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Arctic Innovation Hubs: Opportunities for Regional Co-operation and Collaboration in Oulu, Luleå, and Tromsø

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Abstract: Interest in Arctic issues has been growing in recent years. From an economic perspective, the Barents Region is of significant interest due to substantial investment projects. The European Union has strengthened its presence and influence in the region, playing a role in combatting climate change and optimizing opportunities for northern economic activity. Simultaneously, there have been intentions to narrow the gap between public policy and the private sector to more efficiently exploit business opportunities in the North. Promoting the Arctic's potential for business development and building stronger co-operation between the region's actors are among the recent activities in Arctic development. Innovation hubs generate new businesses from ideas and innovations. They operate in global networks by creating added value and attracting more investment capital and talent. This article explores innovation hubs in three regions in Northern Europe—Oulu (Finland), Luleå (Sweden), and Tromsø (Norway). The article examines, through an innovation hub framework, what kind of business development activities are generating growth in these innovation hubs, and what the differences are between these regions. This article discusses whether it is beneficial to have similar innovation service structures in every region, or if connected Arctic innovation hubs that strengthen Arctic co-operation is a better approach. More intensive co-operation between Arctic actors is most likely to require specific actions.

Introduction

Interest in Arctic issues has been growing in recent years. From an Arctic economic perspective, the Barents Region is seen as an area with high potential due to increasing demand for products and services related to various forthcoming investment projects. In addition, the European Union (EU) has strengthened its presence and influence in the region, playing a role in combatting climate change and optimizing opportunities for northern economic activity. Actions have been taken to narrow the gap between public policy and the private sector in attempts to support the development of new products and services that exploit the cumulative Arctic expertise. One recent development in the Scandinavian Arctic has been the introduction of the “Arctic Valley” initiative to promote Arctic business opportunities. The aim of this initiative is to raise awareness of the Arctic as a region of opportunities for international business, and to build stronger co-operation between regional actors (e.g., academia, business, politics, investors, and so on).

This article explores the concept of innovation hubs, which are generating new business; operating in global networks by creating knowledge, ideas, and innovations; and recruiting investments and talent. Innovation hub thinking is based on the recent changes and trends in the business environment of many companies. One important concept within innovation hubs is co-creation, where different actors work together to achieve shared goals. The commercialization of innovations has been seen as a significant source of economic growth; therefore, innovation policy emphasizes the coordination and facilitation of various development activities instead of more traditional forms of industrial policy such as financial subsidies. Simultaneously, the public sector is seen as the enabler and builder of different platforms. Innovation hubs can be seen as one obvious example of this transition of public industrial policy from direct monetary support towards supporting innovation process with platforms, networking opportunities, and shared expertise.

This article explores innovation hubs in three regions of Northern Europe—Oulu (Finland), Luleå (Sweden), and Tromsø (Norway). These regions were selected to focus on the innovation dynamics of the three largest cities in Northern Europe that reside outside of the core metropolitan areas. This article examines the kinds of business development services that are in these innovation hubs and the differences between these local service structures. Secondly, this article aims to discuss

whether there could be a connected Arctic innovation hub to strengthen Arctic co-operation in the area. An interlinked Arctic innovation hub might increase the effectiveness of commercialization and other business development activities. Requirements for this strengthened co-operation are also discussed.

This article is a preliminary analysis of a topic that needs to be opened for further discussion and research. Analysis includes a preliminary literature review, and the data consists of information provided by local partners. Development of these innovation hubs and the co-operation required is still very much in progress. In further studies, our aim is to make a more in-depth, quantitative analysis of the ecosystem and, also, to obtain a broader understanding of the topic by interviewing multiple actors.

Innovation Hubs

Innovation hubs¹—sometimes called innovation centres or knowledge hubs/centres—are local and creative centres in the global economy that contribute added value (e.g., knowledge, competence, new ideas, innovations) to global networks, and attract talents and investments. Innovation hub is a term used to describe the utilization of local expertise for business development.

National, regional, and local governments are seeking new ways to stimulate job creation and growth that are less dependent on public resources and are more cost-efficient. One of these strategies is the development of innovation hubs (Lange, Handler, & Vila, 2010). From a regional development perspective, it is important to realize regional innovation potential and support activities that enforce this potential (Hautamäki & Oksanen, 2012). A well-functioning innovation hub involves socio-economic targets and the private sector's interests welded together to expand business opportunities (Viitanen, Markkula, & Ripoll Soler, 2013).

Porter (1998) defines clusters as geographic concentrations of interconnected actors in the same field. Lange, Handler, and Vila (2010) call innovation hubs "Next-Generation Clusters" as they highlight that geography cannot be the overriding factor for a successful cluster. They demonstrate that there is an urgent need to update the cluster model and shift the focus toward more globally oriented innovation hubs that are utilizing all the opportunities of the digital economy in terms of collaboration, partnerships, virtualization, and resource sharing.

Innovation hubs can be defined as nodes in the global economy that link to a local innovation and business environment. Clustered know-how in the innovation hub can be called a competence profile (Hautamäki & Oksanen, 2012) or knowledge space (Etzkowitz, 2008), which can be based, for example, on a special technological platform or specialized production expertise. An innovation hub consists of a nodal network of firms or organizations and consumers working together to create value in forms of new ideas and innovations (Prahalad and Ramaswamy, 2004). In this network, knowledge is distributed among actors, encouraging them to take advantage of available information and exchange ideas (Chesbrough, 2004). To the global business network, an innovation should produce some special value—this value can be special expertise, new technology, or a knowledge based business with international appeal (Hautamäki & Oksanen, 2012).

The basis of innovation hub policies is to address the question of what actions need to take place to create a favourable environment for innovation and sustain economic growth (e.g., Lange, Handler, & Vila 2010; Auerswald, 2015). Different types of programs, organizational forms, and co-operation among educational, private, and public domains can accelerate the creation of an innovation hub (Aapaoja & Leviäkangas, 2015). There is no exact formula for creating an entrepreneurial economy, but some similar topics arise from the literature.

Viitanen et al. (2013) emphasize the commitment of the key triple helix actors (e.g., business, government, and post-secondary institutions) and their well-planned and conscious activities in creating an innovation hub with regional significance. A challenge is, however, how to bring various levels of private and public sectors into a system where they are working and reinforcing each other (e.g., Auerswald 2015). Viitanen, Markkula, and Ripoll Soler (2013) present a three-stage model that is needed for creating an innovation hub with regional significance. The first stage is related to the creation of pre-conditions. This is determined through audits. Auditing refers to a comprehensive and honest assessment of the regional potential including the existing built infrastructure and the key technological strengths (own and acquired) of different actors. Second, there must be a willingness to utilize this potential (active participation). The second stage involves elements that are required to build up a successful regional innovation hub, such as joint research and development, innovation capacity, commercialization, and platforms. The third stage involves orchestration and dedicated hub management, where an actor takes responsibility for facilitating the processes of coordination,

program planning, and management; value network development and maintenance; and securing and upgrading the required human resources pool. This third stage involves less public support than stage two. Viitanen et al. (2013) advocate in their article that, in the future, every globally attractive innovation hub will require a core hub organization.

Supporting Commercialization to Enable Economic Growth in the Arctic

Commercialization of ideas and inventions has been highlighted in political agendas rather extensively. In global competition, innovation and commercialization have been seen as significant sources of economic growth—or, more precisely, as a means to maintain the current level of economic welfare when countries like Finland face remarkable challenges such as an aging population.

In the current economic environment, the return of traditional economic policy with increasing public subsidies and transfers, or public investment programs, seems quite unlikely. Focus is increasingly shifting towards more broad-based strategies enabling an entrepreneurial environment (Auerswald, 2015). Innovation policy emphasizes coordination and facilitation of various activities related to commercialization of innovations (e.g., accelerator and incubator programs or services; shared research, development, and innovation (RDI) infrastructure; and networking platforms) (Oksanen & Hautamäki, 2014).

Most innovation hubs contain functions or activities promoting the development of new businesses. These activities are usually referred to as business incubators. Occasionally, business accelerators co-exist with incubators making it difficult to distinguish the two from each other. For instance, there are accelerator programs or services designed for building business models for ideas and innovations before establishing a company (e.g., Avanto Accelerator in Oulu), and there are accelerators for established companies that are focusing on the scale-up stage. Business incubators may focus on young companies with high potential, promoting and supporting them to a higher level quickly (Bruneel et al., 2012), but as well there are incubators supporting early stages of companies regardless of the estimated potential (e.g., Business Incubator of Oulu University of Applied Sciences). Regardless of whether incubators are for-profit or non-profit, they operate with two main goals in mind: (a) enhancing economic development and/or reducing unemployment in a region by facilitating the start-up of new companies, increasing the survival rate and growth of new companies, and, more generally, by training entrepreneurs;

and (b) stimulating firms involved in emerging technologies or the commercialization (or transfer) of research done in universities, research institutes, and firms (Bergek & Norrman, 2008). However, accelerators focus more on intensive and limited duration mentoring, supporting a cohort of companies at the same time and providing additional financing for the ventures. The application process for this type of mentoring is also highly competitive. Business accelerators are quite a new phenomenon, therefore research on accelerators is more limited (Cohen 2013).

Research on business incubators has focused on identifying outcome objectives and suitable criteria and indicators to measure outcomes (e.g., Phillips, 2002). Some studies, however, measure these outcome indicators in relation to goals (e.g., Sherman 1999). Bergek & Norrman (2008) have formed a model of main incubator components, dividing the components into three categories: selection, business support, and mediation. Selection refers to the decision-making process of which ventures to accept and which to reject based on an idea-focused and entrepreneur-focused approach. Business support includes entrepreneurial coaching/training and business development advice, as well as services concerning general business matters such as accounting, legal matters, advertising, and financial assistance. Mediation refers to the incubator's role as an intermediary between "incubatees" and relevant innovation systems. Mediation networks may provide information, knowledge, and expertise vital for the survival of new ventures. There can also be institutional mediation, helping incubatees to understand, interpret, and perhaps even influence the institutional demands introduced by regulations, laws, traditions, and norms.

Identifying the business potential of innovative ideas, formulating and analyzing possible business models, and igniting business operations are all relevant steps when commercializing innovations. Moreover, since it has been widely acknowledged in the Nordic countries that economic growth is closely linked to bringing new, knowledge intensive products and services to global markets, and hence reviving exporting activities, public sector activities that complement the traditional role of financing academic and other research is paramount (Hautamäki, 2008). Therefore, innovation hubs alone are not a sufficient means to secure balanced growth. Rather, economic success requires determined commercialization activities that are embedded as an organic part of an innovation hub.

Innovation Hub in the Scandinavian Arctic

The aim of this article is to provide an overview, through an innovation framework model, of different business development activities in three city regions in Northern Scandinavia, and to distinguish similarities and differences between them. Special emphasis in this article is laid on the Oulu Innovation Alliance model as a source of one concept that could be used for structuring activities and collaboration between the three regions.

Oulu, Finland (capital city of Northern Ostrobothnia) has a population of 200,000. The population of the region is well-educated, with a third of the working population having a university-level degree. The student population in the city totals 30,000. Oulu is also known for its technological expertise and electronics companies. Tromsø, Norway is the largest city north of the Arctic Circle and is home to the world's northernmost university. Tromsø has about 73,000 inhabitants, most of whom live in or in close proximity to the city centre. The city's growth has mainly stemmed from the attractiveness of public institutions such as the university and the hospital. Luleå, in Sweden, is in the province of Norrbotten, which comprises a quarter of Sweden's land area. The population of about 76,000 inhabitants is highly concentrated within the city and its immediate surroundings. Sweden's first technology university and the northernmost university in Sweden, Luleå University of Technology, has had a great impact on business development in the area. Although these three regions differ, they have some shared features. For example, regional development in these three areas is heavily influenced by the local university and all three locations are characterized by the presence of a strong and explicit local commitment to the development of a functioning innovation system.

The Oulu Innovation Alliance (OIA) was created in 2009 and is a co-operation model based on a strategic innovation alliance agreement made by education and research institutes, companies, and the public sector. The purpose of the alliance is to focus on jointly agreed specific innovation areas (e.g., Internet research, energy), invest in the development of agreed infrastructures, and create and develop innovative tools and methods for mutual use. In 2015, a new agreement was created and signed for the years 2016 to 2020. In this new agreement, the ecosystem model was established with the purpose of providing a framework for collaboration between key development organizations in selected spearhead areas (e.g., industry, health, and information & communications technology). Rapid and pervasive changes in the production sector demanded innovative and radical responses in the form of a renewed OIA framework. The participants of the alliance have expressed their willingness and

commitment to work together to catalyze the commercialization of innovations.

Since the OIA collaboration is a new development, it is too early to assess its success. However, by assessing the observations from the development process of OIA, it is possible to explore the key ingredients for this type of innovation hub development. The first ingredient is the key actors' involvement in the design process; workshops, negotiations, benchmarking, and background analysis were all necessary parts of the process. The second ingredient is a joint vision for planned activities and operations so that all parties share the same understanding of the essence of ecosystem thinking according to which co-ordination and facilitation of activities carried out by actors in ecosystems are the main activities. The third ingredient is trust—all participants must trust each other and other actors in the innovation sector. Since the OIA arrangement does not bring new organizations or introduce new services (apart from coordination and expertise) to an innovation system, the practical implementation of the planned actions is dependent on the existing organizations—both public and private. It is challenging to find examples of an arrangement similar to this scale, but the abrupt changes in the local economy in Oulu due to the collapse of the Finnish mobile phone company Nokia after 2007 are somewhat unique as well. It is noteworthy that all key prerequisites for an innovation alliance arrangement do exist in the Scandinavian Arctic. Universities; research, development, and innovation (RDI) organizations; large companies; small and medium sized enterprises (SMEs); and innovative start-ups do play a central role in Luleå and Tromsø, just as they do in Oulu.

Case Studies from the European Arctic

The OIA framework relies on existing actors and activities, rather than building additional organizations and structures, with the intention that OIA arrangements bring coordination and joint development to pre-existing organizations. Additionally, there are expectations that OIA will increase the possibility for new, multidisciplinary innovations to emerge from “collisions” between ecosystems. The first examples of these new areas of innovation are financial technology, digitalization in life sciences, and the circular economy.

For example, the Business Kitchen² concept was developed in the Oulu region as a reaction to the rapid and pervasive change in the local production patterns. An unanticipated decline in the Nokia-related ICT sector brought a large number of well-educated experts to the labour

market. At the very early stages of the change it was observed that rearrangement of the local economy was going to be led by emerging technology start-ups. To support this development, both universities (University of Oulu and the Oulu University of Applied Sciences), and the business development organization of the city of Oulu (BusinessOulu) joined forces. The initial operational functions of Business Kitchen were built on the expertise of the personnel in participating institutions. Researchers, teachers, and business advisers worked together with companies to build business models and commercialization plans for new technological innovations. These co-creation activities were aimed at increasing the number of knowledge intensive companies and also accelerating the growth of the start-ups.

The operational nucleus of the Business Kitchen was revised in the beginning of 2015 when new services were introduced. In this second era of Business Kitchen, the innovative capacity of more than 20,000 university students in the Oulu region were brought closer to the innovation processes of companies to support commercialization and growth with research, demonstrations, and prototypes. It should be noted that replacing university staff with students has not changed the key idea of following the triple helix model in the Oulu area. In this recent model, Business Kitchen acts as the universities' entrepreneurship hub, offering support and advice to university based ideas and innovation. Additionally, Business Kitchen also facilitates the talent pool of university students to utilize students' creative potential to develop local businesses.

In the Luleå region, the Luleå University of Technology (LTU) is a central player in the local innovation system. The university has developed a portfolio of commercialization services as part of the LTU Business³ organization. For example, incubator services are produced by the Arctic Business Incubator (ABI),⁴ a company owned partly by LTU. The incubator, which covers Northern Sweden, has been operating for over a decade. A larger operational area is a clear difference between ABI and Business Kitchen. Luleå, more so than Oulu, relies on a strong connection between start-up development and financial functions, especially venture capital funding.

Essentially, the arrangement of innovation services in Luleå displays the idea of a triple helix model and, so far, the results from innovation hub activities have been encouraging: a number of investment cases have emerged as well as a lively technology start-up community—Luleå's Facebook data centre is one of many examples of the attractiveness of the region.

In the Tromsø area, the key actors in innovation activities are UiT The Arctic University of Norway⁵ and the innovation company Norinnova Technology Transfer AS.⁶ UiT has, in addition to education and research activities, some business development services that connect students to companies' innovation activities (cf. DT Lab). Norinnova has a dual role in the local innovation system. The first role of Norinnova is to provide technology transfer services, commercializing the results of various research activities. The second task of Norinnova is to offer business incubator services. The division of labour between UiT and Norinnova seems unambiguous since Norinnova has its own personnel to provide services, whereas UiT operates by utilizing their students and their studies. However, it is obvious that co-operation between Norinnova and Business Kitchen in piloting a new internationalization service (Arctic Business Corridor⁷) has ignited new considerations about getting students more strongly involved in local innovation systems—to illustrate this development, on 30 November 2016 the embassy of Finland in Oslo and the embassy of Norway in Helsinki organized a joint workshop for universities in Tromsø and Oulu to develop a means to collaborate in activating students to support commercialization of Arctic innovations.

Arctic Europe: Collaboration and Co-operation as Advantages in Global Competition

The Arctic regions of Europe display many of the same challenges as peripheral European areas in general. Peripheral areas usually suffer from rather low levels of attractiveness when it comes to business development and business decisions. The vast natural resources of the Arctic only attract production activities as long as profitability of operations is guaranteed. The Arctic area is continuously struggling to secure sufficient levels of the elements of production (labour and capital). To combat this challenging task, the Arctic areas of Finland, Norway, and Sweden have increased their level of co-operation by linking research and development programs and by intensifying mobility of people—especially students, researchers, entrepreneurs, and business developers.

The framework for more intensive collaboration between European Arctic areas is favourable since the countries involved have roughly similar political agendas (e.g., the Scandinavian welfare system), historical links, and economic conditions. The major differences between these regions, from a joint business development perspective, is the fact that Sweden and Finland are members of the European Union whereas Norway is not, and only Finland is a member of the common currency area

(euro). However, these differences are unlikely to result in the inability of these regions to co-operate in a mutually beneficial innovation agreement.

The idea of “Arctic Valley” (or “Arctic Europe”) has recently been introduced to accelerate collaboration between the regions of Luleå, Oulu, and Tromsø. The “Arctic Valley” initiative is built on the typical hub analogy—it is possible to gain access to the whole Arctic area through any region or node of the hub. In other words, each of the regions (Oulu, Luleå, Tromsø) offers not only their own context or markets but also the context of the Scandinavian Arctic (BusinessOulu, 2015). If “Arctic Valley” became a reality it would raise the attractiveness of the Arctic area by increasing the size of the markets and number of business opportunities. Moreover, this type of close co-operation between areas would help Arctic actors to allocate scarce resources more efficiently—in a collaborative environment there would be no need to build extensive business development service systems for each area separately, and therefore the resources could be pooled together. However, as in any network, cluster, ecosystem, or innovation hub, this development towards tightening co-operation and division of labour between regions would obviously mean reallocation of activities in the Scandinavian Arctic. In other words, some activities would be replaced by others in some regions and this readjustment will understandably be a tedious and somewhat lengthy process. To some extent, “Arctic Valley” serves as an upper-level concept for co-operation and vision for development in the Nordic area, but the operationalization of the collaboration will require more detailed action. It is rather indisputable to conclude that more extensive co-operation between the innovation hubs in the European Arctic needs to be driven by solid political decision making.

The Arctic collaboration to exploit competitive advantages can act as a positive incentive for other Arctic areas to follow the path of OIA in Oulu. For Arctic innovation hubs and their business development activities, the Arctic co-operation seems to be a natural choice. In practice, this would mean more joint development programs, exchange of ideas and expertise, and common commercialization activities and events. Some business development activities do naturally require local implementation, but for the majority of functions the Arctic co-operation would be an opportunity to increase effectiveness. For instance, for new entrepreneurs and businesses, the Arctic area would act as a test bed for proper internationalization and joint activities between regional innovation hubs and would operate as a valuable feedback channel when designing products and business models. There are numerous ongoing activities aiming at developing

testing infrastructure (cf. Oulu HealthLabs⁸), and interest towards these opportunities among the companies is growing rapidly. However, it should be pointed out that testing and even prototyping activities do not reflect the maximal development potential in the Arctic. In terms of economic outcomes, the Arctic should also appear as an attractive context to permanent production and manufacturing activities.

Conclusions

Although there are many challenges unique to Arctic regions (e.g., extreme climate, seasonal variance of temperatures and light, and snow and ice), the Arctic and peripheral regions of Europe in general share many similarities.⁹ For example, low population density, sparse and imbalanced settlement structures, and difficulties with communications and accessibility (e.g., European Union, 2016). These areas also commonly suffer from low economic attractiveness and diversity when it comes to business development and business decisions. In this challenging environment, the Arctic areas of Finland, Norway, and Sweden have increased their level of co-operation to generate growth.

The case studies of this article are three regions in Northern Europe—Oulu (Finland), Luleå (Sweden), and Tromsø (Norway). These three Arctic regions are strong regional centres in northern Scandinavia with a tradition of interconnections between public policy, academia, and industry. This article examines the kinds of business development services that are generating growth in these innovation hubs, and what the differences are between these regions. Secondly, the article discusses whether there could be an interconnected Arctic innovation hub to deepen Arctic co-operation for more effective usage of competitive advantages, and commercialization and enhancement of business development; and the article discusses how this would be executed.

When observing the current status of local innovation hubs in the Arctic, it is apparent that all hubs have been designed to function within the regional context. However, each region has unique strengths and opportunities that could be applied in other regions as well. In the Oulu region, the Business Kitchen concept offers a platform to utilize the potential of university students in the support of business development and commercialization of innovations. The dynamic and flexible attitude of universities enables students to add a variety of business development activities to their studies, which also secures the continuity of Business Kitchen services since tuition is a direct source of funding. In the Luleå region, the pathways to commercialize research results have been

designed thoroughly. Although it is quite common that support of commercialization is limited to testing business models, market surveys, or more technical services for establishing a company, in Luleå the investors and financiers are also directly linked to the innovation system. This has resulted in a strong start-up community and internationally significant investment. Tromsø is the innovation hub with the strongest emphasis on the Arctic, while the cumulative knowledge of various Arctic issues creates a remarkable competitive advantage for the region.

Obviously, business development activities must be tailored to local needs, but the Arctic co-operation could, however, increase the effectiveness of innovation hubs. Arctic co-operation in practice would mean joint development programs, exchange of ideas and expertise, and common commercialization of activities and events. The Arctic area would act as a test bed for internationalization of new entrepreneurs and businesses, and joint activities between regional innovation hubs would operate as a valuable feedback channel when designing products and business models. Eventually, this Arctic network of innovation hubs would appear as an attractive concept and a means to commercialize ideas by combining the strengths of individual hubs. Oulu would provide a model for university collaboration and talent management, Luleå would provide an understanding of critical steps of commercialization, such as market entry and financing, and Tromsø would provide an extensive vision of Arctic challenges and opportunities. Sharing knowledge, understanding, and models of open and continuous communication between regions would improve the chances for success in global competition for the northern areas of Norway, Sweden, and Finland.

It is to be noted that innovation hubs per se do not appear as a sufficient means to secure balanced growth, but economic success requires determined commercialization activities that are embedded as an organic part of an innovation hub. The exchange of ideas and experiences between regions is undoubtedly beneficial for all parties—the OIA framework serves as a pilot project, and since the concept is designed to be agile and responsive the Arctic collaboration provides an additional source of feedback.

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Notes

1. The “innovation ecosystem” term is used increasingly; however, it falls to researchers to bring rigorous meaning and practical usefulness to the innovation ecosystem concept (Oh et al., 2016). In this article the term is not used, instead more established terms such as innovation hub and technopolis are more appropriate and do not require additional efforts in terminology. However, ecosystem literature is essentially part of the literature review.
2. Business Kitchen, <http://www.businesskitchen.fi/>
3. Luleå University of Technology, <http://www.ltu.se/>
4. Arctic Business Incubator, <http://www.abi.se/>
5. Norrinova <http://norinnova.no/>
6. Arctic Innovation Corridor, <http://www.businesskitchen.fi/services/business-x-universities/arctic-business-corridor/>
7. Oulu HealthLabs, <http://ouluhealth.fi/labs/>
8. For more thorough considerations, see e.g., Hintsala, Niemelä, & Tervonen, 2015; 2016; Niemelä and Hintsala, 2016

References

- Aapaoja, A., & Leviäkangas, P. (2015). Local innovation system in northern Finland—Case renewable energy solutions pilots in Oulu. *International Journal of Technology*, 5, 722–732.
- Auerswald, P.E. (2014). Enabling entrepreneurial ecosystems. *Kauffman Foundation Research Series on City, Metro, and Regional Entrepreneurship*. Erwin Marion Kauffman Foundation.
- Bergek, A., & Norrman, C. (2008). Incubator best practice: A framework. *Technovation*, 28(1), 20–28. <https://doi.org/10.1016/j.technovation.2007.07.008>
- BusinessOulu. (2015). Oulun seudun elinkeinokatsaus 2.
- Bruneel, J., Ratinho, T., Clarysse, B., & Groen, A. (2012). The evolution of business incubators: Comparing demand and supply of business incubation services

- across different incubator generations. *Technovation*, 32(2), 110–121. <https://doi.org/10.1016/j.technovation.2011.11.003>
- Chesbrough, H. (2004). *Open innovation: The new imperative for creating and profiting from technology*. Boston: Harvard Business School Publishing Corporation.
- Cohen, S. (2013). What do accelerators do? Insights from incubators and angels. *Innovations*, 8(3-4), 19–25.
- Etzkowitz, H. (2008). *The triple helix: University-industry-government innovation in action*. New York: Routledge.
- European Union. (2016). *Northern periphery and Arctic programme 2014–2020*. Approved by the European Commission on 16 December 2014, updated in January 2016.
- Hautamäki, A. (2008). Kestävä innovointi. Innovaatiopolitiikka uusien haasteiden edessä. *Sitran raportteja*, 76.
- Hautamäki, A., & Oksanen, K. (2012). Suuntana innovaatiokeskittymä. Jyväskylä: Jyväskylän yliopistopaino.
- Hintsala, H., Niemelä, S., Tervonen, P. (2015). Is there an Arctic ecosystem emerging? Oulu region's perspective. *International Journal of Information Technology and Business Management*, 15(1), 21–27.
- Hintsala, H., Niemelä, S., & Tervonen, P. (2016). Arctic potential—Could more structured view improve the understanding of Arctic business opportunities? *Polar Science*, 10(3), 450–457. <https://doi.org/10.1016/j.polar.2016.07.001>
- Lange, A., Handler, D., & Vila, J. (2010). Next-generation clusters creating innovation hubs to boost economic growth. Cisco Internet Business Solutions Group.
- Niemelä, S., & Hintsala, H. (2016). Arctic business potential from Oulu region's perspective—opportunities and obstacles. *ePooki. Oulu University of Applied Sciences Publications* 7.
- Oh, D.S., Phillips, F., Park, S., & Lee, E. (2016). Innovation ecosystems: A critical examination. *Technovation*, 54, 1–6. <https://doi.org/10.1016/j.technovation.2016.02.004>
- Oksanen, K., & Hautamäki, A. (2014). Transforming regions into innovation ecosystems: A model for renewing local industrial structures. *The Innovation Journal*, 19(2), 1–16.
- Phillips, R.G. (2002). Technology business incubators: How effective as technology transfer mechanisms? *Technology in Society*, 24(3), 299–316. [https://doi.org/10.1016/S0160-791X\(02\)00010-6](https://doi.org/10.1016/S0160-791X(02)00010-6)
- Porter, M.E. (1998). Clusters and the new economics of competition. *Boston: Harvard Business Review* 76(6), 77–90.
- Prahalad, C.K., & Ramaswamy, V. (2004). Co-creation experiences: The next practice in value creation. *Journal of Interactive Marketing*, 18(3), 5–14. <https://doi.org/10.1002/dir.20015>

- Sherman, H.F. (1999). Assessing the intervention effectiveness of business incubation programs on new business start-ups. *Journal of Developmental Entrepreneurship* 4(2), 117–133.
- Viitanen, J., Markkula, M., & Soler, C.R. (2013). Systemic development of regional innovation ecosystems – Modernizing the triple helix. In P. Lappalainen & M. Markkula (Eds.), *The knowledge triangle: Re-inventing the future* (pp. 101–116). Helsinki: European Society for Engineering Education SEFI, Aalto University & Universitat Politècnica de València.