailed understanding of the context, at any level. Connection to stakeholders may simply be an understanding of the institutions and regimes that are significant to a specific question, or it may be the development of a truly collaborative partnership with, for example, a local community or a business corporation.

1.7. Outcomes

The potential outcomes of research include scientific papers, educational and outreach materials to share findings with communities and others, and other materials that will increase general understanding of what is encompassed by “sustainable development,” how the term is used in various ways in various contexts, and what common elements can be identified. Research conducted on the theme of sustainable development will add a great deal to understanding of the factors likely to play major roles in the futures of arctic communities and industries. The research should also lead to the development of a network of researchers and stakeholders on a circum-Arctic scale. Such a network will facilitate communication, promote comparative research, and help transfer the findings of research to the practitioners of sustainable development in all sectors. The effective communication of risk to all sectors is critical. The formulation of economic development models can be used to evaluate different scenarios and, for example, the impact of different economic strategies and thus to facilitate ways to avoid crises both regionally and nationally.

In addition to the papers generated by individual researchers and projects, a larger program of research should stimulate synthetic and comparative studies and publications, drawing on the collective

experiences of many projects and researchers. Such products will be particularly valuable as they are few and far between today.

A potentially major outcome is the identification of a suite of indicators of sustainable development and the development of a database of measures of those indicators. Such a database with unique long-term series of data could be immensely useful to decision-makers, planners, and others concerned with the future of the Arctic. It is perhaps unlikely that a single, unified, circumpolar database will be created within the next decade, but progress towards regional databases and a joint meta-database is entirely within reach.

Finally and perhaps most importantly, is the development of appropriate education, outreach, and communication efforts to reach beyond the scientific community. The details of such a program are beyond the scope of this science plan, but should include local efforts by individual researchers as well as larger-scale efforts coordinated by the overall research program and given adequate support. It is essential that such an effort involves persons outside the scientific community to help design, conduct, and evaluate the work that is done. One example of a useful contribution in this regard would be a bibliography or set of reference materials to help introduce arctic residents and others interested in the subject to relevant literature and other resources.

1.8. Implementation

Achieving the goals set out in this ICARP II science plan requires two categories of support. First, and requiring substantial funding, it is essential to continue with the kinds of individual research projects that have generated today's knowledge about sustainable development and that will continue to form the foundation of understanding in the future. Such research is typically funded through national agencies and others, and it is urged that it continue. In this category, it is hoped that researchers find this report stimulating with regard to ideas for projects and, especially, with regard to participating in a larger program of research and outreach.

To accomplish the research required to address the key questions raised in this ICARP II science plan, this first category of support will entail considerable funding for research on a continuing basis. National agencies, industry, and sub-national governments should all be involved in funding appropriate research. The number of questions and sub-questions presented here indicates some of the breadth and depth of the field, and should provide a good indication of the extent of research that can and should be undertaken on arctic economies and sustainable development. Furthermore, researchers are strongly encouraged to make connections with one another and with people outside the research community.

This introduces the second category of support, requiring more modest funding. A three-phase approach is proposed for the second category:

Phase 1: Create a group/network to undertake an initial broad, comparative, integrative analysis, and produce (a) an overview paper for publication (based on available literature), (b) a website on sustainable development in the Arctic, and (c) a proposal for Phase 2 (below). This phase should be completed within one year and should require approximately US\$75,000 in funding.

Phase 2: Develop a larger network (including practitioners as well as researchers) to produce (a) a book or special journal issue, based on available literature, addressing the key questions raised in this ICARP II science plan, (b) a synthesis chapter/paper, and (c) a plan for Phase 3 (below). This phase should take two years and should require approximately US\$250,000, including travel to and support for a workshop.

Phase 3: Continue the development and growth of the network, according to plans developed in Phase 2, and (a) create a database for storing and monitoring indicators of sustainable development identified in Phase 2, (b) promote education and training programs, (c) conduct outreach and communication,

and (d) carry out further research as identified in Phases 1 and 2. This phase should be ongoing and the necessary funding level (or range of options) should be identified as part of Phase 2.

1.9. Funding

National agencies and others should provide funding for the first category of support (Phase 1: individual research projects) identified in section 1.8. The second category of support (Phase 2: a coordinated program) is likely to require cooperative funding by agencies from each participating country. The International Arctic Science Committee (IASC) provides a logical hub for such funding, as well as a source of seed funding to support Phase 1 as an outcome and follow-up to the Second International Conference on Arctic Research Planning (ICARP II).

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