

Innovation in the Arctic: Squaring the Circle

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Introduction

Innovation and entrepreneurship are prominent buzz words in the modern lexicon, reflective of the knowledge economy in which we now dwell. While the possibilities in a world of big data, robotics, and the internet of everything seem endless, they do indeed have limits. Cities, it has become routine to point out, are the harbingers of innovation, and attract creative people who develop and apply the new technologies our economy now depends upon. But where does that leave those in rural and remote communities? Can the Arctic region be a place where new technologies are more readily adapted, much less developed?

This paper will briefly outline the challenges to innovation and entrepreneurialism in the Arctic. It will further describe several bright spots, and potential models, for adopting innovations and technology in the Arctic region, as well as suggest some strategies for closing the Arctic's innovation gap.

Innovation, Entrepreneurship and the Creative Class

As the Western economy has shifted from a manufacturing and industrial base to one driven by services and technology, the types of skills needed to be employable and successful have evolved, with those with post-secondary qualifications, especially university degrees, and especially in the business and STEM (science, technology, engineering and math) fields, doing particularly well. Writing in 2002, Richard Florida described the phenomena in his book *The Rise of the Creative Class: And How It's Transforming Work, Leisure, Community and Everyday Life*, in which he described cities which could attract a diverse, creative and skilled pool of talent (scientific, artistic, entrepreneurial or technological) as the drivers of the new economy.

Around the same time, a renewed focus was placed on the importance of business and innovation clusters such as Silicon Valley, formerly known as agglomeration economies, which drove competition, increased productivity and catalyzed innovation. A consensus emerged: cities, especially large and diverse cities, which

could attract talented and creative people, were the centre of 21st century economy and society.

But where does this paradigm leave a region such as the Arctic? With four million people scattered across a geographically huge area, and with a largely rural population, especially among its roughly 400,000 indigenous inhabitants, the Arctic economy risks becoming – or rather remaining – a raw materials extractor; a periphery to the ever evolving core; “marginal, vulnerable, structurally truncated and functionally dependent” (Petrov 2014: 1). It has become conventional wisdom that the Arctic needs to innovate more, leverage new technologies, and work smarter rather than harder to solve its many social issues and economic impediments. But how feasible is this in practice?

Barriers to Arctic Innovation

The relative dearth in technological innovation in Arctic economy and society has had real consequences in terms of opportunity costs on Arctic communities. Many of the key social challenges in the Canadian Arctic, which has many similarities with rural Alaska, Russia and Greenland, include poor and overcrowded housing; food insecurity; energy insecurity; crumbling or limited infrastructure; lack of access to health care; and limited educational opportunities. Many *existing* technologies could go a long way towards addressing these.

- Better designed housing, with higher insulation ratings, better energy efficiency to cut running costs, resilient to wind and snow, and designed for the family and social structures that exist in northern communities;
- More efficient food production, through local ventures such as farms, greenhouses or grow houses, and processing and marketing of locally harvested foods;
- Enhanced off grid small scale energy production, such as wind, solar, nuclear, hydro, geothermal, and biomass, to reduce dependence on expensive imported diesel, create local employment opportunities, and reduce black carbon emissions;
- More appropriate and resilient materials for infrastructure development and construction;
- Expanded use of telehealth applications; and
- Expanded use of technology-based distributed and decentralized educational opportunities.

The overriding goal would be to make northern communities less dependent and more self-sufficient, while creating local employment opportunities and reducing the amount of economic leakage currently experienced in Arctic communities, where capital and income leaves communities rather than staying within them and being leveraged as local multipliers.

A few things stand out as hurdles in improving the capacity of Arctic communities to develop and embrace new technologies and innovations. The first is a lack of educational attainment, especially in rural and indigenous communities. The North needs better science and math literacy, as well as individuals with post secondary qualifications in the STEM (science, technology, engineering and math) fields to modify and apply technologies developed for a southern or urban context to the particular needs of northern communities.

The second barrier is the inordinate size and scope of the public sector in northern economies. The public sector is notoriously risk adverse, and so long as bureaucrats make the bulk of planning decisions we should not expect experimentation with new ways and means.

The third is the conservative nature of rural and indigenous communities, a phenomenon evident far beyond the Arctic. Traditional ways of knowing are cherished and a sense of communal responsibility is reinforced, but this seems to have deterred entrepreneurialism and the processes that lead to commercialization.

A fourth challenge is the lack of economies of scale in the Arctic, particularly at the community level. It makes investment of capital in new applications of technology particularly risky and lacking a sufficient return on investment. In this way Arctic regions must collaborate closer – an application that works well in northern Alaska may be equally suitable in eastern Greenland or north-eastern Russia, as well as other remote locations throughout the world, such as island nations or the Australian Outback. Markets of a few million people are much more promising than markets of a few thousand people.

A fifth hurdle are the high entry costs for small and medium enterprises in dominant northern sectors, in particular those related to land use and resource extraction. The flip side of high environmental regulatory burdens, duty to consult, and long approval processes is that it prices out most new and small firms.

A sixth barrier is the lack of reliable and affordable telecommunications infrastructure. The internet promises to make health care, education, capital, ideas and networks of thinkers far more accessible to Northerners. But it is crippling expensive and of poor quality in many of the most remote Arctic locations. It is also

worth noting that the internet is only a tool – Northerners will have to take advantage of the doors it opens, and this requires addressing the first four issues.

The Arctic's Creative Class

Andrey Petrov (2014) has explored the presence of a creative class in various Arctic regions and has come to some interesting conclusions. He finds that there is “limited evidence of the creative class’s transformative role in the periphery” (p.4); and at any rate “it is evident that most Arctic regions have relatively weak [creative capital]” (p.6), measured by a *Talent Index*, or number of the population over 20 years of age who have a university degree; *Bohemian Index*, or number of the population in artistic and creative occupations; *Leadership Index*, or number of those in leadership and managerial occupations; *Entrepreneurship Index*, or number of those in business occupations; and an *Applied Science Index* or number of those with applied science occupations.

However there are some hotspots. Yukon, Murmansk, Yamal-Nenets and much of Arctic Scandinavia have educational attainment rates close to or even better than national averages. Several communities, such as Cape Dorset, Nunavut have an exceedingly high Bohemian Index rating based on a strong cultural economy selling traditional arts and crafts. And many communities have a high Leadership Index value, due perhaps to the substantial decentralization of governance functions in the Arctic, especially in self-determining indigenous regions, as well as the prominent role of the public sector.

But while the Arctic finds itself home to several different types of the creative class, perhaps the greatest challenge is establishing creative clusters that are equally represented by four or five of these various creative types. In particular, the Arctic seems to be lacking in the entrepreneurial and applied science classes, and has an uneven representation of the talented class, or those who are highly educated.

Building Blocks of Innovation in the Arctic

If there is a lack of applied technology in Arctic communities, there is not a concomitant lack of resourcefulness. There is no end of anecdotes about hunters fixing snow machines or rifles with whatever materials were on hand, for example. There has been a widespread adoption of social media such as Facebook, and sophisticated use of it for community organizing and advocacy. But amidst thousands of micro-innovations, very little that is transferable, scalable or commercial has emerged. The biggest challenge to Arctic innovation is that the

accumulated knowledge often remains tacit knowledge, not explicit knowledge, which Leonard and Sensiper (1998) define as the following:

Explicit knowledge is shared through a combination process and becomes tacit through internalization; tacit knowledge is shared through a socialization process and becomes explicit through externalization.

As Petrov (2014) explains, “the disconnectedness of frontier firms from communities and networks of practice prevents the transfer of tacit knowledge.” As such it remains of benefit only to the knowledge holder and perhaps those immediately around him or her. Some of this phenomenon may stem from the indigenous culture around sharing knowledge, which traditionally happens orally, and from one individual to another, rather than impersonally, outside the appropriate context, or with an objective of commoditisation.

Outside the community development level, innovation in the Arctic has been world class. The large, multi-national extractive industries have applied impressive technological innovations in order to bring resources to market more economically and in a more environmentally responsible manner. And the state of Arctic science in areas such as climatology and glaciology has become increasingly sophisticated, a path it looks likely to continue following large investments in projects such as CHARS (Canadian High Arctic Research Station) in Cambridge Bay. So there is nothing *inherent* in the geography that precludes innovation, even if it imposes some additional challenges. Some successful and promising initiatives provide models for a way forward.

Yukon Research Centre Cold Climate Innovation

The Yukon Research Centre, based at Yukon College, has dedicated a branch of its work towards cold climate innovation. It focuses on the development, commercialization and export of sustainable cold climate technologies and related solutions for subarctic regions around the world, in particular alternative energy, building construction, climate-related research, environmental remediation, food security and mechanical innovation. Although it is publically funded, and seems not to have profitably commercialized any of its applications, it is promoting a culture of innovation and addressing opportunities that are relevant for a northern context.

Arctic Inspiration Prize

Building on the success of initiatives such as the X Prize, the S. and A. Inspiration Foundation in Canada established the *Arctic Inspiration Prize* in 2012, an annual \$1 million prize to:

Multidisciplinary teams who have made a substantial, demonstrated and distinguished contribution to the gathering of Arctic knowledge and who have

provided a concrete plan and commitment to implement their knowledge into real world application for the benefit of the Canadian Arctic, its Peoples and therefore Canada as a whole.

While the prize has funded many important and innovative initiatives, none have been of a commercial or even economic nature yet.

The University of Alaska Fairbanks (UAF) School of Management, by contrast, has run a more traditional Arctic Innovation Competition since 2009 with different age categories, focusing on improving technologies and advancing commercial initiatives, with recent awards for drone interfaces, lithium battery optimization, improved pegging of hockey nets.

Canadian Economic Development Agency

Established in 2009, the Canadian Economic Development Agency (CanNor) seeks to promote a diversified, sustainable and dynamic economic in the three northern territories. Amongst its programs is an Entrepreneurship and Business Development fund, which directs public dollars to reducing barriers faced by northern Aboriginal business owners, such as providing access to capital to those who may not be able to obtain conventional commercial financing, and developing a culture of entrepreneurship within the Aboriginal community. It also maintains a Northern Economic Index to track GDP growth over time, and a Northern Economic Diversification Index to track relative economic diversification. However many of CanNor's programs are new and there are no successful examples or beneficiaries outlined on its website.

Nordic Models

The five Nordic countries, Iceland, Denmark, Norway, Sweden and Finland, have generally had much more success in developing and adopting new technologies and diversifying their Arctic regional economies. They benefit from less remoteness and geographic vastness, higher educational attainment, and better infrastructure than the rural Canadian Arctic. However their northernmost regions have also been disproportionately reliant on resource development.

One notable initiative to promote innovation and commercialization in the broader Nordic region is Norden's *Nordic Innovation* project, which initiates and finances activities that enhance innovation and co-operates primarily with small and medium sized companies in the Nordic region. The mission is to make it easier to develop and do business in the Nordic region without national barriers. Its website outlines many interesting initiatives to promote entrepreneurship and technological development, but does not articulate success stories.

Economic Development Corporations

One particularly promising model for building a more entrepreneurial culture in the Arctic is the phenomenon of Economic Development Corporations (EDCs), as they are generally called in Canada, or Native Corporations as they are called in Alaska. In the Canadian context, EDCs are the economic and business development arm of a First Nations, Métis or Inuit government. As community-owned businesses, they invest in, own and/or manage subsidiary businesses with the goal of benefiting the Aboriginal citizens that they represent (CCAB 2012). They have been growing sharply in the past two decades and now number approximately 200 in Canada.

In Alaska, Native Corporations are the product of the 1971 Alaska Native Claims Settlement Act (ANCSA), which legislated the transfer of 44 million acres of land, or about 10% of Alaska, and a monetary payments totalling US\$962.5 million to twelve regional and 200 village corporations established under the Act. Today, the regional corporations are drivers of the Alaskan economy, and some are billion dollar companies. In 2011, for example, Alaska Native Corporations occupied eight spots of the top ten Alaska businesses and generated US\$11.89 billion in revenues. Some 62.4% of the 25,138 jobs provided by the 'Top49' Alaskan businesses, as identified by Alaska Business Monthly, were provided by ANCSA businesses.

Increasingly successful, and generally profitable, EDCs potentially represent a third way towards economic development in the Arctic, combining traditional capitalism principles with indigenous values of community prosperity and benefit. However they have played a much larger role in supporting traditional resource based industries than in developing new and innovative markets. There are also concerns that by monopolizing the market for services and sub-contracting in many regions, they are limiting individual entrepreneurship and business development. EDCs are a good model, but not a perfect one.

Strategies Going Forward

If Arctic communities seem to lack a culture of innovation and entrepreneurship, the academic community cannot claim to have been much help in shifting it. As Pelyasov and Kotov (2015) charge, "Not a single Arctic country has produced a monograph or even a scientific article describing the phenomenon of Arctic entrepreneurship. The question may arise: does Arctic entrepreneurship even exist?" (p. 28). Governments at various levels, municipal, regional, and national, have all accepted the mantra that innovation, entrepreneurship, commercialization and educational attainment are critical for future regional economic development. However we continue to have little evaluation, let alone understanding, of successful models in the Arctic context.

Some strategies seem obvious however. Pelysov and Kotov themselves advocate for more international economic cooperation. The Barents region is relatively well advanced in this regards, buoyed by its higher population density and industrial base, but only compared to other Arctic regions. The authors point to the success arising from longstanding cooperation between the Norwegian and Russian Chambers of Commerce and the establishment of 'twin cities' that actively seek to collaborate on economic and other issues together, such as Kirkenes and Nikel. In the North American context, the Arctic Caucus of the Pacific North West Economic Region (PNWER), which includes Alaska, Yukon and Northwest Territories, is seeking such cross-border opportunities including cooperation on infrastructure development to improve returns on investment. Educational and research cooperation, most notably through the framework afforded by the University of the Arctic, has created thematic networks and facilitated the transfer of knowledge. And the recently established Arctic Economic Council, created under the auspices of the Arctic Council, seeks to facilitate business-to-business activities, improving the pace and reducing transaction costs of regional economic cooperation.

All of the above promotes regionalization in the Arctic, an important step to learning from others in relevant contexts and establishing a reasonable market size for Arctic and SubArctic solutions. This is in contrast to the extreme decentralization the Arctic has witnessed in the past few decades, where the local context is privileged to the point where transferring knowledge or scaling up innovations is hampered.

Perhaps the best investment will come from improving educational attainment in the Arctic, especially in the rural and indigenous communities where the gaps are the widest. This raises bigger questions however, of whether the education system should be used to integrate and prepare Northerners for the dominant Western economic paradigm, in which case the quality in particular of science and math education should be emphasized and improved; or to pass on traditional ways of knowing, in which case land-based learning and indigenous languages should be emphasized. In a perfect world one would not need to choose between these two options; in the real world a compromise of one or the other, or both, has occurred. The continuing impacts of the residential school system and its equivalent around the Arctic makes this a very complicated situation.

That said, the debate seems to have moved from whether Arctic communities should innovate, to how they can innovate. There is no magic formula, no government program, no curriculum that can guarantee progress. But a concerted effort from a variety of stakeholders, and encouragement of the processes that we know promote innovation, should help make what are likely inevitable changes in the long term to occur sooner, and in a manner that best supports Arctic community development.

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