

Chapter 12

The Arctic Economy in a Global Context

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Abstract Change has been a characteristic of the Arctic economy since its early history. Today the pattern of change differs from the past in its magnitude, its rate of change, and the complexity of Arctic changes. The differences reflect a number of sources – climate warming, increased accessibility, and economic integration with global markets. This new pattern of change will produce significant impacts on the economies of the Arctic region, from main centers to smaller local communities. In this chapter we consider a number of sources of change, and reflect on the impacts for the new Arctic. We conclude that while the new Arctic will hold many promises and opportunities for formal and informal economies across the region, there are critical challenges to be addressed as the economy becomes an increasingly important player in the global context.

Keywords Resource Extraction • Resource Development • Subsistence • Migration • Climate Change

12.1 Introduction

The new Arctic economy will experience increased economic integration across national borders as well as economic growth. Along with economic growth the new Arctic will continue to be characterized by uncertainty and economic volatility. For Arctic residents, the heightened pressure to adapt to a changing environment will increase. For some this change represents increased threats and challenges to daily livelihoods and economic wellbeing, while for others the new Arctic presents new economic opportunities.

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and the complexity of Arctic changes. The differences reflect a number of sources – climate warming, increased accessibility, and economic integration with global markets. This new pattern of change will produce multifaceted social change with cascading effects on the economies of the Arctic region, from main centers to smaller local communities.

Rapid change and transformation increases the future uncertainty for local and regional economies in the North. Human settlements in the North range from small isolated and scattered communities to larger urban and industrial centers, with variation in the relative importance of formal and informal economies across the Arctic (Larsen and Huskey 2010; Huskey 2010). No matter their size or locality, northern economies are feeling the impacts of global change. Their futures are tied to success in achieving sustainable resource and economic development.

Communities in the North may face both socio-economic challenges and resource constraints that limit their economic prospects and lower their speed of adjustment to economic change. These may include: a narrow and climate sensitive resource base in combination with weak or underdeveloped infrastructure and institutions; a small and scattered population base; geographical isolation and long distances to markets. A community's economic vulnerability and adaptive capacity will vary with factors such as, national economic wealth, available technology, monitoring of potential hardships, availability of income support programs, and the extent of local human and financial resources (Larsen 2010a, b).

Globalization and the transformation of the world economy to a post industrial and knowledge based economy will be reflected in the North. As described by Southcott (2010) the economic transformation of the Canadian North is characterized by communities having moved “from an economy based almost entirely on subsistence and fishing, to an economy dominated by the industrial exploitation of natural resources, to an uncertain future in a world increasingly dominated by a knowledge-based post-industrial culture” (p. 73). However, while change is significant for the Arctic, there is also much that remains the same. Economic outcomes and the industrial structure, conduct and performance will continue to be affected by smallness and remoteness of scattered towns and villages, high costs of production, long distances to markets, and continued high levels of economic uncertainty.

The new Arctic economy will experience increased economic integration across national borders as well as economic growth. Along with economic growth the new Arctic will continue to be characterized by uncertainty and economic volatility. For Arctic residents, the heightened pressure to adapt to a changing environment will increase. For some this change represents increased threats and challenges to daily livelihoods and economic wellbeing, while for others the new Arctic presents new economic opportunities. While economic and political autonomy is growing, many of the region's narrowly resource-based local and regional economies are facing increasing pressures from global change impacts, with these impacts being felt on economic and employment opportunities, distribution of income and wealth, and the allocation of resources between different users (Larsen 2010b; Rasmussen and Larsen 2009).

12.2 Recent Trends in the New Arctic

The Arctic economy is composed of three parts: the formal and market based sector, the traditional and non-market sector, and the transfer sector (Larsen et al. 2010b). The size and relative share of each of these component sectors varies across regions of the North. Each sector will be affected by the economic changes facing the Arctic. The formal market-based part of the Arctic economy has experienced rapid growth at 3.5 % annually over the past decade, with growth rates surpassing that of Arctic nations overall. The Arctic per capita disposable income is estimated at 21,900 USD, with per capita Gross Regional Product (GRP) at 45,400 USD (Huskey et al. 2014).

The Arctic economy is not a single integrated economy but a set of independent economies linked by their similarity of environment and location. These northern economies are, for the most part, remote and sparsely settled and distant from major markets. The money economy of these regions depends primarily on public spending and natural resource production. Even though the regions of the north differ in history, institutions, and culture they are influenced by similar forces. During the first decade of the twenty-first century these forces were changing world markets for natural resources and the liberalization of the development process (Duhaime 2005).

In terms of the value of Gross Regional Product, GRP, the Arctic economy experienced relatively rapid growth between 2000 and 2010. The Arctic economy grew almost twice as fast as the economies of the eight Arctic nations. The primary driver in this growth was increasing demand for commodities and associated rising commodity prices during this period. Expectations of a future of higher resource prices helped to open up the North's storehouse of natural resources to exploration and development. The role of world markets as driver of the Arctic economy could be seen in the slowdown in Arctic economic growth that accompanied the world economic downturn after 2006 (Huskey et al. 2014).

While the value of the Arctic's economic output is significant it is not evenly distributed throughout the north. The Russian Arctic dominates production primarily because of the high value of its petroleum and other mineral resources. Output is also unevenly distributed within each country's Arctic region. This reflects the uneven distribution of natural resources and cities throughout the north. The distribution of output may change in the future as development follows exploration in new areas such as Greenland and the Canadian Arctic (Huskey et al. 2014).

While the Arctic's GRP is significant, the share of regional income in GRP is only about 48.3 %. A large proportion of income generated in the region does not remain in the region but leaves in the form of income, profits, and rents, due to ownership and control of resource development resting in the hands of external actors. Because of the significant outflows of income from the Arctic to pay for various resources used in production, GRP becomes an inadequate measure of what in real terms is available for investment and consumption locally. In addition, as described by Larsen et al. (2010b), the Arctic GRP does not take into account the contribution to income made by the informal and transfer sectors. These caveats mean that the

size of the Arctic economy can be underestimated (when informal sector activity is excluded from calculations) and overestimated (when income and payments flow out of the region).

Problems with measures of economic performance in the Arctic complicate the task of assessing the contribution to local areas of engaging in resource development. In many parts of the Arctic large scale resource development projects may contribute little to the local and regional economy where they are located. The creation of economic linkages may be limited or non-existent and economic activity may be partly or fully decoupled from the local economy. The current picture does not show signs of this changing in the near future.

Though it may be underrepresented in economic data the traditional or subsistence economic harvesting continues as an important sector of many local economies throughout the circumpolar north (Larsen et al. 2010b; Megatrends 2011; Poppel 2006). The importance of cash in subsistence harvesting links the traditional and modern economies in the north. Conflicts over resource use between industrial and traditional users provide another link between these two economies (Aslaksen et al. 2009).

Large scale resource development in the Arctic has the potential to make some local and indigenous communities worse off. The appropriation or degradation of the very assets that are critical to local livelihood strategies may leave some local communities more vulnerable and with increased risk of being without sufficient resources to support their living. Long established cultural values and practices that make local residents more resilient are at risk of being eroded by the increasing rate of social change. There is a growing awareness of the potential disruptive effects of large scale development and the need to balance the economic benefits of development with the protection of the natural assets communities depend on economically, to secure peoples' access to them, and to ensure future sustainability.

12.3 Changes in the Institutions of Resource Development

Decision-making about the development of the North's natural resources is complicated. Historically, national governments have been the North's natural resource owners. Governments decide not only whether particular resources should be developed but also how they will be developed. Government decisions involve a wide range of interested parties. Since the costs and benefits of resource development aren't evenly shared among these affected groups, it is difficult to arrive at a satisfying compromise. Conflict results when groups suffering significant costs are not compensated from the benefits of a project. This is more likely to happen when affected groups aren't involved in the decision making.

In most Arctic nations, the development and production of natural resources is done by international resource firms seeking a profit. Firms weigh the expected benefits of development against the uncertainties of exploration and the cost of development in the North before they decide to participate in development. Resource

development will not happen unless governments and resource producers reach accord on how resources will be produced and benefits will be shared.

When national governments make resource decisions there is no guarantee that residents near the development will gain more than they lose. Local residents could suffer costs from the disruption of local environments and disruption of traditional economic activities. Historically, revenues have gone to national and regional governments through taxes and to international companies through profits. Local resistance to resource development reflected this imbalance between local benefits and costs.

In the last part of the twentieth century significant changes in the relationship between local residents and local resource production were introduced around the North. These institutional changes increased the role of local residents in the decision-making as well as the local share of development benefits. There have been three types of institutional changes which have brought more local control over resource production decisions to residents of the North (Caulfield 2004). Each of these is discussed below:

12.3.1 Self-government

Local majority controlled government allows residents to influence the way resources are developed, to collect tax revenue from resource production, and, in some cases, to act as an owner of local resources. The creation of the State of Alaska in 1959 is an early example of this institutional change in the North. Alaska's North Slope Borough and Northwest Arctic Borough and Canada's Nunavut are examples of local governments established in regions with majority indigenous populations (Fox 2005a, b). The country of Finnmark in the Norwegian north was recently granted greater control over decisions about resource use within its borders (Grimsatd and Sevattal 2007). Greenland is a majority Inuit government which has had limited self-government since 1979 and in 2008 received greater control over its resources.

12.3.2 Local Ownership

Beginning with the 1971 Alaska Native Land Claims Settlement Act (ANCSA), the federal governments in the US and Canada have negotiated a series of settlements with indigenous groups providing these groups with land ownership and control of resources. One motivation for these settlements was the recognition that uncertain indigenous land claims could hold up resource development. Alaska Natives received ownerships shares in 12 profit making regional corporations and over 200 village corporations which were created to receive and manage the resources (Colt 2001). Canadian settlements were achieved through negotiations with specific

aboriginal groups; 26 comprehensive land claims agreements have been settled since 1973. The Canadian settlements provide for participation in land and resource management decisions and governmental control in addition to land ownership and money (Fox 2005a). Outside of North America indigenous groups have not been as successful establishing rights to local resources. Ownership of resources valued in the international market allows indigenous groups to decide when and how to develop resources and to benefit directly when resources are produced.

12.3.3 Acting Like Owners

New institutional arrangements have been introduced which allow residents and local resource users to assume some of the roles of owners without actual ownership. Co-management schemes for subsistence resources, individual fishing quotas, and Impact and Benefit Agreements (IBA) all provide local people with direct say in resource use decisions. Co-management schemes allow local users of traditional resources to share both information and power with government officials to reach collective agreement on the use of these resources. Co-management schemes have been used in Russia, the US, and Canada. Individual Fishing Quotas (IFQ) have been introduced in Alaska, Iceland, and the Faroe Islands. IFQs provide owners with a share of the catch quota set by the government (National Research Council 1999). Quota owners make the decisions about how and when to fish their shares. The Canadian Supreme Court affirmed that it was the duty of mining companies to consult with indigenous groups who may be affected by mining on or near their traditional homelands (Fraser Institute 2012). The IBA consultation allows local communities, like owners, to negotiate contracts which spell out the roles and responsibilities of developer and local aboriginal communities in development of particular properties.

In the Circumpolar North, the national government has historically been the most important institution for making resource production decisions. Over the last half century important changes to northern institutions have been made increasing the rights of ownership and control of northern residents and resource users. This has primarily been a North American phenomenon. These institutional changes have provided mechanisms for reaching positive local outcomes from resource development in the North.

12.4 Migration and the Northern Economy

The North's economic performance is linked to its migration history. The many regions of the circumpolar north are demographically distinct (Bogoyavlenskiy and Siggner 2004; Huskey and Southcott 2010). The northern population density in Russia is 50 times the density of Greenland and Canada. The Russian north is also

the most urban; all but one of the eleven northern cities of Russia have populations over 250,000. The importance of the indigenous population also differs across the North; over 80 % of the population of Greenland and Northern Canada but only 10 % of the population in the Nordic countries is indigenous.

As in most places, the pattern of net migration partly reflects the economic health of the region and its communities. People generally move from places with relatively limited economic opportunities to places with better opportunities. However, migration will also influence the economy of communities in the North. The population of a community will influence its economic opportunities.

Most parts of the circumpolar north share a similar migration experience. The North is generally a sending region. Recently, more people have moved out of the region than have moved into the region. This has not always been the case; in all parts of the circumpolar North there have been historic periods of positive net migration. This is not the case for all places in the North; government and service centers and university towns are examples of communities that have attracted migrants. This doesn't mean that population has everywhere declined; high birth rates in the North American North mean that these regions have experienced population growth.

While people move for a variety of reasons, research in northern Sweden, Alaska, Russia and Canada has found that relative economic opportunities help explain the direction of migration (Westerlund 2010; Huskey et al. 2004; Heleniak 2010; Petrov 2007). People choose to move when they expect the move will make them better off. The strength of this economic effect was found to vary by age, education, gender and family status. In some parts of the north, economic opportunities are defined not just by market work but also by traditional or subsistence opportunities. Participation in traditional activities limits migration from northern places because the skills used in traditional activities are not easily transferable.

Migration responding to economic opportunity is also limited by the cost of moving. The social cost of moving away from family and culture limits migration between places with very different cultures. Social costs are one of the explanations for the stepwise pattern of migration found in Alaska. Costs involve the physical costs of moving which is influenced by transportation infrastructure and distances. These differences are reflected in different migration patterns between villages and cities in northern Canada and Alaska. Both social and transport costs are higher in the more sparsely settled North American North than in the more densely settled Nordic North, so we would expect different rates of migration in these regions.

The new technology of resource development limits the connection between a northern region's economy and its population growth. Development of mines or petroleum resources often takes place at sites distant from local communities. The skills required for modern capital intensive resource development often have to be imported. These skilled workers will not move to the region if development follows a "fly-in-fly-out" arrangement with workers isolated in enclaves from local communities (Storey 2010). This unique character of the northern job market results in out migration from communities even in regions experiencing economic growth.

Migration affects a local economy through its effect on a community's scale, which in turn determines the size of the local market and the cost of producing goods and services. If out migration causes population decline, this will reduce the market for goods and services and increase the cost of local production. This affects the provision of public services as well as the private market. The public sector provides a number of services throughout the north including transportation, housing, and energy. Since economic well-being is influenced by the local provision of goods and services, the link between migration and scale creates a vicious cycle leading to continued population decline.

The 'brain drain' creates an additional link between migration and the local economy. The brain drain occurs when the most productive residents move away. The more educated have been found to be more likely to move from small to larger places or rural to urban places in Russia, Sweden and Alaska. A similar migration pattern is found for the young (Heleniak 1999). The young are attracted to the work and study opportunities and the bright lights of larger places. The out-migration of the young explains the aging found in the Nordic North (Megatrends 2011).

In some Northern communities return migration provides a counter to the brain drain and its negative effect on local economies. Survey data showed that as much as a quarter of the indigenous population in Arctic communities in Alaska, Greenland and Chukotka returned to the community after migrating away (Martin 2010). High rates of churning or cross flows of migration have been found in the Arctic regions of Alaska. These return migrants bring skills learned both through schooling and experience and add to the human capital available in Arctic communities.

12.5 The New Industries in the North

In the first Arctic Human Development Report (2004) the economy of the Arctic was described as combining large scale natural resource production with public sector production and transfers. These sectors accounted for over half of the value of output in the north of six of the eight Arctic nations (Huskey et al. 2014). While this is the general pattern, the economies of the Arctic nations fall into two different groups; the less resource depended European north (including Iceland) and the Russian and North American (including Greenland) north's which are more dependent on resources and public spending. Across the north there are examples of new industries that are not directly related to the production of natural resources.

Tourism is an old Northern industry that is growing in importance. For example, the number of tourists visiting Alaska between 1990 and 2006 more than doubled to almost 1.6 million (Goldsmith 2008). Northern tourism follows the more general trend towards the increased popularity of nature-based tourism throughout the world. An increased navigation season resulting from climate change is one factor which could promote further increases. Predictions are that both land based and ves-

sels based tourism will increase. Reduction in sea ice may open up opportunities for increased expansion of cruise traffic, which is already experiencing rapid growth (Stewart et al. 2010). Cruise tourism has been increasing throughout Greenland, Norway, Alaska and Canada because of decreasing sea ice extent (Larsen et al. 2014b).

There have also been increases in other industries with no direct connection to the extraction of northern resources. Anchorage, Alaska has developed as a major center for handling international air cargo. Geography and air carriers desire to carry heavier payloads and less fuel made Anchorage a likely stop for refueling on international cargo flights, and several carriers sort packages and move consolidated cargo for different destinations (Goldsmith 2008). A second, though less successful, example of the growth of this type of industry was the development of the financial industry in the Iceland. Iceland's financial industry accumulated foreign assets and experienced dramatic growth until its collapse in 2008 (Matthiasson 2009). Each of these illustrates the expansion of industries which are not necessarily northern in the processes, skills, talents or connections used.

The same conditions might also be said for the new types of manufacturing recently introduced to the North. Arctic Finland has a highly developed manufacturing sector which processes natural resources especially timber. During the first decade of this century Arctic Finland experienced the growth of an electronics manufacturing sector located primarily in Oulu. Around the world this sector has experienced dramatic changes which have affected the size and structure of the industry in northern Finland. Even with these changes the sector remains important in the Finnish north (Glomsrød et al. 2009).

The Circumpolar North has become an urbanized region. The region is not simply made up of villages and resource enclaves, but also towns and cities of significant size. While this is not uniform throughout the North, the most recent population growth in the North has been in urban centers leading to a growing urban concentration of the northern population (Megatrends 2011). These urban areas are centers of industrial activities, service provision, and government activities. The concentration of population provides opportunities for new types of activities. The bigger concentrated market allows local producers to compete with importation of goods and services from outside the north.

The importance of knowledge or human capital to the growth of most developed economies is much discussed. With natural resource extraction as its economic driver, the Arctic may seem the last place where the knowledge economy would have an impact. However, the northern knowledge economy is reflected in the development of both the Icelandic finance industry and the electronics industry in Finland. The petroleum and other resource sectors have advanced in high cost, and remote regions through the use of new technology. The Arctic nations have recognized the importance of creating this northern human capital with the creation of a series of northern universities and colleges to train northerners and developed regional expertise (Megatrends 2011; Hirshberg and Petrov 2014).

12.6 Economic Volatility and Uncertainty

Resource extraction and export markets have a long history in the Arctic, and have been seen as key drivers of growth and development throughout much of northern history. In theory, improved utilization of factors of production, expanded factor endowments, and the creation of economic linkage effects are well-known potential benefits that may follow a strategy of large scale resource development and export trade. However, in reality northern strategies of primary export trade in renewable and non-renewable resources may be largely ineffective for many localities. Some of the explanations are that weaknesses may result when markets for primary products grow slowly, when earnings are unstable due to price fluctuations, and when expected economic diversification around an export industry is nonexistent or limited. Furthermore, significant instability and fluctuations in earnings may result if production is concentrated in one or a few products, and if the destinations for exports include only a few external markets. This may result in a country or region remaining heavily dependent on imports of both final and intermediate products, as well as imported personnel, and in turn, opportunities for generating value added locally may be lost. This describes a scenario not unfamiliar to many northern regions (Larsen 2010b).

The narrow and natural resource base is a central characteristic of the formal and market based economy in the Arctic. It is also a key source of instability and increases the economic vulnerability to climate change, as most of the natural resources of the Arctic are climate sensitive. The degree of volatility in local economies is unlikely to disappear anytime soon. Economic fluctuations are undesirable not least because they tend to trigger fluctuations in other variables such as government revenue and investment, which may have impact on short run economic stability and long run economic development. While regularly reversing deviations are less problematic – as income can fluctuate over time and yet be known in advance with some certainty – it is the sporadic elements of deviations from some normal level of earnings that are likely to be the greater cause of concern. Events that are predictable or certain do not necessarily have adverse consequences, since regularly reversing fluctuations make it easier to predict the level of exports and income each year and to judge the correct timing for implementing possible stabilization policies. Still, in the Arctic, the scope for corrective action in response to economic deviations may be more limited in some regions due to a range of resource constraints including lack of economic and political autonomy in many places. Local and regional governments may therefore be less able to undertake effective offsetting policies to minimize shock effects, even if they could predict the future accurately (Larsen 2003).

While the Arctic has witnessed an increase in economic and political autonomy, and also a growing focus on resource development throughout much of the Arctic, many regions and localities remain in a state of economic dependency, such as for example seen in the case of Greenland and Nunavut, and many Russian northern regions. These dependent economies can be described by their economic structures

having relatively few and weak relationships between different economic sectors with only limited local production serving as inputs into other sectors of the domestic or local economy. Also, resource use in these “dependent economies” tends to be less flexible than what may characterize more advanced or diversified economies, with limited ability to adapt to the effects of economic shocks and disturbances. Their economic growth tends to be highly dependent on external factors and markets, and external demand is an important factor in the ability to make full use of productive capacity as well as justifying and financing large-scale investment to expand capacity. Larsen (2003) found that in the case of Greenland the economy is characterized by a high degree of economic dependence, and this has led to instability and dampened the rate of economic growth and development. Southcott (2010) argues that in the case of Canada, the dominance of a dependent economy controlled by large resource corporations is likely to continue into the future as diamond mining and oil and gas development increase in importance. Similarly, large scale natural resource development projects in the North have often meant that economic goals in the Arctic have been elevated over environmental or social goals.

What is efficient and profitable for the individual or a particular company, may not be so for society, but rather may have significant societal consequences. The Arctic provides examples of economic growth having been sought through unsustainable use of natural resources and levels of consumption. With the increasing importance of change, environmental and social problems in the Arctic are becoming ever more visible, and there is increasing pressures placed on finding sustainable and more resilient pathways forward.

Global perceptions of the Arctic as an area of new potential for resource exploitation and intercontinental shipping is one result of the increased awareness of climate change (e.g. Arctic Council 2009). Warming will open up Arctic seas providing new shipping lanes and increasing the accessibility to Arctic natural resources. Increased accessibility is expected to reduce the cost of producing the North’s resources for the world market. When lower production costs from global climate change are combined with an increased world demand for resources from the emerging economies, the distant and once uneconomic resources of the far north will be linked to global markets and play an increased role in the world economy. However, while climate change and globalization can be expected to alter the composition and stock and flow of resources, the nature and extent of their effects is highly uncertain, including the impacts for the environment and the marine sectors.

12.7 Climate Change Impacts

Climate change and increased world demand for Arctic resources are likely to have both positive and negative effects on the economic production and welfare of the Arctic’s residents. Reductions in sea ice extent, duration, and thickness will likely increase human presence and economic activities in the Arctic in the near to long-term (Forbes 2011; AMAP 2011; IPCC 2007, 2014). Impacts from increased

shipping include not only pollution but also potential increases in marine invasive species through ballast water and vessel hulls which present important ecological challenges for ecosystems and economic and cultural livelihoods in the Arctic (Lassuy and Lewis 2013; Arctic Resource Development 2012). Longer ice free seasons and reduced ice coverage will not only increase Arctic shipping (Stephenson et al. 2011; Arctic Council 2009; Prowse et al. 2009; Larsen 2010a, b), but also introduce new threats to food security and quality of life in the region. For many local communities, continued access to traditional harvested resources is linked closely to livelihoods and overall wellbeing and closely tied to cultural survival (Larsen et al. 2010a, 2014a; Larsen and Fondahl 2014).

ACIA (2005), AMAP (2011) and IPCC (2014) describe the range of possible costs and benefits from the observed and projected impacts of a changing climate. In the marine ecological system and fisheries sector, for example, expected impacts may include changes in stock and species, alteration of fish migraton routes, changes to harvesting costs, and increased stock productivity and yield, with some commercial fish species becoming both more plentiful and an engines of economic growth, while others – such as shrimp around Greenland – may migrate further north or disappear altogether from commercial harvesting. At the same time, reports suggest that increased maritime activity could in the worst case scenario lead to potentially devastating oil spills, the pollution of commercial fishing grounds and endangerment of key species, thereby adding considerable stress to Arctic economies and livelihoods.

Climate warming may also present additional challenges for northern development and infrastructure design from the impacts associated with ground disturbance and construction. The impacts of changing climate will become increasingly significant over longer time scales (Prowse et al. 2009). In the case of the Canadian oil and gas sector, thawing permafrost and changes in snow cover will necessitate an increased focus on low-impact vehicles and/or changes in seasonal scheduling of exploration activities (Ibid.). The unpredictability of the winter season and the winter ice road system will necessitate greater flexibility in scheduling of exploration and extraction activities. Winter roads are temporary roads on frozen ground, that enable the transport of equipment and cargo for resource development and construction projects, and resupply to remote communities that would otherwise be uneconomic using permanent roads or aircraft (Stephenson et al. 2011). Winter roads provide critical transportation infrastructure in Alaska, Finland, Russia, Norway, Sweden, and Canada. Projections suggest there will be a broad pattern of declining winter road accessibility potential on land and rising ship accessibility potential in the Arctic Ocean by year 2045–2059 (Ibid.).

Projected changes in air temperature, snow accumulation, and sea ice directly alter travel times by restricting or enabling transportation modes in land (e.g. winter/ice roads) and ship speeds at sea. Projections suggest significant changes in annually averaged inland and maritime transportation accessibility by mid century (2045–2059) versus the baseline of year 2000–2014: e.g. change in inland

transportation for Iceland in terms of square km is projected to be minus 82 %, for Finland -41 %, Norway (-51 %), Sweden (-46 %), Greenland (-11 %), Russia (-13 %), Alaska, USA (-29 %). Whereas for maritime-accessibility, the increase in ocean area (square km) is projected to be 19 % for Canada, Greenland (28 %), Russia (16 %), USA (5 %), while for Iceland and Norway it is projected to be only negligible, and for Finland there is no change (Ibid.). Thus, inland transportation will likely become more challenging, whereas maritime transportation will become more accessible, and hence the impact of climate change on resource development will depend in part on whether extraction is on or off shore, and the type of transportation used for moving resources to markets.

Resource development and production in the Arctic must increasingly consider the effects of climate change on permafrost and ground stability. Mining, energy and timber industries will face shorter time windows for ground transport of equipment and risk becoming uneconomic in some areas. Costly mitigation efforts will therefore need to be factored in and may include building permanent roads, as in e.g. Nunavut, Canada. At the same time, there are other factors than sea ice that affects Arctic shipping and transportation, such as e.g. economics in general, existence of port infrastructure, tariffs etc., which will continue to be part of cost benefit analyses in evaluating the feasibility of resource projects in the new Arctic.

Climate change and social change present new challenges for institutions in the north to be more flexible, resilient and robust, and to find ways of increasing the ability to cope with rapid change in biological systems. Climate change and its consequences for natural resources is an additional factor in raising the level of economic vulnerability in the new Arctic. There is risk associated with all human activity in the Arctic, and this has been the case since the early history of extractive industries in the North. Questions remain however of how to manage the increasing level of risk associated with these industries, and how to reduce it to a level that is acceptable to most stakeholders. Indigenous inhabitants of the Arctic whose livelihoods are intimately connected to the land might have a much lower tolerance for risk (Arctic Resource Development 2012). This raises important questions of who defines what the acceptable level of risk should be, and how to address the potentially diverse range of values and goals, and in turn, how to solve conflicts of interest over resource use between the many different stakeholders in the new Arctic. The future of the Arctic economy will necessitate increased attention to risk management. Managing risk is about managing the combination of hazards, vulnerability, and exposure. This suggests that future approaches to managing Arctic environmental- and economic change must be firmly based on principles that take into account the fragile and vulnerable Arctic environment and the increasing social and environmental risks associated with human activities. Finding effective ways of internalizing environmental externalities originating from large scale resource development in the Arctic will increase in importance.

12.8 Concluding Comments

A number of challenges beyond climate will persist in developing strategies to realize long-run sustained growth in the new Arctic, including the existing limits on resource flexibility, the constraints on entering into new and foreign markets and the difficulties associated with a very small and scattered population base which presents barriers to achieving economies of scale in domestic markets.

Future studies on the Northern economy must acknowledge the growing complexity and interconnections between different human and bio-physical systems. A classic dilemma in our industrial world and the new Arctic is presented by the tendency of resource development to inevitably represent some sort of tradeoff between a healthy environment and economic growth. While this may be coined a classic trade-off, in the new Arctic it can be described as a new and growing challenge involving an increasing rate and magnitude of climate change along side the ongoing social, cultural and economic changes, and the seemingly converging challenges of climate, environment, economy and human development in the Arctic. While the new Arctic will hold many promises and opportunities for formal and informal economies across the region, there are critical challenges to be addressed as the economy becomes an increasingly important player in the global context. In addressing issues of economic growth and development the consideration of impacts on human development is essential, including analyses of questions related to the possible divergence or convergence between economic outcomes and the overall wellbeing of Arctic residents.

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