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Sustainable Development and Capabilities for the Polar Region

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Abstract The paper develops a sustainable development framework for individual and collective capabilities in mixed subsistence and wage-based economies. We apply this framework to such regions of the Arctic and evaluate interactions and conflicts between two sectors of the mixed economy and between current and future generations of Arctic inhabitants. A recent Arctic Social Indicators Report published by the Arctic Human Development Report (AHDR) Task Force recognizes the importance of the mixed economy in the Arctic and aims to integrate collective assets, as well as individual assets in order to understand the human development in the Arctic. Yet due to its concerns of comparability of social development and data availability across the whole Arctic region (of which some parts do not have the similar population structure), its proposed indicators are not capable of covering the social development of predominantly indigenous regions of the North. We emphasize the importance of tracking collective capabilities, as well as individual capabilities to sustain community development. In addition we suggest that environmental sustainability, which is ignored by the AHDR Task Force, has to be integrated with social development as environmental deterioration significantly influences the social well-being and cultural stability of traditional inhabitants of the Arctic. We critically review the proposed indicators of the AHDR Task Force and make supplementary and alternative suggestions.

Keywords Social development indicators · Sustainable development · Individual and collective capabilities · Arctic region · Indigenous people

1 Introduction

The notion of sustainable development had its origins in the eighteenth and nineteenth centuries with such classical economists as Malthus and Mill that started thinking about

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'limits to growth' (Collados and Duane 1999: 443). However, it was not until the late 1980s with the World Commission on Environment and Development (also referred to as the Brundtland Commission) that a debate about sustainable development began to emerge. In 1987, the commission published a report entitled *Our Common Future*, in which they defined sustainable development as "development, which meets the needs of the present generation without compromising the ability of future generations to meet their needs," (Chance and Andreeva 1995: 221). Various models of sustainable development have been developed, but they mostly "remain conceptual frameworks that lack the specificity and precision necessary for application" to the sustainable development of communities or specific regions (Collados and Duane 1999: 442). Moreover, the sustainable development literature often tends to overemphasize two pillars-the economic and environmental (ecological) dimension (Chance and Andreeva 1995: 222) and misinterprets or underestimates the importance of the cultural and social dimension of sustainability. Yet, there is a growing body of literature, which pays attention to the importance of social and cultural dimensions of sustainable development that had previously been understudied. For instance, many authors have recently underlined the importance of local people's knowledge, which is reproduced through their cultural and social practices, in developing sustainable development strategies for their communities (Humphreys 2002; Pretty 2003; Dale and Newman2006; Ulluwishewa et al. 2008; Crate 2006; Fisher 2008). Pretty (2003: 1913) emphasizes that "good knowledge about local resources" is one of the preconditions for communities "to use natural resources sustainably over the long term". Ulluwishewa et al. (2008) indicate how the knowledge of two indigenous communities (Maori and Dusun) in New Zealand and Brunei Darussalam can be used to develop indicators for sustainable management of the natural resources surrounding these communities. In addition, some scholars point out the importance of social capital in the establishment of community resilience to cope with external shocks and stresses (Dale and Newman 2006: 16). Similarly, others emphasize that sustainable economic development can only be achieved through taking social and cultural values of the communities into account (Fisher 2008).

There is evidence that a sense of place, based on local distinctiveness, provides an economic and social advantage to a community (Mesch and Manor 1998) and enhances the potential for sustainable decision-making (Uzzell et al. 2002). Emergent senses of place impact the connectivity in a community, and directly affect social capital formation, and thus ultimately enhance our possibilities for a sustainable future (Dale and Onyx 2005). In essence, a strong sense of place has a higher chance to result in mobilization for sustainable development initiatives. Without doubt, the recent emphasis on social and cultural dimensions of sustainability broadened the scope of the sustainable development studies and enabled the cross-fertilization of different theoretical approaches with a goal to create a more holistic view of development that encompasses social, cultural, economic, and environmental aspects of sustainability.

The capability framework offers a potential contribution to the sustainable development literature (see Anand and Sen 2000; Lessmann 2010; Crabtree 2010). Similar to sustainable development, the capability perspective pursues a multi-dimensional approach to development. It addresses the multiple goals of personal well-being and, therefore, has implications for economic and human development. Development is not only considered in terms of economic growth and economic outputs such as Gross National Product (GNP), but also involves social, cultural, and community factors such as "greater access to knowledge, better nutrition and health services, reduced vulnerability to mental and other illnesses, security against crime and physical violence, political and cultural freedoms, and participation in community activities" (Deneulin 2006: 1). Furthermore, both sustainable

development and capability approaches aim to guarantee the well-being of all groups of people in society today, as well as the well-being of future generations (Anand and Sen 2000; Lessmann 2010). Protection of the environment is seen as one of the priorities to ensure that "future generations would continue to enjoy similar opportunities of leading worthwhile lives that are enjoyed by generations that precede them" (Anand and Sen 2000: 2030).

Although the capability approach addresses issues of sustainability, it does not fully address how to deal with potential conflicts between intergenerational and intragenerational equity and collective and individual capabilities. These potential conflicts are especially important in mixed economies that consist of a traditional food provision sector and a wage-based sector. The Canadian Index of Well-being (CIW) has recently shown that although Canadians are experiencing improvements in many categories over the last 18 years, three areas show signs of deterioration: the environment, time use and leisure and culture. This indicates a possible decline in natural assets that sustain future well-being and the capability of individuals to find time for activities that matter for themselves or are important for the community or collective capabilities.

The Arctic Social Indicators (ASI) Report (Larsen et al. 2010a) is a recent initiative to provide meaningful indicators for the development of Arctic communities. It comes up with 6 critical domains but is not incorporating sustainable development and interactions or conflicts between the subsistence and wage-based sector of the economy. The ASI report is following up on an earlier survey of living conditions in the Arctic (SLiCA) (Poppel et al. 2007) that had very similar 6 domains but consisted of 583 different indicators that could not consistently be measured for all regions of the Arctic. As a result the ASI report emphasizes measurability, ease of data collection and comparability between Polar Regions.

In this paper we first review suggestions to integrate the capabilities approach with sustainable development frameworks. We then discuss collective and individual capabilities and assets, and their implications for well-being and functionings in a mixed economy. Next we evaluate Arctic Social Indicators that are currently being proposed by the Arctic Social Indicators Project and contrast them with other relevant social and sustainable development indicators. Based on our discussion of collective and individual capabilities in Arctic mixed economies we make a number of recommendations for a more place-based approach for Arctic Social Indicators, particularly for Arctic areas with a large fraction of indigenous populations, which is the case in most regions of the Canadian Arctic, Greenland, some regions of Alaska and Chukotka (Siberia, Russia). We also suggest supplementing existing categories with additional indicators and add two additional categories, which we refer to as *Natural Resource andEnvironmental Sustainability* and *Community Vitality*.

2 Sustainable Development, Social Well-Being and the Capability Approach

An important characteristic of the capability approach is its emphasis on individuals' freedom to make decisions for their own development. The capability perspective focuses on "the freedoms people actually enjoy choosing between different ways of living that they can have reason to value" (Sen 1990: 116). In that regard, the capability approach goes beyond the existing assets that people possess and queries whether people can transform these assets into the capabilities they want to achieve. The capability approach considers 'capabilities' as means to achieve personal well-being (or functionings). Lessmann points

out that "the capability approach defines personal well-being in terms of the beings and doings a person achieves and the capabilities to choose among different combinations of such functionings". To illustrate, 'riding a bike', 'eating country food', and 'having local knowledge about hunting and harvesting' are capabilities, while 'being healthy', and 'working' are functionings (Lessmann 2010: 4). Gore argues that collective assets should be incorporated into the analysis as "they are important constituents of the freedoms of individuals" (Deneulin 2006: 55). Drawing from Gore's work, Deneulin underlines that the capabilities approach ignores the impact of collective assets (such as democratic freedom in a society, social norms, power structure of the society, language and family relationships) on the lives of individuals (Deneulin 2006: 54).

If we followed the logical reasoning of Deneulin's analysis we should also consider natural resources and environmental services as a distinct category for collective assets, which flourish certain collective capabilities. Thus, like the other collective assets, natural resources should also be analyzed separately so as to assess the sustenance of related collective capabilities. To fully understand whether there exist sustainable paths for communities, there is a need for developing a framework which addresses the issues discussed above because the sustainability of collective capabilities is essential for establishing and preserving the resilience and adaptability of Aboriginal communities in the North. Furthermore, the existence of mixed economies in these communities complicates the interaction between individual and collective capabilities because the sectors of the mixed economy[1] possess different individual and collective capabilities, which can potentially be in conflict with each other.

The subsistence sector depends on renewable resource and environmental assets (such as wild animals, lakes, rivers, seas, and land). These sources constitute the basis of hunting and harvesting activities that support subsistence living. Integral to the subsistence sector is to maintain renewable resources at a level that can sustain living off these resources for future generations. The cultural and social practices of providing essential means of living cannot be separated from subsistence activities and serve as the social assets of the subsistence sector. These practices necessitate the sharing of resources and responsibilities within the community in the forms of 'cooperative production', 'wide distribution', 'mutual aid', 'feasting', 'ritual observance', and 'associated ethical norms' (Usher et al. 2002).

Without doubt, the transfer of 'traditional knowledge' is fundamental for the preservation of human assets (as well as environmental assets) in the subsistence sector of mixed economies. Social networks facilitate the transfer of traditional and local knowledge to future generations. By means of these networks, young generations are trained for hunting and harvesting. The existence of sharing networks and people's access to these networks undertake the function of sustaining human assets in the subsistence sector.

In Table 1 we distinguish between individual and collective capabilities, beings and functionings in a typical mixed economy. The individual capabilities of the subsistence sector involve having access to country food, having access to traditional knowledge, sharing hunting and harvesting duties, participating in cultural activities, and going hunting and harvesting. These capabilities in the subsistence sector enable people to live a healthy life, to belong to a social network, to be safe during hunting and harvesting, to have a land-based identity, to work to sustain life, to consume highly desirable country food, and to

[1] The 'mixed economy' is a widely accepted model of indigenous communities in the Arctic (International Arctic Science Committee (2009)). It is characterised by "two spheres of activity, institutions, and practices": wage and subsistence sectors (Usher et al. 2002: 177).

enjoy hunting activities. Collective capabilities involve the ability to transfer local knowledge to future generations, the existence of social and community networks which preserve food sharing practices, capacity and control over local resources. In addition access to natural resources and environmental services influence collective capabilities to maintain current lifestyles, a land-based identity and good health. The access and availability of natural resources and environmental services is itself a collective capability that might be influenced to a large degree by external forces such as climate change or centralized wildlife management rules.

The wage sector has its own individual and collective capabilities (Table 2). Individual capabilities generally focus on having income to buy non-traditional food and other living expenses, having access to professional networks, formal education and training, having access to jobs, and having access to modern housing and health services. These capabilities aim to make individuals more educated and employable, enable them to earn more income, and to increase their longevity. Collective capabilities (such as access to neighbourhood networks, opportunity for union membership, access to informal work networks, voluntary organizations, and social networks) in the wage sector serve to create safe neighbourhoods, ensure job security and benefits, facilitate peer exchange of experiences and problems, provide an outlet for collective activities without work pressure and competition, and ensure the transition from school to work among students.

The capability framework assists us to identify the crucial collective capabilities necessary for the sustenance of the communities; however, it is unable to satisfactorily integrate the institutional power and capacity into its analysis. Sufficient institutional independence and capacity give Aboriginal communities the power to preserve their traditional sector, which is essential for the survival of their crucial collective capabilities.

Table 1 Capabilities, and beings and functionings in the subsistence sector of the mixed economy

Individual capabilities	Individual beings and functionings	Collective capabilities	Collective beings and functionings
Have access to country food Have access to traditional knowledge on hunting and harvesting Share hunting and harvesting duties Participate in cultural activities Go hunting and harvesting	Being healthy Belonging to a social network Being safe during hunting and harvesting Having a land-based identity Working to sustain life Consuming country food Pleasure of hunting activities	Community has a capability to transfer traditional knowledge to future generations The existence of social and community networks which preserve food sharing practices, as well as sharing duties for hunting and harvesting Community has capacity and control over local resources Community has sufficient access to environmental and renewable resources	Community being resilient to external shocks Equal access to traditional knowledge and traditional opportunities Preservation of traditional social and human assets Community preserving cultural practices and identity (including food sharing, recreational activities, subsistence hunting, and language … etc.) Community self-governance

Table 2 Capabilities, and beings and functionings in the wage sector of the mixed economy

Individual capabilities	Individual beings and functionings	Collective capabilities	Collective beings and functionings
Have income to buy food and other living expenses	Being more educated and acquiring human capital	Access to Neighbourhood networks	Neighbourhood Being Safe and offering comfort (integration into neighbourhood)
Have access to professional networks	Acquiring wealth	Opportunity for Union Membership	Job security and benefits
Have access to formal education and training	Being employed	Informal work networks	Peer exchange of experiences and problems
Access to jobs	Living longer	Voluntary Organizations	Outlet for collective activities without work pressure and competition
Access to housing	Finance hunting activities	School networks	Ensure the transition from school to work
Access to health services			

Therefore, the capability framework should address the interactions and sharing of responsibilities among the institutions at different levels of governance (local, territorial, provincial, federal, or global), which necessitates addressing the issues of independence, power and capacity (Lehtonen 2004: 211; Bilgin 2012). It is important to understand how local institutions are embedded into the complex hierarchy of institutions at territorial, provincial, or federal level, and to what extent they can respond to the demands for sustainable development (Lehtonen 2004: 212). We address the assessment of crucial individual and collective capabilities for Polar Regions with an evaluation of well-being indicators for the Arctic.

3 Well-Being Indicators for the Arctic

At the international level, one of the earliest attempts to develop a social development index was Estes's (1988) *Index of Social Progress*, which focuses on issues related to health, education, cultural homogeneity, natural disaster vulnerability, political and civil liberties, and social security legislation. Without doubt, the United Nations Development Program's Human Development Index—that includes three dimensions such as health, education, and a decent way of living—revived and intensified the debate about measuring the progress of nations in terms of quality of life. Later, in his piece called *Value-Based Index for Measuring National Quality of Life*, Diener (1995) expanded the indicators of the Human Development Index and created two separate indices for developing and developed countries—the Basic Quality of Life Index and the Advanced Quality of Life Index.[2] Veenhoven (1996) suggested a Happy Life-Expectancy Scale that is based on 'civil registration of death' and 'survey data on happiness' (which is derived from the "person's overall evaluation of his/her life as-a-whole").

[2] The basic QOL Index is composed of seven variables such as 'purchasing power', 'homicide rate', 'fulfillment of basic physical needs', 'suicide rate', 'literacy rate', 'gross human rights violations', and deforestation, while the Advanced Quality of Life Index includes seven variables like 'physicians per capita', 'savings rate', 'per capita income', 'subjective well-being', 'percent attending college', 'income equality', and 'environmental treaties signed'.

There is also a Canadian initiative to develop a well-being index. The Canadian Index of Wellbeing (CIW) currently provides eight detailed research reports on different, but interconnected, categories of well-being: *Living Standards, Healthy Populations, Community Vitality, Democratic Engagement, Time Use, Leisure and Culture, Education and Environment*. It published its first set of indicators in 2009 and updated some of them in 2010 and 2011. The CIW was developed based on a number of pilot studies in different non-aboriginal and Aboriginal communities across Canada. It is, therefore, very relevant for well-being indicators in the Arctic. Also it is a very up to date index that only recently came into place and that is progressively updated and fine-tuned.

Although the above-mentioned indices are essential to the development of social indicators research in the Polar region they cannot fully accommodate the idiosyncratic characteristics of Polar Regions. At the international level, one of the earliest attempts to address these shortcomings and to develop more meaningful indicators for the Arctic was the Study of Arctic Living Conditions (SLiCA), which was initiated in 1997 to measure and understand the material (living conditions) and non-material (quality of life) well-being of indigenous people in the Arctic Region. The main motivation of the study was to compare "one's own living conditions with those of other populations with the same developmental characteristics—instead of comparisons with the majority populations in the various countries" (Andersen and Poppel 2002: 278). To achieve this, two questionnaires were developed: 'one that contains a common core of questions which is employed in all areas of the project and 11 questionnaires containing region-specific questions' (Andersen and Poppel 2002: 283). These questionnaires covered the four dimensions of the living conditions with 583 indicators for the Arctic region: family ('family relationships' and 'household economy'), background ('mobility,' 'language,' and 'education'), lifestyle ('employment', 'harvest', 'leisure', 'spirituality', 'identity', and 'health'), and environment ('housing,' 'income and expenses,' 'technology,' 'safety and justice,' 'resource management,' 'environmental health,' 'political resources,' and 'community viability') (Andersen and Poppel 2002: 289).

The Arctic Council Ministerial meeting then decided in 2002 to develop a set of social indicators for the Arctic. At the latter meeting, the Standing Committee of Parliamentarians of the Arctic Region called for the adoption of the Arctic Human Development Report (AHDR), which would gather, assess, and integrate knowledge on the conditions of humans living in the Arctic (Larsen et al. 2010b: 18). To achieve this, an expert team prepared the AHDR. The team initially adopted the United Nations Human Development Index (UNHDI), which covered the indicators of life expectancy, education, and GDP per capita. Nevertheless, being aware of the peculiar conditions of the Arctic, the group also integrated three additional domains to the AHDR: 'fate control', 'cultural integrity', and 'contact with nature' (Larsen et al. 2010b: 18) which are related to our discussion above on the importance of collective capabilities, as well as individual capabilities for human development. Fate control refers to "being in charge of one's own destiny [either as an individual or a collective whole *our emphasis*]"; "cultural integrity is a matter of being surrounded by and able to interact regularly with others who share belief systems, norms, and a common history"; and contact with nature is an "opportunity to interact on a regular basis with the natural world" (Larsen et al. 2010b: 20).

Another well-known index for the Arctic is the social cohesion index suggested by Duhaime et al. (2004: 304). It is composed of six indices (social capital, demographic stability, social inclusion, economic inclusion; community quality of life, and individual quality of life). The social capital index includes indicators such as 'trust and confidence in civic institutions', and 'participation in volunteer organizations and other related

activities'. The demographic stability index covers 'measures of in- and out migration of individuals as well as the population growth rates of Arctic communities', whereas the social inclusion index focuses on 'access to informal networks of emotional, social and material support'. 'Economic inclusion' embraces "variables that measure an individual's involvement in the market economy through labour activity, employment insurance, social assistance, pension cheques and/or other forms of transfer payments". The community quality of life index measures 'satisfaction with a series of conditions and services in the community' such as job satisfaction, satisfaction with job opportunities in the community, education, cost of housing, availability of country food, access to country food, personal safety, 'availability of health services'. The last one is the index of subjective well-being index, which is composed of 'five item mental health inventory' and 'general subjective QOL (or happiness) measure' (Duhaime et al. 2004).

Without doubt, the Arctic Social Indicators Report (2010) is an important initiative to discuss meaningful indicators of individual and collective well-being in the Arctic. It provides a thorough discussion of many factors that need to be considered and evaluates data availability, affordability and ease of measurement. Based on our discussion of individual and collective capabilities, and the social well-being and the sustainable development literature, the proposed ASI has, however, a number of limitations.

First the report does not discuss and include sustainability measures. Only few of the social development indices involve environmental indicators (e.g. *Value-Based Index for Measuring National Quality of Life*); however, these indicators are not capable of fully analyzing the changes in the eco-system and natural resources in the Arctic and their implications on social and cultural well-being of communities. In the literature, the sustainable development framework of the United Nations, World Wildlife Fund's Living Planet Index (LPI), Environmental Sustainability Index (ESI), Environmental Performance Index (EPI) generally measures air and water pollution, changes in biodiversity and habitat, fisheries, forestries, and agriculture, and climate change. Unfortunately, currently there is not any specific sustainable development index for the Arctic region. Yet, perhaps, the environmental indicators of the North West Territories (NWT) of Canada could help us understand a better picture of the shifts in the environmental and natural resources since these indicators provide more information about the idiosyncratic characteristics of the Arctic. Similar to the other sustainable development indices, the State of the Environment Report of the NWT involve indicators for water quantity and quality and air pollution, climate change ….etc., but it also involves some place-specific indicators, e.g. indicators related to permafrost, vegetation, species at risk, status of endemic and rare species, and Arctic wildlife population trends. Moreover, the Report provides information on energy supply and the depletion of non-renewable resources. Also, the Canadian Index of Well-Being provides relevant environment indicators for the Arctic region such as primary energy production, final energy demand, residential water use and a water quality index. We use the relevant indicators from these sustainability frameworks and add further Arctic-specific environmental and natural resource indicators under the domain of *Natural Resource and Environmental Sustainability* to the ASI.

Secondly the ASI focuses on some collective capabilities in the subsistence sector such as language retention and fate control but does not recognize the important dynamics in mixed economies of Aboriginal communities. A better reflection of the dynamics of both sectors would incorporate the domain of *Community Vitality* that many other human development indices such as the *Social Cohesion Index*, the SLiCA study and the Canadian Index of Well-being (CIW) adopted.

Thirdly the ASI is not comprehensive enough. It leaves out important indicators in each domain. For instance, *Fate Control* indicators do not identify the limitations imposed by central governments on local or regional policy discretion, and the capacity of local or regional governing bodies to prepare and implement policies and regulations. Also, we believe that the *Contact with Nature* domain does not really capture to what extent Arctic residents spend time on the land and experience true contact with nature.

Fourthly, the ASI suggests a minimum set of seven key indicators. Based on evidence in the Canadian Arctic we think that these are not the most important and representative indicators, and that the number of indicators is too limiting. Empirical analysis using data from the Aboriginal People's Survey and form SLiCA for the Canadian Arctic (Édouard and Duhaime 2012) identified self-evaluation of health condition, a geographic mobility index (based on survey data), status on the job market, strength of family ties and solidarity of extended family as the best predictors of Inuit's feeling of satisfaction of life in the community. The same variables as well as housing conditions and family income explained Inuit's feeling of despair. We, therefore, think that any meaningful social indicators for the Arctic have to address at least these significant explanatory variables for well-being in the Arctic.

Finally due to the distinct differences in Arctic regions we think it would be more useful to distinguish between local place-based indicators and general indicators that apply to all regions of the Arctic, rather than trying to find the smallest common denominator for comparisons across the Arctic. Comparing developments and indicators in Iceland and Norway to developments in Nunavut or Nunavik, for example, is not very insightful as the latter have at least 85 % Inuit populations that actively share marine and land mammal stocks.

On the basis of these concerns, we would like to suggest a revised set of indicators that builds on the ASI but is more suitable for the regions with high Aboriginal people populations. We suggest a slightly more comprehensive minimum set of indicators than the ASI, but that is not as detailed and difficult to collect as the thorough work of the Survey of Living Conditions in the Arctic (SLiCA) (Poppel et al. 2007) and that integrates sustainable development with human development, institutional capacity and power relations. We think it is important to derive a set of manageable and meaningful indicators that can be collected and tracked over considerable time series, and that can assist in the assessment of individual and collective well-being of Aboriginal people in the Arctic.

Since the CIW shares a number of categories and indicators with the ASI and already collects data for these categories we will incorporate relevant CIW categories in addition to our own recommendations (see Table 3) that are based on our capabilities model, other suggestions in the literature and empirical evidence from well-being studies in the Arctic.

3.1 Health and Population

The Arctic Social Indicators identify many important health and population measures such as suicide rate, obesity rate, access to health care, and child mortality rate. The CIW also identifies depression, diabetes, health-adjusted life expectancy and population with a regular family doctor as important indicators. The latter indicators are important measures in the Canadian Arctic where diabetes, depression and suicide are alarmingly increasing phenomena for many communities. In addition, addiction and drug abuse are important indicators that would provide information about the health status of the population as well as community vitality. We would like to add collective and individual capabilities in the subsistence sector that could contribute to potentially reduce diabetes, heart diseases,

Table 3 Well-being indicators for a mixed economy

1. Health and population	2. Living standards	3. Education	4. Cultural well-being
Child mortality rate (ASI)	Per Capita	The proportion of students pursuing post-secondary education opportunities (ASI)	Cultural Autonomy (ASI)
Access to Health Care (ASI)	Household income (ASI)	The ratio of students successfully completing post-secondary education (ASI)	Language Retention (the percentage of people speaking native language) (ASI)
Suicide Rate (ASI)	Unemployment rate (ASI)	The proportion of graduates who are still in the community 10 years later (ASI)	Belonging (the percentage of people engaged in recreational or subsistence activities, and the size of subsistence economy) (ASI)
Obesity Rate (ASI)	Poverty rate (ASI)	high school completion (CIW)	The percentage of time spent on the previous day in social leisure activities (CIW)
Smoking Rate (ASI)	Subsistence harvest (weight) (ASI)	early childhood education (CIW)	The average number of hours in past year volunteering for culture and recreational organizations (CIW)
Total Population (ASI)	Long-term unemployment (CIW)	developmental health in kindergarten (CIW)	Traditional language is used in everyday activities (such as at schools, on the job, etc.) (*)
Number of Births (ASI)	Wealth and income distribution (CIW)	student-educator ratios in public schools (CIW)	
Number of Deaths (ASI)	Housing Suitability and Affordability (CIW)	proportion of bilingual educators in elementary and secondary school (*)	
Self-rated health (ASI, CIW)	Employment quality (CIW)	high school graduation rate (*)	
Depression (CIW)	Household real organic income (*)	Time spent for traditional training on land by young people and middle-aged people (*)	
Diabetes (CIW)	The value of traditional food and its distribution (*)	The number of elders actively involved in training younger generations (*)	
Health-adjusted life expectancy (CIW)	Persistence of Unemployment (*)		
Population with a regular family doctor(CIW)			
Addiction and Drug Abuse (*)			
Access to Country Food (*)			
Belonging to a food-sharing network (*)			

Table 3 Well-being indicators for a mixed economy

5. Contact with nature	6. Fate control		7. Natural resource and environmental sustainability (*)	8. Community vitality (CIW)
	Collective	Individual		
Per capita harvest of traditional food (by weight) (ASI, *) Hunting output distribution (coefficient of variation) (*) The number of people involved in processing of hides and other hunting by-products (*) The number of people in the outfitting industry and other land-based jobs (*)	The percentage of indigenous members in governing bodies (municipal, community, regional) relative to the percentage of indigenous people in the whole population (ASI) The percentage of individuals who speak a mother tongue (whether Native or not) in relation to the percentage of individuals reporting corresponding ethnicity (ASI) The percentage of public expenses within the region (regional government, municipal taxes, and community sales taxes) raised locally (ASI) ('fiscal ability' indicator) Actual influence of indigenous representatives or authorities in the determination of natural resource management rules (*) The proportion of valuable subsurface land rights owned or governed by territorial, regional or local institutions (*) Policy discretion (*) Institutional Independence (*) Local Capacity (*)	The percentage of elections in which an individual votes (ASI) Satisfaction with influence local people have on the management of natural resources (ASI) Satisfaction level with one's standard of living (ASI) Percentage of individuals who speak mother tongue (whether Native or not) in relation to percentage of individuals reporting corresponding ethnicity (ASI) Volunteering rate for political activities (CIW) Voter turnout in elections at different government levels (CIW) Satisfaction with democracy (CIW) Household Real Organic Income (*)	Environmental status: (1) impacts of climate change in the region: changes to ecosystems and their impacts on communities and food sources (Stats Canada, NWT); (2) quality of water resources (CIW); (3) contaminated sites (*) Renewable Resource Stocks: (1) measurement of Wildlife stocks changes in the area(*); (2) Availability of water resources (CIW) Depletion of non-renewable resources: (1) changes in the stock of minerals, oil and gas and other non-renewables (*); (2) Inventory of stocks (*) Energy supply: (1) affordability and availability of energy sources for heating, transportation, and electricity supply (CIW,*) Waste disposal and diversion rate (CIW)	Volunteering (CIW) Violent Crime (CIW) Number of close relatives(CIW) Involvement in Group Activities (CIW) Percentage of all full time employment jobs that are in the community (*)

* Our suggestions

depression and suicide rates. Social networks and belonging are essential for the resilience of communities especially in times of decrease in food stocks, climate change … etc. (Nelson et al. 2008; Édouard and Duhaime 2012). Access to country food, which contributes to a healthier diet for indigenous people, is sustained by the existence of strong social networks and strong sense of cultural belonging (Wein et al. 1996; Lambden et al. 2007). We, therefore, also suggest incorporating into the domain of health and population *access to country food* (survey based) and/or *belonging to an active food sharing network* (survey-based), as well as strength of family ties (Édouard and Duhaime 2012).

3.2 Living Standards

The ASI considers material well-being rather than living standards as a distinct category and suggests using conventional statistical indicators such as GDP, per capita household income, the standard unemployment rate and net migration rates. The causal links between net migration and individual and community well-being are not obvious. Even the ASI report mentions that net migration rates often do not show a clear trend. In many examples net migration is negative over some years and positive in other years and has a relatively flat long-term trend (Hamilton et al. 2010: 40). Instead we suggest to use self-reported consideration to move (geographic mobility) as an indicator for dissatisfaction with living conditions as used in Canada's Aboriginal People's Survey and SLiCA (2001). In addition we advocate indicators that measure the persistence and quality of employment and adequate and affordable housing, as well as capabilities to keep communities vital and attractive to younger residents. These indicators were identified as important predictors of well being by Édouard and Duhaime (2012) for Inuit regions. Since employment is often temporary in Arctic communities, it would be very useful to consider a flow-based indicator that measures duration of unemployment, search times and time spent away from home communities. Although per capita household income is a useful figure, it is also important to know to what extent this income comes from government transfer payments in order to get a better sense of dependency from government support. We suggest including household real organic income, which is equal to income minus government transfers adjusted for region-specific prices to measure purchasing power. The latter could be a better indicator to assess material well-being, self sufficiency and affordability of living in specific Northern communities/regions.

Subsistence harvesting by weight is a very important figure suggested by the ASI Working group. Country food has an important economic value due to high imported food costs and the high valuation of country food by local residents. Most studies that inquire into the value of country food such as caribou, whale or seal meat only look at its replacement value in the store. This leads to a significant underestimation of the value of country food. Northern Aboriginal people value hunting and acquiring country food and forfeit time and money to do so. We, therefore, need to assess this valuable natural capital asset as part of material well-being. We suggest measuring the value of traditional food and its distribution (which will require travel cost models and contingent valuation surveys as conducted for example by Berman and Kofinas (2004) for Old Crow, Yukon). Having sufficient country food is also an indicator of being healthy, which in turn contributes to productivity and material well-being of indigenous people. In order to better understand changes in the mixed economy including the crucial access to country meat we also propose to measure country food distribution with an inequality index such as the Gini coefficient or the coefficient of variation (a ratio of the standard deviation of harvest per household divided by mean harvest per household). Housing suitability (people living in

crowded dwellings) and affordability is one of the major social issues in the Canadian Arctic today where at least 40–50 % of the Inuit population has inadequate housing (Statistics Canada 2006). This was also confirmed by more detailed housing surveys in Nunavut for example (Statistics Canada 2010) and by statistical analysis for all Inuit households in Canada (Édouard and Duhaime 2012). These kind of surveys and data sets could be the basis for a more comprehensive and consistent indicator set for many of the Arctic regions.[3] Wealth and income distribution and employment quality are also important indicators that are already measured and collected at the national level in Canada by the CIW.

3.3 Education

The Arctic Social Indicators (ASI) Report supports formal education indicators as measures to understand the level of higher (post-secondary) education in the Arctic. Two of the indicators pertain to the pursuit and completion of post-secondary education, and one indicator (*the proportion of graduates who are still in the community 10 years later*) intends to measure the *brain-drain* from communities. The ASI report discusses a large number of other potential important indicators such as the availability of early childhood education programmes, student graduation rates, and student–teacher ratio. A recent report by the National Committee on Inuit Education in Canada (National Strategy on Inuit Education 2011), estimates that approximately 75 % of Inuit do not graduate from grade 12 in secondary school. The National Committee recommends investments to achieve three broad goals:

1. Offering support to children to help them stay in school.
2. Providing a bilingual curriculum to achieve literacy in the Inuit language and at least one of Canada's official languages, and learning resources that are relevant to the Inuit culture, and history and worldview.
3. Increasing the number of education leaders and bilingual educators in our schools and early childhood programs.

Based on the recommendations by the National Committee, which also apply to many other Arctic regions, we suggest including indicators that measure early childhood education, performance in elementary school, high school completion, and high school graduation rates. The CIW already measures high school completion, early childhood education, and developmental health in kindergarten and student-educator ratios in public schools. In addition there is a need for indicators that identify the proportion of bilingual teachers in elementary and secondary school, traditional training and the formation of local knowledge (which integrates scientific and non-traditional knowledge with traditional knowledge). Indicators such as time spent for traditional training on land by young people and middle-aged people (to measure the transfer of traditional knowledge between generations) and the number of elders actively involved in training younger generations are

[3] The survey of living conditions in the Arctic already identified the following 16 distinct regions with a significant indigenous population (Poppel et al. 2007): (1)Nunavik (Canada), (2)Labrador (Canada), (3) Inuvialuit, (Canada) (4) Nunavut (Canada), (5) Sydgronland (Greenland), (6) Midgronland (Greenland), (7) Diskobugten (Greenland), (8) Nordgronland (Greenland), (9) Ostgronland (Greenland), (10) Anadyr (Chukotka, Russia), (11) Central (Chukotka, Russia), (12) Eastern (Chukotka, Russia), (13) Western (Chukotka, Russia), (14) North Slope (North Slope Borough in Alaska), (15) NANA (Northwest Arctic Borough in Alaska), (16) Bering (Alaska).

essential for sustaining communities and a critical local knowledge base. The ASI report ignores education and human capital in the subsistence sector.

3.4 Cultural Well-Being and Vitality

The ASI report suggests measuring cultural and language retention. We believe that it is also important to measure the extent to which traditional language is used in everyday activities (e.g. at schools, on the job, etc.). The transfer of traditional activities, social and cultural practices to future generations would not be possible without the daily practice of native language. Cultural well-being should, however, not just be tied to traditional activities or the subsistence sector. In a modern mixed economy new cultural and leisure activities emerge in communities that might replace or complement traditional cultural activities. We think it is also important to track new directions communities take. Based on the CIW we, therefore, propose to include: the percentage of time spent on the previous day in social leisure activities, and the average number of hours in the past year volunteering for culture and recreational organizations.

3.5 Contact with Nature

Contact with nature indicators of the Arctic Social Indicators Report focus on the consumption and harvest of traditional food. The report refers to Chief Charlie Jones of the Pacheedaht First Nation in British Columbia, Canada, who attributed his longevity to eating "proper food"—whale, seal, elk, deer, bear, beaver, and salmon. We think that the proposed Contact to Nature indicators capture positive health impacts from eating country food more than actual contact with nature by the Arctic population. Throughout Arctic regions of Alaska and Canada we witness the emergence of "super-hunters" (20–30 % of all households) who account for 70 % of harvest production (Wolfe 1987; Thornton 2001; Magdanz et al. 2002; Natcher et al. 2012). In Deering, Alaska, sixty percent of all the moose and caribou harvested were hunted by fourteen percent of the households (Magdanz et al. 2002). There is some evidence from a study in the Arctic community of Old Crow (Yukon) that 82 % of households did not participate in hunting at all (Berman and Kofinas 2004). More meaningful Contact with Nature indicators would provide insights about per capita harvest, the distribution of harvest activity and what proportion of households is actively involved with hunting or land-based activities. We, therefore, propose to use per capita harvest of country food as well as the coefficient of variation of hunting output or effort. This could be done in aggregate or for key species. Further important measures that could be included are the number of people involved in processing of hides and other hunting products. In addition the number of people in the outfitting industry and service sector directly related to hunting activities would give us a sense of nature based activities that could strengthen contact to nature. Even tourism, Arctic security, and environmental monitoring and prospecting jobs (which often are combined with hunting activities) could also be good indicators of land-based activities.

3.6 Fate Control

Fate control refers to both individual and collective capabilities of native control over their own destiny. Accordingly, people or communities "must have the capacity to make their own decisions and the resources to implement these decisions" (Dahl et al. 2010: 129). The

ASI report recommends measuring collective and individual capabilities in four sub-domains (political power, decision-making power, economic control and knowledge construction) respectively. The report suggests, as the single most important collective fate control indicator, the percentage of surface lands legally controlled by the inhabitants through public governments and Native corporations. We agree that this is a very important indicator of control over the most vital resources that feed into economic, cultural and community well-being. Most renewable resources such as land and marine mammals are, however, co-managed in a complex way between regional, territorial, federal, and international authorities. An indicator could establish the relative role and influence of indigenous representatives or authorities in the determination of natural resource management rules and policy choices. For example one could think of scales (0–4) such as *exclusive control, shared control with others, limited input, no control,* or relative voting power scales. Furthermore, we have information about renewable resource allocation (e.g. in the form of quotas or tags) for various Polar Regions that indicates to what extent subsistence activities can be practiced (e.g. with no constraint, with certain limitations, not at all, etc.). Finally it is important to assess what proportion of nonrenewable resources is legally under *the control of indigenous or local organizations or institutions.* This indicator refers to subsurface land rights and not just jurisdiction over surface land. We, therefore, suggest measuring the proportion of valuable subsurface land rights owned or governed by territorial, regional, or local institutions separately from co-management power for renewable management.

The ASI report proposes two collective fate control indicators to measure indigenous people's political power and economic control. The suggested collective political power indicator measures 'the percentage of indigenous members in governing bodies (municipal, community, regional) relative to the percentage of indigenous people in the whole population'. Economic control (what we refer to as 'fiscal ability') measures the percentage of public expenses within the region raised locally (by the regional government, through municipal taxes and community sales taxes). Despite being important in certain Arctic regions, these two indicators do not sufficiently represent collective political and economic fate control. Even if indigenous people are well represented in governing bodies and these bodies raise sufficient revenues for their public services, it does not guarantee self-governing power of these governing bodies. Central governments often impose limitations on local or regional policy discretion and reserve the right to overrule or veto certain decisions. In addition local or regional governing bodies often lack capacity to formulate, execute, and implement policies and regulations. Therefore, we suggest three additional collective fate indicators: 'policy discretion', 'institutional independence', and 'local capacity'. (Sorens 2011b) creates an indicator that measures the variety of policies for which a regional government has responsibility on a scale from 0 to 3 for 3 policy areas. We adjust the scale for 6 relevant policy areas in the Arctic (based on the Ministries of the recently created Territory of Nunavut). Instead of using the term 'policy responsibility', we choose 'policy discretion', because certain Arctic regions might have authority over policy areas but not necessarily choose to execute their authority. The scale would be as follows:

0: no authoritative competencies in any of these six areas: economic policy, cultural and language policy, education policy, health policy, social policy (including housing policy), environment policy.
1: authoritative competencies in one of the six areas above.
2: authoritative competencies in at least two of the six areas above.
3: authoritative competencies in at least three of the six areas above.

4: authoritative competencies in at least four of the six areas above.
5: authoritative competencies in at least five of the six areas above.
6: authoritative competencies in at least five areas above, and in at least two of the following: residual powers, police, and authority over own institutional set-up, local government.

An 'institutional independence' indicator measures the relative degree of power that the central government possesses to change or veto the policies of regional or local governing bodies at will (ranging from 0 to 3) (Sorens 2011a: 208).[4]

Our suggested third indicator for policy and political control is 'local capacity', which can reflect whether local authorities have the professional staff to formulate or implement public policies.[5] This indicator can be measured by first disaggregating the public service occupations into categories such as policy analysts, teachers, social workers, health professionals, and scientists, and then calculating the ratio of these professionals per capita. Certain international standards for 'local capacity' for different occupations exist. For instance, the World Health Organization (WHO) has set a minimum threshold of 23 health professionals (doctors, nurses, and midwives) per 10,000 people in order to fulfill essential maternal and health services (WHO 2012). In the absence of international standards, the local capacity indicator can still provide some insights for comparing regions in terms of their relative local capacity in different public service occupations. For example, the number of public servants with Masters or equivalent degrees in each policy sector could be useful indicators to explain the erosion or strengthening of local capacity in specific policy areas. The ASI report also provides a cultural collective fate control indicator (or knowledge construction indicator): the percentage of individuals who speak a mother tongue (whether Native or not) in relation to the percentage of individuals reporting corresponding ethnicity. This indicator can complement the collective fate control indicators discussed above.

Alongside the collective fate control indicators, the ASI report also suggests individual fate control indicators, forming the individual fate control index, which consists of the individual participation rate in elections, satisfaction of individuals in the management of natural resources and with their way of living, and the proportion of individuals speaking their mother tongue. As suggested earlier we also think that individual organic household income would be a good indicator of individual economic fate control. It may also be useful to add the volunteering rate for political activities and satisfaction with democracy that are used by the CIW.

Finally we think that the ASI report is missing two crucial categories of indicators that are of particular importance in the Arctic. The report does not consider natural resource

[4] The institutional depth variable is scored "0" if there is no functioning general-purpose administration at the regional level, in which case all the other variables are also zero; "1" if there is a deconcentrated, general-purpose, regional administration (i.e. regional administrations are mere central government outposts), in which case the representation variable is zero; "2" if regions have non-deconcentrated, general-purpose administrations that are subject to central government veto; and "3" if regions have non-deconcentrated, general-purpose administrations that are not subject to central government veto (Sorens 2011a: 217).

[5] At first glance, this indicator seems highly correlated with education indicators of a given region; yet these professionals may not necessarily be the people who were born and earned their education in this region. Some may argue that it is not sustainable to bring people from the South to fill the public service positions in the Arctic; yet it can also give some extra time for the Aboriginal communities in the North to establish their human capital for the public sector, while benefiting from the expertise of these professionals in policy-making and implementation processes.

and environmental sustainability and community vitality. This is surprising since the dependence and link to environmental resources is very apparent in the Arctic. Every economic, cultural, and political activity and decision is somehow connected to the Arctic environment. In addition community vitality is very influential for community and individual well-being, particularly in isolated Arctic communities. We, therefore, strongly suggest including these two additional indicator domains.

3.7 Natural Resource and Environmental Sustainability

Environmental sustainability refers to the availability of environmental, renewable and non-renewable resources for both present and future generations of Arctic residents. This is a particularly important category since it provides the core requirement for survival in the Arctic. Environmental resources are nowhere as important as in the Arctic due to its isolation and harsh conditions that require a certain abundance and access to wildlife and other environmental services. We suggest the following quantifiable indicator categories:

1. Environmental status:
   (a) Impacts of climate change in the region: Changes to ecosystems and their impacts on communities and food sources.
   (b) Quality of water resources [water quality index (as used by CIW)].
   (c) Contaminated sites (number and exposure rates).
   (d) Waste disposal and diversion rate (already measured under CIW).
2. Renewable Resource Stocks:
   (a) Measurement of wildlife stock changes in the area (based on stock assessment reports).
   (b) Community or individual quota allocations.
   (c) Availability of water resources [related to residential water use (CIW)].
3. Depletion of non-renewable resources:
   (a) Changes in the stock of minerals, oil and gas and other non-renewables. (inventory of stocks)
4. Energy supply:
   (a) Affordability and availability of energy sources for heating, transportation, and electricity supply (dependence on non-local resources for energy, average energy and electricity prices, energy efficiency in buildings and transport).

Some categories are already measured in national accounts (e.g. Environment Canada's Sustainable Development Indicators and Enviro Stats by Statistics Canada (for example on Arctic ice conditions) and fall usually under the category of natural capital. It would not be so difficult to collect and measure this data for specific Arctic regions. The North West Territories (NWT) is already publishing a State of the Environment Report with many of the mentioned indicators (NWT 2011). It will help to identify how sustainable living in specific areas of the Arctic is. If we do not measure this information we might conclude that certain regions are developing very favourably, but we do not know how short-lived positive developments are. In addition a reduction of critical renewable resource stocks might very well also reduce collective capabilities to maintain healthy living conditions, cultural well-being, transfer of knowledge, contact with nature and ultimately fate control.

Table 4 Minimum Set of Indicators for the Arctic

Domain	ASI	Our suggestion
Health and population	(1) Infant mortality, (2) Net migration	(1) Self-rated health (2) Housing suitability and affordability (3) Access to country food (4) Geographic mobility
Living standards	(2) Net migration, (3) Consumption/harvest of local foods, (4) Per capita household income	(4) Geographic mobility (5) Consumption/harvest of local foods, (6) Real per capita household income, (7) Household real organic income, (8) Persistence and quality of employment, (2) Housing suitability and affordability
Education	(5) Ratio of students successfully completing post-secondary education	(9) High School Graduation Rate, (10) Time spent on traditional training on the land (11) Proportion of bilingual educators in elementary and secondary school
Cultural Well-being and Vitality	(6) Language retention	(12) Language Retention (measured appropriately)
Contact with Nature	(3) Consumption/harvest of local foods	(13) Hunting output/effort distribution, (5) Consumption/harvest of local foods
Fate Control	(7–11) Collective fate control index or (7) the percentage of surface lands legally controlled by the inhabitants	(14) Decision-making power over wildlife management, (15) Renewable resource allocations, (16) Fiscal Ability, (17) Policy Discretion, (18) Local Capacity, (19) The proportion of valuable subsurface land rights owned or governed by territorial, regional or local institutions (7) Household real organic income (economic independence), (12) Language retention
Natural resource and environmental sustainability	None	(20) Critical natural capital stock, (21) Energy dependency and prices (15) Renewable resource allocation
Community vitality	None	(22) Time spent for volunteering (23) Crime rates

3.8 Community Vitality

Community vitality is recognized by the CIW as one of the most important categories (Scott 2010). An individual's relationship to their community—the opportunities that are available and the quality and strength of relationships—is very much linked to individual and collective well-being. Arctic communities have a mix of traditional and modern characteristics. The vitality of a community and the well-being of individuals is no longer just a function of cultural well-being. Certain aspects of traditional communities are lost as communities are developing and new opportunities, networks, and relationships arise. As some Arctic communities are drastically changing we think it is especially important to track *sense of belonging, social, civic and economic participation, the size of social networks* and *crime rates*. We, therefore, propose to adopt Volunteering, Violent Crime, Sense of Belonging, Number of Close Relatives and Friends and Involvement in Group Activities

from the CIW. In addition we recommend measuring the percentage of all full time employment jobs that are located in close proximity to the community. The latter will indicate to what extent the community labour force is commuting to other communities or mining sites, and, therefore cannot be as actively involved in vital community activities.

4 Minimum Set of Indicators

In the discussion of ASI we noticed some overlap in different domains. Some indicators represent several categories and some indicators might have strong correlations with other indicators. It is important to point out the minimum set of indicators that still gives us valuable insights about changes in human development, individual well-being and individual and collective capabilities. The ASI Report has made a recommendation of seven key indicators (see Table 4) including an index of collective fate control (consisting of four collective indicators). In the case that the latter is too difficult to construct, the report suggests using the percentage of surface lands legally controlled by the inhabitants through public governments and Native corporations as a single indicator for fate control. Table 4 contrasts the minimum set of indicators recommended by the ADHR Task Force and the set derived from our analysis and framework.

The major health problems of indigenous people in the Arctic are linked to poor nutrition (typically processed nonlocal food sources), crowded dwellings, poor nutritional education, and high addiction rates (Zhong-Cheng et al. 2010). Measuring changes in these health indicators is directly related to avoidable infant death (Zhong-Cheng et al. 2010) and also a good indicator of other health and community vitality measures. We, therefore, suggest including these indicators in the minimum set. Since addiction can come in many forms we suggest including it in the self-rated health questions.

Per capita household income is a good proxy for income discrepancies between regions but does not give us the complete picture of living conditions and material well-being. Housing availability, conditions and affordability is one of the major concerns in Canadian Arctic communities. In some areas of the Canadian Arctic, the core housing need (which is measured by adequacy, suitability, and affordability of dwellings) is extremely high. For instance, the core housing need of Nunavut (44.5 %) is the highest among the provinces and territories in Canada (Co-operative Housing Federation of Canada 2007: 18). Édouard and Duhaime (2012) also identify housing conditions as a major factor for Inuit well-being. We also think that once per capita income is measured we should also construct real household organic income by factoring out transfer payments and factoring in a regional or local price index. The latter will be a better figure of independent material well-being and local purchasing power.

Since high school graduation rates are so low compared to national averages in many areas of the Arctic we think it is more useful to track changes in the latter indicator rather than the ratio of students successfully completing post secondary school. Furthermore, improvements in high school graduation rates are probably more important for local employment opportunities and could even reduce short term net migration. Effective education in a mixed economy also involves balancing of traditional training on the land with Southern style elementary and secondary education. It is crucial to measure time spent on traditional training on the land and to have a critical proportion of bilingual educators in elementary and secondary school as outlined by the National Committee on Inuit Education in Canada.

Table 5 Characteristics of suggested minimum set of Arctic Indicators (AI)

Name of indicator	Type of indicator	Geographical scale of measurement	Scope	Unit of measurement	Frequency of measurement
Self-rated health	Qualitative	Community	All of Arctic	Individual	Every 2–4 years
Housing suitability and affordability	Quantitative (inhabitants per bedroom, $ per m^2)	Community	All of Arctic	Household	Every 2–4 years
Geographic mobility	Qualitative (reasons for moving)	Community	All of Arctic	Individual	Every 2–4 years
Consumption/ harvest of local foods	Quantitative (kg/person by key species)	Community	Indigenous areas	Household	Every 4 years
Real per capita household income	Quantitative	Community	All of Arctic	Household	Every 2 years
Household real organic income	Quantitative	Community	All of Arctic	Household	Every 2 years
Persistence and quality of employment	Quantitative and Qualitative (employment flow variables, job satisfaction surveys)	Community	All of Arctic	Individual	Monthly (quantitative), Job Satisfaction every 2 years
High school graduation rate	Quantitative	Community	All of Arctic	Individual	Every 2–4 years
Time spent on traditional training on the land	Quantitative	Community	Indigenous areas	Individual	Every 4 years
Proportion of bilingual educators in elementary and secondary school	Quantitative	Regional/ territorial	Indigenous areas	School	Every 4 years
Language retention	Qualitative (use on the job, in schools, in leisure activities)	Community	Indigenous areas	Individual	Every 4 years
Hunting output/ effort distribution	Quantitative and Qualitative	Community	Indigenous areas	Household	Every 4 years
Decision-making power over wildlife management	Index	Regional/ territorial	All of Arctic	Regional/ territorial/ community	Whenever there is a significant change
Renewable resource allocations	Quantitative and qualitative	Community	All of Arctic	Community/ household	Annual or by allocation cycle
Fiscal ability	Quantitative	Regional/ territorial	All of Arctic	Regional/ territorial	Annual

Table 5 continued

Name of indicator	Type of indicator	Geographical scale of measurement	Scope	Unit of measurement	Frequency of measurement
Policy discretion	Index	Regional/ territorial	All of Arctic	Regional/ territorial/ Community	Whenever there is a significant change
Local capacity	Index	Regional/ territorial	All of Arctic	Regional/ territorial/ community	Whenever there is a significant change or annual
The proportion of valuable subsurface land rights owned or governed by territorial, regional or local institutions	Quantitative and Qualitative	Regional/ territorial/ community	All of Arctic	Regional/ territorial/ community	Whenever there is a significant change
Critical natural capital stock	Quantitative	Regional (by management zones)	All of Arctic	Regional and per household	According to stock assessment schedules
Energy dependency and prices	Quantitative	Regional/ community	All of Arctic	Community	Annual
Time spent for volunteering	Quantitative	Regional/ community	All of Arctic	Individual	Every 2 years
Crime rates	Quantitative	Regional/ community	All of Arctic	Individual	Every 2 years

We agree that language retention (if measured appropriately including every day use in jobs and schools) is a good proxy for cultural well-being and vitality. For contact with nature we suggest using an index of relative hunting effort distribution in addition to the consumption/harvest of country food per household per capita. This will most likely only involve an additional question in hunting surveys.

For fate control the ASI recommends to focus on a composite index that consists of the four collective indicators (see Table 3). A composite index requires, however, value judgments about the relative weights put on each individual indicator. We do not see any benefit in aggregation of these diverse fate control categories. The percentage of surface lands legally controlled by the inhabitants is a valuable indicator, but alone does not capture actual control over economic, public and natural resources by the polar region in question. Furthermore, as we discussed above, it is not difficult to construct political indices that measure relative decision-making power of local, provincial, and territorial governing bodies in public decision-making. This is particular relevant for federal countries with several levels of government. Also, household real organic income will give us an idea about economic independence and relative self-sufficiency at the individual level.

As we identified earlier it is crucial for an Arctic region or community to define its critical natural capital stock that will provide collective capabilities to sustain subsistence activities, transfer of knowledge, and land-based identity. In the process of evaluating an inventory of natural assets (which is often required for effective and transparent wildlife

management and the fulfillment of land claims agreements) local knowledge is established with all its educational benefits. It also can enhance trust among harvesters and between harvesters and scientists. In addition it is important to provide an indicator for energy dependency from non-local resources and local energy prices as an indicator for current and future living conditions and potential barriers to economic development. Finally we suggest two indicators that measure community vitality. The first one is the percentage of people that volunteer in any community or for political activities and the second one is a measure of crime rates within a region or community.

In total we suggest a minimum of 23 indicators for 8 domains that will provide us with a meaningful picture of progress in human and sustainable development in the Arctic for areas with and without predominantly Aboriginal populations. This is slightly more than the 11 indicators suggested by the ASI. For the 6 domains of the ASI report we only add 8 more indicators that are not necessarily much more difficult to measure. Some of that information is already available. Other indicators (such as 'policy discretion') require political science analysis, which is less costly and time-consuming as repeated surveys. We, therefore, think the minimum indicator recommendations by the ASI need to be reconsidered. Table 5 provides more details about our suggested minimum indicators and in what areas of the Arctic they could be measured at what geographical scale and at what frequency. Most of the data is already available in some regions (e.g. NWT) or has been measured at one point in time (e.g. APS, SliCA). The political indices would need to be constructed but this would not be too challenging and costly, and does not need to be as frequently updated. The frequency of data collection might vary according to national or regional data assessment cycles and are just approximate suggestions.

5 Conclusion

Despite certain limitations of the capability approach introduced by Amartya Sen, the approach can contribute to enhance our understanding on conceptualizing sustainable development. The revisionist versions of the capability approach emphasize incorporating collective assets, and related collective capabilities, as well as individual assets and individual capabilities, into the evaluation of well-being. The sustenance of collective assets and capabilities are of particular concern for indigenous people who are affected by rapid social, cultural, and environmental changes. Without doubt, the sustainability of collective assets (e.g. food sharing networks, language, traditional knowledge, and other cultural practices) have played key roles in enhancing the collective capabilities of indigenous communities to adapt and to develop resilience to such rapid changes over thousands of years. In order to survive in harsh conditions and to maintain their cultural vitality indigenous groups rely on collective capabilities that sustain knowledge, collective action and that are crucially linked to the monitoring and adaptive management of dynamic ecosystems and natural resources. The sustainability of natural resources and the environment in Polar Regions fosters crucial collective capabilities to maintain healthy populations, to secure certain diets and living standards, to educate future generations, to preserve cultural identity and traditional languages, and to maintain contact with nature and practice hunting activities. In essence natural and environmental resources provide the raison d'être for remaining in this harsh environment. These natural assets also provide opportunities to grow and develop communities. The challenge is to balance the conversion of natural capital into other assets without eroding critical collective and individual capabilities.

In our paper, we discuss critical collective and individual capabilities, which might be essential to community and individual well-being in the polar region. It is not a list of capabilities as Nussbaum (2000) suggested. It rather forces communities and regions to decide what core capabilities are essential for their survival. In the absence of these core social, cultural, environmental assets and capabilities it would be challenging to choose between alternative paths for sustainable development in the North. Well-being indicators force us to keep inventory of these core capabilities, and they allow us to keep track of changes. This enables us to become better judges of change and development visions.

The ASI initiative is a step in the right direction. The ASI Task Force has done some tremendous work to come up with meaningful indicators. We think, however, that it misses two essential domains of human development in the Arctic. We need to track the sustainability of human development and Arctic ecosystems, as well as the integration of the wage-based sector with the subsistence sector. Furthermore, indicators should not be merely chosen because of data availability or ease of comparisons between regions. Indeed, due to ASI's concerns of comparability of social development and data availability across the whole Arctic region (of which some parts do not have the similar population structure), its proposed indicators are not capable of covering the social development of predominantly indigenous regions of the North. Data limitations will always be an issue, but we cannot let it dictate what we measure and count for human progress and well-being. The construction of consistent and continuous time series of data and political indices are key to more meaningful analysis of progress and well-being in the Arctic. We suggest complementing some of the ASI indicators with other well-being indicators and with specific indicators for Polar Regions that some scholars have already started to measure. Perhaps some of the measures will not be readily available, but we should strive to make them available if they are crucial to the well-being of Arctic residents. The Arctic Council should continue to put pressure on national and regional statistical offices to continuously collect these data sets. Yet, being aware of the issues of affordability and data availability, we provide a minimum set of indicators that could serve to provide valuable insights on changes in human and sustainable development, individual and collective capabilities, and individual and collective well-being for all regions of the Arctic.

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