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Arctic subsea communication cables and the regional development of northern peripheries*

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Abstract. Some years ago, the Arctic Ocean was still described as one of the last oceans that did not have subsea communications cables across it. This situation is now changing. One of the greatest increases in global data transfer is predicted to be traffic between Asia and Europe, and the Arctic Ocean offers a shortcut, making physical cable connections shorter and decreasing latency. Recent developments regarding two ongoing subsea communications cable projects (Quintillion and Arctic Connect), which aim to connect East Asia and Europe, are discussed, and the connection between these projects and regional development policies in Hokkaido and northern Finland are analysed. It is shown that the proposition that improved international connectivity through subsea communications cables could bring information-intensive industries into the region had been stronger in Finland. This is largely due to a lack of information and awareness concerning these projects among the regional actors in Hokkaido; however, no concrete policy or funding instrument has been developed in either of the case regions.

Keywords: *Arctic, subsea data cable, connectivity, regional development, Hokkaido, northern Finland.*

Introduction

This paper focuses on two case regions and two case projects. In addition to the northern peripheries of two developed countries with a high-level of technological knowledge, Hokkaido, Japan and northern Finland (including Lapland, Northern Ostrobothnia¹ and Kainuu) have also been mentioned as potential regions to be connected by a planned cable through the Northeast Passage. This is the Arctic Connect project, which originated in Finland but is international in nature and is continuing under the leadership of the mainly state-owned Cinia Group. The other case project is led by Quintillion Subsea Holdings, which has already installed a subsea communications cable around Alaska and is moving to Phase 2 of its project, i.e., installing a subsea communications cable between Alaska and Japan.

In this study, new Arctic subsea communications cable initiatives were investigated with a two-fold objective. First, the objective was to introduce the recent developments of two ongoing subsea communications cable projects that aim to connect East Asia and Europe. Second, the objective was to analyze the connections between these projects and the regional development policies in the northern peripheries. The latter objective was converted into the research questions regarding how much decision makers and regional developers know about the Arctic subsea communications cable initiatives; what types of attitude have been adopted; what types of possibilities have been recognized and which types of links regional developers perceive between sub-

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¹ In some occasions referred as the Oulu region.

sea communications cables and other regional development projects; and what types of resources regional decision makers utilize to allocate support to the Arctic subsea communications cable projects. In addition to contributing to an understanding of the infrastructure projects and policy making in the Arctic and northern regions, this study contributes to discussions concerning broadband policies. Grubestic and Mack recently argued that extant discussions on broadband and associated policies are overwhelmingly focused on broadband for personal use, and issues relevant to business adoption and the use of broadband are ignored [1, Grubestic T.H., Mack E.A., p. 7].

This research is based on published reports and policy papers, newspapers and other media sources, interviews and participatory observations. As a self-reflective remark, the author would like to note his role as a contributor to the Hokkaido-based discussion concerning the Arctic subsea communications cables; however, it is believed that active participation in the discussion does not nullify one's ability to analyze the policy making and knowledge exchange processes. This article consists of an introduction to the conceptual and theoretical discussion concerning the relation between an information and communication technology (ICT) infrastructure and regional development as well as a short description of the two main Arctic subsea communications cable initiatives. This is followed by an introduction to the broadband policies and ICT industry development in Hokkaido and northern Finland, an analysis of the approaches adopted for the possibilities of the Arctic subsea communications cable initiatives and concluding remarks.

Connectivity, information and communications technologies and regional development

Internet and broadband have been described both as gateway technologies and as general-purpose technologies. Thus, these technologies have fundamentally transformed the way both people and businesses operate and how and where economic activity is organized [2, Czernich N., Falck O., Kretschmer T., Woessman L., pp. 505–506; 3, Mack E.A., p. 5]. Considering their importance, it is not surprising that it has long been acknowledged that telecommunications technologies and related infrastructures are key factors upon which the competitiveness of firms, productivity and the comparative advantages of regions are critically dependent [4, Gillespie A., Williams H., pp. 1311–1312; 5, Capello R., Nijkamp P., pp. 7–8; 6, Cambini C., Jiang Y., pp. 559–560].

Still, the relation between ICTs and regional economies should not be oversimplified. For example, in the past two decades, contradicting analyses concerning the impacts of ICTs on the competitive positions of regional economies and firms' locational preferences have emerged. While echoing claims concerning the death of distance through the availability of high-quality telecommunications infrastructures, the so-called de-concentration school has predicted a relocation of firms from expensive and congested central city locations to suburban areas; however, the concentration school has suggested that ICTs would only reinforce the advantageous position of central urban areas. During its early history, the internet was conceived as a decentralizing and geography-free technology, but many researchers have claimed that because connections and bandwidth are unequally distributed, cyberspace is dependent on the real world's spatial realities and

that the internet has simply become another concentrated infrastructure layer supporting the existing hierarchies between regions. Furthermore, it is assumed that the availability of ICT solutions will not nullify the importance of face-to-face conversations and that the forces of agglomeration economies will draw firms to central locations, such as where knowledge spillovers are more likely and labour markets are more heavily concentrated. In other words, the drivers of industrial clusterisation are not overruled by the presence of modern ICTs. The third and currently dominant approach predicts more heterogenous impacts of ICTs on firm locations based on firm and industry-specific characteristics [7, Malecki E.J., Wei H., p. 362; 3, Mack E.A., p. 6; 1, Grubestic T.H., Mack E.A., pp. 122–124].

In addition to recognizing the continued importance of location, attention must also be focused on the significance of connectivity. Namely, it has been claimed that even remote geographical locations with multiple peering points (i.e. possibility to exchange traffic between administratively separate internet networks), abundant power infrastructures and a concentration of diverse fibre backbones are attractive to data or information-intensive industries. At the same time, the local presence of industries, such as data centers, can generate a significant demand for telecommunications services and can contribute to regional development by spurring infrastructure investments even when the local residential demand is at a relatively low level [3, Mack E.A., p. 24; 1, Grubestic T.H., Mack E.A., pp. 125, 131]. Similarly, the high-speed internet via a broadband infrastructure may further facilitate macroeconomic growth by accelerating the distribution of ideas and information, fostering competition and increasing the development of new products and processes [2, Czernich N., Falck O., Kretschmer T., Woessman L., p. 505].

While these types of conclusions from the academic literature may seem promising from the perspective of the economic revitalization of remote regions, it is not clear whether they are known, accepted and shared among policy makers. The policy cycle is a relatively simple model that describes complex policy making processes and divides them into a series of stages (for example: agenda setting, policy formulation, legitimation, implementation, evaluation, termination). While understanding that this model is not offered as theory explaining or predicting behavior and recognizing the numerous ways to label different stages, this study borrows from the vocabulary of the policy cycle to construe the steps different regional stake holders have taken vis-à-vis the Arctic data cable initiatives [8, Bridgman P., Davis G., pp. 99–100; 9, Cairney P., pp. 32–34].

The Arctic subsea communications cable initiatives

The Russian Optical Trans-Arctic Submarine Cable System (R.O.T.A.C.S.) project, which was launched in 2000, was the first serious attempt to connect northern Europe and East Asia with a subsea fibre optic cable through the Arctic Sea. The project was led by the Russian company Polarnet, which planned to connect Tokyo and London. Despite receiving approval from the Russian Intergovernmental Commission for Information and Communications Technologies in October

2011 as well as financial support from the Ministry of Telecommunications in January 2013, the project did not materialize [10, Delaunay M., p. 504]².



Fig. 1 The Arctic Submarine Communications Cable Projects (Quintillion and Arctic Connect)³

Black line: Arctic Connect, planned route; Orange line = Quintillion, planned route; Red line: existing Quintillion (Alaska) and Cinia (Finland-Germany) submarine communications cables; Dotted line: planned Bothnia Bay submarine communications cable line and planned terrestrial connection through Finland.

At the beginning of the 2010s, Arctic Fibre emerged as the second major Arctic subsea communications cable initiative. This project was developed by a Canadian company with the same name. The aim was to create a nearly 16,000-kilometre subsea fibre optic cable connection between Asia and Europe through the Northwest Passage. The new system was also expected to

² Arctic Economic Council Telecommunications Infrastructure Working Group, "Arctic Broadband. Recommendations for Interconnected Arctic" 2016, 25, Interview with Suvi Linden, Vice Chairperson, NxtVn (Oulu, Finland, 23 May 2017).

³ This map is a rough estimate based on the material published by Quintillion and Cinia. Rather than describing the actual routes, branching units and cable landing stations, it describes the general ideas of these large-scale projects.

improve connections to remote communities in Canada and Alaska [11, Starosielski N., pp. 16–18]. The implementation of the project became possible, though after Quintillion Subsea Holdings, based in Anchorage, Alaska, acquired Arctic Fibre's assets and became the company that would build and operate the system. Quintillion itself is a privately-owned business incorporated in 2012⁴. Quintillion's project is divided into three phases. The construction of Phase 1, which involved a system that includes the subsea communications cables around Alaska and new terrestrial cables, has been completed and is in service. Decisions concerning the Phase 2 project, i.e. installing a subsea communications cable between Alaska and Japan, are expected to be made soon. While the illustration on Quintillion's homepage designates Tokyo as the location of the Japanese end of the cable, according to a representative, the question concerning the planned landing site in Japan is currently under consideration⁵.

The re-emergence of the project to install a subsea communications cable through the Northeast Passage is based on an initiative taken by Finland. For example, while a January 2015 report on sustainable development in the Scandinavian Arctic that was commissioned by the Prime Minister's Office in Finland lacks reference to such a cable, the roots of the project are visible in the March 2015 report, which was commissioned by the Confederation of Finnish Industries and written by Paavo Lipponen, the former Prime Minister of Finland. This document designates a communications cable from Asia to Europe along the Northeast Passage and through Finland as a particularly important project for Finland⁶. Two months later, the Ministry of Transport and Communication commissioned the report 'Technical-Economic Study on the Northeastern Passage Undersea Cable' from Petri Hyyppä of Proceed Consulting Ltd and Stan Kramer of the David Ross Group. According to the report on 26 October 2015, the geographical location of Finland provides an advantage in attracting investments, such as data centers and other digital infrastructures, from major internet players and content providers. The project was strongly connected to the Baltic Sea cable (C-Lion1), which was under construction at that time. The existing backhaul fibre connections within Finland were considered enough for a diversified connection up till southern Lapland; however, the need for further improvements in the northern routings was acknowledged⁷.

The Ministry of Transport and Communications commissioned another report concerning the prerequisites for international cooperation to initiate the Northeast Passage telecommunica-

⁴ Phone interview with Kristina Woolston, Vice President, External Relations, Quintillion (Sapporo, Japan, 9 March 2017); S. Downing Quintillion CEO out, new one in, as project nears completion. *Must Read Alaska*. 04 August 2017 URL: <http://mustreadalaska.com/quintillion-ceo-new-one-project-nears-completion/> (Accessed 19 December 2017).

⁵ Phone interview with Woolston (n 11); Quintillion, Quintillion Completes Installation of Historic Alaska Subsea Fiber Optic Cable System. 24 October 2017, Press release; Quintillion, Quintillion Names Interim CEO. URL: <http://qexpressnet.com/quintillion-names-interim-ceo/> (Accessed 19 December 2017).

⁶ Prime Minister's Office: Growth from the North. How Can Norway, Sweden and Finland Achieve Sustainable Growth in the Scandinavian Arctic. Report of an Independent Expert Group. 20 January 2015 Prime Minister's Office Publication 4/2015; Lipponen P. *A Strategic Vision for the North: Finland's Prospects for Economic Growth in the Arctic Region*. Confederation of Finnish Industries, 2015. pp. 7, 9, 23, 26.

⁷ Hyyppä P., Kramer S. Teknistaloudellinen Selvitys Koillisväylän Merikaapelin Toteutumisedellytyksistä. *Liikenne- ja Viestintäministeriö*. 26 October 2015.

tions cable project from Paavo Lipponen and Reijo Svento, the former CEO of the Finnish Federation for Communications and Teleinformatics on 2 May 2016. Their final report, which was delivered on 10 November 2016, states that the underwater fibre cable connection (about 10,500 km from Japan and China to Kirkenes in Norway and Kola peninsula in Russia) would make it possible to implement a fast telecommunications route from Asia to northern and central Europe because the new cable would be connected to the Baltic fibre cable connection between Helsinki and Rostock. The report also indicated that the project would be broad and multinational. The implementation would require commitments from at least Russia, China, Japan, Norway and the relevant EU countries⁸. The Finnish government has expressed its support to the Arctic Connect project in various international and home forums since the release of the report. While the Ministry of Transport and Communications organized an international high-level bureaucratic meeting for representatives of different countries related to the Arctic Connect project in March 2017⁹, Cinia Group holds the primary responsibility for the advancement of the project and the establishment of a separate project organization that is to carry out the development phase (for example, legal structuring and permitting, project marketing, financial model, environmental studies, technical solutions and business plan for the implementation process), which is expected to last from 2017–2019. After the implementation phase, the cable system should be completed by the early 2020s. While the plans concerning the routes of the cable system and the locations of the landing stations on the western end of the connection are already openly discussed, plans concerning the East Asian end are expected to become more detailed in the spring of 2018. The same can be said of the planned landing in Alaska, which was added to the project relatively recently¹⁰.

National broadband policies and the regional ICT industry in Hokkaido, Japan and northern Finland

Globally known assessments, such as the International Telecommunication Union's ICT Development Index and the World Economic Forum's Networked Readiness Index, indicate that Japan and Finland offer an advanced environment for the development of ICT, and the key stakeholders in both countries are willing and capable of utilizing the possibilities offered by the ICTs;¹¹ however, research concerning broadband policies in Finland and Japan includes contradicting conclusions. Bauer concluded in 2010 that fiscal and industrial policy programs, such as tax incentives, subsidies, public-private partnership and government investments, had been widely used histori-

⁸ Lipponen P., Svento R. *Report on the Northeast Passage Telecommunications Cable Project. Summary*. Ministry of Transport and Communications. 25 November 2016.

⁹ Interview with Aleksi Härkönen, Ambassador in Charge of Arctic Affairs, Ministry for Foreign Affairs, Finland and Riitta Gerlander, Desk Officer, Ministry for Foreign Affairs, Finland (Helsinki, Finland 3 March 2017); Email from Marjukka Vihavainen-Pitkänen to author (10 March 2017).

¹⁰ Conversation with Jukka-Pekka Joensuu, Executive Advisor, Cinia (Sapporo, Japan, 17 October 2017); Cinia. *Arctic Connect: Submarine Cable System*, 2018.

¹¹ ITU. ICT Development Index 2017. URL: <http://www.itu.int/net4/ITU-D/idi/2016/#idi2016rank-tab> (Accessed: 21 December 2017); World Economic Forum. Networked Readiness Index. URL: <http://reports.weforum.org/global-information-technology-report-2016/networked-readiness-index/> (Accessed: 21 December 2017).

cally but were scaled back in most countries with the onset of liberalization and privatization. He cited South Korea, Japan and the Nordic countries as examples of nations that have been firmly committed to liberalization but that retained a strong complementary role for the public sector even before the economic downturn of 2008, after which many other countries reconsidered the role and importance of state intervention through public broadband programs [12, Bauer M., pp. 65–66]. While Bauer combined all Nordic countries, Eskelinen, Frank and Hirvonen found differences between the broadband policies of Finland and Sweden. According to their findings, Sweden launched its national ICT infrastructure programme in 2000 and assumed an interventionist stance relying on the public sector. On the other hand, Finland published its broadband strategy, which emphasized the role of markets and technological neutrality, in 2003 [13, Eskelinen H., Frank L., Hirvonen T., pp. 413, 415–416].

Meanwhile, the Broadband 2015 project was launched in December 2008 as a resolution of the Finnish Government. The aim of the project was to ensure that fast broadband networks in the areas where their commercial availability was unlikely. The goal of the programme was that by the end of 2015, more than 99% of users would have access to a 100Mbps broadband connection within two km of their permanent place of residence or place of business. The total amount of public funding available was 130 million euro, including state aid and funding from municipalities and from the EU Rural Development Programme for Mainland Finland.¹² Although this project did not achieve its aims by the end of 2015, similar types of activities have continued. Furthermore, compared to most Arctic regions, the existing broadband situation in northern Finland is favorable¹³.

The Japanese Government has also been active in promoting broadband services. The IT Strategy Headquarters was established based upon the IT Basic Act in 2001. For broadband infrastructure deployment, competition policies have been key issues from the beginning. In 2003, the government expanded its e-Japan Strategy, which had existed since 2001, to stimulate the spread of broadband, especially to non-profitable areas, with programs providing a combination of subsidies, tax incentives and low or zero-interest loans for broadband operators. Then, the u-Japan Policy and the New IT Reform Strategy were successively introduced in 2004 and 2006, respectively, to increase broadband expansion and network enhancement. As in Finland, the next target was set in 2015. The i-Japan Strategy 2015 was established in July 2009 and aimed for a nationwide 100 Mbps for mobile and 1 Gbps for fixed-line broadband by 2015 [6, Cambini C., Jiang Y., p. 561]¹⁴.

¹² Finnish Communications Regulatory Authority. Fast Broadband Project Brings Ultra Fast Internet to Sparsely Populated Areas. URL: <https://www.viestintavirasto.fi/en/steeringandsupervision/broadband2015.html> (Accessed: 18 December 2017).

¹³ The Arctic Council. Task Force on Telecommunication Infrastructure in the Arctic. Telecommunications Infrastructure in the Arctic: A Circumpolar Assessment, 2017. pp. 51–59.

¹⁴ IT Senryaku Honbu, 'i-Japan 戦略 2015～Kokumin Shuyaku no 「Dejitaru Anshin・Katsuryoku Shakai」 no Jitsugen wo Mezashite～Towards Digital Inclusion & Innovation' (6 July 2009); Ministry of Internal Affairs and Communications, National Broadband Policies: 1999–2009, Japan. URL: http://www.soumu.go.jp/main_sosiki/joho_tsusin/eng/presentation/pdf/091019_1.pdf (Accessed: 21 December 2017).

As far as the existing ICT industry is considered, significant differences can be observed between different areas within northern Finland and Hokkaido. The region around the city of Oulu forms the greatest population center in northern Finland, and it is also the home of a major ICT industry cluster. Around the turn of the millennium, Oulu was considered one of the largest wireless telecommunication technology research and development centers worldwide. While the problems of Nokia, the 'engine company' of the region, and the changes it made in its strategy concerning mobile phone business in the late 2000s and the first half of the 2010s revealed the structural weaknesses of the highly specialized Oulu-based high technological sector, the past few years have witnessed an increasing diversification of the ICT industry, the emergence of new service-oriented businesses and a reconstruction of the regional innovation collaboration system [14, Oinas-Kukkonen H., Similä J., Pulli P., p. 272; 15, Salo M., pp. 83–85, 87, 97–98; 16, Simonen J., Koivumäki T., Seppänen V., Sohlo S., Svento R., pp. 289–293, 298–301, 303]. At the same time, Oulu has become home to the 5G test network and many actors involved in IoT-related business¹⁵. Despite the existence of the ICT industry, northern Finland lacks an ICT infrastructure, such as sub-sea fibre cables and large-scale data centers. Although the CSC (IT Centre for Science) data center is in Kajaani (the Kainuu region)¹⁶, northern Finland has not been as successful as northern Sweden (especially the Luleå-Boden area) in its attempts to attract international and home businesses data centers. The biggest data center investments in Finland, such as a Google data center in Hamina, have been made in the southern part of the country.

While the service sector, primary production and foodstuff industries, and recently the tourism industry, have played dominant roles in the Hokkaido economy, the ICT industry has a significant role as well. The historical roots of policies aimed toward the promotion and concentration of knowledge-intensive, high-tech companies in Hokkaido date back to the 1980s, and the 1990s witnessed the emergence of the Sapporo Valley concept, which was used to describe the Silicon Valley-type accumulation of high technology startups in Sapporo, usually within close proximity to Hokkaido University [17, Hokkaidō Jōhō Sangyōshi Henshū linkai; 18, Yamada S., pp. 318–321]. Connections were also built between Hokkaido and northern Finland, as the Oulu region and especially its ICT cluster became an important benchmarking case concerning the successful incubation of industrial clusters. The close cooperation lasted approximately a decade beginning in the mid-1990s [19, Saunavaara J., pp. 130–132]. Despite the recent positive indications, high expectations concerning the development of the ICT industry in Hokkaido have not materialized. One rec-

¹⁵ University of Oulu. Experimental 5G Research. URL: <http://www oulu.fi/university/node/46729> (Accessed: 12 April 2018); University of Oulu. CWC Introduces Olympic Visitors to the Future 5G/ URL: <http://www oulu.fi/cwc/node/44399> (Accessed 12 April 2018); Mitzner D. Oulu, the World's Northernmost Tech Hub is Making a Comeback. The Nordic Web, 28 November 2016. URL: <https://thenordicweb.com/oulu/> (Accessed: 12 April 2018); DNA. Oulussa On Maailman Kovin IoT-Yhteisö. URL: <https://www.dna.fi/yriyksille/blogi/-/blogs/oulussa-on-maailman-kovin-iot-yhteiso> (Accessed: 12 April 2018).

¹⁶ Lapland Chamber of Commerce, *Arctic Business Forum Yearbook 2017*. Lapland Chamber of Commerce, May 2017. Pp. 103–104; Renforsin Ranta. Companies of Renforsin Ranta. URL: <http://www.renforsinranta.fi/companies> (Accessed: 18 December 2017).

ognized reason for the relatively moderate development is the lack of an engine company that would have pulled others toward success in its wake. The lack of a strong local ICT industry has also been accompanied by a shortage of ICT infrastructures. While most of the international subsea communications cables land in the area near Tokyo, which also hosts a large majority of data centers and servers in Japan, only one international subsea communications cable reach to Hokkaido, connecting Japan's northernmost island with the island of Sakhalin¹⁷. Still, based on new strategy papers or issues raised as the main themes of events concerning the economic development of these regions, it can be concluded that the growing importance of issues such as IoT, AI and digitalization in general have been recognized in both northern Finland and Hokkaido¹⁸.

Different approaches to the possibilities linked to the cables

Some years ago, the Arctic Ocean was still described as one of the last oceans that was not crisscrossed with subsea communications cables [10, Delaunay M., p. 503]. This situation is now changing — not least because one of the greatest growth rates in global data transfer is predicted for traffic between Asia and Europe, and the Arctic Ocean offers a shortcut, making the physical cable connection shorter and decreasing latency. Nevertheless, the attention paid to and interest in the improved connectivity through the Arctic has not been equal in both ends of the planned connection.

Level of awareness

It is necessary to be aware of the Arctic communications cable initiatives before any connections between them and the development of any region can be envisioned. Similarly, an issue or problem has to be identified before it can be placed on the political agenda. Therefore, it is important to mention the major differences in awareness concerning the Arctic subsea communications cables. Questions concerning the Arctic Connect and its direct and indirect effects became openly debated and widely recognized issues in Finland after the Lipponen-Svento report was released. While the Finnish government has promoted this initiative both in home and international arenas, it has also been indirectly connected to Finland's chairmanship in the Arctic Council through the focus on connectivity¹⁹. The Arctic Connect initiative is also dependent on northern

¹⁷ Cloud Network Infrastructure Workshop. Gurōbaru—Kuraudonettowaakusu Kenkyūkai kara no Hokkaidō—Nihon—Sekai he no Teigen [Senryakuteki Hikari Kaitei Keeburu ni yoru Gurōbaru Keizai Inobeeshon], 16 May 2014. pp. 1–2; Interview with Tsuyoshi Yamamoto, Professor, Hokkaido University (Sapporo, Japan, 27 January 2017).

¹⁸ See, e.g.: Interview with Mika Riipi, County Governor, Regional Council of Lapland (Rovaniemi, Finland, 6 June 2017); BusinessEXPO. 31st Hokkaido Business Expo. URL: <http://www.business-expo.jp/content/> (Accessed: 18 December 2017); City of Sapporo. Sapporo-shi IoT Inobeeshon Suishin Konsōshamu Kaiin Kigyō Boshū. URL: <http://www.city.sapporo.jp/keizai/top/topics/it/iotlab.html> (Accessed: 19 December 2017).

¹⁹ See, e.g.: Lehti A.E. *Sipilä Tapaa Huomenna Medvedevin – Neuvottelupöydässä Isot Investoinnit' Kauppalehti*, 8 December 2016. URL: https://www.kauppalehti.fi/uutiset/sipila-tapaa-huomenna-medvedevin--neuvottelupoydassa-isot-investoinnit/A3cA4X2b?ref=iltalehti:9123%253Futm_source&utm_medium=boksi&utm_campaign=AlmaInternal&_ga=1.148081909.332578641.1398684574 (Accessed: 19 December 2017); Staalsen A. Sipilä, Medvedev Discuss Trans-Arctic Cable. *The Independent Barents Observer*, 9 December 2016. URL: <https://thebarentsobserver.com/en/arctic/2016/12/sipila-medvedev-discuss-trans-arctic-cable> (Accessed: 19 December 2017); Virtanen J. Pääministeri Sipilä Lensi Lentokoneen Tromssaan ja Paljasti Suomen Arktisen Iskulauseen: Jos Se Toimii Suomessa, Se Toimii Kaikki-

Norway, where it has been discussed²⁰. Signs of the wider cross-border regional approach can also be seen, such as in the joint declaration supporting the Arctic Connect from the chambers of commerce of Lapland, Oulu, Troms and Swedish Lapland²¹. Meanwhile, the Quintillion project has received surprisingly little if any visibility in Finland despite its similarity to the Arctic Connect project²².

In the case of Hokkaido, the discussion concerning the Arctic subsea data cables remained almost non-existent for some time. When the Northwest Passage cable project was still led by Arctic Fibre, the company openly acknowledged Hokkaido as a potential landing site in Japan. The Cloud Networks Infrastructure Workshop, which was established in 2010, was chaired by Professor Yamamoto Tsuyoshi from Hokkaido University and was comprised of representatives from various ICT companies, prepared its own plan proposing a new subsea communications cable connecting Hokkaido with the main island in 2014. The working group also incorporated the Arctic Fibre initiative into its proposal²³. Representatives of the Hokkaido government were also aware of and participated in the process that led to the publication of the proposal²⁴; however, the proposed project did not materialize, and the connection with Arctic Fibre faded. While interest among the Hokkaido-based experts waned, or at least the project was placed on hold, the public discussion never began. A study of the *Hokkaido Shinbun* — the leading newspaper in Hokkaido — archives revealed only one article from May 2014 that mentions Arctic Fibre. This article discusses Professor Yamamoto's submission of a plan to the governor of Hokkaido to develop Hokkaido as a base for an international communication infrastructure. Furthermore, searches in the archives of some of Japan's major national newspapers have not revealed any articles that discuss the Arctic subsea communications cables²⁵.

alla' Helsingin Sanomat, 23 January 2017. URL: <https://www.hs.fi/ulkomaat/art-2000005057297.html> (Accessed: 19 December 2017).

²⁰ Nilsen T. Trans-Arctic Fiber Cable Can Make Kirkenes to High-Tech Hub. *The Independent Barents Observer*, 4 December 2016. URL: <https://thebarentsobserver.com/en/industry-and-energy/2016/12/trans-arctic-fiber-cable-can-make-kirkenes-high-tech-hub> (Accessed: 19 December 2017).

²¹ Rautajoki T. Lapland Chamber of Commerce, Kristian N. Sørheim Nilsen Troms Chamber of Commerce, Wallin S., Swedish Lapland Chamber of Commerce, and Tuovinen J. Oulu Chamber of Commerce. Arctic Connect – Arctic Cooperation for a New Digital Highway to Asia.

²² Neither the Lipponen-Svento nor the Hyypä-Kramer report refer to Quintillion, Arctic Fibre or Alaska. When the author conducted searches on the homepages of one national (Helsingin Sanomat) and two regional (Kaleva and Lapin Kansa) newspapers on October 2, 2017, search term “Quintillion” did not reveal any article referring to the company or its project. Simple Google searches combining words “Quintillion”, “Arctic Fibre”, “datakaapeli” (data cable in Finnish), “merikaapeli” (sea cable in Finnish) reveal only a very few blog postings from private citizens.

²³ Cloud Network Infrastructure Workshop. Gurōbaru—Kuraudonettowaakusu Kenkyūkai kara no Hokkaidō—Nihon—Sekai he no Teigen [Senryakuteki Hikari Kaitai Keeburu ni yoru Gurōbaru Keizai Inobeeshon], 16 May 2014, pp. 4, 13, 22.

²⁴ Group interview with Tomoyuki Nakata, Chief Coordinator, Industrial Promotion Division, Hokkaido Government, Satoko Chaya, Chief Coordinator, Industrial Promotion Division, Hokkaido Government, Hiraku Okabe, Director, Office of International Business, Hokkaido Government and Yoshinao Okabe, Chief Coordinator, Office of International Business, Hokkaido Government (Sapporo, Japan, 12 October 2017).

²⁵ Hokkaidō Shinbun. Kokusai Tsūshin Infura Dōnai ni Kyoten Seibi wo' Hokkaidō Shinbun (Sapporo, 27 May 2014), p. 4; These searches were conducted by research assistant Fukuda Chizuru in February and March 2017.

On the other hand, some traces of the submitted proposal can be found. The Hokkaido government's new vision for Hokkaido, published in August 2015, for example, referred to the ICT corridor project derived from the 2014 proposal.²⁶ The Hokkaido Prefecture's policy paper concerning the Northern Sea Route — a topic which has strongly dominated discussions concerning the Arctic region in Hokkaido — was compiled by the Office of Logistics and Ports in February 2016, and it briefly refers to the subsea communications cables that could be laid in the Arctic waters²⁷; however, when the author interviewed the representatives of the same office in April 2017, they were not aware of any ongoing discussion concerning this issue within the Hokkaido government. Some of them had, however, heard about the Finnish interest in the cable project when visiting Helsinki as a part of a larger delegation in August 2016. Similarly, Arctic Fibre was the only initiative that was familiar to the representatives of the Industrial Promotion Division and Office of International Business in September 2017. They were neither aware that Arctic Fibre had merged with Quintillion nor aware of the recent developments of the project²⁸.

The discussion concerning the Arctic communications cables and their possibilities for Hokkaido showed signs of revival in the spring and summer of 2017. Besides the speeches given in home seminars, Hokkaido's position in relation with the Arctic subsea communications cables gained some visibility during the 2nd Top of the World Arctic Broadband Summit organized by the Arctic Economic Council in cooperation with Business Oulu on 14–15 June 2017. The international seminar 'Arctic Data Cables, Digitalization and Regional Development', which was held in Sapporo on 17 October 2017, introduced the current stage of the Arctic Connect project and discussions concerning data centers and connectivity to the different stakeholders in Hokkaido. Furthermore, it can be expected that these questions will attract some media attention at the end of June 2018, when the 3rd Top of the World Arctic Broadband Summit will be organized in Hokkaido.

Attitudes, recognized possibilities and links with other regional development projects

In the case of Finland, the link between the Arctic subsea communications cables and other ICT-related projects has been strongly emphasized for years. The strategy for northern Finland, which was announced by the four northernmost regions in Finland already in August 2014, brought the Northeast Passage submarine data cable connection forward as a possibility that might attract data center investments in northern Finland²⁹. The more recent reports commissioned by the Ministry of Transport and Communications concerning the cable connection and

²⁶ Hokkaido Government. Shin – Hokkaidō Bijon Suishin Hōshin, August 2015. p. 76.

²⁷ Hokkaido Government. Hokkyoku kaikōro no rikatsuyō ni muketa hōshin, 2016. p. 26.

²⁸ Group interview with Tomoaki Kagawa, Chief Coordinator, Office of Logistics and Ports, Hokkaido Government, Kuniaki Suzuki, Councillor, Office of Logistics and Ports, Hokkaido Government, Noriyuki Shirato, Deputy Director, Office of Logistics and Ports, Hokkaido Government (Sapporo, Japan, 18 April 2017); Group interview with Tomoyuki Nakata, Chief Coordinator, Industrial Promotion Division, Hokkaido Government, Satoko Chaya, Chief Coordinator, Industrial Promotion Division, Hokkaido Government, Hiraku Okabe, Director, Office of International Business, Hokkaido Government and Yoshinao Okabe, Chief Coordinator, Office of International Business, Hokkaido Government (Sapporo, Japan, 12 October 2017).

²⁹ Pohjois-Suomen Neuvottelukunta. Uusi Pohjoinen – Suunta Suomelle! 27 August 2014. p. 35.

statements from different politicians and key actors representing the regional developers all refer to data centers, digital infrastructure investments and other business opportunities related to digitalization. Interviewees representing regional developers of northern Finland have emphasized the link between the Arctic Connect project and the ongoing discussion concerning the possibility to connect Finland with the Arctic Ocean through a railway connection between northern Finland and Norway. In other words, Arctic Connect and Arctic Corridor could be viewed as parts of a plan to establish a logistical corridor through which both cargo and data could travel. They have also emphasized the potential symbolic meaning of the Arctic Connect that could pave the way for the railway connection between Finland and Kirkeness³⁰. At the strategical level, Arctic Connect has already been incorporated into the Transport and Logistic Strategy of Northern Finland, and to some extent, it has been incorporated into the new regional development programs of the three northern counties³¹.

The Regional Development Programme for Kainuu focuses most attention on the importance of the planned submarine communications cable connection between Europe, northern Finland and Asia. Whereas this document emphasizes this project's importance to Kainuu and envisions new data centers and investments from Asia to the region, the other regional programs make weaker references to the Northeast Passage communications cables and data centers. Kainuu's primary interest most likely reflects the regions existing involvement in data center businesses. The plan concerning Lapland mentions the subsea communications cable along with the Arctic railway as the future connecting elements between East Asia and Europe; however, discussions concerning the latter play a much larger role in the document. The parts concerned with digitalization do not refer to infrastructures, such as subsea communications cables or data centers. Although the ICT industry and issues such as 5G, IoT and AI play highly significant roles and despite the importance of accessibility and connectivity, which are recognized along with the Arctic possibilities in the new Regional Development Programme for Northern Ostrobothnia, neither subsea communications cables nor data centers are clearly mentioned in the document³². According to an informant, the wording of the document does not refer to a lack interest in the submarine cables. However, the Regional Council seems to have a more natural role to play in the advancement of

³⁰ Hyyppä P., Kramer S. Teknistoloudellinen Selvitys Koillisväylän Merikaapelin Toteutumisedellytyksistä. *Liikenne- ja Viestintäministeriö*, 26 October 2015. pp. 10–11; Lipponen P., Svento R. Report on the Northeast Passage Telecommunications Cable Project. Summary. Ministry of Transport and Communications, 25 November 2016. pp. 4, 6; Interview with Timo Lohi, Development Manager, Region of Northern Lapland (Kemi, Finland, May 18, 2017); Interview with Mika Riipi, County Governor, Regional Council of Lapland (Rovaniemi, Finland, 6 June 2017).

³¹ Interview with Mika Riipi, County Governor, Regional Council of Lapland (Rovaniemi, Finland, 6 June 2017); Liikennevirasto, 'Pohjois-Suomen Liikenne- ja Logistiikkastrategia' (15 August 2017); Lapin Liitto, 'Lappi-Sopimus. Lapin Maakuntaohjelma 2018–2021' (November 2017); Kainuun Liitto, 'Kainuu-ohjelma. Maakuntasuunnitelma 2035, Maakuntaohjelma 2018–2021, Luonnos 3.10.2017' (3 October 2017); Pohjois-Pohjanmaan Liitto, 'Pohjois-Pohjanmaan Maakuntaohjelma 2018–2021' (2017).

³² Lapin Liitto. Lappi-Sopimus. Lapin Maakuntaohjelma 2018–2021, November 2017. pp. 19–20, 30–35, 42; Kainuun Liitto. Kainuu-ohjelma. Maakuntasuunnitelma 2035, Maakuntaohjelma 2018–2021, Luonnos 3.10.2017 (3 October 2017), p. 20; Pohjois-Pohjanmaan Liitto. Pohjois-Pohjanmaan Maakuntaohjelma 2018–2021, 2017. pp. 6–8, 19–20.

national broadband projects within their own region³³. Meanwhile, the authorities of the city of Oulu, which hosted the EU Arctic Stakeholder Forum in June 2017, have utilized the visibility gained through the event and promoted the importance of trans-Arctic data cable connection between Europe and Asia to the European Commission³⁴. One of the most recent expressions of interest and support was issued in January 2018 when the cities of Oulu and Rovaniemi and the Kainuu region committed themselves to the planning of the terrestrial cable route through northern Finland in cooperation with Cinia³⁵.

In the case of Hokkaido, a specific support scheme has been developed to attract new data center investments to the island. Data centers have been recognized as one of the target industries within the framework of subsidy programs based on the Hokkaido Industry Promotion Ordinance, and they are also mentioned in the current Hokkaido Comprehensive Development Plan inaugurated in 2016³⁶. The activities, which aim to attract data center businesses, began in the late 2000s and are based on an understanding of Hokkaido's advantageous position when compared to other regions in Japan. Namely, the cold climate, small risk of earthquakes or tsunamis and availability of land at reasonable prices have been considered assets compared to home competitors. As the price of electricity is a major constraint of international competitiveness and because the energy prices in Hokkaido have been above the national average since the shutdown of the Tomari nuclear power plant, expectations have been higher than the actual outcomes. Namely, new large-scale data centers have not been established in Hokkaido since 2011, when Sakura Internet built one of Japan's largest data centers in Ishikari³⁷.

While attempts to invite new data centers are mainly focused on home actors, the completion of the document 'Proposal for the Establishment of a Data Centre in Hokkaido' in June 2017 could be an indication of the more international approach that was mentioned during an interview. This document, which was prepared by the prefectural government, cites the three municipalities Ishikari, Tomakomai and Bibai as the most promising locations for new data centers in Hokkaido and emphasis their municipality-level financial support programs for data center investments.

³³ Interview with Jussi Rämetsä, Planning Director, Council of Oulu Region (Oulu, Finland, 5 March 2018)

³⁴ European Commission. Summary Report of the Arctic Stakeholder Forum Consultation to Identify Key Investment Priorities in the Arctic and Ways to Better Streamline Future EU Funding Programmes for the Region, 2017. pp. 8–9.

³⁵ Cinia. Koilliväylän Datakaapelista Virtaa Pohjois-Suomen Maakuntien Elinkeinoihin. URL: <https://www.cinia.fi/arkisto/koillisvaylan-datakaapelista-virtaa-pohjois-suomen-maakuntien-elinkeinoihin.html> (Accessed: 12 April 2018)

³⁶ Group interview with Tomoyuki Nakata, Chief Coordinator, Industrial Promotion Division, Hokkaido Government, Satoko Chaya, Chief Coordinator, Industrial Promotion Division, Hokkaido Government, Hiraku Okabe, Director, Office of International Business, Hokkaido Government and Yoshinao Okabe, Chief Coordinator, Office of International Business, Hokkaido Government (Sapporo, Japan, 12 October 2017); Committee for the Promotion of Investment in Hokkaido, Hokkaido Business Location Guidebook, As of March 2016, March 2016. p. 29.

³⁷ Cloud Network Infrastructure Workshop. Gurōbaru—Kuraudonettowaakusu Kenkyūkai kara no Hokkaidō—Nihon—Sekai he no Teigen [Senryakuteki Hikari Kaitei Keeburu ni yoru Gurōbaru Keizai Inobeeshon], 16 May 2014. pp. 15–17, 22; Kaihatsu Kōhō. Deeta Sentaa Ricchi ni okeru Hokkaidō no Kanōsei—Sakura Intaanetto no Keiken kara. Kaihatsu Kōhō, 2014. 14(9), pp. 20–21, 24; Ministry of Land, Infrastructure, Transport and Tourism. Hokkaidō Sōgō Kaihatsu Keikaku, March 2016; Interview with Tsuyoshi Yamamoto, Professor, Hokkaido University (Sapporo, Japan, 27 January 2017).

Nevertheless, the attempts to promote Hokkaido as an attractive location for data centers have not involved international subsea communications cables since the Arctic Fibre initiative³⁸.

Allocated resources

While funding schemes and subsidiary programs, for example, would be clear examples of resource allocation, the lack of such policy instruments does not necessarily imply the lack of interest. Despite the role of the public sector in the broadband policies mentioned, both academic experts and representatives of the Hokkaido Prefectural Government have emphasized that the construction of subsea communications cables is outside the traditional domain of the public sector. In other words, a small number of companies hold the decision-making power and capability to implement such processes in Japan³⁹. Therefore, even if regional and local actors viewed the improvement of connectivity as a method to improve the attractiveness to data center companies, financial support for the subsea communications cable projects would not be easily accessed. While the Japanese approach towards subsea data cables is not exceptional, as they have always been mainly private ventures in different parts of the world [7, Malecki E.J., Wei H., p. 366], other types of examples exist. For example, it has been reported that China's Ministry of Industry and Information Technology and state-owned China Telecom Corporation are participating in discussions related to the Arctic Connect⁴⁰. This is not surprising, as China has included the Arctic in its Belt and Road Initiative, and state-owned Chinese actors have played significant roles in different infrastructure projects in the Arctic⁴¹.

The existence of various statements and strategy papers supporting the advancement of the Arctic Connect project can be considered an indicator of the shared understanding among the regional developers and economic interest groups in northern Finland; however, the leading role of private enterprises has also been mentioned by Finnish regional actors and representatives of the national government. While expressing their support for the projects, regional actors have a quite limited if any role to play, such as in the funding of the Arctic subsea communications cable project. Their role could be much larger, such as in the case of a subsea cable that is planned to be

³⁸ Hokkaido Government. Department of Economic Affairs. Proposal for the Establishment of Data Center in Hokkaido, June 2017; Group interview with the representatives of the Hokkaido Government Office of International Business and Industrial Promotion Division (Sapporo, Japan, 12 October 2017).

³⁹ Interview with Tsuyoshi Yamamoto, Professor, Hokkaido University (Sapporo, Japan, 27 January 2017); Group interview with Tomoyuki Nakata, Chief Coordinator, Industrial Promotion Division, Hokkaido Government, Satoko Chaya, Chief Coordinator, Industrial Promotion Division, Hokkaido Government, Hiraku Okabe, Director, Office of International Business, Hokkaido Government and Yoshinao Okabe, Chief Coordinator, Office of International Business, Hokkaido Government (Sapporo, Japan, 12 October 2017).

⁴⁰ Shi T. 10,000 Kilometers of Fiber-Optic Cable Show China's Interest in Warming Arctic. *BloombergPolitics*, 14 December 2017. URL: <https://www.bloomberg.com/news/articles/2017-12-13/undersea-cable-project-shows-china-s-interest-in-warming-arctic> (Accessed: 18 December 2017).

⁴¹ Pettersen T. Russia and China Sign Agreement on Belkomur Railroad. *Barents Observer*, 4 September 2015. URL: <http://barentsobserver.com/en/business/2015/09/russia-and-china-sign-agreement-belkomur-railroad-04-09> (Accessed: 11 April 2018); Yamal LNG. About the Project. URL: <http://yamallng.ru/en/project/about/> (Accessed: 11 April 2018); The State Council Information Office of the People's Republic of China. China's Arctic Policy. URL: http://engli.sh.gov.cn/archive/white_paper/2018/01/26/content_281476026660336.htm (Accessed: 11 April 2018).

built from southern Finland to Bothnian Bay. This new cable is planned to connect the Oulu and Tornio regions in Finland and possibly also the Luleå region in Sweden with the existing cable system between Finland and Germany. The Bothnian Bay cable project is highly relevant from the perspective of the Arctic Connect project, as these planned subsea communications cables would eventually be connected with each other through a terrestrial connection. At the same time, the Bothnian Bay cable may be dependent on the willingness of local governments and local businesses to invest in landing stations, for example. The public authorities have already supported this plan in 2015, when the Centre for Economic Development, Transport and Environment (ELY Centre) of North Ostrobothnia paid half of the investigation that was conducted by a private consulting firm⁴².

The activities of local actors in the Hanko area can also be used as an example of local actors' capabilities. The local enterprises and municipalities of Hanko and Raseborg (with a combined population only around 40,000) aimed to create a significant node for international data traffic and hoped to attract new data centers to the area. Therefore, they established C-Fibre Hanko Ltd. and gathered 3 million euro to create a new branch connection for the C-Lion1 subsea data cable in Hanko. To the best of the author's knowledge, similar types of activities have not emerged, at least not yet, in northern Finland.⁴³

Conclusion

The Arctic subsea communications cable projects are ICT infrastructure projects that can be approached from different angles. Borrowing Catherine Middleton's words, they could be supported as enablers of the Information Age and the knowledge economy [20, Middleton C., p. 9]. While there are regions in the Arctic where even a discussion concerning internet access as a basic human right is valid due to a lack of any or proper connections⁴⁴, these projects seem to appear to be mainly potential business cases both in northern Finland and Hokkaido, where broadband is already widely available. In other words, regional developers' attention mainly focuses on these projects' capabilities to bridge the two global economic centers via a new connection through the Arctic; however, this type of approach does not nullify the fact that the Quintillion project has enabled fast and feasible broadband services for many remote communities in Alaska, and it may

⁴² Elinkeino-, Liikenne- ja Ympäristökeskus, Pohjois-Pohjanmaan ELY-keskuksen Yritysrahoituskatsaus, Loka-joulukuu 2015. URL: <https://www.ely-keskus.fi/documents/10191/8852023/Pohjois-Pohjanmaan+ELY-keskuksen+rahoituskatsaus+IV.pdf/c524511b-5cbb-4bc4-bc1e-b1cb5bf324e9> (Accessed: 11 April 2018); Business Oulu. Perämeren Kaapelista Elinvoimaisuutta ja Kilpailukykyä Pohjoisille alueille. URL: <https://www.businessoulu.com/fi/uutiset/perameren-kaapelista-elinvoimaisuutta-ja-kilpailukyky-pohjoisille-alueille.html> (Accessed: 13 April 2018).

⁴³ Interview with Suvi Linden. Vice Chairperson. NxtVn. (Oulu, Finland, 23 May 2017); Cinia. Cinian ja C-Fiber Hanko Oy:n Uusi Tietoliikennetyhteys Kiihdyttää Liiketoimintamahdollisuuksia. URL: <https://www.cinia.fi/arkisto/cinian-ja-c-fiber-hanko-oy-n-uusi-tietoliikennetyhteys-kiihdyttaa-liiketoimintamahdollisuuksia.html> (Accessed: 19 December 2017); Cinia. A New Cinia Connection Links The Hanko Area Directly to International Data Networks. URL: <https://www.cinia.fi/en/archive/a-new-cinia-connection-links-the-hanko-area-directly-to-international-data-networks.html> (Accessed: 19 December 2017).

⁴⁴ More about this discussion, see e.g.: United Nations General Assembly. Human Rights Council. Report of the special Rapporteur on the Promotion and Protection of the right to Freedom of Opinion and Expression, 16 May 2011. A/HRC/17/27.

serve a similar type of role later in northern Canada. Similarly, the Arctic Connect project may become a major advancement in the availability of broadband services in the Russian Far North. Still, these projects do not necessarily easily apply to the traditional broadband policy context of Finland and Japan, where the focus has often been on spreading services to remote areas within national borders.

When comparing these two regions, it can be concluded that the proposition that improved international connectivity through subsea communications cables could bring information-intensive industries to the region has been stronger in northern Finland; however, the regional actors in Hokkaido have also shown interest in the information they have recently received. Based on the vocabulary of the policy cycle model, it can be concluded that a policy issue has been identified and that a stage of agenda setting has been reached at least in northern Finland⁴⁵. The current approach — supporting in principle but without major economic involvement — may either reflect the outcome of the policy analysis and policy formulation processes or the ongoing natures of the processes. While the wide support that the Arctic Connect enjoys in Finland may indicate a relatively smooth legitimation process, the lack of information concerning the policy instruments and their economic impacts makes it difficult to predict the potential course of consultations between different interest groups. Furthermore, when the possibility of actions on behalf of the sub-state actors is considered, attention should focus on the characteristics of potential actors. In other words, while a prefecture or a county, for example, may have more resources or greater experience in large-scale development projects than a single municipality, it may lack the possibilities, rights and incentives to act. Therefore, municipalities, which often are landowners, actors in charge of the land use zoning and geographically smaller entities surrounding a potential landing station, may eventually become the key regional players, as the Hanko-Raseborg example shows.

References

1. Grubestic T.H., Mack E.A. *Broadband Telecommunications and Regional Development*. Routledge, London and New York, 2016, 206 p.
2. Czernich N., Falck O., Kretschmer T., Woessman L. Broadband Infrastructure and Economic Growth. *The Economic Journal*, 2011, pp. 505–506.
3. Mack E.A. Broadband and Knowledge Intensive Firm Cluster: Essential Link or Auxiliary Connection. *Papers in Regional Science*, 2014, no. 93, pp. 3–29.
4. Gillespie A., Williams H. Telecommunications and the Reconstruction of Regional Comparative Advantage. *Environment and Planning A*, 1988, vol. 20, pp. 1311–1312.
5. Capello R., Nijkamp P. Telecommunications Technologies and Regional Development: Theoretical Considerations and Empirical Evidence. *The Annals of Regional Science*, 1996, no. 30, pp. 7–30.
6. Cambini C., Jiang Y. Broadband Investment and Regulation: A Literature Review. *Telecommunications Policy*, 2009, no. 33, pp. 559–574.
7. Malecki E.J., Wei H. A Wired World: The Evolving Geography of Submarine Cables and the Shift to Asia. *Annals of the Association of American Geographers*, 2009, no. 99, pp. 362–366.
8. Bridgman P., Davis G. What Use is a Policy Cycle? Plenty, if the Aim is Clear. *Australian Journal of Public Administration*, 2003, no. 62 (3), pp. 99–100.

⁴⁵ Bridgman and Davis (n 8) pp. 99–100; Cairney (n 9) pp. 32–34.

9. Cairney P. *Understanding Public Policy: Theories and Issues*. Palgrave Macmillan, Hampshire, 2012, pp. 32–34.
10. Delaunay M. The Arctic: A New Internet Highway? *Arctic Yearbook*, 2014.
11. Starosielski N. *The Undersea Network*. Duke University Press, Durham and London, 2015, pp. 16–18.
12. Bauer M. Regulation, Public Policy, and Investment in Communications Infrastructure. *Telecommunications Policy*, 2010, no. 34, pp. 65–79.
13. Eskelinen H., Frank L., Hirvonen T. Does Strategy Matter? A Comparison of Broadband Rollout Policies in Finland and Sweden. *Telecommunications Policy*, 2008, no. 32, pp. 412–421.
14. Oinas-Kukkonen H., Similä J., Pulli P. Main Threads of ICT Innovation in Oulu 1960–1990. *Faravid*, 2009, no. 33, pp. 247, 272.
15. Salo M. High-Tech Centre in the Periphery: The Political, Economic and Cultural Factors behind the Emergence and Development of the Oulu ICT Phenomenon in Northern Finland. *Acta Borealia: A Nordic Journal of Circumpolar Societies*, 2014, pp. 83–107.
16. Simonen J., Koivumäki T., Seppänen V., Sohlo S., Svento R. What Happened to the Growth? – The Case of the ICT Industry in Oulu, Finland. *International Journal of Entrepreneurship and Small Business*, 2016, no. 29, pp. 287–308.
17. Hokkaidō Jōhō Sangyōshi Henshū linkai, *Sapporo Baree no Tanjō - Sapporo Valley Story Jōhō Bencha no 20 nen*. Hokkaidō Jōhō Sangyōshi Henshū linkai, Sapporo, 2000.
18. Yamada S. Jōhō — Sofutowea Sangyō. *Hokkaidō Sangyō Shi* / Ed. by Ōnuma M. Hokkaidō Daigaku Tosho Kankōkai, Sapporo, 2004, pp. 318–321.
19. Saunavaara J. The Role of International Development Strategies in the Making of the Regional Development Policy: Hokkaido as a Case Study. *Urbani Izziv*, 2017, no. 28, pp. 130–132.
20. Middleton C. Beyond Broadband Access: What Do We Need to Measure and How Do We Measure It? *Beyond Broadband Access: Developing Data-Based Information Policy Strategies*/ Ed. by Taylor R.D., Schejter A.M. Fordham University Press, New York, 2013, p. 9.