The Arctic: Opportunities, Concerns and Challenges

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The Arctic is often thought of as the land of polar bears and explorers. There are already several industries operating in the Arctic, through the Arctic, or at the periphery of the Arctic Circle. Receding and thinning sea ice with climate change provides increased access to natural resources, shipping routes and touristic areas, thereby providing new opportunities for economic development in the Arctic. The rewards for operating in the Arctic are potentially extremely high and attractive, but at high financial, environmental and social costs in an environment which remains financially very risky. Some stakeholders have started securing access to Arctic resources, sowing the seeds for a 'cold rush'. Such 'cold rush' has not materialised yet, slowed down because of high economic costs and political sensitivity. The main political challenge ahead is to successfully reconcile the different perspectives and interests in the Arctic. One option to facilitate this reconciliation is to build up existing institutional capacity in line with the pace of economic development. There is certainly strong potential for creating shared economic wealth and well-being. Actual choices made by Arctic industries and countries for economic development, coordination and cooperation for establishment of environmental and social safeguards within the coming years will shape what the future Arctic will look like.

The Arctic refers to an oceanic area around the North Pole and Arctic Circle partly covered in sea ice and surrounded by frozen lands. The Arctic is made of two zones: the Arctic Ocean and the Arctic region. The Arctic Ocean is bordered by five sovereign states (United States of America, Canada, Denmark, Norway, and the Russian Federation) subject to international law of the sea (in particular under the United Nations Convention on the Law of the Sea, UNCLOS, of 10 December 1982). The Arctic region is broader and encompasses all states which have land in the Arctic Circle. The Arctic region includes all five states bordering the Arctic Ocean, with the addition of Iceland, Finland and Sweden. There is no agreed delineation of an 'Arctic Region' and population estimates vary from 4 to 10 million depending on the geographic extent considered (Ahlenius *et al.*, 2005, p.6 & 14; Norway Ministry for Foreign Affairs, 2015, p.5; Duhaime and Caron, 2006).

The Arctic is part of the global climate system with heat redistribution through ocean currents between the North Pole and the equator, as well as heat and nutrient redistribution between

surface waters and the deep abyssal plains (Ocean and Climate, 2015). Impacts from climate change in the Arctic are stronger and faster than any other areas of the globe. The Arctic is therefore seen as the 'canary in the mine', an early warning sentinel of climate change impacts (The Arctic – The Canary in the Mine. Global implications of Arctic climate change. Norwegian-French conference in Paris, 17 March 2015).

The Arctic sea ice is now shrinking and thinning because of rising concentrations of anthropogenic greenhouse gases in the atmosphere, leaving longer sea ice-free seasons (Speich *et al.*, 2015; Parkinson, 2014; Kwok and Rothrock, 2009; Serreze *et al.*, 2007; Boé *et al.*, 2009; US National Snow and Ice Data Center in Boulder Colorado, 03 March 2015). Scientific scenarios and models have shown that sea level could drop slightly in certain areas of the Arctic and increase by more than 70 cm along the east coast of the United States (Ocean and Climate, 2015).

Such changes in the Arctic open up access to Arctic ocean-floor resources and sea routes, with new opportunities for economic development in the region which could impact global trade patterns and trends (Valsson and Ulfarsson, 2011). If left open and uncoordinated, such economic development has the potential to lead to a wild 'cold rush' driven by selfish interests rather than a concerted effort to make the most of these new opportunities for society as a whole and create shared wealth and well-being.

- What potential economic benefits would we derive from economic development of activities in the Arctic, and at what costs?
- What potential environmental and social consequences would such economic development have?
- Have there been any signs of a 'cold rush' materialising yet?
- What are the political challenges ahead if we are to make the most of the new economic opportunities arising in the Arctic?

THE ARCTIC, A PLACE OF INTENSE ECONOMIC ACTIVITY BUT WITH WIDE VARIATIONS BETWEEN COUNTRIES AND INDUSTRIES

There are several industries already operating in the Arctic, through the Arctic, or at the periphery of the Arctic Circle. These include fishing and forestry, mining (oil, gas, minerals), shipping (sea transport), manufacturing (fish processing, electronics), Arctic tourism, and other services associated with human settlements such as education, health care, administration, postal services, shops and restaurants, hydro power and windmill parks, military activities (Ahlenius *et al.*, 2005, Duhaime and Caron, 2006, Conley *et al.*, 2013, Glomsrød and Aslaksen, 2009; Dittmer *et al.*, 2011). Additionally, the Arctic supports subsistence activities outside the cash economy such as fishing, hunting, caribou and reindeer herding, gathering, and traditional food processing

Fig.1 — Patterns of trade and barter between neighbouring human communities, regional hubs, and urban communities. Data collected between 2004-2006 in six western Alaska human communities. Source: Magdanz et al. (2007, p65).

(Glomsrød and Aslaksen, 2009; Ahlenius *et al.*, 2005, p.27). Such subsistence activities are associated with significant traditional trading and bartering between different Arctic populations (Figure 1; Glomsrød and Aslaksen, 2009).

The Arctic, at the **macroeconomic** level, displays intense economic activity linked to the exploitation of natural resources, and a very dominant service industry (Figure 2; Duhaime and Caron, 2006; Glomsrød and Aslaksen, 2009). Exploitation of natural resources includes geographically concentrated large-scale extraction of non-renewable resources such as hydrocarbons, nickel, diamonds and gold, as well as geographically widespread small-scale commercial fishing and forest exploitation. The public sector often accounts for 20-30% and the overall service industry for over 50% of all economic activity in the Arctic regions.

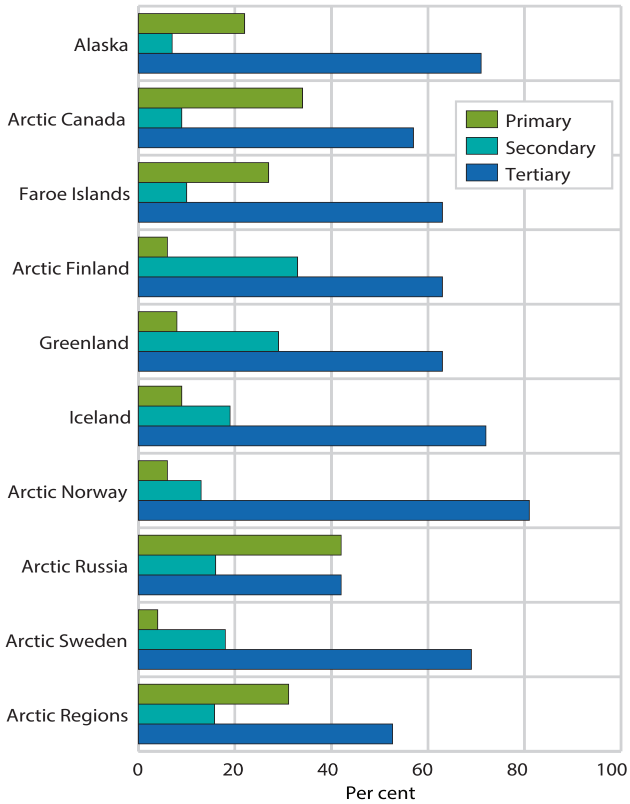

Fig.2 — GDP (%) by main industry in the different Arctic Regions (reference year: 2003) (Source: Duhaime and Caron, 2006, Figure 2.1 p.19). Primary sector: large-scale extraction of non-renewable resources, small-scale commercial fishing and forest exploitation; secondary sector: manufacturing and construction; tertiary sector: service industries.

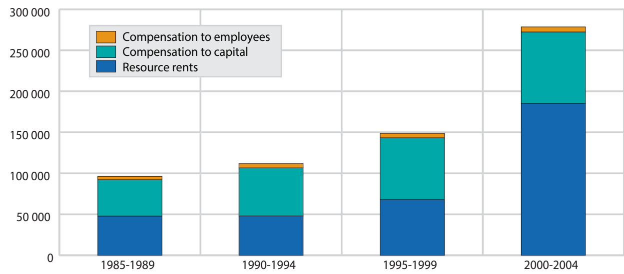

Fig.3 — Five-year average decomposition of gross production in the Norwegian oil and gas (offshore) sector (Source: Duhaime and Caron, 2006, Figure 1 p.24).

At the **microeconomic** level, the resource rent derived from production in the Norwegian oil and gas (offshore) sector has risen quite significantly in 2000-2004 compared to previous periods (Figure 3). Resource rents for renewable natural resources are much lower, with hydropower and forestry associated with positive resource rents, commercial fisheries associated with negative but increasing rents, and aquaculture associated with positive and negative resources rents (Figure 4).

The Arctic has limited shipping activity dominated by population resupply along the Northern Sea Route and Northwest passage, fishing in the ice-free waters around Iceland and in the Bering, Barents and Norwegian Seas, and tourism along the coasts of Northern Norway, Southwest Greenland and Svalbard (Peters *et al.*, 2011). Bulk cargo is associated with large mining operations in Alaska (zinc) and Russia (mainly nickel) and limited oil and gas transport mostly taking place on the Eurasian side (Peters *et al.*, 2011).

LOCAL OPPORTUNITIES FOR DEVELOPMENT OF ECONOMIC ACTIVITIES ARISING WITH CLIMATE CHANGE IN THE ARCTIC: POTENTIALLY HIGH ECONOMIC BENEFITS FOR HIGH ECONOMIC COSTS IN A HIGH-RISK ENVIRONMENT

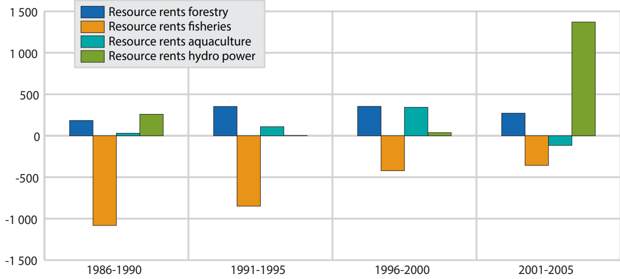

Fig.4 — Five-year average resource rents from the renewable natural resources in Norway (Source: Duhaime and Caron, 2006, Figure 2 p.25).

All industries operating in the Arctic region are faced with slightly different opportunities and constraints arising because of climate change in the Arctic, associated with potentially high economic benefits but for high economic costs in an environment that is financially risky to operate in. The receding ice sheet cover allows for increased physical access to natural resources such as fish and timber (renewable resources), oil, gas and minerals (non renewable resources). Such increased access could translate into additional economic revenues for the fish, timber, mining (oil & gas, minerals) industries. Economic opportunities arise mainly with increased physical access or access time to quantities of natural resources, not so much because of increases in market prices.

Most of the following descriptions and numbers rely on the use of models for predictions of future outcomes and are often subject to a high level of uncertainty. The quality of the outputs from such models depends on data quality, trends and understanding at the time the models were established. The predictions from such models should be considered with caution, especially when very optimistic, as they may not fully materialise, or only in 2030-2050. The second difficulty in judging actual opportunities is based on the fact that the numbers of potential gains put forward are not always based on evidence but rather on perceptions.

The **shipping (sea transport) industry** would benefit from greater use of Arctic and circumpolar (sea transport) shipping routes such as the Northern Sea Route (the shipping lane along the Russian Arctic coast that connects Europe to the Asia-Pacific region), the Northwest passage (along the North American coastline), or the Bering Strait (53-mile strait between Siberia and Alaska) thanks to reduced ice cover extent and thickness and longer ice-free periods increasing seasonal availability to maritime traffic (Conley *et al.*, 2013, p.32-37; Peters *et al.*, 2011). These routes cut down miles, shipping time and fuel costs, which combined with high fuel costs increase their appeal to the industry. Estimates of 40% shipping cost saving and recent cost saving 'records' between Europe and Asia are widely quoted to illustrate the economic potential of these routes. More recent studies accounting for ship performance in ice conditions are far less optimistic with only 5-16% cost saving now, and up to 29% in 2030 and 37% in 2050 (Peters *et al.*, 2011; Liu and Kronbak (2010). Actual cost saving needs to be traded off with the higher costs for ice class ships, non-regularity and slower speeds, navigation difficulties and risks of accidents from poor visibility and ice conditions, as well as the need for extra ice breaker service (Liu and Kronbak, 2010). There are a limited number of public-use deep-water ports, re-fuelling stations, or reliable re-supply locations, limited communications and emergency response infrastructure including search and rescue capacity in the Russian Federation and Northern Europe and almost non-existent communications and emergency response infrastructure along the North American coastline (Valsson and Ulfarsson, 2011; Dawson *et al.*, 2014). All these could reduce the appeal of using Arctic shipping routes rather than the Suez or Panama canals, especially after recent drop in oil prices reducing actual cost saving (Peters *et al.*, 2011).

The **Arctic fishing and aquaculture industry** would benefit from increased stock levels. Southern and pseudo-oceanic temperate fish species stocks are relocating North (Barents and Bering Seas), which could lead to unprecedented harvest levels most likely benefiting commercial fisheries (Hunt Jr. *et al.*, 2013; Christiansen *et al.*, 2014; Falk-Petersen *et al.*, 2015). The Barents Sea already displays higher levels of fish biomass density, with productivity at all trophic levels increasing with climate change and increased upwelling of nutrient-rich waters such as that of winter 2012. Actual streams of economic benefits depend on successfully

avoiding overfishing under yet insufficient Arctic fisheries biological data (Christiansen *et al.*, 2014). Economic benefits are to be traded off with the negative impact of climate change and ocean acidification over calcareous shellfish (e.g. clams and oysters) and zooplankton (krill, pteropods consumed by salmons) (Ocean and Climate, 2015). It has been suggested that climate change could be directly or indirectly one of the causes of the disappearance of commercial species such as King Salmon off the coast of Alaska (Conley *et al.*, 2013). Climate change can negatively impact subsistence fishing in areas where it constitutes a major livelihood source (Himes-Cornell and Kasperski, 2015). Actual cost saving because of higher fish stocks needs to be traded off with the higher fuel costs in addition to those generally applicable to navigating the Arctic, and the high monitoring and enforcement costs to mitigate illegal, unreported, and unregulated (IUU) fishing in the Arctic (WWF, 2008).

The **oil and gas industry** would benefit from increased physical access to oil and gas resources including offshore reserves in the Chukchi Sea. 400 oil and gas onshore fields north of the Arctic Circle already account for approximately 240 billion barrels (BBOE) of oil and oil-equivalent natural gas - almost 10 percent of the world's known conventional resources (cumulative production and remaining proved reserves) (Bird *et al.*, 2008). The total undiscovered conventional oil and gas resources of the Arctic believed to be recoverable using existing technology are estimated to be approximately 90 billion barrels of oil, 1,669 trillion cubic feet of natural gas, and 44 billion barrels of natural gas liquids, with approximately 84% of the undiscovered oil and gas occurring offshore (Bird *et al.*, 2008). Oil and gas exploitation in the Arctic however comes with high costs for Arctic resistant infrastructure and operations, as well as capital costs for purchase of exploration licenses, leases, drilling permits, equipment and personnel (Conley *et al.*, 2013). There is still low competition from alternative energies - which have longer term potential - such as wind, waves, hydropower from the huge rivers that flow into the Arctic Ocean, and geothermal energy in a few places (Valsson and Ulfarsson, 2011). Following a report by Lloyd's, a large UK-based insurance market, and Chatham House, a British think tank, in April 2012, not all insurers are happy to insure operations in the Arctic (e.g., German bank West LB), partly in relation to the logistical and operational challenges due to the harsh and unpredictable Arctic conditions (Conley *et al.*, 2013). The recent drop in oil prices, combined with the exploitation of previously non-commercial natural reserves (e.g., shale and other unconventional gas) have generally reduced incentives to operate in the Arctic (Conley *et al.*, 2013).

The Dutch company Shell has pioneered efforts for offshore exploitation of oil and gas reserves in the Beaufort and Chukchi seas. The total investment cost for such operation is estimated to over US $4.5 billion for lease acquisition in 2005 and 2008, one sixth of its annual capital spending budget (Conley *et al.*, 2013). Total investment may exceed US $40-50 billion, which represents a significant financial risk for the company (Conley *et al.*, 2013).

The **mineral industry** would benefit from increased physical access to mineral resources such as lead and zinc in Alaska, gold in Canada, rare earth elements in Greenland, diamonds and iron in Canada and Greenland, aluminium in Iceland, and nickel in Russia (Duhaime and Caron, 2006; Conley *et al.*, 2013). In particular, Greenland could become a gateway for China's commercial entry into the Arctic region following recent discovery of large reserves of rare earth metals and increased Chinese strategic interest in these resources (Gattolin, 2014, Conley *et al.*, 2013). The GFMS index for base metals has increased by 300% between June 2002 and June 2007 (Gattolin, 2014, Conley *et al.*, 2013) whilst gold extraction has been put on hold in Alaska following low world market prices (Conley *et al.*, 2013). Mineral exploitation in the Arctic comes at high infrastructure and operation costs to withstand the harsh weather conditions. Infrastructure development and maintenance (road or rail corridors) is often borne by government rather than industry. Infrastructure development could unlock exploitation of resources (e.g. copper exploitation on hold in Alaska for lack of infrastructure, Conley *et al.*, 2013).

Climate change in the Arctic seems to have extended access to areas of touristic value, benefiting the **Arctic tourism industry** directly. It has opened up previously inaccessible areas for exploration and use by the expedition cruise ship industry as well as lengthened the shipping season (Dawson *et al.*, 2014). There is globally increasing demand for 'remote' tourism experiences and for the unique and iconic landscapes and wildlife which have led to an increase in Arctic tourism (Dawson *et al.*, 2014). Itineraries around Arctic Canada have more than doubled from 2005 to 2013, even if they remain limited with less than 30 itineraries a year (Dawson *et al.*, 2014). Infrastructure and operation costs for Arctic tourism operators are decreasing with climate change (Dawson *et al.*, 2014). Transaction costs are however high for tourism in Arctic areas, with operation permits difficult to obtain in some countries or associated with a high opportunity cost for the country because of tax avoidance and lack of effective communication between government agencies (Dawson *et al.*, 2014). Information costs can be high for navigation in 'unchartered' 'wild' Arctic areas, with navigation accidents such as the grounding of the Clipper Adventurer in the summer of 2010 occurring because of the poor accuracy of nautical maps (Dawson *et al.*, 2014).

The limited Arctic manufacturing industry would benefit from increased inputs availability such as fish for processing (Iceland, Greenland), rare earth minerals for electronics (Arctic Finland), and aluminium for smelting (Iceland) (Glomsrød and Aslaksen, 2009). As for other industries, high costs of capital, technology, qualified labour and transportation to consumption centres from manufacturing centres usually limit the development of the manufacturing industry in the Arctic (Conley *et al.*, 2013; Arctic.ru, March 2015). Changing and unpredictable climate conditions as well as thawing permafrost will likely increase investment and repair costs.

The **service industry serving local Arctic populations** would indirectly benefit from increased economic activity in the region but also most likely incur additional costs for infrastructure development and maintenance such as roads not covered by the private sector (Conley *et al.*, 2013).

ENVIRONMENTAL CONCERNS

The main environmental concerns are linked to the loss of pristine environment and unique Arctic ecosystems because of climate change or Arctic economic development pressures. In the USA, the Alaska National Interest Lands Conservation Act established in 1980 the Arctic National Wildlife Refuge (ANWR), a 19 million acre protected wilderness area including caribou herds, polar bears, and mammals as well as numerous fish and bird species.

Arctic economic development is associated with a high risk of air and marine pollution, particularly from oil spills, Persistent Organic Pollutants (POPs), heavy metals, radioactive substances, as well as the depletion of the ozone layer (Kao *et al.*, 2012; Conley *et al.*, 2013). Shell's operations in the Arctic have been slowed down following its oil spill barge, the Arctic Challenger, being damaged and lack of appropriate oil spill response measures in place (Conley *et al.*, 2013). Pollution generated by heavy diesel fuels of Arctic sea transport and tourism ships is a concern because of the accelerated sea ice decline it induces (Conley *et al.*, 2013). Concerns over pollution generated from mineral extraction have stalled mineral extraction for gold in Alaska (Conley *et al.*, 2013). The high risk of oil spill and reputational damage this could cause, insurers 'cold feet' to cover oil extraction in the Arctic combined with the high financial costs and risks have led to Total and BP to back off from the Arctic (Conley *et al.*, 2013).

Climate change externalities are a concern, as carbon emissions are more damaging in the Arctic than elsewhere (Whiteman *et al.*, 2013). Whiteman *et al.* (2013) estimated that methane released only from Arctic offshore permafrost thawing would have a price tag of USD 60 trillion in the absence of mitigating action, representing about 15% of the mean total predicted cost of climate-change impacts of USD 400 trillion. Mitigation could potentially halve the costs of methane releases (Whiteman *et al.*, 2013). Economic consequences are global, but with about 80% of them impacting the poorer economies of Africa, Asia and South America with increased frequency of extreme climate events (Whiteman *et al.*, 2013).

SOCIAL CONCERNS

Social concerns arise with climate change itself or with economic development and industrialisation. Most of the focus is on indigenous and resident populations of the Arctic who heavily depend on subsistence resources provided by their environment. The receding ice sheet and unstable ice pack because of climate change reduces game and sea mammal subsistence hunting and ice fishing opportunities (Ahlenius *et al.*, 2005 p.4; Himes-Cornell and Kasperski, 2015). Economic development generated increased competition for access to resources within and between industries. There is increased competition for fishing resources between coastal trawl and subsistence fishers in southern-based fisheries (Ahlenius *et al.*, 2005 p24). There is competition between subsistence fishing and offshore oil and gas extraction (Alaska) and between subsistence herders and oil and gas extraction (Russia) (Conley *et al.*, 2013; Duhaime and Caron, 2006)

Increased Arctic tourism is approved by indigenous and resident populations so long as it is managed well and respects sensitive and culturally important shore locations, wildlife and other natural landscapes (Dawson *et al.*, 2014). This has occurred de facto in Arctic Canada following 'good will' and high ethical standards of expedition cruise operators, but may be prone to change with new comers entering the industry because of a lack of formal regulation. Health risk concerns from indigenous population have in some cases stalled mineral extraction (e.g., uranium in Alaska, Conley *et al.*, 2013). Mineral extraction has been stalled in a few Alaska locations following strong indigenous concerns and contestation (e.g., gold and coal, Conley *et al.*, 2013).

As illustrated by historical changes in Russian governance, heavy dependence of Arctic communities on only one industry (service) makes Arctic population vulnerable to industry and government withdrawals with dire social consequences in an environment where employment alternatives are extremely limited (Amundsen, 2012; Glomsrød and Aslaksen, 2009).

THE SEEDS ARE SOWN, BUT THE 'COLD RUSH' IS STILL DORMANT

Industries in the Arctic could potentially reap very high economic rewards from operating there, but the overall high investment and operation costs make it a financially high-risk environment to operate in and reduce its competitiveness compared to other regions of the world. All stakeholders seem to act to position themselves in the starting blocks by strategically securing access rights to Arctic resources and circumpolar routes. The 'cold rush' has not really started yet, with all stakeholders exercising relative caution in relation to the huge financial, reputational and political risks involved with economic development of the Arctic.

POLITICAL CHALLENGES AHEAD: RECONCILING DIFFERENT PERSPECTIVES TO MAKE THE MOST OF NEW OPPORTUNITIES AND INCLUDING ENVIRONMENTAL AND SOCIAL CONCERNS IN THE ARCTIC

Very contrasted perspectives and social values of the Arctic co-exist: '**wilderness**' to environmental organisations for preservation or bequeath to future generations, a '**frontier**', source of energy and minerals, to industry, a '**home**' to over a million indigenous people, and a place of '**strategic and geopolitical interest**' to government for military, energy and environmental security (adapted from an original citation by Sheila Watt-Cloutier in Ahlenius *et al.*, 2005). The main political challenges ahead would seem to be linked to the conciliation of such contrasted perspectives, minimising conflicts between them and ensuring they can live alongside one another peacefully at a pace keeping up with that of very fast economic development associated with a 'cold rush'.

One possible way to achieve this would be through integration of science, economics and diplomacy for conflict resolution (Berkman and Young, 2009). Science can provide a 'neutral' and recognised

basis for establishing trust, monitoring, reporting and verification between all parties. Economics can provide assessment tools that consider trade-offs and resource use conflicts. Integration of science, economics and diplomacy could help bring together globally well-connected climate change winners in the Arctic and local and global losers. In turn, this could lead to realise economic opportunities arising with climate change in the Arctic while taking environmental and social concerns into account. The exact pathway to realise this will most likely vary within countries, between countries and between the local and the global levels, with the choice and choice processes for such pathway the responsibility of local and national decision-makers.

Within countries, economic and human development can be identified along three models: the 'North American model' which is a neo-liberal regime at the last frontiers (highly concentrated around extraction of non renewable rehouses), the 'Scandinavian model' which follows the redistribution mode of Northern Europe, and the 'Russian model' which is heavily shaped by its history (Glomsrød and Aslaksen, 2009). New institutional approaches for improved natural resource management have been explored in some Arctic areas with promotion of co-management and joint stewardship. This restructuring of power and responsibilities among stakeholders requires political will to move to decentralisation and collaborative decision-making with improved coordination between indigenous populations and government (Glomsrød and Aslaksen, 2009). Policies for promotion of external interests in the Arctic that recognise local populations as well as improved data over economic activities and distribution of benefits, social and environmental indicators have the potential to help minimise conflicts between stakeholders (Ahlenius *et al.*, 2005). Some Arctic countries have adopted measures for prevention of pollution with associated legally recognised compensation mechanisms, and established national strategies for adaptation to climate change and energy security (Ahlenius *et al.*, 2005; Amundsen *et al.*, 2007). For instance, Canada is extending the reach of its Arctic Waters Pollution Prevention Act (Berkman and Young, 2009). Some Arctic countries have set up national research programmes with an objective to inform action in the Arctic for adaptation under climate change (The Arctic – The Canary in the Mine. Global implications of Arctic climate change. Norwegian-French conference in Paris, 17 March 2015). Such national initiatives, however, do not allow to resolve transboundary issues with a need for supra-national approaches (Berkman and Young, 2009).

Between countries, there are a number of jurisdictional conflicts (Figure 5), increasingly severe clashes over the extraction of natural resources and trans boundary security risks, and the emergence of a new 'great game' among the global powers with global security implications (Berkman and Young, 2009). Regional and international cooperation seems to be generally favoured in spite of demonstrations of unilateral sovereignty extensions in disputed or international areas (flag planted by Russia under the North pole, unilateral extensions of Iceland fishing quotas, Northern Sea Route and Northwest Passage disputed sovereignty statuses).

Few but important binding international agreements apply to the Arctic. The United Nations Convention on the Law of the Sea, UNCLOS, of 10 December 1982 is considered one of the main binding agreements providing a legal framework for use of the Arctic to this day. UNCLOS helps regulate access to Arctic resources, maritime traffic and pollution through clear identification of national jurisdictions and provision of a mechanism for dispute resolution (Berkman and Young, 2009). In addition to the UNCLOS, there are a number of other international conventions that are relevant for Arctic (Dawson *et al.*, 2014): the International Convention for Safety of Life at Sea (SOLAS) which focuses on safety requirements, the International Convention for the Prevention of Pollution from Ships (MARPOL) which focuses on environmental protection, the Convention on Standards of Training of Seafarers (STCW) which focuses on training and competency, and The Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) which applies to part of the Arctic and provides a guide for international cooperation on the

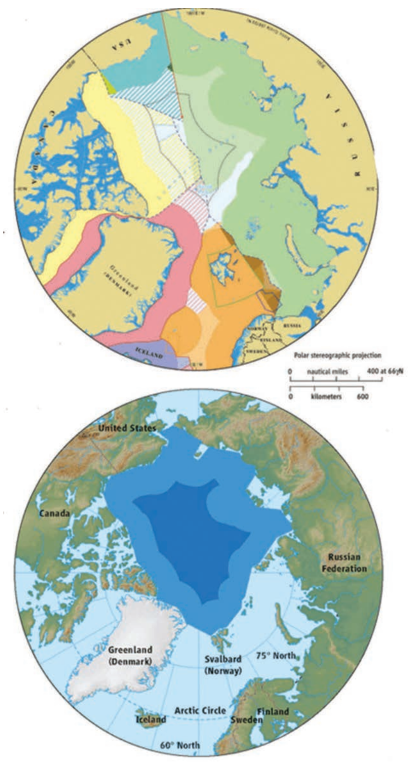

Fig.5 — Arctic sea ice Jurisdictional representations of the Arctic Ocean with boundaries based on (top) sea floor as a source of conflict among nations (different colours) and (bottom) overlying water column as a source of cooperation, with the high seas (dark blue) as an international space in the central Arctic Ocean surrounded by economic exclusive zones (EEZ, light blue). Source: Berkman and Young (2009).

protection of the marine environment of the North-East Atlantic.

More recently, a number of framework agreements have been established, in particular in relation to shipping in the Arctic, search and rescue operations and pollution management. They provide some guidance and structure for international cooperation in the Arctic. The International Maritime Organization (IMO) has been promoting adoption of a series of voluntary guidelines such as those 'for Ships Operating in Ice-Covered Arctic Waters' in 2002, 'on voyage planning for passenger ships operating in remote areas', and 'for passenger ships operating in areas remote from SAR facilities' (Berkman and Young, 2009). The IMO has more recently adopted in 2014 an International Code for Ships Operating in Polar Waters (or 'Polar Code'). The Polar Code will be made mandatory under the International Convention for the Safety of Life at Sea (SOLAS) from 2017, There are current discussions to make the Polar Code compulsory under the International Convention for the Prevention of Pollution from Ships (MARPOL).

All these agreements have been possible thanks to the work of intergovernmental organisations such as the United Nations and its agencies (e.g., International Maritime Organization), and international fora such as the Arctic Council. Such organisations and fora provide platforms for dialogue between countries and have successfully led to the establishment of concerted and mutually agreed 'win-win' coordinated and concerted action. The Arctic Council is formed by 8 states with land within the Arctic Circle: the United States of America (Alaska), Canada, Denmark (Greenland and the Faroe Islands), Iceland, Norway, Sweden, Finland, and the Russian Federation. The Council is a high level intergovernmental forum for Arctic governments and peoples (http://www.arctic-council.org). It is the main institution of the Arctic and was formally established by the Ottawa Declaration of 1996 to provide a means for promoting cooperation, coordination and interaction among the Arctic States, with the involvement of the Arctic Indigenous communities and other Arctic inhabitants on common Arctic issues, in particular issues of sustainable development and environmental protection in the Arctic. The Council has no regulatory authority but has facilitated the production of scientific assessments such as the Arctic Climate Impact Assessment (ACIA) by its Arctic Monitoring and Assessment Programme (AMAP) working group, Conservation of Arctic Flora and Fauna (CAFF) working group, along with the International Arctic Science Committee (IASC). The Council has successfully brought Arctic issues to the attention of global fora, with the 2001 Stockholm Convention on Persistent Organic Pollutants in part informed thanks to the work of the Arctic Council (Berkman and Young, 2009).

There are a number of international scientific monitoring and research bodies leading scientific initiatives and projects, in the Arctic. Such international collaborative scientific projects could provide a basis to build trust and enhance Arctic state cooperation through establishing

scientifically sound common baselines (Berkman and Young, 2009). These include (but are not limited to) the International Arctic Science Committee, the European Polar Board, the French Arctic Initiative (`Chantier Arctique français').

There is real potential to harness and develop existing institutions (*i.e.* organisations, binding and non binding agreements) and build up existing institutional capacity. The pace of economic development will be extremely fast when the cold rush starts. Current economic development is already creating new institutional needs in the Arctic. One of the challenges will be to build up existing capacity fast enough to keep up with the pace of economic development. There is certainly strong potential for creating shared economic wealth and well-being. Actual choices made by Arctic industries and countries for economic development, coordination and cooperation within the coming years will shape what the future Arctic will look like.

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