

Innovation opportunities from rebuilding a city: the case of moving the city of Kiruna

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Abstract

This paper is a presentation of a contemporary research project conducted at the Department of Business Studies in Uppsala. The purpose of the study is to learn more about innovation processes from a network perspective. We will do so through a case study of a huge city move in the far North of Sweden following the process of rebuilding the infrastructure of an entire city in real time. We will investigate the innovations created in this process and focus especially on how what is new relates to what is established. The case study view innovation as a result of a number of resource combinations being made within the network. By understanding the decisions made and actions taken by various actors in the resource formation process, we will reach a better understanding of the organization process related to innovation. The potential value of this study is to capture the formation and development of networks as they emerge and organize to further the theoretical insights into the nature of network dynamics and innovation.

Keywords: innovation processes, industrial networks, resource development, process research

Introduction

In 2004, the large Swedish mining company Luossavaara Kiirunavaara Aktiebolag (LKAB) announced publicly that the expansion of their underground ore body over the past 100 years, which is now approximately two kilometers deep and progressing at a 60-degree angle to the east, had begun to encroach upon the city limits of Kiruna. As the mining operations continue, waste rock fills the cavities that form from the extraction of ore. This creates ground deformations and fractures on the earth's surface over time. Consequently, these deformations have begun to disrupt and destabilize the foundation of the city's infrastructure, including railways, roads, and bridges; water and sewer pipes; district heating culverts; and electrical and telephone lines, all of which become a great risk to the livelihoods situated in the city center. Out of necessity and under the advisement and support of LKAB, the municipality of Kiruna responded to the announcement and decided in September 2011 to relocate and rebuild the entire city center 3 kilometers east of its current location, to begin anew. The new city center will replace the deconstruction of 500,000 square meters of the existing city so as to maintain a semblance of normalcy as well as a level of safety for residents of Kiruna as this urban transformation of moving the city continues to unfold. The total cost of the urban transformation is approximated to be 25-30 billion SEK. According to Swedish mineral legislation, LKAB will take responsibility for the entire financing of the relocation to compensate for the damages incurred by the community of Kiruna.

This paper is a presentation of a study in which we follow and investigate the process of moving the city from an innovation perspective. The moving and rebuilding of an entire city is a large-scale transformation effort implemented by a plethora of public and private actors, with differing logics and agendas. This large-scale transformation effort comes with the unique opportunity to build a city from the ground up; to rethink the infrastructure that has served the city in the past and reconsider how to make changes that contribute to a sustainable future for Kiruna. As argued by the municipality of Kiruna, this is "*a fantastic opportunity to transform Kiruna into an international example of a sustainable society in a short time.*" We claim that it is also a unique opportunity for us as researchers to follow a huge infrastructural project and learn about innovation processes as they unfold.

The purpose of this study is to learn more about innovation processes in industrial networks in general, and about the construction of infrastructural solutions (i.e. to develop the innovations needed in the new city) in particular. The case study views innovation as a result of a number of resource combinations being made within the network. By understanding the decisions made and actions taken by various actors in the

formation processes studied, we will reach a better understanding of the organization process related to innovation. We will be able to study how old relationships are utilized for the purpose of innovation, how new relationships are established in the process, and how networks are utilized, shaped and (re-)shaped in the process.

To realize the purpose, the following broad research questions can guide the inquiry of this research study:

- How do networks of actors organize and implement the innovation processes in this large-scale urban transformation over time?
- How do the varying resources and competencies of actors influence the innovation process?
- What are the theoretical implications of the innovation processes studied within the context of this urban transformation?

Theoretical underpinnings

An industrial network perspective (Håkansson & Snehota, 1995) allows us to consider the ways that resources and activities are combined amongst actors, which create opportunities and potential for innovation and problem-solving, and offers a means to better grasp the relational dynamics that are in motion and the change processes that involved actors are a part of. An industrial network perspective extends the concept of innovation beyond “what a firm does” to include a broader context of innovation (Freytag & Young, 2014). In this broader context, innovation is conceptualized as a non-linear, collective process (Van de Ven, 1999), i.e. as an interactive “flow of ideas and activities directed by actors which combine and recombine resources” (Freytag & Young, 2014, p. 361).

The realization of ideas depends on the willingness of actors to “collaborate in novel ways and thus enhance the network developments and change” (Aarikka-Stenroos et al., 2017, p. 90). It is through interaction and relating to others in the network that innovation takes form (La Rocca et al., 2013; La Rocca & Snehota, 2014). Joint aspirations are achieved through interaction and relating, which become the means to create and realize an entrepreneurial idea (Håkansson & Snehota, 1995; Aarikka-Stenroos et al., 2017). In relation to innovation, there is always a prevailing network in place prior to entrepreneurial activity. But it is the innovation that causes the boundaries of the existing network to be reconfigured, which perhaps allows the innovation to become embedded in the existing network structure (Halinen, Salmi, & Havila, 1999). The embedding of the innovation shifts it from being just a momentary phase to long-lasting change that becomes stable and a part of the existing network structure over time (Aarikka-Stenroos et al., 2017).

The relevance to understand the relationship between entrepreneurial action and how the innovation process takes form from an industrial network perspective has become quite prevalent (Snehota, 2011; Ciabuschi et al., 2012; Aaboen, La Rocca et al., 2017). Snehota (2011) and Ciabuschi et al. (2012) suggest that if the formation phase of innovation is to be understood, studies need to investigate the interdependent relationships between actors involved in entrepreneurial action in the network and demonstrate the innovation process is about the collective enactment and exploitation of opportunities in the business network. Ciabuschi et al. (2012, p. 228) argue that the concept of opportunity in the business formation process is not so much about discovery and exploitation, but rather opportunities are developed and enacted through interaction and co-action of trustworthy network partners. Ciabuschi et al. (2012) link this finding to the process of effectuation (see e.g. Sarasvathy, 2001).

The innovative task in the context of transforming a city’s infrastructure is challenging since it brings together a network of actors from civil society, business industry, and research, aiming to reconstruct the city and to innovate through an ongoing exchange of resources and activities between actors involved. This network dynamic is considered to be rather heterogeneous as civil society, business industry, and research organizations come with both similar and different values and objectives, which guide how they organize, make decisions, and manage (Van Der Wal, de Graaf & Lasthuizen, 2008). These sector differences are challenging to manage because these heterogeneous actors need to collaborate jointly when identifying problems and formulating solutions, which requires knowledge sharing and integration (Leite & Bengtson, 2018; Nissen, Evald & Clarke, 2014).

It is the interaction and cooperation amongst actors that fosters innovation as it offers the means to adapt and change within networks (Lundgren, 1995, p. 207). The involvement of and cooperation amongst this

diverse network of actors, however, are not without complication and often present a paradox in the interactive nature of the network. Hoholm and Olsen (2012) recognize this paradox as the dual processes of mobilizing resources and learning, which are seen as contrary forces in an innovation process. On the one hand, as the network of actors emerges and expands so does the commitments made by actors and availability of resources, which decreases uncertainty and facilitates the innovation process through generating knowledge. On the other hand, as the learning increases in the network, it tends to multiply the potential innovative trajectories available in the network, which increases uncertainty and complexity. Summing up the theoretical underpinnings: this is a story about the nascent nature of an innovation process that is taking form and it is made up of a diverse network of actors engaging in an interactive process of learning how to rebuild a city, together. The starting point for the study is an industrial network perspective on the innovation process which views innovation as assembling and mobilizing heterogeneous resources (Hoholm & Olsen, 2012), acting and learning under conditions of uncertainty (Hoholm & Arahujo, 2017), and developing interactive relationships with the established network (Rubach, Hoholm, & Håkansson, 2017).

Research design

Adopting a process perspective in research involves addressing the empirical ‘how’ questions of how a context-specific and temporally-situated phenomenon unfolds and evolves over time. Since we theoretically take an industrial network perspective to study the complexity and nuanced dynamics of how actors interact and organize action, a process perspective allows us to conceptualize networks and relationships “as dynamic inter-relationships reconstituted incessantly by ongoing activity, and in and through which participating organizations are themselves adapted or reproduced through space and time” (Bizzi & Langley, 2012, p. 225). Furthermore, a process perspective of industrial networks affords focus on temporal change in the form of emergence and evolution as opposed to fixed states between variables (Bizzi & Langley, 2012). Over recent decades, the industrial marketing and purchasing (IMP) group continues to adopt a process perspective in qualitative case studies (Axelsson & Easton, 1992; Lundgren, 1995; Halinen, Medlin & Törnroos, 2012) to discern how organizations collectively manage change through their relationships and networks (Håkansson & Snehota, 1995).

This study is designed as a longitudinal, processual, in-depth case study to examine how the development of events, activities, and choices emerge and sequence themselves over time (Van de Ven, 2007) and unfold in context (Pettigrew, 1997) to begin theorizing about their temporal patterning (Bizzi & Langley, 2012). We have chosen to design the case study as a multiple process (embedded cases within the overall case) study in order to reach the depth needed. Through the investigation of three micro innovation processes within the overall urban transformation process, we hope to reach diversity and depth in empirics in the topic of innovation processes in networks. The three micro innovation processes chosen concern (1) an “anti-development” process from a development perspective – the demolition of the first residential area, (2) an innovation process full of symbolic value / city image aspects of the urban transformation – the design and construction of the new city hall, and (3) an innovation process that exploits the opportunity to rethink existing infrastructure to achieve greater sustainability - the improvement of the district heating system.

The longitudinal and processual aspects of this case study are achieved through interviews with key practitioners and social observations of events and meetings related to the organizing of the urban transformation over the course of four years (2016 – 2020). Secondary empirical material is collected to build an understanding of the founding and history of the city since 1900, as well as to aid in understanding all the decisions made in the urban transformation process since its start in 2004. A summary of collected primary and secondary empirical material thus far is presented in Table 1. The urban transformation process is anticipated to continue through year 2030, but the significance of our window of time collecting empirical material in Kiruna is that there are evident physical and social changes unfolding presently.

Table 1. Summary of collected empirical material, October 2016 – October 2018

Empirical material source	Total and breakdown
Primary source: Semi-structured Interviews	36 interviews with 29 practitioners. Each interview is approximately 60 minutes in length. All interviews are recorded and transcribed. Interviews are primarily conducted in Swedish, occasionally in English.
Primary source: Social observations	18 occasions, with each occasion ranging from 2 hours to 3 days. Occasions consist of management meetings, board meetings, workshops, conferences, press demonstrations, and reflection meetings. All social observations are observed in Swedish.
Primary source: Informal dialogue	Informal conversations with project manager of the IP Kiruna project 7 times, either in person or over the phone, from October 2017-May 2018; a tour of the new city center of Kiruna with explanation of the historical use of the land; tour of the new city hall prior to opening with explanation of materials used and installations.
Secondary source: Archival material	Project descriptions; comprehensive urban development plans; resident survey analysis; presentation materials; municipality of Kiruna website; municipality of Kiruna magazine and brochures; LKAB website; LKAB magazine and brochures; meeting minutes; The Book of LKAB; Ögonblick i Kiruna photo documentation books (2009-2010, 2010-2012, 2012-2015, 2015-2018).
Secondary sources: Media material	Relevant news articles from Dagens Nyheter, Norrbottens Kuriren, Norrland's Social Democrat, and Kiruna tidningen; radio episodes from P1 on Sveriges Radio; SVT Norrbotten TV.

The empirical background of the urban transformation

In this section we present the empirical background of the Kiruna case.

How the history of LKAB became Kiruna's history

LKAB has established itself as an important economic engine in Sweden's export industry and industrial development for over a century. Since LKAB was founded in 1890 and post-World Wars, the exports from the mining operations in the ore fields of Norrbotten strengthened Sweden's economy at a time when there was great stagnation, and subsequently, secured its ability to focus on building a welfare state (Carlgren, 2015). Over the past century, LKAB has cumulatively produced more than one and a half billion tonnes of iron ore, supplying primarily the steel markets of Europe, as well as markets in the Middle East, North Africa, Asia, and the United States (LKAB, n.d.) Yet, only one third of the Kiirunavaara's ore body has been extracted, which leaves plenty of reserves for continued development.

However, this continued development of LKAB's mining operations in Kiruna doesn't occur in isolation and never has. The iron ore mine is located in a barren, remote wilderness with a harsh subarctic climate. At the time of its founding in 1890, there were no skilled employees to hire to begin operations, no homes to house potential employees, no stores to offer necessary food and supplies, no commercial businesses or suppliers to begin networking with, no customers to market to, and no infrastructure to transport the iron ore from the Arctic Circle to the rest of Europe and abroad. However, as the Iron Railway Line progressively took form throughout the 1890s, a labor force of miners, railway workers, architects, business men and geologists ventured northward to establish livelihoods in Kiruna. And so too began the establishment and expansion of the city of Kiruna.

Kiruna 1.0: A city plan far ahead of its time

In 1885, LKAB appointed the geologist Hjalmar Lundbohm as first managing director of operations. Two years later, LKAB delegated the task to Lundbohm to begin designing a detailed city plan to build a complementary society to support the operations of the iron ore company (Brunnström, 1980; Kiruna kommun, 2000a). The ambitions for this new city were high. Lundbohm recognized that the city plan went

beyond mere construction of a city. He had a vested interest in not only the versatility of the Swedish natural stone for building purposes, but also in the economic and social mobility of the city's residents, as the iron ore mine was dependent on a contributing and thriving workforce (Johansson & Erkner, 1977). Kiruna would be a well-planned, well-organized and climate-adapted city, with the aim to attract residents to the sparsely populated hinterland. The construction of the city was a critical precondition for the iron ore mining operations in the mountains of Luossavaara and Kiirunavaara (Vajstedt, 2012).

Lundbohm built a model city 145 kilometers north of the Arctic Circle. He strategically chose Mount Haukivarra as the location of Kiruna as it was situated between the two mining mountains of Luosavaara and Kiirunavaara. This allowed for ease of communication between mines and commuting for the workers; wind protection and milder temperatures in a sub-zero climate; as well as a view of the surrounding Arctic landscapes, all while within the city.

The empirical story of the urban transformation

This section describes the start of the transformation and three embedded cases that function as a means to illustrate the innovation qualities that are characteristic to the context of Kiruna.

Kiruna 2.0: A process of relocating and rebuilding a city

The city of Kiruna that was designed and built in 1900 grew and flourished for over 100 years. However, something shifted in 2004 that would alter the future trajectory of Kiruna and the home that it provides its residents. In 2003, LKAB's measurement diagnostics indicated that the city of Kiruna was no longer unaffected by the mining operations. The following year, LKAB presented its first fracture forecast to the municipality of Kiruna and the community. In that same year, the municipality of Kiruna made the only feasible decision; the city of Kiruna would need to be relocated in order for mining operations to continue. This is how Kiruna has since been known as "the city that will move".

Since the realization in 2004 that the city of Kiruna needs to be relocated, and many urban transformation changes are underway: The Luossajärvi lake has been drained; the train station and railway have been relocated; certain residential neighborhoods have been and are in the process of being demolished; cultural buildings have been relocated; the old city hall has been closed; the new city hall has been built and opened; the new passage for the European highway 10 is being constructed; the continued construction of the new city center is expected to be completed by 2022. With all these changes in motion, a certain pride associated with the original vision of Hjalmar Lundbohm for the city remains constant throughout Kiruna's evolving story. The director of the municipality of Kiruna reiterates this historical influence: "The vision of Hjalmar Lundbohm influences how we work with the urban transformation. Now when we develop the new city plan, we talk about Kiruna 2.0" (Interview Niemi, 17 October 2016).

Actors responsible for envisioning and reconstructing Kiruna 2.0

The interdependent relationship between the city of Kiruna, the municipality of Kiruna, and LKAB has shared an intertwined history over the past century. The city's economy has relied heavily on the income stream that LKAB supplies via employment as well as investments in the community and the mining company depends on the laboring efforts of the residents of Kiruna to drive its mining operations. Since the announcement was made by LKAB that the city of Kiruna needs to be relocated, there have been a number of negotiations, disputes, and agreements on how to best distribute the responsibilities of this urban transformation process. Never before have LKAB and the municipality of Kiruna needed to work so closely on something so complex, and which neither of them have previous experience in. It took time for LKAB to learn the operational ways of the municipality and vice versa; there is a level of transparency and service that municipalities need to fulfill to maintain trust with their constituency that is not necessarily the standard with companies, state-owned or not. The agreement that the municipality of Kiruna and LKAB came to was a distribution of responsibilities; the municipality would take decisions on behalf of the reconstruction of the new city of Kiruna and LKAB would take those on behalf of the deconstruction of the existing city of Kiruna, in addition to the complete financing of all de- and reconstruction of the urban transformation process.

The pressing necessity to rebuild the city of Kiruna from the ground up has presented actors in Kiruna with the opportunity to rethink the current infrastructure and its current technologies and consider which innovative solutions could be utilized to create a sustainable future for Kiruna. The executive project manager for sustainability at the municipality of Kiruna maintains that the urban transformation process is:

“An example of a business model based on an innovation process. Take the challenges we identify in our efforts to build a new city, hopefully a sustainable city in an arctic climate. We will create new technology solutions and services, and if we have achieved them here, then the solutions can be used anywhere in the world.” (Interview Nilsson, 05 December 2016).

With this in mind, the following three cases are project examples of how innovation is unfolding and taking shape on the ground (microprocesses) as a result of the urban transformation process. The first two cases highlight innovation projects that must take place as a consequence of needing to move the city. The first case is an illustration of how innovation is considered in the deconstruction of the old city as opposed to the development of the new city. The second case illustrates how innovation is conceived as an additional feature to integrate. In contrast to the first two cases, the third case emphasizes innovation as the foundation that guides the whole conception and implementation of the project.

Demolishing the residential neighborhood of Ullspiran

In this urban transformation process, the development of something new often corresponds to the deconstruction of something old. The residential neighborhood of Ullspiran lies in the direct path of the subsidence caused by the underground mining operations of Kiirunavaara. With approximately 400 meters between the gradual sinking effects of the ground’s surface and the residential area of Ullspiran, it was the first area of the city to be affected and thus decommissioned and demolished in 2015. Ullspiran is an example of how innovation is implemented when deconstructing in the construction a new city.

When tearing down this residential neighborhood and its apartment buildings, LKAB hired a demolition contractor, Kolbäcks Återvinning AB, that considered how to extend the lifecycle of some of the building material and household appliances, so they would not go to waste, but rather serve another functional purpose. The aim of this first demolition project was to economically and sustainably recover approximately 96 percent of the debris as recycled and reusable material (LKAB, 2015a; Törmä, 2015): “The best economy in such a project is to recycle as much as possible. And then we prefer to keep that low price so that people want to buy instead of having to drive it to destruction” stated Kolbäcks manager Mats Helin (Törmä, 2015, p. 157).

Building the new city hall

The modern structure that is the new city hall of Kiruna stands tall and completed in an open, bare field that was once an industrial district. On the 28 August 2018, LKAB officially handed over the new city hall, known as Kristallen (the Crystal), to the municipality of Kiruna, and in return the municipality of Kiruna handed over the old city hall, known as the Igloo, and the land in which it is located to LKAB. LKAB’s plan is to demolish it come the turn of the year in order to facilitate the continuance of underground mining operations. This event has been coined as “a historic building exchange” by LKAB (Lindblad, 2018).

The second case is about the construction of the new city hall, which is symbolic for number of reasons. The first reason is that it is the first building to be built in the new city center, so it sets the tone for what this city center is anticipated to be: modern, attractive, and sustainable. The second reason is that the new city hall is constructed by LKAB for the municipality of Kiruna as a replacement for the one that must be demolished due to the subsidence. The new city hall is a grand gesture of goodwill between LKAB and the municipality of Kiruna that represents that these two actors are in good standing with each other and both have a vested interest in working together to relocate and rebuild the city. The third reason is that LKAB’s task is to replace the old city hall by building a new city hall that is of “corresponding size, function, and quality” (interview Mäkitaavola, 24 January 2018). Since no new buildings have been constructed in Kiruna for over two decades, the environmental standards and regulated building materials that are the norm in construction today are considered innovative in the context of Kiruna.

Improving the existing district heating system

The third case is about improving the energy efficiency of the existing district heating system in the city of Kiruna by using existing resources already available in the context of Kiruna. The pressing necessity to rebuild the city of Kiruna has presented actors in Kiruna with the opportunity to rethink the current infrastructure of the city and its current technologies, and to consider which innovative solutions could be utilized to improve the energy efficiency and reduce environmental impact and economic costs associated with the current infrastructure. Together, LKAB and Tekniska Verken, a subsidiary of the municipality of Kiruna responsible for maintenance of the infrastructure, plan to establish an environmental-friendly and cost-effective energy system that utilizes the residual energy from the underground iron ore mining operations of Kiirunavaara:

“The goal of the new energy system is to provide the community with residual heat from LKAB, thereby reducing the need for other fuels, which reduces future environmental impact. This is an important part of LKAB's sustainability work and important for the urban transformation in the journey toward a climate-smart society.” (Jan Moström, CEO of LKAB, Luossavaara Kiirunavaara AB, 2018a).

and to channel it into the district heating grid that serves the homes and commercial premises in the city of Kiruna:

“This is a part of the puzzle to achieve the sustainable society. Our customers receive green, sustainable and low-cost district heating, while at the same time we minimize CO₂ emissions and other greenhouse gases in our energy production.” (Jan Fjordell, CEO of Tekniska Verken AB, Luossavaara Kiirunavaara AB, 2018a).

Conclusion

There is so much in the context of Kiruna that the actors are not able to properly account for, but what they are able to control for is an attempt to actively create a future that they desire through innovation and with the information and means that are available to them. What is becoming apparent is that this urban transformation process taking form in Kiruna is not only a physical transformation of rebuilding a city, but also an intellectual and technological transformation that complements the physical transformation. How the city gets there and which shape it takes are dependent on the innovations, ideas, expertise, competencies, information, and resources that emerge through interaction as the actors continue to move the urban transformation process forward.

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