5

A Co-created Network Community for Knowledge and Innovations – Promoting Safety and Security in the Arctic

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Abstract

The cooperation between Arctic states – Russia, the United States, Canada, Denmark, Iceland, Norway, Sweden, and Finland – has been particularly peaceful while geopolitical tensions have risen elsewhere (Pezard et al., 2017). Discussions on prospecting Arctic natural resources (Haftendorn, 2016., p. 133) have raised new challenges also to knowledge and information management. Therefore, this paper argues that there is a need to develop a co-creation network among higher education and key end users, for knowledge and information sharing and promoting innovation, which will contribute on safety and security in the Arctic domain. The research question for this paper is: How can end users be involved in the process of creating a co-creation network for knowledge and information sharing to contribute on innovations to Arctic safety and security?

The method focuses mostly on the third phase of the Engeström's (2007) expansive learning process, *modeling a new solution*. This is a participatory work in progress. Beyond the desk review, the notes from co-creation network partner communication and meeting discussions have been and are gathered under the Chatham House rule (Chatham House, 2016) to ensure anonymity of all people participating in the process. Creating a new long-term co-operation program of higher education and end users, a co-creation network will attempt to engage a still disengaged field by affecting change to currently scattered and unlinked programs and systems, and build alignment of best practices. This co-creation network needs to be multi-disciplinary and multi-institutional to bring disparate security and safety management and other researchers and experts together with both one another, and with end-users. Online platforms can facilitate the information and knowledge sharing, as well as enable the co-creation of innovations among the network community. This paper provides a suggestion of the process for co-creation and knowledge exchange between the network members.

The enhanced Arctic research and study community aims to contribute to a safer, more secure and cleaner domain. Developing insights on sustainable economic growth, international processes and best practices, may lead to increased situational awareness as well as supports decision-making – for the benefit of the Arctic.

Key Words: Co-creation of knowledge, Innovation, Co-creation Network, Knowledge, Arctic Security

Introduction

The Arctic is the northern circumpolar region and its ice covered ocean (Heikkilä & Laukkanen, 2013). Economic and human activity is increasing there, partly because the climate of the Arctic is warming. The Arctic Ocean is projected to become nearly ice-free during the summer times within the next 30 to 40 years. Thus, global climate change is opening new Arctic possibilities, such as drilling for natural resources and new sea routes that cut distances between the Pacific and Atlantic oceans. But, these also present new challenges. "*Regardless of the risks involved, these Arctic routes and possibilities are a hot topic and shipping in the Arctic will most likely increase in the future*" (Salokannel, Knuuttila & Ruoslahti, 2015: p. 2).

The Northeast Passage between Europe and Asia is 30 – 40 % shorter than the route through the Suez Canal (Guy & Lasserre, 2016). There is still little traffic on the Northeast Passage, but it is constantly increasing. There is a growing need to cooperate and share information that benefits the security and safety of living, transport, and economic use in the Arctic environment (Ruoslahti & Knuuttila, 2016). "*The regulations concerning the safety of shipping, Arctic navigation services, and the readiness to prevent various accidents and to act in accident situations are badly inadequate… Surveillance arrangements in the Arctic sea area and cooperation between the authorities can be seen as an area of development …*" (Finland's strategy for the Arctic region, 2010, p. 28).

Also beyond the national strategies the necessitated additional multilateral strategies have been argued to ensure stable and harmonized priorities (Haftendorn, 2016. p. 134). European Maritime development, for example, seeks to respond to challenges facing the entire European maritime domain in an integrated and cross-sectorial way (European Coast Guard Functions Forum, 2014), which can serve as a working example also for the Arctic regions. The agreement of the Arctic Council on Cooperation in Aeronautical and Maritime Search and Rescue in the Arctic (Arctic Council, 2011) and the International Maritime Organization's (IMO) Guidelines for Ships Operating in Polar Waters (IMO, 2010) are important indicators of development towards proactive safety and security and coordinated coast guard functions related activities in the Arctic domain.

End users in this context are the affected communities living in the region, key political decision makers, private sector companies, shipping and drilling industries, with a presence on the Arctic seas; as well as the coast guard functions, who oversee security and safety in the region. Denmark, Norway, Russia, United States, and Canada have Arctic coastline. Also Sweden and Finland have Baltic Sea coast-line that becomes ice covered during winter months.

The focus of this paper is to investigate the process of involving public and private institutions, and, in particular of end users, in creating an enhanced Arctic research and study community. A network for knowledge and innovation contributing to Arctic safety and security that will involve the actors in active communication. A network of co-creation to promote safety and security on the Arctic domain (later: co-creation network) can add communication and new forms of cooperation through cross-sectorial and regional research and development in issues such as: common awareness, risk pictures, preparation against disaster, joint capacity building, resource pooling and innovations. Built network cooperation will benefit and add value to all sectors working towards a safer and more secure Arctic maritime domain.

This research question for this paper is: How can end users be involved in the process of creating a co-creation network for knowledge and information sharing to contribute on innovations to Arctic safety and security?

2. Literature review

2.1 A Safety and Security Gap in the Arctic

For a long time, the Arctic has been seen as an exceptional space, "an apolitical space of regional governance, functional co-operation, and peaceful co-existence" (Käpylä & Mikkola, 2015, p. 5).

The last decade has seen the Arctic re-emerge as a political component, due to the exceptionally rapid warming and reduction in the Arctic sea ice cover, which is especially noticeable during the summer months. The Arctic is opening up "and substantial natural resource bases as well as new maritime routes in the area were becoming more easily exploitable" (Käpylä & Mikkola, 2015, p. 6).

The Arctic includes the Northern fringes of Europe, Asia, and North-America. Besides the increasing economic and human activity in the Arctic regions, about 4 million people live there permanently. Research shows that the climate of the Arctic is warming (Heikkilä & Laukkanen, 2013). Between 2005 and 2010 was the warmest period ever measured in the Arctic and the extent of Arctic sea ice has never been recorded as low as it was in 2012 (European Commission, 2012).

The rate of the warming of the Arctic, and the decrease of the ice-cover have been surprisingly rapid. There is a great deal of pressure and increased strategic, political, and economic interest to the area. A future, where the Arctic Ocean could, much like the Baltic Sea around Finland today, freeze in winter and melt in summer is easily imaginable (Heikkilä & Laukkanen, 2013; Gascard, 2014). Russia, for example is building an Arctic gateway of its sea route, the Northeast Passage. Its traffic

is increasing and is expected to continue increasing (Zalyvsky & Eduardovna, 2015; Guy & Lassarde, 2016). Vessels are aided by nearly two dozen Russian icebreakers and protected by a string of 10 up-to-date search-and-rescue centres along the route. Continued increase in the near future on this Arctic gateway that the Russians are building between European and Asian ports is predicted. "…*to reduce risks, Russia imposed a mandatory piloting scheme along the northern sea route (NSR)*" (Guy & Lasserre, 2016; Gascarde, 2014).

Over 200 transit traffic vessels have passed through the Northeast Passage on Russia's Northern Sea Route between 2010 and 2014, with 71 in 2013 alone (Guy & Lasserre, 2016). Besides transit traffic, there are additional traffic, within the Arctic that load or unload cargo to and from the region, and transport of supplies to local communities or industry.

"*For the first time ever, an ice class 1A bulk carrier "Nordic Orion" 225 m long from the Nordic Bulk Carriers A/S Danish company, is using the North West Passage in September 2013 as a transit trade lane when transporting 75000 tons of coal from Vancouver, Canada to the port of Pori in Finland*" (Gascard, 2014, p. 13).

As activity in the Artic is increasing, the discussion on the safe use of Arctic resources is a very contemporary topic. This paper argues that there is a need to develop a co-creation network to increase knowledge and innovation, and to promote and ensure safety and security in the Arctic domain.

Fees paid by shippers, help cover costs of improvements to the sea route. This busier maritime transportation corridors are also starting to stimulate inland development; a railroad is planned to connect Russia's mineral-rich interior to its Arctic coast and liquid natural gas facilities on the coast are scheduled (Heininen, et. al., 2014; Lipponen, 2015).

The US Geological Survey (2011) estimates that the Arctic holds 30 % of undiscovered oil and 30% of undiscovered gas supplies, offshore and in depths of under 500 meters. This creates an increasing presence and development possesses specific safety and security challenges for maritime safety and security and Coast Guard functions (Guy & Lasserre, 2016; Salokannel, Knuuttila & Ruoslahti, 2015): Increasing economic activity and Arctic sea traffic may cause safety and environmental impacts. Arctic tourism, involving cruise ships in particular is increasing; and yet there are very limited monitoring and surveillance capabilities (Gascard, 2014).

Possible rescue operations will be extremely difficult in case of accidents and emergencies, as the northern coast of Russia, Alaska, and Canada are largely uninhabited and have few harbours. Possible oil discharges could inflict large areas while there is no real oil destruction response capacity available. Due to the lack of a regulatory framework, uncontrolled fishing may occur. There is a lack of international navigation aids and of common Risk analysis in Cost Guard Functions (Salokannel, Knuuttila & Ruoslahti, 2015; Ruoslahti & Knuuttila, 2016).

2.2 Knowledge and Innovations

Knowledge is an important source to competitive advantage and "*a key to the success of modern organizations and creative higher education*" (Pirinen, 2015, p. 1). The capability to create organizational knowledge is a key to innovate. The dynamic interactions among all level roles lead to creation of new

knowledge instead of individuals. Knowledge creation leads to continuous innovation and finally to competitive advantage. (Nonaka, I. & Takeuchi, H. 1995. p.6).

Co-created knowledge, knowledge from sharing experiences and knowledge with reflection, is a process of participation in work and social communities. These networks use common information sharing environments and build trust and confidence in one another through interactions between them. A collective responsibility to facilitate a collective R&D progress results in investigations; inventions and innovations (Pirinen, 2015). Co-creation feeds from common objectives and it can occur in both physical and digital arenas. (Bhalla, 2014), where the collaborators can share tools and collaborative processes. There should also be a structure of formal contracts between the collaborators. Valkokari et. al. (2012, p. 27), note that: "… *a strategic approach to knowledge management is a key element of success within networked innovation, both in the theory and in the practices*…".

The issue arenas model for organizational communication (Vos, Schoemaker, & Luoma-aho, 2014; Luoma-aho & Vos, 2010) explains multi-stakeholder communication, while Galvagno & Dalli (2014) note that co-creation is useful in promoting innovation, as is a strategic approach to knowledge management. A strategic approach is a key element of success in networked innovation, according to Valkokari, et. al. (2012).

Online platforms provide secured online possibilities for needed common information sharing environments, co-creative knowledge creation, and for sharing information and finally research results (Bhalla, 2014; Saarinen, 2012; Hosie, et. al., 2003). The computers made the delivery of education possible and the material were able to deliver both print and electronical media (Moore, 1990). The critical components of successful integration of technology innovations within education and training settings and influences the adoption rate of such technologies are transparency in user interface design and Human Computer Interaction (HCI) (Charalambos, 2004.). Shared information are needed in externally funded projects and innovation networks; participation in which is an important channel of knowledge transfer (Pirinen, 2015; Di Cagno, et. al., 2014); and where combining management of projects, networking, and learning is challenging (Ruoslahti, et. al., 2011).

3. Methodology

To build a basis for the creation of the co-creation network this study uses Engeström's (2007) expansive learning process together with the understanding of Nonaka & Takeuchi (1995) Knowledge Creation model to support innovations. The expansive learning process consists of the following phases: (1) Questioning existing practices, (2) Analysis of existing practices, (3) Modeling a new solution, (4) Exploring the new solution, (5) Adopting the new solution, (6) Evaluating the process, and (7) Solidifying and expanding new practices.
This paper focuses on the third phase of the expansive learning cycle, modeling a new solution. The method is participatory and a work in progress. Conclusions from co-creation network partner

communication (meetings, discussions, workshops, events) are gathered under the Chatham House rule (Chatham House, 2016) to ensure anonymity of all people participating in the study. The data is collected from public sources, and from work completed 2011 – 2016. The data consists of the conclusions from discussions with policy maker representatives, and from the Laurea UAS internal documentation (documentation of European CISE (Common Information Sharing Environment roadmap and CISE Education Network). It also includes the notes from a cooperation workshop with World Maritime University in August 2014 and European Maritime Day 2015, and from Center for Island, Maritime, and Extreme Security – CIMES meetings 2011 - 2014. The data includes also the work conducted in ShipArc 2015.

4. Results

The results of this paper focus on the possible actors needed to a co-creation network in Arctic domain with its main aim. As this is still a work in progress, this paper is limited to the current situation and knowledge.

5.1 Coordination Structures on the Arctic Research and Development Actions

5.1.1 The Arctic Council
The Arctic Council is the most important international forum for cooperation in the region. The Artic Council is formally established in Ottawa Declaration of 1996 as high level intergovernmental forum which aims to provide a means for promoting cooperation, coordination and interaction among the Artic States (Arctic Council, 1996). The particular issues concentrate on sustainable development and environmental protection in the Artic. Canada, United States, Russia, Denmark (Greenland and the Faroe Islands), Iceland, Norway, Sweden, and Finland are member states of the Arctic Council together with permanent participants of six councils representing indigenous peoples of the Arctic. The Arctic Council promotes various forms of collaboration in the Arctic Region (Arctic Council, 1996).

The Arctic Council has a very broad scope, but the Agreement on Cooperation in Aeronautical and Maritime Search and Rescue (Arctic Council, 2011) demonstrates that safety and security in the Arctic domain are an important part of it. The co-creation network will be able to raise topics to the attention of the Arctic Council decision making and, thus increase awareness of safety and security related issues and solutions, and cooperation among its member states. The decision making may benefit from the work of co-created network community.

4.2 Networks of Researchers and University of the Arctic
An important form of collaboration are scientific research networks on Arctic issues; notable networks of Arctic research and education are the International Arctic Science Committee (IASC), providing guidelines for international science policy and research cooperation on the Arctic; the Association of Polar Early Career Scientists (APECS), promoting cooperation between students and researchers in

the early phase of their careers; and University of the Arctic, a network of close to 140 institutions from Arctic countries, enhancing research and student exchange, training between participating universities (University of the Arctic, 2013).

"*The University of the Arctic (UArctic) is a cooperative network of universities, colleges, and other organizations committed to higher education and research in the North. Our members share resources, facilities, and expertise to build post-secondary education programs that are relevant and accessible to northern students*" (University of the Arctic, 2013). To promote focus the UArctic has thematic networks. An alternative is, that the co-creation network be structured into a thematic network under the University of the Arctic.

5.3 Safety and Security on the Maritime Domain and Coast Guard Functions in Europe
European Maritime Policy seeks to respond to challenges facing the European maritime domain in an integrated and cross sectorial manner. Issues, named Coast Guard Functional activities, have been defined by the European Coast Guard Functions Forum (ECGFF) (European Coast Guard Functions Forum, 2014): The European coast guard functions are maritime safety and vessel traffic management; fisheries control; maritime border control, surveillance, security, customs activities, and law enforcement; also maritime environmental protection and response; accident and disaster response; and search and rescue at sea; plus other related activities (Figure 1).

Figure-1: The Constructive Manner of the Terms of Reference (TORs) of Coast Guard Functions (European Coast Guard Functions Forum, 2014)

The European Union and its Member States are working towards a future of integrated non-military maritime surveillance and deeper Coast guard functions related coordination. This development will improve coordination and the wider implementation of platforms, such as EUROSUR (Frontex, 2015) and CISE – Common Information Sharing Environment, for example (European Commission, 2015). Present national Coast Guard education systems mainly serve operational targets and are regulated by professional and organizational purposes; thus post-graduate, and post-doctoral, levels of education

are not included.
A Co-creation Network could promote more unified requirements to educational institutions in the field (coast guard and other actors on the maritime domain). National authorities use, their own educational resources, and also those of other public and relevant private actors. To fully exploit the potential of an integrated maritime policy, the Coast Guard Functions approach could be extended to the academic and educational sectors (WMU Workshop, 2014).

Coast Guard Cooperation Networks
Coast Guard Cooperation Networks include: the Baltic Sea Region Border Control Cooperation (BSRBCC), the Northern Atlantic Coast Guard Forum (NACGF), the Black Sea Littoral States Border/Coast Guard Cooperation Forum (BSCF), the Mediterranean Coast Guard Services Forum (MEDFORUM), and the North Pacific Coast Guard Forum (NPCGF). They all have a regional maritime focus in maritime safety and security, environmental protection, combat of cross-border crime, and enhancement of information exchange (PERSEUS, FP-7 Project, 2013).

These networks represent the different authorities in charge of Coast Guard functions in each country. Thus each of these member organizations will also have educational and research structures and institutions such as mentioned above. The relevant coast guard cooperation networks for the arctic are the Atlantic, Baltic, and Pacific Coast Guard Forums (Figure 2), which cover the entire Arctic domain.

Figure-2: Relevant Northern coast guard cooperation networks for the co-creation network on the Arctic Domain

Today national Coast Guard educational institutions form bodies of knowledge through their interaction with practitioners on the field. Professional best practices are transferred from generation to generation both inside and outside of existing formal curricula. A coordinated, genuinely open and coast guard functions focused post graduate study environment for authority officers is now missing. For example, active coast guard personnel are not always as free, to address and discuss professional problems and lacking solutions in an open academic manner, as retired officers are (Third European Maritime Domain Security Planning Meeting, 2013).

5.5 The Added Value of an Arctic Co-creation Network Community
The Arctic co-created network community would benefit and add value to all sectors aiming towards a safer and more secure Arctic domain. As stated earlier current coast guard education systems lack post-graduate, and post-doctoral, levels of education, as well as matching levels of basic and applied

research and study. The co-creation network aims to be a multi-disciplinary cooperation body, bringing now disparate researchers and institutions together with other security and safety management, and coast guard functions oriented researchers and institutions. Thus, the co-creation network would have a clearly broader focus than existing coast guard institutions; but also a much more defined scope and focus than the University of the Arctic (Second European Maritime Domain Security Planning Meeting, 2012).

The purpose of this co-created arctic network community could add communication and new forms of cooperation through cross sectorial and regional research and development in issues such as common awareness, risk pictures, preparation against disaster, joint capacity building, resource pooling. All these developments will require open study and common mechanisms, such as the co-creation network would provide. One purpose is to complement existing coast guard forms of cooperation, one of the main ones being the European Coast Guard Academies Network Project initiative (Third ECGFF Secretariat Meeting, 2013).

The co-created arctic network community can broaden the focus of today's defined training oriented National Coast Guard Institution educational programs; while bringing focus to very broadly defined academic basic research and study networks, such as the University of the Arctic. Most added value will come from a cooperation and study platform for individual students and researchers interested in a multi-disciplinary approach toward security and safety of transport, and human and economic activity in the Arctic environment. The co-creation network will enhance information exchange and participation possibilities in EU and Government Agency funded research and development projects.

5.6 Participation and involvement
The co-created Arctic Network Community key participants will be institutes that either educate coast guard personnel or participate in research and development in topics, which are (loosely) under coast guard activities and processes topics as discussed above. Many educational and research institutions will not be official coast guard authority institutions, but have related programs to safety and security, maritime domain, and coast guard development and education issues. Potential institutions are those which focus on IMO based maritime safety aspects, security management focused institutions, relevant technological institutions, environmental research institutions, and those of customs authorities, etc. (WMU Workshop, 2014).

The co-creation network can help create long term involvements such as information and knowledge sharing which affect change into the current status quo of scattered and unlinked programs and systems. It can demonstrate new knowledge on how a cooperation should work in the future (e.g. in SAR) – not only technically, but also as a process to change the current mind-sets to cooperate more and share information to benefit the security and safety of living, transport, and economic use in the Arctic environment.

One working group of Arctic network community may focus on building the networks around research and studies that aim to lead to safer, more secure and cleaner seas, through sustainable economic growth. Better information and knowledge sharing will lead to better situational awareness and sound to decision-making – for the benefit of the Arctic seafarer. If the route of R&D related learning can be extended and generalized, higher education institutions will face new opportunities from their networked expertise (Pirinen, 2015): "… higher education institutions can increase their contribution to the innovation system; higher education institutions can keep co-creation and innovation processes alive at the regional, national and global levels;…"

Arctic network community development should also lead toward Artic security related online education. Education programs, which provide learning possibilities that are not tied to time or place. An as flexible of an approach as possible will empower students "to choose their own learning curriculum according their own interest. That is the benefit having so many universities and institutes on board" (Heinonen, 2016).

Artic safety and security education can be facilitated as online basis among and between network members. The platform can provide secured online possibilities for sharing the information and research results and related to the issued topics as well as facilitate the online learning. To integrate the social dimension into the pedagogy of online learning environments, Felix (2005) has proposed the synthesis of the cognitive constructivist and social constructivist approaches. This online learning will follow constructivist understanding and the constructivism can be manifested in online settings; e.g. as defined above (Hosie, Clifton, & Joe, 2003).

In a role of an individual expert (researcher, student, other expert), the expert will have the wide selection offering the various participating institutions sharing research results, created knowledge and information and finally study curriculum based on individual and professional preferences to result in a PhD or a multi-disciplinary Master's or Doctorate of Business Administration. Authority officials will have a broader venue of advancing their knowledge and education (Third European Maritime Domain Security Planning Meeting, 2013; Gröndahl, et. al., 2014).

The research of co-creation range between the smallest collaborative innovation in new product development processes to a wider theory of co-creation research stream (Galvagno & Dalli, 2014), and a co-creation network can be active throughout this spectrum. A co-creation network will need common objectives to work towards, it will exist and operate in both digital and physical arenas, share cooperation tools and collaborative processes, and we shouldn't forget contracts between the collaborators (Bhalla, 2014).

Conclusions

Creating a new long-term co-operation among Arctic experts, a co-creation network community can engage a still disengaged field by affecting change to currently scattered and unlinked programs and systems, and build alignment of best practices. New knowledge and more effective future cooperation, technically and as a process, may bring about a change of current mind-sets and provide further innovations to meet with the set objectives. This research aims to provide insights on ways to involve end users in the co-creation process. This could help other collaborative problem solving processes that need input of end users.

This co-created Arctic network community needs to be multi-disciplinary and multi-institutional, bringing disparate security and safety management and communication researchers together with both one another, and with end-users. An online platform will serve learning online and sharing research results and co-creation information between the network members and experts.

The co-creation network aims to broaden the focus of today's defined training oriented national coast guard institution educational programs, and create broadly defined academic basic research networks and larger community bringing all end users to the same network. This should provide an opportunity to experience a multi-disciplinary approach toward security and safety of activities in the Arctic. The enhanced Arctic research and study society aims to contribute to a safer, more secure and cleaner domain, and develop insights on sustainable economic growth, international processes and best practices, leading to increased situational awareness and decision making – for the benefit of the Arctic.

Also, the education programs in this context can provide learning possibilities that are not tied to time or place. A flexible approach may enable students across the network to choose a learning curriculum based on content and interest. This paper suggests that the co-created Arctic network community should also award higher levels of post post-graduate and post-doctoral education. The network can be a UArctic thematic network, having a much more defined scope and focus on coast guard functions, security, and safety on the Arctic maritime domain than the University of the Arctic itself; while also having a clearly broader higher education focus than any coast guard institution or their cooperation networks.

Further work will focus on the process of co-creation and knowledge exchange between the network members to identify ideal modes of cooperation.

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