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Larsen, Sanne Vammen; Bors, Eleanor K.; Johansdottir, Lara; Gladun, Elena; Gritsenko, Daria; Nysten-Haarala, Soili; Tulaeva, Svetlana; Sformo, Todd

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A Conceptual Framework of Arctic Economies for Policy-making, Research, and Practice

Sanne Vammen Larsen
Aalborg University
Eleanor K. Bors
Oregon State University
Lára Jóhannsdóttir
University of Iceland
Elena Gladun
University of Tyumen
Daria Gritsenko
University of Helsinki
Soili Nysten-Haarala
University of Lapland
Svetlana Tulaeva
North-West Institute of Management
Todd Sformo
University of Alaska Fairbanks and
North Slope Borough Department of Wildlife Management

Abstract

The Arctic currently holds a prominent place in global policy. It is a sparsely populated region experiencing major consequences of global change, such as climate change, shifting demographics, and globalization. These substantial and rapid changes create both opportunities and risks for economic development. Informed policy-making for sustainable development in the Arctic will require an understanding of the specific structures of arctic economies, with a focus on the existence of mixed economies that contain both subsistence and market aspects, the interplay among different economic systems, and the broader contexts in which they function. This paper presents a conceptual framework that allows for comparative analysis of arctic economies within their institutional, social, cultural, and environmental contexts. Utilization of the conceptual framework will enable more complete system-level analyses by helping to describe the complex relationships among apparently disparate parts of the Arctic's diverse economic systems. The framework can be used across the social and natural sciences, practice, and policy-making. Furthermore, this framework is applicable to regions outside of the Arctic that also have distinct mixed subsistence and market economies.

Arctic economies and sustainability

The Arctic is the northernmost region of Earth, geographically defined as the area within the Arctic Circle, a line of latitude about 66.5° north of the Equator. Definitions of the Arctic vary. According to the Arctic Human Development Report, approximately four million people inhabit the Arctic (Heleniak and Bogoyavlensky, 2014); while the

University of the Arctic uses a broader definition that results in a population of approximately 13.1 million people (University of the Arctic, n.d). The Arctic includes eight states of Greenland (Kingdom of Denmark), Canada, the United States, Norway, Russia, Sweden, Iceland and Finland (Nordregio, 2013).

For centuries, the Arctic has been a region rich in peoples, cultural diversity, language, and environments. Long-standing traditions and sophisticated learning underlie the success of arctic inhabitants, serve as a source of pride, and represent the foundation of circumpolar societies (Albert, 2001). In recent years, the Arctic has been subjected to numerous rapid changes and has grown in the global consciousness (Fondahl and Nymand, 2014). Impacts of climate change, for example, are being observed earlier and developing more rapidly than in many other parts of the world (Box et al., 2019; IPCC, 2014). As summarized by the Arctic Council (2013, p. x):

> The Arctic is changing rapidly in ways that interact and fundamentally affect the region's ecosystems and societies. Climate change is important, but it is not the only driver of rapid changes in the Arctic. In many contexts, social, political and economic drivers may be of greater importance than global warming.

These unprecedented changes may not only create opportunities for economic development (Oxford Research, 2018), but may also impose disproportionate risk on arctic communities (Emmerson and Lahn, 2012).

Change in the Arctic affects economic activities within the region, for example, small-scale production for the local community, and activities that interact with and respond to external events in other regions or the global economy more broadly. One example of this kind of interaction is the extraction of natural resources for the global market (Huskey et al., 2014). As stated by Huskey et al. (2014, p. 151) the economy in the Arctic region is not one integrated economy:

> but rather a region of different economies with similar characteristics. The Arctic economic region shares economic and environmental conditions that shape the economy of any part of the region. But because the area crosses the boundaries of countries, the overall regional economy and its effect on human development is influenced by the variety of different histories, institutions and resources that affect economic performance.

One important common characteristic of the Arctic is the co-existence of a market and subsistence economies (Holen et al., 2017). For informed decision-making in the Arctic, the interplay among these co-existing subsistence and market economies must be understood and accounted for in policy- and decision-making. Considering these complexities also supports the preservation of sustainable subsistence cultures, which are closely linked to the lands, seas and resources of the Arctic.

This paper presents a conceptual framework for comparative analysis of arctic economies within their broader institutional, social, cultural, and environmental context by situating the traditions of subsistence and market economies on a continuum. It does not seek to define sustainable decisions, per se. Rather, this work is built on the premise that informed decisions are more likely to lead to sustainable actions through more holistic and complete approaches to policy problems. The importance of information and knowledge as a basis for decision-making for sustainable development is, for example, emphasized in the Agenda 21 as it states:

> In sustainable development, everyone is a user and provider of information considered in the broad sense. That includes data, information, appropriately packaged experience and knowledge. The need for information arises at all levels, from that of senior decision makers at the national and international levels to the grass-roots and individual levels. (United Nations, 1992, p. 346)

This is reaffirmed in the outcome document of the UN conference of Sustainable Development in 2012, pointing as a means of implementation to a need to: 'facilitate informed policy decision-making on sustainable development issues and, in this regard, to strengthen the science-policy interface' (United Nations, 2012, p. 70).

Implementing a conceptual framework in order to build a clear understanding of the economic systems in the Arctic is of particular urgency, because at this point in time it is the focal point of a variety of possible economic development activities, for example, in the extractive sector, infrastructure, tourism and shipping (Brigham, 2010, 2011). This also means that there are many decisions concerning which development pathways to choose (Emmerson and Lahn, 2012; Fondahl and Nymand, 2014). To undertake system-level analysis, the complex relationships among apparently disparate parts of a system have to be described and understood in a holistic manner. Furthermore, viewing the scale and context of the economic system is of particular importance in the Arctic, where there are close connections among individuals, nations and the circumpolar region, and the economic, environmental, social and cultural spheres of life.

Conceptual frameworks – defined as 'the system of concepts, assumptions, expectations, beliefs, and theories that supports and informs ... research' (Maxwell, 2005, p. 39) – are used widely in research as a way of integrating the list above into research design and analysis. Frameworks are critical tools in interdisciplinary research for a qualitative description of the way knowledge is related and organized across disciplines (Jabareen, 2009). Inter and transdisciplinary collaboration relies on common definitions and frameworks to facilitate effective dialogue. Conceptual frameworks have been implemented successfully in the study of social-ecological systems (Collins et al., 2010), circular economy (Moreno et al., 2016), multiple types of risk assessment (Kasperson et al., 1988), sustainability science (Turner et al., 2003), and

numerous other fields. Also, other frameworks for working with arctic economies have previously been used in models that seek to include a quantitative value of subsistence activities in economic studies (e.g. Poppel, 2006) and in models where the arctic economy consists of formal economy, local economy and transfers from higher levels of government (Huskey et al., 2014).

Description of the framework

Figure 1 presents a conceptual framework of arctic economies. At the center of the conceptual framework is a representation of subsistence (non-monetized), and market (monetized) economies (boxes in the innermost circle), and the spectrum of potential mixed economies between them (double-headed, dashed arrow). These economies exist across a range of spatial scales – from local to global, represented within the gradual gray shading of the inner circle; furthermore, these economies exist within institutional, social, cultural, and environmental contexts, represented in the framework as concentric circles.

Sliding scales: market and subsistence economies

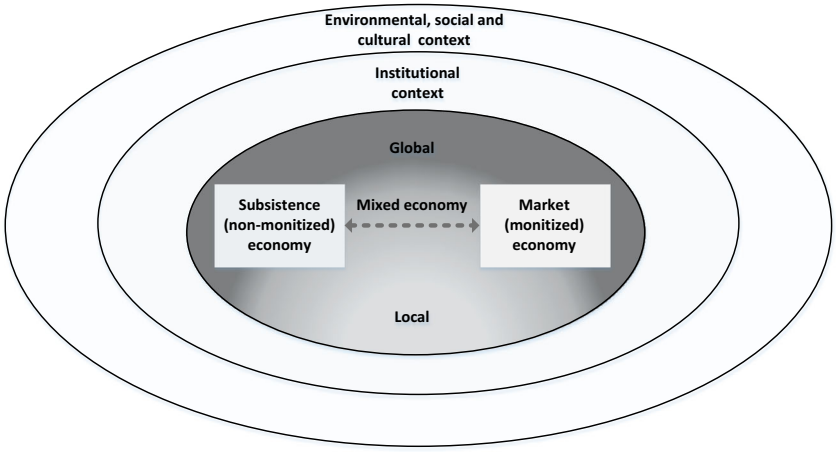
The foundational components of the framework are subsistence and market economies presented as 'ideal types'; however, it is understood that Arctic economies are rarely entirely comprised of one mode or the other in a pure form (Huskey, 2010). In fact, mixed economies exist on this sliding scale between economic models (Poppel, 2006).

Hunting, whaling, trapping, herding, fishing, animal husbandry, and gathering are examples of activities that can belong to a subsistence economy (Glomsrød et al., 2017; Poppel, 2006). It is important to recognize that subsistence is not only an economic activity, aimed at producing needed items but also figures prominently in culture, identity, and community as stressed by the Inuit Circumpolar Council's definition of subsistence:

> A highly complex notion that includes vital economic, social, cultural and spiritual dimensions. The harvesting of renewable resources provides Inuit with food, nutrition, clothing, fuel, harvesting equipment and income. Subsistence means much more than mere survival or minimum living standards . . . It enriches and sustains Inuit communities in a manner that promotes cohesiveness, pride and sharing. It also provides an essential link to, and communication with, the natural world of which Inuit are an integral part. (ICC, 1992, p. 36)

The Arctic Human Development Report asserts that: 'Customary harvesting practices are not only culturally but also economically important locally, although their role varies by region, ethnic group, urban or rural setting, and generation' (Duhaime et al., 2004, p. 74). There is a risk of underestimating this actual economic importance of the subsistence economy in official surveys of an economy, as it is not necessarily monetized and therefore needs to be estimated in a different way than the monetized market economy (Huskey et al., 2014). As stated by Finn Lynge (1998) in an address to the Inuit Circumpolar Conference, an issue that has received far too little attention is 'the issue of quantification of subsistence values. . .What evades a monetary assessment has no interest for the statisticians. For governments' economic planners, what cannot be counted in money does not count'. Social science surveys that have been conducted to quantify subsistence values show their importance. For example, a survey across Greenland, Chukotka and Alaska showed that five out of ten households report that about half or more than half of the meat and fish consumed was harvested through subsistence activities (Poppel, 2006). Concerning the economic value, a survey in Nunavut conducted from 1996 to 2001 showed that the monetary value of the

Figure 1. A conceptual framework visualizing arctic economies that exist on a market-to-subsistence spectrum. These economic systems function on local to global spatial scales and are embedded within institutional, environmental, social, and cultural contexts.



meat and fish from subsistence consumed would be between 30 and 35 million Canadian dollars per year if purchased in a store (Poppel, 2006). These examples illustrate the important and more-easily quantifiable aspects of the subsistence economy in the Arctic, added to this is the difficulty of trying to do justice to the cultural significance of subsistence, highlighting the necessity of including subsistence in frameworks for policy-making and research in the Arctic.

Market economy is different from subsistence economy in many ways. As a concept, it is based on utilitarian theory that 'postulates the economy as consisting of individuals who are considered to be concerned about their own selfish interests, indeed as those who are trying, at least in the economic realm, to maximize their expected satisfaction' (Kurien, 2015, p. 76). The market economy revolves around gaining as much economic value in monetary terms from as little monetary economic effort as possible (Jespersen, 1998; Kurien, 2015). In its purest form, the market economy functions through deals, where exchange of commodities, products, and services take place between consumers and producers in a market. In this manifestation, free competition means that supply and demand regulate prices. In practice, markets are not entirely free, but rather are regulated by institutions. Market economies are based on factors of production including labor, capital (both financial and production facilities, machines, etc.), land, and natural resources (Jespersen, 1998; Kurien, 2015). In the Arctic, market economy plays a critical role especially through activities based on the large-scale extraction of natural resources (e.g. mining, oil and gas production, and fisheries), and in the increasing growth of tourism and shipping industries (Emmerson and Lahn, 2012; Huskey et al., 2014). Generally, across the Arctic, the economy is growing (measured by the gross regional product, a monetary measure of the goods and services produced in the region within a year), and private market economy is increasingly important (Huskey et al., 2014).

Subsistence economies differ from market economies not simply because they are often non-monetized or only partially monetized but also because the factors of production are regarded in a different manner (Robinson and Ghostkeeper, 1987). Land and natural resources, human capital, physical capital, and knowledge are not exchanged in the same way; decisions are made using different processes; and profit is shared based on other principles. Notably, in a market economy the connection between production and use of the factors of production is to some extent lost, because production and consumption is often removed from the origins of the resources and not necessarily accountable for the impacts of, for example, over-exploitation (Jespersen, 1998). As can be seen from the above descriptions, this differs from the subsistence economy. While there are distinct differences between the two types of economies, they coexist and blend in the Arctic, where partially monetized subsistence economies and fully monetized market economies are closely intertwined. The interaction of market and subsistence economies in the Arctic occurs in various ways. For example, in Greenland, households are able to sell their produce, which is not the case, for example, in Alaska. In the Scandinavian North, reindeer herders live and operate under circumstances dominated by a market economy, where most products from the reindeer business are sold (Poppel, 2006), even though reindeer herding seldom sustains in a market economy without subsidiary business such as tourism, handicraft or forestry (Klokov, 2004; Myrvall, 2004). In some cases, households are included in the market through informal economic relations with market players. This usually occurs in the absence of effective formal rules or market infrastructure. It was a typical situation for Russian arctic regions in 1990s. A particular example was barter transactions between oil companies and the local population. Nowadays these relations became more formalized, but reindeer herders in the Russian Arctic have become dependent on monetary compensations and benefit sharing of oil companies and the state, as they have moved to using fuel and motorized vehicles for subsistence activities (Henry et al., 2016; Klokov, 2004; Myrvall, 2004).

Subsistence activities in other regions of the Arctic also depend on the use of cash to purchase supplies, equipment, and technology to facilitate subsistence activities (Huskey, 2010). As stated by Huskey et al. (2014, p. 163):

> The negative impacts of development in the international economy of the North may damage ecosystems that support traditional economies as in the reindeer herding regions of the Russian North. However, income brought into the local economy because of activity in the international economy may also have positive impacts on the traditional [subsistence] economy. Cash may make the subsistence activities like hunting and fishing more productive.

These positive interactions between the two types of economies are combined with other, negative trade-offs. Some emphasize potential to create a sustainable Arctic economy by implementing large-scale industrial activities such as gas and oil development resulting in an increased workforce and smaller-scale collateral market; others emphasize potential damage to a 'fragile and pristine natural environment which provides multiple sources of well-being to the Arctic's four million inhabitants' (Johannsdottir and Cook, 2019, p. 1). From a subsistence or mixed economy standpoint, it should be recognized that damage to a fragile environment is more than just a count of acres because the environment is inextricably tied to traditions and cultures: damage to land is both physical and symbolic (Hopson, 1976). Furthermore, negative impacts on resources that support the subsistence economy will have consequences for local communities. In Southeast Alaska, hunting must be practiced further away from villages and has become more difficult and dangerous. However, it has been claimed that subsistence hunting and fishing has become more important for the native people because of its cultural value, in tandem with decreasing subsistence hunting and fishing for living (Dombrowski, 2007). It should be understood,

therefore, that the substitution of mixed subsistence economies with market economies creates long-lasting effects that can be considered 'basically economically irreversible' (NRC, 2003, p. 242).

The shift between the two types of economies can also have impacts in terms of cultural significance, power of ownership, and democratic rights, as can be seen from a specific example of a shift from subsistence to market economies through gas and oil benefit sharing in Alaska. Invited testimony of Eben Hopson, former Mayor of the North Slope Borough, to the Berger Inquiry recounts how the discovery of recoverable oil in the Prudhoe Bay area and the 'restoration of democratic self-determination to all Inupiat' (Hopson, 1976) are tied together. In summary, Mayor Eben Hopson's testimony to the Canadian Royal Commission delineates the complex web of ideas and events in the 'slide' toward a mixed, cash economy that is tied not only to safe, responsible industrial development – allowing for the perpetuation of Alaska Native cultures and subsistence activities and profit-sharing – but also is tied to the reinstatement of democratic principles of circumpolar Arctic peoples: 'One of the things I am trying to say in this paper is that our Native Land Claims is an integral part of the oil and gas development in Alaska, and this is also true for Canada and Greenland' (Hopson, 1976). As seen through this example by Hopson, subsistence should be understood by policy-makers as connected to many, if not all, of the contexts in the framework.

It is also important to note that indigenous populations do not only have interests and stakes in subsistence and mixed economic activities, but also in market economy. An example of overt integration of market principles with subsistence (or mixed) economy can be seen in the Alaskan Native Claims Settlement Act (ANCSA) of 1971. This Act attempts to balance claims of Native land rights with the then recently discovered oil fields at Prudhoe Bay (1967) by designating land (44 million acres) and dispersing of funds ($962.5 million) for the creation of regional and village corporations. From the start, these corporations were legislated as for-profit and owned by native shareholders (Case and Voluck, 2012) in exchange for the 'collaborative use of their land' (Kuukpik n.d.). However, in exchange, all previous Alaska Native claims were dismissed (Huntington, 1992). After amendments to improve the ANCSA, the establishment of the Alaska National Lands Conservation Act, and decades of business development, some Native corporations, such as the Arctic Slope Regional Corporation (ASRC) and NANA Corp. are extremely influential in Alaskan economy and have become worldwide business leaders and corporations. The corporations employ a total of 58,000 people and are involved in activities such as mining, oil and gas, construction, real estate, and tourism (Resource Development Council, n.d). They support native communities not only through providing jobs and dividends to their shareholders but also through their social programs (e.g. Arctic Slope Regional Corporation, n.d.). However, interests of corporations and native communities are not always consistent, and a balance between exclusive market economy and the needs of subsistence economy is not always easy to maintain. In Southeastern Alaska, lack of funds forced several village corporations to cut old growth forest on most ANCSA land by the late 1980s and early 1990s causing severe problems for subsistence economy (Dombrowski, 2007).

Because of the intertwined nature of the two types of economies and the fact that there are shifts between them, the framework presents them as a continuum, or sliding scale, to highlight the nuances of mixed economies and the interactions among economic systems.

Spatial scales: local to global

In addition to existing on a subsistence-to-market continuum, economies in the Arctic vary in the spatial scales. In our framework this is reflected as a gradation of shading in the inner circle. While subsistence economies often exist on smaller regional and local spatial scales, the monetized, market aspects of arctic economies are usually tied to the global economy. According to the Arctic Human Development Report, 'The local and international economies often behave like two separate economies, occupying the same space, but with little in common' (Huskey et al., 2014, p. 154).

Global economic interest in the Arctic has increased in part due to climate change, which will likely improve access to previously inaccessible natural resources (Emmerson and Lahn, 2012; Eskeland and Flattorp, 2006). The global interest in the Arctic is reflected in emerging concepts as for example the notion of a 'GlobalArctic', brought forth at the Arctic Circle Assembly in Reykjavík, Iceland in 2015 (for background on the conference session see Arctic Circle, 2015). Such concepts are, however, much broader than economic issues as it includes elements of geopolitics and security in the Arctic region, as well as 'ecological, economic, environmental, cultural, political, and societal processes' (Heininen and Finger, 2017, p. 199). The growing number of Arctic Council Observers from non-arctic states, inter-governmental and inter-parliamentary organizations, and global and regional non-governmental organizations (NGOs) also highlights the Arctic's shift from regional to global importance. To illustrate this development, current Arctic Council Non-Arctic State Observers include India, Korea, Singapore, the People's Republic of China, and European countries such as France, Germany, Italy, and the United Kingdom. The growing international interest and economic activities at global scale in the Arctic is focused on large-scale and capital-intensive industries such as shipping, oil and gas extraction and fisheries (e.g. Emmerson and Lahn, 2012; Gritsenko, 2018; Huskey et al., 2014; Pan and Huntington, 2016).

In addition to participating in the economy at global and international spatial scale, the Arctic is home to many overlapping and interacting economic activities at national, regional and local scale (referred to as 'local level' for brevity). Compared to the global scale, local economic activities are often led by individuals or smaller groups using a mix of modern and traditional methods of production, and the activities are often less centralized but rather scattered geographically (Huskey et al., 2014). Examples of sectors

participating in the economy at a local scale are not only tourism, fishing, and subsistence activities, but also production of goods for the market based on local resources, such as cosmetics, arts and crafts, and specialty food. An example in fisheries is the development of a new Commercial Fishing Strategy in Nunavut, Canada, which aims to create commercial fisheries in Canada's newest Province (Government of Nunavut, 2016). This economic endeavor will grow the local economy in the provincial capital of Nunavut but will also allow the Province to participate in the National fisheries market.

The context of arctic economies in the framework

No economy exists in a vacuum. In fact, the context in which economic activities exist can have profound impacts on that economy. There are two main categories of external contexts represented in the framework: the institutional context and the social, cultural, and environmental context.

Institutions are regarded as 'rules of the game', representing formal rules and procedures as well as conventional practices (informal rules) that structure the relationships between actors and socio-economic structures (North, 1990). The Arctic institutional context encompasses a variety of formal and informal rules, including international and national legislation and regulations, regional conventions, and legally non-binding guidelines, as well as a variety of actors who create and maintain these rules (Heininen et al., 2015). The institutional context of any specific economy or economic activity may include multiple levels that also vary on the geographic scale from local to global, and in between the two extremes of subnational self-governing constituencies, territories, states, provinces and counties. This also includes the eight nations that are member states in the Arctic Council and several both sub-regional and multi-lateral institutions operating in the Arctic.

The institutional context at the global level is determined by the activities of the transnational players such as the UN, International Maritime Organization (IMO), International Labor Organization (ILO), WWF, Greenpeace and others. They form global institutions that influence the activity of actors at the global level. The examples of such global rules are standards elaborated by UN, World Bank, ILO, international conventions and agreements. Most of these global rules are aimed at developing the global market, protecting the interests of the most vulnerable groups, and developing co-operation between countries and regions. The next cross-regional level of the rules is related to the regulation of actors' activities in the Arctic region. These are standards and agreements developed by the Arctic Council, Barents Euro Arctic Council, Inuit Circumpolar Council and other international organizations operating in the Arctic. Examples of such rules adopted for the Arctic region could be Polar Code, The Ilulissat Declaration, Arctic Search and Rescue Agreement. The next institutional level is related to the formation of rules in the territories of concrete Arctic states. These may be laws enacted at the national level or subnational level, which regulate the industrial and economic activity in the Arctic countries or protect the rights of local people living there. At the local level, the work of international or national institutions is reinforced or weakened by local norms and regulations. The institutional diversity of the Arctic region is illustrated in Table 1.

The apparent complexity of the institutional context across the Arctic makes it a vital part of any analysis related to arctic economies. The institutional context defines ownership and decision-making power over natural resources, whether this is centralized or local. This is critical, for example, in defining where the distribution of income and benefits from exploiting the resources (Hopson, 1976; Huskey et al., 2014). Similarly, the institutional frameworks set up for subsistence activities shape some of the possibilities for example via quota systems or designated grazing lands for reindeer (Poppel, 2006). The institutional framework can also be affected by shifts in the economic system, as emphasized above in the statements from Mayor Eben Hopson (1976), which highlight how democratic self-determination can also be strengthened by economic change towards increasing market economic gain.

Perhaps the most important framing of the Arctic comes from the environmental, social and cultural context in which economies function. We have chosen to keep these three domains as one concentric circle – the outermost circle of the framework – because they are inextricably linked in the Arctic. Climate change is a very prominent example of the importance of the environmental context. This pervasive environmental issue can influence shifts and interactions between market and subsistence economies by enabling new natural resource-based economic activities, as well as decreasing transport costs as melting ice opens new shipping routes (Huskey et al., 2014; Poppel, 2006). On the other hand, climate change might also make both resource development and some subsistence activities more difficult due to diminishing and unpredictable ice (Huskey et al., 2014; Poppel, 2006). Looking then to the importance of the social and cultural context of an economy, one example is the question of what line of work young people prefer. In Greenland for example, the number of professional hunter licenses has decreased, and the average age of hunters have increased, partly explained by the profession ranking low among the youth. According to Poppel (2006, p. 72) 'If the decrease in the number of professional hunters continues, the profession will be extinct within a generation'. This change in social and cultural context of what constitutes a desirable job and lifestyle can have large impacts on the composition of the local economy.

Potential applications of the framework in science-based decision-making support

As stated earlier, conceptual frameworks are useful across sciences. Their role is particularly to enable framing and deconstructing of issues, laying the basis for a structured

Table 1. Institutional diversity in the Arctic (Heininen et al.,)

Level	Examples of the Actors	Examples of the institutions
Global level	International Maritime Organization (IMO), United Nations Organization (UN), World Trade Organization (WTO), International Labor Organization (ILO)	United Nations Division for Ocean Affairs and the Law of the Sea, United Nations Declaration on the Rights of Indigenous Peoples, ILO Convention 169
Cross-regional level	Arctic Five, Barents Euro Arctic Council, Inuit Circumpolar Council, Saami Council, and the West Nordic Council, the Arctic Council, Northern Forum	Polar Code, The Ilulissat Declaration, Arctic Search and Rescue Agreement
National level	Canada, the Kingdom of Denmark, Iceland, Finland, Norway, the Russian Federation, Sweden, and the United States of America	National legislation
Regional level	Arctic Slope Regional Corporation, Alaska Eskimo Whaling Commission	North Slope oil producer agreement
Local level	Municipalities, tribal councils, boroughs, local indigenous associations, reindeer herding cooperatives, corporations	Local rules and norms

analysis, and extending the understanding of the issues. This in turn can aid policy- and decision-making in the search for solutions to problems and be of use to academic scholars and practitioners. We will provide a modest number of examples to illustrate the potential utility of the framework proposed in this paper.

Risk analysis

In terms of analyzing risk, the conceptual framework can be useful for highlighting the causal mechanisms of risks and opportunities exchanged between different parts of the economy and its context. As described above, the conceptual framework highlights the interplay between market and subsistence economies and the conflicts of interest, systemic risks, and trade-offs that might result from these interactions.

As a specific example, environmental impact assessment (EIA) is a much-used proactive risk analysis and management tool across the Arctic and the globe. Its purpose is to identify, assess and mitigate social and environmental impacts – or risks – of proposed economic development activities and feed information into the decision-making process (IAIA, 1999). When analyzing the impacts of a proposed economic activity, the framework can provide an overview of impacts and how they interact. For example, a proposed mine would be considered an activity connected to the market economy. The mine can have impacts on the environmental, social and cultural context, in many different ways following many different causal mechanisms. It could, for example, cause water pollution (environmental impact), causing decreased fish populations impacting the possibilities for local fishermen (social impact), and causing them to change their traditional way of life (cultural impact). The mine could also cause an impact on the subsistence economy because it prompts locals to take jobs in the mine, reducing their subsistence activities. Whether such a slide from subsistence towards market economy is a negative impact or a positive impact is a matter for discussion and dependent on the context; however, using the framework for risk analysis can help highlight this movement and facilitate such discussion.

Natural resource management

Understanding the economic composition and contexts of the Arctic may also improve outcomes in natural resource management. Sound natural resource management requires scientific study of the resources themselves and the environment in which they are found. In addition to research specifically designed to address management needs (e.g. fisheries surveys conducted by a fisheries management body, or local municipalities providing scientific studies for bowhead whale management), researchers from many disciplines study arctic systems. In general, when conducting natural science research in a region, it is important to understand the ways in which that research fits into the broader systems of the region. This holds true in the Arctic. Research success in the Arctic depends on and is enhanced by a deeper understanding of existing arctic economies. From both the perspective of an outside researcher studying the region and a resource manager seeking evidence-based approaches to management, explicitly engaging with the complexities of arctic economies may improve outcomes.

One specific example of strategic incorporation of both the subsistence and market economies in natural resource management comes from the Canadian Arctic. The Nunavut Fisheries Strategy (Government of Nunavut, 2016), published by the Provincial Government of Nunavut, highlights the importance of a subsistence fishing economy and the ways in which commercial fisheries might interact with subsistence fishing. The second objective in the plan's third strategic priority, "Harvest levels, access, and allocation," is to: 'Understand subsistence harvest needs and areas of conflict with commercial fishing. Look at how fishing areas are used by local people and families' (Government of Nunavut, 2016, p.33). Another example at a local level having international effects is the North Slope Borough-Department of Wildlife

Management (NSB-DWM) that conducts scientific research on bowhead whales including health and population studies that are directly used by the International Whaling Commission for hunting quotas. Reliance on traditional knowledge allowed this department to transform all of the naïve claims held by non-local scientists that helped to form a moratorium on hunting in the mid-1970s. The claims were disputed by whalers, and NSB-DWM treated each supposition as testable hypotheses that were ultimately disproved (Albert, 2001; Von Duyke et al., 2019).

Communities in the Arctic have also expressed the importance of research engagement with the existing social, political, and economic structures in the region. For example, it is common to hear requests in meetings that occur in Alaska Native communities for scientists to spend time in communities before conducting research to get community input on scientific objectives (Albert, 2001). These types of discussions during public meetings have led to formalized statements by the US Interagency Arctic Research Policy Committee 'Principles for Responsible Conduct in the Arctic' (Glenn, 2003; IARPC, 2018). These principles highlight the importance of building relationships, being knowledgeable about local communities and conditions, and establishing effective communication. As an example, research focused on living natural resources may be important for a species that is important to arctic stakeholders either for subsistence or commercial purposes.

Business development

The usefulness of the proposed framework in relation to business development is highlighted here by two examples of analyses conducted by Lloyd's of London on arctic-related business opportunities and risk. One focuses broadly on business opportunities and risk in the high north (Emmerson and Lahn, 2012), and the other one focuses on the energy insurance industry in extreme environments such as the Arctic (Rees and Sharp, 2011).

The first report covers major changes happening in the Arctic and the uncertainty and risk that these changes pose to market economy activities, such as oil and gas, mining, fisheries, tourism, shipping, and logistics. The changes include environmental and climate change, sea ice retreat, impacts on ecosystems, and how the changes impact the economic and political future of the Arctic. To a certain extent, even the traditional business model of insurers is changing due to climate related uncertainty where '[the insurance] industry must take a new approach to underwriting, looking ahead and not simply basing decisions on historical patterns' (Lloyd's, 2006). The report also highlights arctic governance issues, and how to assess and manage arctic-related risks, consisting of ownership and liability, political and reputational risk factors, risk mitigation and management, risk transfer and risk governance (Emmerson and Lahn, 2012). However, these issues are addressed mainly from a market perspective, ignoring the critical importance of subsistence and mixed economies in the region, for example what risks and opportunities might be relevant for the subsistence economy by changes as well as market economy activities. The only concrete reference to subsistence economy is the following: 'In Canada, Arctic energy and mining projects play into complex federal politics and the domestic politics of indigenous peoples across the north' (Emmerson and Lahn, 2012, p. 33). Additionally, it is recognized that within the Arctic Council, indigenous groups, as non-voting permanent participants, may be highly influential within the domestic politic arena, and therefore, co-operation with indigenous communities need to be planned (Emmerson and Lahn, 2012).

The second report (Rees and Sharp, 2011) provides an overview of what it entails to drill for oil in an extreme environment, such as deep-water drilling in the Arctic. It assesses environmental issues and regulatory changes, as well as discusses the impact of the Deepwater Horizon oil spill in the Gulf of Mexico in 2010 (National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, 2011), and how to improve risk management. It acknowledges potential damages to 'local ecosystems, particularly oceans and wildlife, and disruption to indigenous populations' (Rees and Sharp, 2011, p. 17), without identifying to what scale these disruptions could be. Marine related oil spills in the Arctic may even go so far to have existential consequences for subsistence economies in the case of worst-case scenarios of oil spills (Johannsdottir and Cook, 2019).

Business-related analysis that discusses and evaluates various possible economic development activities could benefit from the conceptual framework proposed in this paper. Using such a framework could provide a structure that highlights and contextualizes the complex mixed economy in the Arctic to facilitate a more holistic discussion of the opportunities and risks facing sustainable economic development in the region. To give a specific example, the framework has proved useful when studying the systemic risk of maritime-related oil spills in an arctic context considering different scales of risk: subsistence level, enterprise level, portfolio level (industry), systemic level, and existential level. Taking into account the co-existing economies it becomes evident that in worst-case scenarios of oil spills there might be social, cultural, environmental, and economic consequences, in addition to security and policy implications, and consequences affecting businesses involved in the disaster and their partners (Johannsdottir and Cook, 2019).

Discussion: Implications for policy-making

As exemplified above, the framework proposed in this paper can be useful as a knowledge basis for making decisions about future developments and policies. The framework can be useful for understanding conflicts of interests in terms of risks versus opportunities, when proposed economic activities are being evaluated. As in the example of the mine, what can be considered an opportunity in terms of market economy can at the same time constitute a risk to other market economic activities or to the subsistence economy either directly or indirectly. The same could be the case for

other important developments in the arctic economy including large infrastructure projects, opening up for hydrocarbon activities, and developing social programs or resources. As for example stated by Berger (1977):

> It is self-deception to believe that large-scale industrial development would end unemployment and underemployment of native people in the North. In the first place, we have always overestimated the extent to which native people are unemployed and underemployed by understating their continuing reliance on the land. Second, we have never fully recognized that industrial development has, in itself, contributed to social, economic, and geographic dislocation among native people. (Berger, 1977, p. 123)

Understanding and highlighting such conflicts in a systematic way can be useful for making balanced and informed decisions when trade-offs specific for mixed economies are involved. Also, as highlighted by Holen et al. (2017) understanding these interplays is necessary if it is chosen to compensate local populations for the negative impacts from developments on their possibilities for subsistence. This is specifically visible in the example described above of balancing subsistence and commercial fisheries in northeast Canada. Such positive examples are valuable for areas, such as the Scandinavian North suffering for constant land use disputes between reindeer herding, forestry, mining, tourism and wind power production (e.g. Lassila, 2018; Mazzullo, 2018; Skarin et al., 2018).

Generally, the continuum of economic values and contexts represented in the framework can assist policy-makers by providing a more complete scaffolding for framing issues. From a western (and scientific) perspective, the ability to isolate and reduce issues to one or two contexts is desirable in providing a linear path for development; however, this reduction can also lead to the all-too-common criticism that deliberation is too restrictive for some of the affected parties (National Research Council, 1996).

As a specific example of a policy discussion for which the framework can be useful is whether the arctic economies are sliding towards increasingly being a market and monetized economy, as discussed in section 2, and whether this is the right path for the Arctic. The Arctic Human development report has pointed out that using GDP as one of the main indicators used to measure market economies by ignoring the subsistence economy and the value it represents underestimates production: 'The more important traditional activities are in a region of the Arctic, the greater the underestimation of total output' (Huskey et al., 2014, p. 151). The framework presented in this paper contributes to these discussions by highlighting the role of subsistence economies in the total economic system. It enables decision-makers to include important contributions of subsistence activities to achieving and maintaining thriving communities (e.g. Akearok et al., 2019). The economic values and contexts in the framework (Figure 1), therefore, can serve as a more integrative characterization of the economy in the Arctic, for the tying together of higher-order contexts and values, rather than reduction to fewer levels.

Conclusions

This paper presents a conceptual framework useful to characterize and contextualize arctic economies for various types of analysis and policy discussions, aiding informed decision-making towards sustainable development. It encompasses both subsistence and market economies, emphasizing the sliding scale of mixed economies that exists between them. It also brings forth the institutional context of arctic economies, as well as the social, cultural and environmental context in which they exist. Examples of usefulness of the framework have been discussed, including risk analysis, natural resource management, business development, and policy and decision-making. However, this only presents parts of the potential of utilizing the framework, it may also be of relevance for other parts of the globe, mainly in other places with a similar economic set-up with a strong dual system of market and subsistence economy.

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Author Information

Sanne Vammen Larsen works as an Associate Professor at The Danish Centre for Environmental Assessment at Aalborg University, Denmark. She works with impact assessment broadly as well as specifically in the Arctic.

Eleanor Bors is a marine biologist with experience working in international policy. She uses molecular biology techniques to answer questions about the ecology and population dynamics of marine species in order to better understand how humans directly and indirectly affect the marine environment.

Lára Jóhannsdóttir is an academic director and a Professor at the Environment and Natural Resources Graduate Programme, Faculty of Business, University of Iceland. Her practical experience is from the finance sector. In her academic work she focuses on corporate social responsibility, corporate sustainability, insurance, responsible investments, and the Arctic.

Elena Gladun is a Doctor of Law, Professor at the Institute of State and Law, the University of Tyumen, Russia. Her research interests are the northern indigenous peoples and legal regulations of natural resource use and environmental protection in the Arctic.

Daria Gritsenko is an Assistant Professor at the Aleksanteri Institute and Helsinki Center for Digital Humanities (HELDIG), University of Helsinki. She is also a member of the Helsinki Institute of Sustainability Science. Her work focuses on policy-making activities of private actors, environmental sustainability, and polycentric governance.

Soili Nysten-Haarala is a Professor of Commercial Law and Dean of the Faculty of Law of the University of Lapland, Finland. Her field of interest covers international business law, proactive contracting and legal design, as well as governance of natural resources and megaprojects.

Svetlana Tulaeva is an Assistant Professor at the Russian Presidential Academy of National Economy and Public Administration. Her research interests include legislative studies and economic sociology. She has participated in research projects concerning governance of natural resources and sustainability of indigenous people in the Arctic.

Todd Sformo is a biologist for the North Slope Borough-Department of Wildlife Management in Utqiaġvik (Barrow), Alaska, and Research Scientist at the University of Alaska Fairbanks-Institute of Arctic Biology. He evaluates health, abundance, and stressors of arctic subsistence species such as fish, bowhead whales, and polar bear.