Transforming regions into innovation ecosystems:
A model for renewing local industrial structures

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ABSTRACT

This article elaborates on how to overcome regional structural crises by transforming regions into innovation ecosystems. The article uses a literature review and case study methods to examine the structural change that many regions and cities all over the world are going through, and it investigates how to manage this change and support innovation as efficiently as possible. The ecosystem approach emphasizes the position and roles of local and public actors in developing innovation activity. The case study concentrates on Jyväskylä, a small industrial city in the region of Central Finland. In 2009, the region faced an economic crisis when the mobile device manufacturer Nokia closed its research center in Jyväskylä.

The case study resulted in a model for building innovation ecosystems. The model consists of authentic dialogue, Triple Helix cooperation, the core organization, and futures studies. The article clarifies the concepts of the innovation ecosystem and hub, and shows how innovations require a special ecosystem where innovations emerge when different actors collaborate and co-create.

The research has implications for innovation practices and studies. The results are relevant for many small cities and regions, especially ones with a strong industrial history, whose real challenge is how to transform their economies into innovation economies. The research adds to the studies on innovation environments and supports the creation of world-class innovation ecosystems through deep cooperation among local, regional, and national actors.

***Keywords**:* innovation, change management, innovation hub, regional development, structural change, systemic change

Introduction

Both national innovation systems and regional developers are struggling to meet the demands of the constantly changing global competitive environment. Countries, regions, and cities all over the world are undergoing major structural changes as the economy shifts from manufacturing to services and as waves of sociotechnical development shape the innovation landscape. To manage the structural change and to support innovations as efficiently as possible, local innovation environments need to be developed and strengthened.

In this article we elaborate on the concepts of the innovation ecosystem and the innovation hub and present a model for managing regional structural change and development. We have attempted to answer two research questions: 1) How regions and cities be systematically transformed into innovation ecosystems? and 2) How can local industrial structures be renewed? To answer these questions we explored the building process and the special characteristics of innovation ecosystems, and analyzed the changes in innovation activities and policies. As a result we present a systemic model for building modern innovation ecosystems. The next section consists of a conceptual review of innovation ecosystems, hubs, and systemic development. The latter sections consist of the empirical case study and a description of the model for building innovation ecosystems.

As our overall aim, we investigate creative hubs in the global economy. We argue that innovations require a special ecosystem that includes top-level universities and research institutions, sufficient financing and a local market, a skilled labor force, specialization as well as cooperation among companies, and global networking. This kind of ecosystem requires the creation of world class innovation hubs where a high quality of life and excellent business possibilities are combined. Such a hub can be built through deep cooperation among local, regional, and national actors. However, in reality relatively few regions have exhibited this kind of renewal capability (Etzkowitz & Klofsten, 2005). Innovation tends to cluster in certain sectors or areas which grow faster and imply structural changes (Fagerberg, 2006). Similarly, regional development is shifting towards large clusters, cities, and metropolitan areas, while most of the value creation, R&D activities, and patenting happen in the global-level innovation hubs. For smaller regions and urban areas it is essential to identify and support the full innovation potential of the area.[1]

The article presents a case study from the city of Jyväskylä, located in the region of Central Finland. Our empirical case deals with the whole region, but in practice, most of the activities take place in the city of Jyväskylä and the cities in the surrounding area, thus we use the term Jyväskylä region. In spring 2009, the Jyväskylä region faced a structural change as two major employers, Nokia and Metso Paper, started to cut down their production. Nokia shut down its local research and development unit, leaving hundreds of highly skilled professionals unemployed. New operational visions, however, were swiftly initiated. This case study acts as an example of how to respond to rapid structural change. Following Etzkowitz and Klofsten (2005), the case is analyzed in the light of four stages of innovative regional development: inception, implementation, consolidation, and renewal.

Key concepts and theoretical framework

In this section we review literature from relevant disciplines and clarify questions regarding what innovation ecosystems and hubs are, what the dynamic of systemic change is and how different models for systemic development have explicated the formation of regional innovation activities, management, and collaboration. The existing literature includes both

[1] Following OECD classifications, large metropolitan areas consist of urban areas with a population of 1.5 million or more; metropolitan areas with a population of between 500,000 and 1.5 million; medium-sized urban areas with a population of between 200,000 and 500,000 and small urban areas with a population below 200,000 people.

empirical and theoretical studies, and provides an initial impression of the area of structural change and innovation.

Innovation hub and innovation ecosystem

The two main concepts of this article are the innovation ecosystem and the innovation hub. The innovation hub, or innovation center, usually refers to a region or a place with an extraordinary amount of accumulated knowledge and innovativeness. The term emphasizes the utilization of local knowledge and competences. Another more demanding criterion for an innovation hub is its connection to global value networks and its ability to create value in the global economy (Prahalad & Krishnan, 2008). The definitions often reflect the models of regional innovation systems such as the Triple Helix (Etzkowitz & Leydesdorff, 2000) or learning regions (Asheim, 2000), but the logic behind constructing regional innovation systems varies from the localized, path-dependent inter-firm learning processes to regionalized national innovation systems, where R&D and scientific research have taken a much more prominent position (Asheim & Coenen, 2005). However, all ideal models and types emphasize strong regional networking. Other terms used to describe these kinds of environments include knowledge hub or knowledge center (e.g. Kao, 2009; Youtie & Shapira, 2008). In this study, the innovation hub is defined as a local, creative center in the global economy.

The term innovation ecosystem refers to a dynamic, interactive network that breeds innovation. In practice, the term can refer to local hubs, global networks, or technology platforms. It also has roots in industry and business clusters (Porter, 1998; Estrin, 2008). In our study the emphasis is on local, regional ecosystems and their development. The culture of innovation has been developing from the beginning of the industrial era, especially in growing cities and metropolitan areas (Kim & Short, 2008) such as Manchester in the United Kingdom, an example of the first true innovation milieus (Hall, 1998). Today, Silicon Valley is one of the most important and best-known innovation ecosystems, and its experiences are emulated in other places all over the world, from Tel Aviv, Israel to Bangalore, India (see e.g. Kao, 2009; Kenney, 2000; Christensen et al., 2004; Munroe, 2009).

An innovation ecosystem consists of a group of local actors and dynamic processes, which together produce solutions to different challenges. The main features of the ecosystem include top-level universities and research institutions, sufficient financing for new companies and research plans, a symbiotic combination of large established companies and new startups, specialization of and cooperation among companies, service companies specialized in the needs of local companies, a sufficient local market for new innovative products, and global networking (Munroe, 2009; Kenney, 2000). In addition, successful ecosystems have a "community of fate", meaning that the actors of the region see that their success is linked to the success of the whole region (Hautamäki, 2010).

To make the ecosystem alive and renewable, a risk taking entrepreneurial culture is essential. Another special feature is re-cycling, the continuous movement of ideas and people. People move easily between companies and from research institutions to business and vice versa. Interactive, dynamic companies are at the core of the ecosystem. The most famous example of this characteristic is Silicon Valley, with its highly entrepreneurial, radical-thinking and risk-taking culture (Munroe, 2009; Saxenian, 2006). Supporting services are similarly important.

These include intermediary organizations, which are often local organizations such as technology centers, enterprise incubators, and development companies whose primary tasks are to facilitate the transfer and commercialization of technology, and the development of innovation networks (Koskenlinna et al., 2005).

In sum, innovation activity is linked to a certain environment and its networks. It concerns businesses and companies, research institutions, financiers, policy makers, company personnel, consumers, and other interest groups. The ecosystem approach emphasizes the position and roles of local and public actors in developing the innovation activity.

Structural change and systemic innovation

Building favorable conditions for innovation is a challenge for leaders at national, regional, and organizational levels. Often this process involves long-term, widespread structural changes (e.g. Geels & Schot, 2007). Systemic change and systemic innovations are part of the many challenges faced by modern society: energy issues, transportation systems, health care systems, reforms in agriculture, waste systems, and more. Changing a region or city into an innovation hub also requires a systemic view.

Systemic innovations are related to transitions of sociotechnical systems and are usually described by jumps or transitions. Transitions can be large, such as the transition from a rural society to an industrial one, or more restricted, like the one from telegraph to telephone. It is important that systemic innovations are related not only to technological change but also to societal and cultural changes: changes in user contexts and symbolic meanings. Today systemic innovation is often a key part of national innovation strategies (for more about Finland, see Hautamäki, 2010). However, the strategies often lack practical measures and guidelines. This lack might be because the concept of systemic innovation is still new and underdeveloped. A few approaches, however, help to understand the concept. First, an understanding of the complexity of social change is important (e.g. Streeck & Thelen, 2005; Hämäläinen & Heiskala, 2007). We need information about changes in markets, consumer behavior, politics, and culture (Geels & Schot, 2007; Geels, 2010). The general rules that affect innovation include technological possibilities, market demands, competitor behavior, and politics, but a systemic view also requires careful study of cultural contexts, people, and their beliefs and values.

Another approach to systemic change and innovation is to explore the adoption of new technologies such as alternative energy sources, electric cars, high-speed rails, or the reform of the health care system by the application of information technology. In the case of a new technology, it is important to evaluate its maturity, costs, needed changes in legislation and other related issues. In addition, the practical framework is affected by the general values of society and development of trends, such as the awareness about climate change and sustainable development. Geels (2010) points out that to address the challenges around normativity, directionality, and social mobilization we may need to study additional dynamics related to civil society, social movements, and consumer behavior. Geels (2010) also suggests that further crossovers with cultural studies, political economy, economic sociology, and consumer studies are fruitful for a comprehensive study of sociotechnical transitions

Systemic innovation, like structural change, is a learning process. The system adjusts itself and changes its operations and structures. Likewise, innovation develops through feedback and experiences. A single innovator seldom has all the know-how that is required in order to successfully implement innovations. Actors in the ecosystem are dependent on the others' resources, expertise, and connections (Kosonen, 2008; Scott & Storper, 2003). An essential part of systemic innovation is that the changes are actualized simultaneously in different sectors and arenas. In the process, a variety of interrelated factors change so that the whole system is altered – and, ultimately, improved. In our studies, we have reviewed approaches for systemic change and development. These approaches and models, such as Triple Helix (Etzkowitz, 2008) and collaborative rationality (Innes & Booher, 2010), were utilized in the structural change case study of Central Finland, and further combined and refined in order to develop a novel systematic model for building innovation ecosystems. The case study and the model are presented in the next sections.

Case study: The innovation hub of Central Finland

Central Finland's economy has its roots in the pulp, paper, and metal industries. The reasons for a strong forest industry are natural: in addition to the forests, the lakes and rivers of the region were crucial at the beginning of the industrial era (Seppälä, 2012). As in the Finnish economy as a whole, the forest products industry has been the region's most valuable and renewable resource for a long time (Sabel & Saxenian, 2008). The metal industry became important during and after the Second World War, with, for example, the first Valmet tractors being assembled in 1951. The focus of the region's economy has changed throughout its history, from sawmills to paper, cardboard, and machinery; from paper machines and guns to tractors and electronics; from gunpowder to the chemicals industry (Sabel & Saxenian, 2008). In addition, the University of Jyväskylä (founded in 1863 as a teacher's college) has been one of the driving forces of growth, attracting quality students and resources to the region. Historically, educational services have always been at the core of the region's economy. The establishment of Finland's first three Finnish-speaking schools (1858–1864) proved to be important steps for the later development of Jyväskylä and the surrounding region.

Later, Nokia's dominance in all measures of Finland's innovative capacity was striking. In 2002, Nokia was responsible for some 40 percent of total R&D spending in Finland (Sabel & Saxenian, 2008). The main cities were Helsinki, with a Nokia Research HQ; Espoo with Nokia HQ and Network products; Turku and Tampere with Nokia Research Center units; and Oulu with Nokia Network products. A Nokia Research Center was also established at the end of the 1990s in the city of Jyväskylä, a change which helped the region to become more innovative. Being an innovative region posits that the success of a region is no longer based on natural geographical characteristics such as forests, but on knowledge and the ability to renew (for innovative regions see e.g. Etzkowitz & Klofsten, 2005).

Generally, Finnish competitiveness has been based on innovation. The important forest and ICT companies have been good at generating new knowledge using internal resources such as R&D (Sabel & Saxenian, 2008). However, both the forest products industry and the telecommunications and ICT sectors have faced crises and cut down their processes. This

reduction has created challenges as well as new opportunities in the form, for example, new innovation policies. Particularly the establishment of the regional centers of expertise and competence clusters around 2007 stimulated greater cross-sector, cross-domain experimentation and new collaborations in projects that had some potential to redefine the sectors themselves (Sabel & Saxenian, 2008). The other significant change has been a public recommitment to local and regional level economies and innovation systems, with the building of a regional innovation hub being part of that new commitment.

The perspective of the current case study is the management of change, and we elaborate on how one Finnish region has overcome the most recent structural crisis in 2009–2010. Following the stage model and the Linköping case of Etzkowitz and Klofsten (2005), we have examined the development from the perspective of innovative regions.

Nokia leaves the city

In 2009–2010, the Central Finland region and its 260,000 inhabitants experienced a broad structural crisis. After the deep recession of the 1990s, the region's development strategy focused heavily on ICT expertise and as a result Jyväskylä, the largest city of the region with 80,000 inhabitants, became one of the most important information technology growth centers in Finland. The establishment of a Nokia Research Center in Jyväskylä at the end of the 1990s was also part of that process. The region was branded as a *Human Technology Center*. During this period, the traditional paper and machinery industries were also relatively strong.

However, in spring 2009, the Jyväskylä region faced a new kind of structural change. Two major employers, Nokia and Metso Paper, began to reduce their research activities. Nokia shut down its R&D unit in Jyväskylä, leaving more than 300 highly skilled professionals and researchers unemployed. Altogether, the region lost about 1000 knowledge-intensive jobs in a short period. At the same time, other structural change processes were occurring in the public sector (e.g. municipal mergers and various governance and service process renewals). Global shifts away from traditional industry towards the service economy naturally shaped the process. Similar structural development has since taken place also in other areas in Finland (Guidoum, 2010).

The operating model for structural change

The Jyväskylä region was declared nationally as a structural change area. A special Structural Change Working Group was established in collaboration with the Ministry of Employment and the Economy of Finland. The measures to overcome the crisis included support and services to the skilled workers who lost their jobs and to companies for creating new businesses. In cooperation with the University of Jyväskylä, the unemployed were also provided with the option to continue their education through PhD studies and participate in special research programs funded for that purpose by Nokia and Tekes – the Finnish Funding Agency for Technology and Innovation.

The University of Jyväskylä swiftly initiated a new operational vision with Nokia, other businesses, and the City of Jyväskylä. The successful operations of the ecosystem not only saved jobs but also created new employment and companies. The structural change program showed positive results. The 300 former Nokia employees were quickly recruited by other IT companies

(e.g. Ixonos Ltd) and SMEs of the region. By the end of 2009, 11 new companies had been founded by the professionals that were released from Nokia. By 2011, practically all the professionals fired in 2009 were again employed. Between 2009 and 2010, about 450 new ICT sector jobs were created, more than the amount Nokia terminated. Most new jobs were created by companies such as Ixonos, Digia, and Tieto. Ixonos also bought the research equipment from the Nokia laboratory and R&D activities in mobile technology have continued.

The operations covered firms, individuals, and new growth industries. What was crucial in the model is that public funding organizations, and service providers were strongly committed to cooperation and to service development. During the operating process, designated working groups were formed in cooperation with firms, local authorities, universities, research organizations, and NGOs.

Between 2009 and 2011, the situation and the expertise of the region were analyzed, modeled, and developed systematically. The human technology approach was strengthened during the process and the regional industrial clusters started to renew themselves with new spearhead branches such as education and training, well-being and health, new-generation machines and equipment, modern housing and living technologies, dynamic bioenergy, and ICT. This process was carried out within the Finnish national Centre of Excellence program. The steps taken to implement and manage this kind of systematic change are not completely unique and, for example, the European Union's new strategies, such as Horizon 2020 and Smart Specialization, build on similar operations based on each country's or region's strengths, competitive advantages, and potential for excellence.

Stages of development

The stage model has four stages, which are described below. The model provides a flexible framework to achieve the goals of knowledge-based social and economic development. For the case study we have adapted Etzkowitz and Klofsten's model to analyze the development in Central Finland, especially during and after the recession of 2008–2009. The stages provide a framework to systematize the development described above, and they portray knowledge-based regional development under a wide variety of circumstances. At stage 1, actors are at the strategic level. At stages 2 and 3, they are more operative. Then, at stage 4, they return to a strategic approach. Of course each regional development project is a unique instance with its own peculiarities, and general models should not be derived from famous cases such as Silicon Valley. However, some general elements can be identified, such as the Triple Helix and the role of the university (Etzkowitz & Klofsten, 2005; Krige, 2004). We also argue that the stage model is useful when exploring the development of innovation ecosystems and innovation hubs. The development does not have to be linear, but some linear elements can usually be found. For example, linear regional development often begins with the development of a knowledge base, and this is followed by interaction among Triple Helix actors (Etzkowitz & Klofsten, 2005).

Various actors have worked together to develop the innovation activities, and synergies in the Jyväskylä region. The region has not undergone a radical and carefully designed transformation into a knowledge-based region, but it has rapidly reacted to national and global development. When analyzing the stages in Central Finland, we have paid special attention to

activities linked to the development of the innovation ecosystem. The Triple Helix thesis in the background has helped to systematize the elements.

The first stage in Etzkowitz and Klofsten's model is the incipient stage. During this stage, the idea about a new regional development model emerges. The goal of the stage is to generate a new economic base for the region. The structure of this first stage consists of informal interaction between different actors such as a university, municipality, research labs, and large and small firms. The process includes informal meetings, discussion about regional plans, and the influence of external ideas and successful cases. Activities include initial service activities for early firms in incubators, basic infrastructure, and other aspects. We start our description of the region's development from the depression of the early 1990s, because it had a deep effect on the economy of Finland and its employment, culture, politics, and atmosphere. After the depression, Central Finland's economy was revitalized through various development projects and the emergence of a new industry, ICT. In Finland, the government's support and coordination of knowledge-based R&D had begun in 1986 when the Technology Development Center TEKES was founded, but it was in the mid-1990s when the ICT sector really started to boom. Finally, the Nokia phenomenon pushed Finland into a new phase and helped transform the country into a successful information society (Castells & Himanen, 2002). Together with Helsinki, Oulu, Tampere, and Turku, Central Finland (especially the city of Jyväskylä) was one of the main ICT regions in Finland and after the depression new focus areas were swiftly chosen. The greatest growth occurred in the electronics sector.

The second stage is the implementation stage. It means the start-up of new activities aiming for adequate infrastructure (hard and soft) for different types of entrepreneurs. The stage includes the formation of networks of entrepreneurs, and informal educational and social activities. The process includes establishing new organizations for promoting entrepreneurship, and activities such as spin-off-firms, clubs, networks, incubators, and science parks, as well as initiatives outside and inside of the university. In Central Finland, the ICT sector triumphed between 1995 and 2001. In 1996, for example, the regional development company Jykes Ltd. was established to promote business, create business environments, and improve cooperation between companies and the public sector (for Double Helix vs. Triple Helix, see Etzkowitz, 2008). In 2006, Jykes established an affiliated company, Jyväskylä Innovation, in order to further strengthen the innovation activities in the region, and the main industries of the region were reorganized around new kinds of clusters. Clusters (Porter, 1998) are seen as one step towards building innovation ecosystems that are versatile and constantly crossing industrial and organizational boundaries in order to secure a region's success. In 1994, the JAMK University of Applied Sciences was founded in order to strengthen the knowledge base of the region and its subsequent development has been successful. At the University of Jyväskylä, the current Faculty of Information Technology was established in 1998 and it has attracted significant numbers of students. In 2008, however, a severe recession once again deeply impacted the country.

The third stage is the consolidation and adjustment stage. The goal of this stage is to increase the efficiency of the system. This increase requires that regional actors cooperate to enhance the efficiency of resources in particular and also to better meet the needs of firms. The process includes forming, for example, a new networking plan and a network of support organizations. Activities include meetings between actors to define the roles and to support each

other. The new business development objectives for Central Finland were defined during 2010. The vision of Central Finland was revised and the strategies for achieving that vision were developed in the new Regional Development Plan. Another plan, the Regional Strategic Programme 2011–2014, usually referred to as the growth plan of Central Finland, was also released. In addition, in 2009 the business incubator Protomo started in Jyväskylä and created ten new startups in a year (Pitkänen, 2010). For financial support, in 2010, the regional authorities granted an additional six million euros in funding to companies in the region. The main actors in this stage were the regional development companies Jykes and Jyväskylä Innovation; the Regional Council of Central Finland; the City of Jyväskylä; the Centre for Economic Development, Transport and the Environment; the Ministry of Employment and the Economy of Finland; and the University of Jyväskylä. In development projects funded mainly by TEKES, the Regional Council of Central Finland, and the University of Jyväskylä, various new development models and tools were analyzed and promoted. The results culminated in the common goal of an innovation hub in Central Finland.

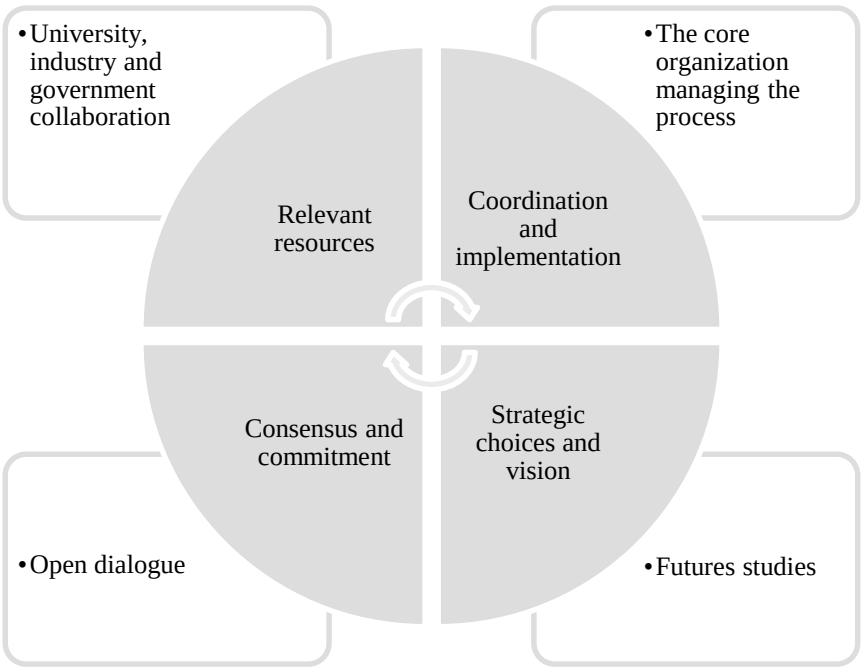
Around 2011, the City of Jyväskylä also started its largest urban development project for the next decades: Kangas-project (http://www3.jkl.fi/blogit/kangasjyvaskyla). It is a good example of transformation from traditional manufacturing towards urban living, services and culture. After 130 years of paper manufacturing, Kangas paper mill was closed by Sappi Finland Oyj in the summer 2010 and later sold to the City of Jyväskylä. The urban planning of Kangas begun with an EU-funded pilot project and continued with new participation methods that combined citizen's and communities' ideas with architecture competition. 600 people participated in the process, and 15 000 people visited the websites. The expertise of people and communities were transformed into an urban plan by the competitors of the architectural master plan competition. Early participation was done with several methods; an open web-based forum, 14 facilitated and self-run workshops, and consultation in public spaces, such as shopping centers and a pub. Also digital storytelling and graphic facilitation were used in workshops. The main development themes are based on city's strategies, need for new housing areas and the ideas of the citizens from the participatory project.

The region studied is slowly moving towards the fourth stage of development: the self-sustaining growth stage. Self-sustaining growth means avoiding decline and creating continuous redevelopment. The goal of the stage is to renew the system by identifying new areas of growth linked to new research and by questioning existing activities. The structure of the stage consists of the highest levels of the system with power and influence. The process includes discussion of what is lacking in the region, and activities include meetings in smaller groups and communication with the public through, for example, newspaper articles and brochures. It is crucial to achieve the goal of the fourth stage, because self-sustaining growth is at the core of the innovation ecosystem. By 2013 in the Central Finland, the fourth stage has not been fully reached. However, the goal has been accepted by key stakeholders such as the City of Jyväskylä, the regional development companies, and universities.

A model for transforming regions into innovation ecosystems

This section presents a systemic model for building innovation ecosystems. The model is based on our studies and experiences within the Jyväskylä region. It has been presented in Finnish in Hautamäki and Oksanen (2012). Figure 1 summarizes the methodology.

Figure 1: Model for building innovation ecosystems



Source: Authors

Our development models and methods were introduced in the first part of the article. We chose these because of their systemic approach and their ability to explain the interaction of an innovation ecosystem. The empirical exercises in Central Finland provided unique material for further developing the methodology, but the model itself is general– it is not tied to any specific country, region, or city. The model consists of four important elements.

These elements are based on Triple Helix cooperation, the method of authentic dialogue, and the concept of core organization. In addition, futures studies were chosen to complement the final methodology, because understanding and determining future trends and events have proved to be important during the structural crisis in Central Finland.

First, building up the local innovation ecosystem is often based upon the Triple Helix model (Etzkowitz, 2008). In the Triple Helix Spaces model, universities and other knowledge-intensive institutions create new know-how and build up the knowledge space. Industry and business utilize this new knowledge and develop the innovation space. The public sector acts as an enabler of the innovation environment. The process brings together different actors to brainstorm, discuss, and evaluate proposals. Cooperation between different actors is often informal, but long-term collaboration requires agreements and shared financial efforts. Including

users or citizens in the model has its own challenges, but these can be answered on a project basis or by creating more systematic forms of interaction through, for example, social media. What makes the Triple Helix Spaces model interesting is the movement and change within spaces. People change jobs and may work simultaneously in various spaces. Etzkowitz and Ranga (2010) argue that transitions and changes among the spaces are to occur in different directions as a nonlinear process, starting from any space in different regional circumstances.

Second, innovation activity is influenced by numerous actors and their interests, while traditional ways of decision making and planning give way to more collaborative actions. The basic method for collaborative rationality is open dialogue in which actors are able to express their views. Innes and Booher (2010) also emphasize informal situations and citizen participation in strategic processes within different systems. Third, formulating the core organization is one of the crucial steps in the building process. In the Triple Helix model it is formulated by developing the consensus space, a physical and/or a virtual platform for cooperation. The space brings the Triple Helix actors together to discuss, evaluate risks and promote the things that individual organizations would not be able to achieve alone.

Finally, futures studies provide the innovation ecosystem with the ability to cope with a rapidly changing world where insecurity is high. Futures studies are used to collect knowledge about the future and analyze it critically, creatively synthesizing a desirable future from the many alternatives and systematically presenting this future. This practice assists the actors in preparing for possible changes. In applying future studies and foresight, data is systematically gathered from the operational environment and future images, and visions of the mid- and long-term future are formulated (Marien, 2002). A common vision is important because all actors of the innovation ecosystem must see that their success is linked to the success of the whole system. In practice futures research consists of various surveying methods (e.g. Delphi questionnaires), scenario methods (e.g. future tables), and system methods (e.g. soft system methodology). (Hietanen, 2012; Ralston & Wilson, 2006; Keenan et al., 2003). In analyzing the building processes of innovation hubs, we found that especially in pioneering projects, the results of the futures research must be given to business operators and other possible utilizers already during the research process. Pilots, experiments, and follow-up projects should be started as soon as possible. The key is not the methods, but a multi-step process: identification, interpretation, and action.

Conclusions and next steps

The model presented in this article has implications for innovation processes, innovation management, and innovation studies. The development of innovation hubs and ecosystems is rationalized for two reasons. First, innovation hubs as specialized places of knowledge and business produce value for global networks. Second, building innovation hubs is presented as one possible response to regional structural changes and crises. The development methodology of such environments is crystallized into four concepts and development measures that need to be actualized systematically. Open dialogue is needed in order to form common views and goals. Deep and long-term collaboration between universities, industry, and government acts as a basic model for regional cooperation and agreements. Futures studies help actors to orientate

themselves to changes, recognize their own strengths and make strategic choices. The core organization is responsible for planning and implementing the measures needed, project coordination and promoting dialogue. All four components should be developed systematically. It is especially important to get all the stake holders and actors within the innovation hub to commit to a common vision.

The model is based on analyses of innovation environments and on a case study of the development of the innovation ecosystem in Central Finland. The case of Central Finland acts as a model for overcoming a rapid structural crisis. In Central Finland's case, this crisis meant a severe recession in 2008–2009 and the reduction by two major employers of their production in the region. In summary, the model we have developed provides one approach to managing structural change and adds to the fields of innovation research and regional development. Such a methodology is motivated by the notion that in many places all over the world there is a real need to better utilize regional resources, and to gather local strengths in order to develop innovation ecosystems and centers.

As the structural change in Central Finland is still in progress, more research is needed to strengthen and modify the model according to new experiences and additional data from this case and other comparable cases. Similarly, more research is needed in order to address the dynamics of systemic change and its implications on innovation environments. Given the limitations of this study, the presented development path cannot act as a universal guide for overcoming a structural crisis, but the results provide valuable insights into systemic change and the building process of innovation ecosystems.

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