Vaasan yliopisto
UNIVERSITY OF VAASA

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The Ostrobothnian Model of Smart Specialisation

PROCEEDINGS OF THE UNIVERSITY OF VAASA
REPORTS 195

Julkaisija	**Julkaisupäivämäärä**	
Vaasan yliopisto	Marraskuu 2014	
Tekijä(t) Seija Virkkala Antti Mäenpää & Åge Mariussen (Toim.)	**Julkaisun tyyppi** Toimitettu julkaisu	
	Julkaisusarjan nimi, osan numero Vaasan yliopiston julkaisuja. Selvityksiä ja raportteja, 195	
Yhteystiedot Vaasan yliopisto Filosofinen tiedekunta/ Aluetiede PL 700 65101 Vaasa	**ISBN** ISBN 978–952–476–576–3 (print) ISBN 978–952–476–577–0 (online)	
	ISSN ISSN 1238–7118 (print) ISSN 2323–6833 (online)	
	Sivumäärä 178	**Kieli** Englanti
Julkaisun nimike Älykkään erikoistumisen Pohjanmaan malli		

Tiivistelmä

Älykäs erikoistuminen on EU:n uusi kasvustrategia, jota luonnehtii uusien alueellisten liiketoimintamahdollisuuksien yrittäjämäinen etsiminen, sektorirajat ylittävien toimintojen tunnistaminen ja kehittäminen sekä toimintojen priorisointi. Sen keskeinen piirre on ns. triple helix -toimijoiden eli korkeakoulujen, yritysten ja julkisten organisaatioiden välinen yhteistyö. Julkaisussa esitetään tutkimustuloksia näiden tahojen yhteistyösuhteiden, eli relaatioiden rakenteesta ja toiminnasta Pohjanmaalla. Tutkimus perustuu 53 haastatteluun ja yhteistyön rakennetta mitataan mm. kumppaneiden sijainnin ja tärkeyden kautta. Yhteistyötä analysoidaan myös ns. gap/kuilu -indeksillä, joka on tiettyyn relaatioon kohdistetun osa-alueen odotuksen ja kokemuksen välinen erotus. Tämän avulla saadaan tietoa yhteistyöverkoston pullonkauloista sekä hyvistä ratkaisuista.

Tulosten perusteella Pohjanmaan innovaatiojärjestelmä on yritysvetoinen ja toimijat ovat suhteellisen tyytyväisiä paikallisiin yhteistyökumppaneihinsa. Suhteet ovat tosin epäsymmetrisiä, sillä yritykset tekevät yhteistyötä eniten muiden yritysten kanssa ja julkisen hallinnon toimijat sekä korkeakoulut nojaavat niin ikään enemmän yhteistyöhön yritysten kuin omien sektoreidensa kanssa. Pohjanmaan verkostot ovat kuitenkin yhtenäisiä, sillä yhteistyön odotusten ja kokemusten väliset kuilut ovat suhteellisen pieniä. Erityisesti korkeakoulut ja energiateknologiayritykset ovat hyvin verkostoituneita. Melkein puolet haastatelluista kertoi teknologioiden kehittämisen kumppaneiden sijaitsevan Pohjanmaalla ja alueella on vahva yrityksiä ja korkeakouluja yhdistävä teknologiatausta.

Pohjanmaan älykkään erikoistumisen malli on kehittämisväline, jota voidaan käyttää älykkään erikoistumisen suunnittelussa EU:n eri alueilla. Malli koostuu kyselytutkimuksesta, gap -analyysistä, ryhmäkeskusteluista, kehittämistoimenpiteistä ja arvioinneista. Tavoitteena on tunnistaa yhteistyön kuiluja ja kehittämistoimenpiteitä ehdotetaan näiden kuilujen pienentämiseksi, uusien yhteyksien luomiseksi tai heikkojen yhteyksien vahvistamiseksi.

Asiasanat

älykäs erikoistuminen, triple helix, yhdistävyys, alueellinen innovaatiojärjestelmä, gap -analyysi

Publisher
University of Vaasa

Date of publication
November 2014

Author(s)
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Antti Mäenpää &
Åge Mariussen (Eds.)

Type of publication
Edited Publication

Name and number of series
Proceedings of the University of Vaasa. Reports, 195

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P.O. Box 700
65101 Vaasa
Finland

ISBN
ISBN 978–952–476–576–3 (print)
ISBN 978–952–476–577–0 (online)

ISSN
ISSN 1238–7118 (print)
ISSN 2323–6833 (online)

Number of pages
178

Language
English

Title of publication
The Ostrobothnian Model of Smart Specialisation

Abstract
Smart specialisation is a new growth strategy within the EU that can be characterised by regional level entrepreneurial discovery, identification and development of cross-sectoral activities, selection and prioritisation of the activities under development, and experimentation. One important aspect is the connectivity of triple helix actors (companies, universities and public organisations). This report describes findings derived from a survey about connectivity in the region of Ostrobothnia. The dynamics of the network were analysed with the help of gap indexes between expectation and experience concerning a group of relationships. These indexes provide information about the bottlenecks and good solutions among the relationships of the actors. A detailed questionnaire was prepared and tested, and 53 interviews were conducted in the autumn of 2013.

The major finding was that the innovation system in Ostrobothnia is business oriented and relatively well connected. The relations are asymmetric: companies mostly have connections with other companies and both the public and university sectors rely more on the companies than on their own sectors. The networks in Ostrobothnia are locally embedded and cohesive, so gaps are relatively small. The analysis shows that universities and energy technology companies in particular are well connected through their regional triple helix. Almost half of the partners in technological development come from the region, and there is a shared regional technology platform between the universities and the companies.

The Ostrobothnian model is a development tool that can be used in smart specialisation planning across the EU. The model consists of surveys, gap analysis, focus group meetings, policy measures and evaluation followed up by a repeat of the procedure. The gaps are identified, and policy measures are suggested to bridge the gaps, create new links and strengthen the weak ones.

Keywords
smart specialisation, triple helix, connectivity, regional innovation system, gap analysis

PREFACE

This publication is the final report of a project on smart specialisation in Ostrobothnia. The project was initiated by Jerker Johnson from the Regional Council of Ostrobothnia. He also produced the project plan and selected the project's participants. The project was implemented from December 2012 to April 2014. The other members of the project group were Niklas Ulfvens and Irina Nori (Regional Council of Ostrobothnia), Seija Virkkala, Åge Mariussen and Antti Mäenpää (University of Vaasa, Regional Studies), Josu Takala, Daryna Shylina and Sara Tilabi (University of Vaasa, Industrial Management), Christian Johansson and Peter Björk (Hanken School of Economics, Marketing), Kenneth Norrgård and Kimmo Paulaharju (Vaasa University of Applied Sciences, Information technology) and Åsa Hagberg-Andersson (Novia University of Applied Sciences).

The project on smart specialisation in Ostrobothnia is a continuation of the Regions of Knowledge project (RESGen), which was built up as a triple helix concept and as an AMCER (Advanced Monitoring and Coordination of EU R&D Policies at Regional Level) project within the ESPON programme. Ostrobothnia participated in this study with seven other regions. The AMCER project benchmarked the Ostrobothnian regional innovation system with other participating regions providing an outsider view for the region. The project on smart specialisation in Ostrobothnia, based on the findings of these former research projects, aimed to have a regionally structured dialogue on innovation and related policies.

The ideas of the Ostrobothnian model and the related questionnaire have been developed in partnership with many educational institutes and researchers. Industrial management researchers led by Josu Takala developed Sustainable Competitive Advantage (SCA) methods including gap analysis inside companies. Mariussen, Mäenpää and Virkkala applied gap analysis in the context of a regional triple helix, and planned the model used in the survey. They also planned the questionnaire for the triple helix actors. The other project group members, in particular Jerker Johnson, offered valuable comments on the model and to the questionnaire. We also received useful comments about the questionnaire from Håkon Finne (Sintef, Norway) and Elias Carayannis (George Washington University, USA) at a seminar on 15.3.2013 and in the seminar 'Measuring Quadruple Helix Connectivity: Towards a Strategy for Smart Regional Governance' on 13.5.2013. The survey and the Ostrobothnian model for smart specialisation were presented by Jerker Johnson in a peer review seminar of the S3 Platform in Vaasa on 14.5.2013, and he received valuable feedback. Subsequently, the survey was presented at many scientific conferences.

The final questionnaire was challenging for the respondents, and we warmly thank those who gave their valuable time to fill in the questionnaire. The difficult task of conducting interviews with the rather complicated questionnaire was carried out by Antti Mäenpää.

During the project, connectivity analysis was developed as a method of regional development policy. This method includes the survey, gap analysis, focus group meetings, policy measures and evaluation. This report presents a connectivity analysis, which we believe is the first step in the smart specialisation strategy of Ostrobothnia. In the concluding chapter, we present our follow-up suggestions for the smart specialisation programmes both in Finland and in Ostrobothnia.

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1 INTRODUCTION

Antti Mäenpää & Seija Virkkala, University of Vaasa: Regional Studies

1.1 Objectives of the Study

The aim of our publication is to describe the connectivity of triple helix actors in the region of Ostrobothnia and to introduce a method that can be used in smart specialisation planning in Ostrobothnia and other regions of the EU. This development tool is called the Ostrobothnian model of smart specialisation.

The analytical starting point of our tool is the model of the connected–disconnected region (Goddard & Kempton 2011) based on a triple helix setting between companies, universities and public administration. The triple helix framework and the model of the connected-disconnected region are seen in a context of regional innovation. The basic hypothesis is that the greater the extent to which different triple helix actors are connected to one another the more innovative the region becomes. Therefore it is crucial to analyse and measure the structures and functions of different triple helix relations.

In this study, we map the connections between and within triple helix actors based on methods of social network analysis. The depths of triple helix relations are also studied with the help of the gap analysis approach developed by Ranta and Takala (2007). This method was originally used to measure the operations and risk levels inside companies and was adapted in this study to work for the regional level and between various types of actors.

This background led to the current Ostrobothnian model. Our model for smart specialisation consists of surveys, gap analysis, focus group meetings, policy measures and evaluation. We also use the knowledge taxonomies developed by Lundvall and Johnson (1994) in the framework of the method. We are still testing the connectivity model, but we expect that it can be used as a more general method of regional development policy in other contexts and regions.

According to our main findings, Ostrobothnia is a relatively well connected region but the relations are asymmetric: companies mostly have connections with other companies and both the public and university sectors rely more on the company sector than on their own sectors. It therefore seems that Ostrobothnian innovation systems are business driven.

Smart specialisation strategies and regional innovation policies can be directed towards nurturing new industries, on the one hand, and towards increasing the innovation potential of the existing ones on the other hand. Regional authorities should seek a good balance between these two tasks. The new industries can be nurtured by searching for new combinations of existing technologies or activities. This process is described in the literature of evolutionary economic geography by the term 'related variety', and it is found at the core of the entrepreneurial discovery process. The study on smart specialisation in Ostrobothnia was concentrated more on the development of the existing industries and on the enhancement of their innovation potential by analysing the structure and function of the triple helix network. However, connectivity analysis can be seen in light of entrepreneurial discovery, particularly when the gaps, holes, missing and weak links are identified, and when policy measures are suggested to bridge the gaps, fill the holes, create new links and strengthen the weak ones.

The rest of this chapter introduces the smart specialisation concept, with an emphasis on the smart specialisation project in Ostrobothnia via six steps of the Guide on Research and Innovation Strategies for Smart Specialisation, also known as the RIS3 Guide (Foray et al. 2012). Chapter 2 discusses the role of smart specialisation strategies among other regional development tools in Finland. Chapter 3 introduces the conceptual framework of our study and the basic research questions. The methodology will be described in Chapter 4, which presents the questionnaire and explains the data collection method. Chapter 5 presents the statistical analysis of the empirical findings of our survey. Chapter 6 illustrates data based on Sustainable Competitive Advantage method, and provides another view of the results. Chapter 7 summarises and interprets the empirical findings, and discusses research challenges. It presents connectivity analysis as a regional development model that can be used to prepare and to evaluate development programmes like smart specialisation strategies and transnational learning. In the final chapter, we describe the connections between national (INKA) and regional programmes and suggest further steps for regional smart specialisation strategies in Ostrobothnia and Finland.

1.2 What is Smart Specialisation?

The European Union (EU) has struggled to stimulate the economy of Europe for nearly a decade now. As more production-based work is transferred to Asia, Europe needs good ideas to enhance and sustain its growth. During one brainstorming session in the 2008 Knowledge for Growth seminar in Barcelona, a group led by Dominique Foray came up with a solution for a new European development strategy: a smart specialisation strategy (Foray, David & Hall 2009; Midtkandal & Sörvik 2012; Mariussen 2013: 1). The answer to the challenges of globalisation and economic crisis facing Europe is to create new growth through innovation based on smart specialisation.

The EU is now building an innovation union with a regional innovation policy initiative that includes smart specialisation. Smart specialisation is a strategic approach to economic development through targeted support for research and innovation. It is the basis for European Structural Fund interventions and is part of the region's policy contribution to the Europe 2020 jobs and growth agenda (S3 Platform 2014). According to the S3 platform (2014) smart specialisation:

"...involves a process of developing a vision, identifying competitive advantage, setting strategic priorities and making use of smart policies to maximise the knowledge-based development potential of any region, strong or weak, high-tech or low-tech".

The EU initiated several regional innovation policy programs, of which smart specialisation is the third (RIS3). Many concepts of smart specialisation are recognisable from the earlier initiatives and reveal roots within innovation system theory and science-based R&D, but these concepts are now developed into a multi-dimensional policy approach involving matters of regional development policy (McCann & Ortega-Argilés 2013). Smart specialisation differs from the earlier European level regional innovation strategies because it aims to be an integral part of regional development planning. It reflects the ambition of the European Commission to integrate research policy (Horizon 2020), innovation policy, and the regional development policies of the Structural Funds.

What does *smart specialisation* mean? Are some economic activities better than others? What kind of development is really the smartest? How do the Europeans determine what is best for all the different regions and countries within Europe? Well, they do not, and that is the whole idea.

Europe contains many different countries and regions, each with its own system for development and innovation, and with a distinct economic background. Thus,

the smart specialisation strategy needs to differ in different regions and cannot be formulated on a national level alone. There might be significant differences between regions dedicated for international export or agriculture for instance. Different regions have different challenges and also unique abilities to solve them (Midtkandal & Sörvik 2012.)

Thus, being smart is not copying other regions' great ideas, particularly if the regions differ significantly from the home region. Essentially, the idea is to make a strategy for one's own region based on its strengths. That is why it is crucial to have real experts from the region involved in the development of the strategy. Smart specialisation strategies can be based on existing strategies, as long as those are made for the region in question and can be empirically proved to be accurate (Foray et al. 2012: 8, 11, 18).

Evidence-based strategy is another important aspect of the smart specialisation concept. Essentially, one can separate smart specialisation into two parts: *smart* and *specialisation*. The smart part has a couple of components. First, the region has to have some knowledge-based on empirical studies and research that provides an accurate strategic framework (Foray et al. 2012: 8; European Commission 2013: 10). This helps regional politicians make better decisions and discuss strategy with other regional actors. Evidence-based strategy and broad discussions might also gather wider support in the implementation phase of the strategy.

Second, the concept of *smart* emphasises the role of research units such as universities, or laboratories. In order to promote regional, and therefore, European development and cohesion, cooperation between regional actors and researchers is crucial. Universities are considered to be the key enablers of regional cooperation and are important partners for the other actors of the region (Foray et al. 2012: 40; Etzkowitz & Leydesdorff 2000: 109–110).

Third, the notion *smart* also means that economic activities will be more research based. For example, tourist regions and sectors can be developed with research on the experience economy, and the marketing and organising can be based on the application of information technology.

Proper research capabilities are important for the *specialisation* part of the smart specialisation strategy. Different regions can compete on the global market as much as possible based on the idea of specialisation. Every region within Europe should have its own distinct area of expertise. Related research concerning these areas is very important in the long run, because without research, the development of the regional specialisation might not reach its full potential (Foray et al. 2012: 8; European Commission 2013: 10).

Specialisation or prioritisation is probably the hardest part of the strategy for many regions. There should not be too many objectives or areas for specialisation. If the development funds spread out to all possible objectives, then none of the actors receive enough funds to fully develop. The regional actors should select only a limited number of high-priority economic activities and these should be based on empirical evidence, as the strategy aims to further enhance the existing knowledge base and regional-based skills. Smart specialisation means concentrating knowledge resources and linking them to prioritised activities. This allows regions to take advantage of scale, scope and spillovers in the production and use of knowledge (Foray et al. 2012: 11, 14–15; Midtkandal & Sörvik 2012; Foray & Goenega 2013: 4).

Emphasis is placed on export-oriented activities that provide income for the regional economy. Entrepreneurial expertise is required for strategy formation because entrepreneurs know about the markets, including their challenges and opportunities. Additionally, entrepreneurial expertise can be found in universities and public organisations, particularly if there are not many companies in the region (Foray et al 2012: 12, 92; Midtkandal & Sörvik 2012).

The entrepreneurial process of discovery is in itself an essential part of smart specialisation. It means that regional actors and partnerships are searching for new business opportunities and evaluating them just as companies do. Regional actors should study the markets they target with their main export items and assess the labour and infrastructure conditions. Then, the regional developers should encourage cooperation among the different partners: companies, universities and public actors. Regional entrepreneurship is a way of creating new growth and of providing a new way of marketing (branding) the regional economy via specialisation.

An important component of smart specialisation is also cross-sector coordination. Such coordination links innovation and science policymaking with Structural Fund strategies of place-based regional and national development. This has been done before, through specific programmes such as the Region of Knowledge programme. Now, it is becoming mainstream. This is being accomplished in a way that borrows heavily from the regional planning methods of the Structural Funds, where bottom-up processes and place-based development are high on the agenda. Part of this process of cross-sector discovery includes peer reviews of mutual learning. The smart specialisation platform, funded by the EU in 2011 and based in Seville, organises conferences and seminars for the regions in which participants can present their smart specialisation strategies and receive feedback from experts from around Europe.

In summary, smart specialisation represents a place-based approach to economic development. The essential characteristic of the strategy includes linking research and innovation with economic development in new ways. Examples include the entrepreneurial process of discovery and the setting of priorities by policymakers in close cooperation with local actors (Foray et al. 2012: 15).

Smart specialisation builds on earlier theories of regional innovation and innovation policies while reflecting new theoretical notions. The importance of interaction between companies and other actors (universities, public organisations) is emphasised in regional innovation system theories (Cooke, Boekholt & Tödtling 2002; Cooke, Heidenreich & Braczyk 2004), and they were the basis of earlier regional innovation policies of the EU like the Regional Technology Plan (RTP), the Regional Innovation and Technology Transfer Strategy (RITS) and the Regional Innovation Strategy (RIS), across the 1990s and 2000s. Innovation as such has become a core element in regional development policies (Morgan & Nauwelaers 1999).

Previous EU policies to support regional innovation strategies took into account and developed place-based strategies to focus on the unique assets and strengths of the region. When identifying investments in innovation, regions need to diversify starting from their existing strengths and skill base, with the application of generic technologies to regionally specific industries and considering the connectedness within and between regions (Charles, Gross & Bachtler 2013).

Smart specialisation can be seen as the synthesis of different frameworks, and therefore some concepts might acquire new meaning. For example, the concept of 'related variety' developed in the field of evolutionary economic geography, meaning that regional economies can grow when they diversify into sectors similar to the existing regional knowledge base (Frenken, Van Oort & Verburg 2007: 687). In the smart specialisation context, related variety is then the identification and development of relevant cross-sectoral activities. The novel insight is that smart specialisation policy should concentrate on activities instead of sectors or firms. Foray (2011) calls this level of intervention 'granularity'. For example, a region should develop eco-tourism and not tourism as a sector or specific tourism firms. Alternatively, a region could support nanotechnology applications in the modernisation of the pulp and paper industry and not the industry or specific firms as such.

The second novel insight is the process of entrepreneurial discovery. According to the business theory advanced by Kirzner (Shane 2003) entrepreneurs are continually searching for, identifying and evaluating new business opportunities and this process is called entrepreneurial discovery. According to Foray and Rinoldi

(2013), entrepreneurial discovery at the regional level is what regional policy makers and developers should do, focusing on the activities instead of sectors. Again, this reflects the granularity principle of Foray. The policy makers can search for the entrepreneurial knowledge and discoveries to realise a regional vision. They should be able to differentiate between simple innovation and discoveries that have the potential to generate new areas of specialisation and that might constitute the cornerstone of smart specialisation (Foray & Rinoldi 2013).

The third new notion found within smart specialisation is experimentalism. There is no guarantee of success in any particular action; indeed, some actions will lead to failure. Smart specialisation relies on the theories of experimental learning based on Sabel (1992) and on Sabel and Zeitlin (2010), and it develops the idea of self-discovery elaborated by Hausman and Rodrik (2003). According to the argument, innovation policy needs to allow for experiments in order to discover what works and what does not work in a particular context. Failures must also be noted in order to identify success. The idea of discovery and experimentation points to the role of indicators and evaluations (McCann & Ortega-Argilés 2013).

The concept of inclusiveness, new to regional innovation policy, suggests opportunities for all sectors in the regions, even if all sectors or activities cannot be supported. As described earlier, the prioritisation of activities with potential for regional growth is essential for smart specialisation. However, prioritisation will change over time, and eventually new priorities will be identified.

Geographically, the area of cooperation, networking and development is growing as the level of specialisation is narrowing. Most regions rely on global value chains, including flows of knowledge and trade, through access to transnational communities of shared knowledge.

1.3 Six Steps to a Successful Smart Specialisation Strategy and the Smart Specialisation Project in Ostrobothnia

One way to further understand the smart specialisation strategy is to look for information on how to create a successful strategy. These six steps for a smart strategy are from the RIS3 guide, which has been created to act as a handbook for smart specialisation (Foray et al. 2012: 27). The different steps are:

1. Analysis of the regional context and potential for innovation.
2. Governance: Ensuring participation and ownership.
3. Elaboration of an overall vision for the future of the region.
4. Identification of priorities.
5. Definition of coherent policy mix, roadmaps and action plan.
6. Integration of monitoring and evaluation mechanisms.

Following these steps should enable regions to create their own strategies for smart growth. However, these steps only provide the framework for a successful strategy. Thus, the order of steps may vary, and at some point a region might need to return to the beginning and conduct further analysis before adapting the final version of the strategy (Foray et al. 2012: 17; Mariussen 2013: 3). We will illuminate the smart specialisation project in Ostrobothnia via these steps.

Step 1 begins with an analysis of the regional economy and its capability for innovation. This is a rather crucial step as the analysis provides the basis for the entire strategy. There are numerous examples of how to analyse regional properties. One might research the economic background, history, demography and other factors. There are many proper methods, and which are used depends on how sound they are and how relevant to the specific region (Foray et al. 2012: 29–30).

The point of departure for a discussion on smart specialisation in Ostrobothnia is that the region lies at the centre of Finland's energy technology industries, as its largest cluster in the Nordic countries lies within the hinterland of the regional capital, Vaasa. However, Ostrobothnia is also known for two other strong export-related clusters: boat building and fur farming. There were several studies conducted on these industries that helped to prove their importance for other regional actors. So, the basis for the specialisation was already clear for the Regional Council of Ostrobothnia and other stakeholders. Furthermore, the basic characteristics of the innovation system in Ostrobothnia were based on findings of other research projects like AMCER, a project of the ESPON programme concentrating on the comparison of eight regions in Europe (AMCER Report 2012); however, the analysis did not stop there.

At the end of 2012, the Regional Council of Ostrobothnia wanted to develop a tool for smart specialisation (as explained in Chapter 4). The Regional Council used the experience of the region's experts in order to measure the connectivity of the triple helix actors in the region through spesific questionnaires. The interviewer also asked about cooperation with the main industries, which confirmed that three industries (energy technology, boat building and fur farming) were important for different helix actors. The emphasis was on the cooperation of the regional actors rather than on single industries, although these were also noted.

Step 2 addresses the governance of the strategy and ensures the participation of regional actors. It is important to invite all the regional actors to the process of creating the strategy, as they have the practical knowledge of the region. According to the instructions formerly presented in the guide book, companies and universities should be highly appreciated partners in this mutual planning (Foray et al. 2012: 21). In Ostrobothnia the smart specialisation project of developing and testing the gap analysis method was organised as can be seen in the Figure 1.1.

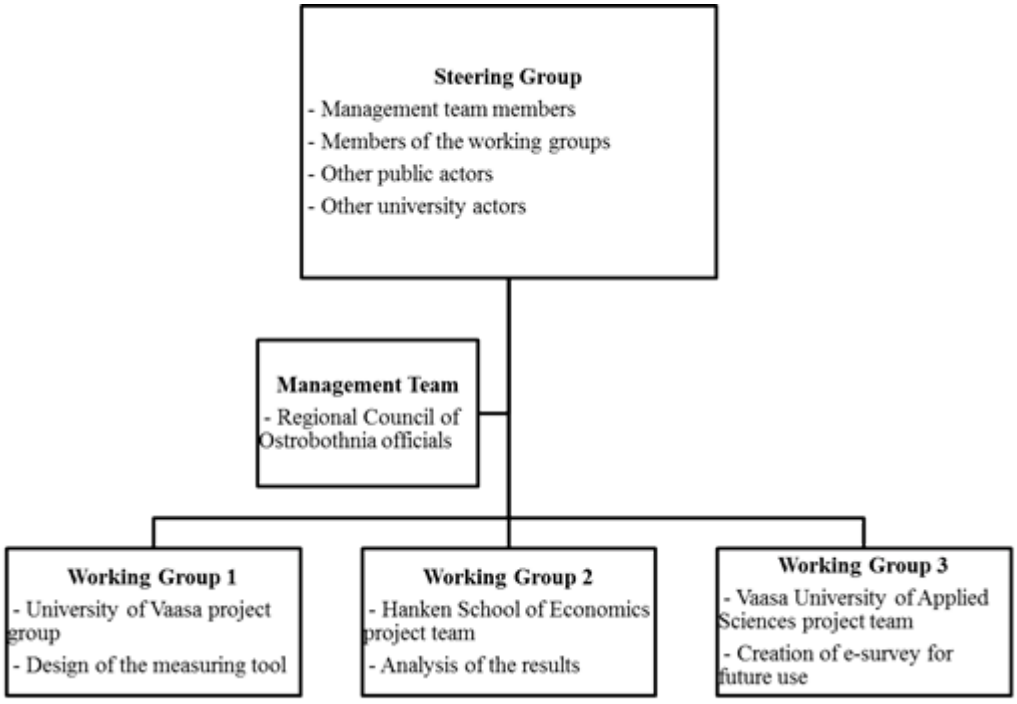

Figure 1.1. The governance of the Ostrobothnian smart specialisation project

Several university project groups and officials from the Ostrobothnian Regional Council were involved in the project work. All members of the working groups and management teams held positions in the steering group. However, this was not a group with the authority to make strategy decisions. There were no company representatives within the project group, but companies were involved as the findings from the survey were introduced and discussed in three focus groups where different industries spoke for themselves.

Step 3 concentrates on the creation of a shared vision for the region's future. The idea is to create such an attractive vision that all the regional actors would want to be part of it. A good vision should map a route to new economic opportunities

and address societal challenges; therefore, this vision should represent broad interests (Foray et al. 2012: 22, 45–47). The overall vision of the smart specialisation project in Ostrobothnia was constructed on the idea of a 'Connected Region', which can also be the long term goal of the Regional Council and one tenet of a smart specialisation strategy.

Step 4 addresses the identification of priorities. The idea is to choose specific and achievable objectives for the use of development funds. These can be different types of projects, or they can promote one type of technology, particularly one of the key enabling technologies. The idea is to set clear examples of smart specialisation and outline its benefits; therefore, the priorities should be chosen accordingly (Foray et al. 2012: 52; Saublens 2014).

According to the approach in the study, the priorities are defined through gap analysis. Gaps are differences between expectations and experiences of triple helix actors concerning cooperation with other actors in the selected three sectors in Ostrobothnia. These priorities most likely involve the promotion of cooperation through mutual projects or can be used for creating forums that promote cooperation among certain industries or sectors. The smart specialisation strategy in Ostrobothnia might include other priorities based on, for example, new activities and new combinations of technologies.

Step 5 concentrates on the definition of coherent policies and all the other planning involving the implementation of the project. After the priorities are clarified, this is usually the next step to set the strategy process into motion. The basic idea of this step is to set timetables, and provide funds for projects and create plans for their implementation. One example could be a project that studies the possibility of introducing one of the key enabling technologies to a regionally important industry (Foray et al. 2012: 23).

The smart specialisation project in Ostrobothnia encourages suggestions for policy measures after identifying the largest development challenges in the cooperation between triple helix actors. For example, suggestions for concrete plans will be discussed in the focus groups with stakeholders. In Chapter 8 we will suggest development programmes for Ostrobothnia based on the findings of gap analysis.

Step 6 is about monitoring and evaluating the process. Monitoring refers to the actions done to ensure that the strategy is properly prepared and concentrates on the former five steps and their implementation during the process. Evaluation should be made after a strategy has been implemented and there are some results to evaluate. The basic idea is that the strategy is properly pursued, with clear indications of its achievements (Foray et al. 2012: 24, 59; Saublens 2014).

The smart specialisation project in Ostrobothnia, in terms of its evaluation and monitoring stage, uses the gap index as an output indicator for a smart specialisation strategy aimed at improving the connectivity of the region. The policy measure with an objective for better connectivity in the region is a success if the gap index of the specific relationship is reduced after the policy intervention. The idea is to repeat the measurement so as to identify bottlenecks in the triple helix network.

The project provides insight into the smart specialisation strategy in Ostrobothnia, particularly through the measurement of connectivity and through the project's modelling of regional development policy. The model helps to identify the development challenges and responds by bridging the gaps through policy interventions discussed with relevant stakeholders. The gap index can also be an indicator when evaluating the success of a specific policy intervention. This input is only one source of the smart specialisation strategy (Table 1.1). The smart specialisation strategy as a policy programme is still in development, and there remains open questions such as those surrounding entrepreneurial discovery. In Chapter 8, the smart specialisation strategy in Ostrobothnia will be presented in relation to the INKA programme.

Table 1.1. The input of the smart specialisation research project to the smart specialisation strategy in Ostrobothnia

Steps in the smart specialisation strategy	**Smart specialisation in Ostrobothnia -project; possible input to smart specialisation strategy**
Analysis	Connectivity of triple helix actors: structure and functioning of the actor network, technology partners
Governance	Project governance Stakeholders engagement in focus group meetings
Elaboration of an overall vision	'Connected region' Development of selected sectors
Identification of priorities	Gaps between expectations and experiences of triple helix actors in the three selected sectors
Definition of policy mix	Measures to bridge the observed gaps
Monitoring and evaluation	Repetition of the survey: Have the gaps been bridged?

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2 THE ROLE OF SMART SPECIALISATION STRATEGIES IN REGIONAL STRATEGIES

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The purpose of this chapter is to analyse the shortcomings of the current regional planning system and to describe the added value of preparing Regional Innovation Smart Specialisation Strategies (RIS3). This chapter will provide the rationale for the smart specialisation project in Ostrobothnia and explain the reasons behind the solutions adopted in the Ostrobothnian model for RIS3.

2.1 The Planning Instruments

The point of departure in programme based regional development is that regional development is not an issue for any single institution but requires wide cooperation in the use of regional development resources. The Law on Regional Development and the Administration of the Structural Funds (2014/7) stipulates that the responsibility for regional development lies with the municipalities and with the state. Regional Councils, as joint municipal organisations, were established to administer this dual responsibility. They are governed by their own political body with a basis in municipal elections and represent the regional development authority and have an obligation to provide planning documents expressing regional 'political will'. The documents are also expected to incorporate state initiatives and plan their implementation regionally. In this way the Regional Councils are assigned a role of mediating between state and regional desires in order to promote a smooth functioning regional development system.

The *Regional Strategy* document defines the most important development efforts in the region and is a combination of the desired long-term development goals, necessary strategic choices, development strategies and the most important projects in terms of regional development. To implement the *Regional Strategy* the Councils prepare an *Implementation Plan* every two years. This includes the most important projects and other measures executing the Regional Strategy and other development programmes, together with details of the required financing.

The *Spatial Plan* is a general plan outlining the use of land in the region or parts of the region. The plan sets out the principles of land use and community structure and designates areas requiring regional development. The purpose of the plan is to settle national, regional and sub-regional land use issues. It is used as a gui-

deline when drawing up and amending local master plans and detailed local plans, and when other measures are taken to organise land use.

However, these documents, written in general terms, are legally non-binding and usually used as a basis for negotiations with the state government. The Regional Strategy finds its concrete form in the Implementation Plan that is essentially a tool for influencing the state budget. The Spatial Plan is approved by the Ministry of Environment after consultations with the Regional Councils. After being approved it will provide the framework conditions for detailed local plans.

2.2 Challenges in Forming Tools for Regional Innovation Policy

The ambitious task of combining all development measures in one document may sound attractive but is an illusion in practice. Below, we will argue the case and explain why the political process of setting up the documents will not necessarily provide a list of development measures in terms of importance, when considering innovation. Previously, there was an emphasis on innovation, but this has become more pronounced with the introduction of smart specialisation as a central tool in regional policy aimed at fostering innovation and competitiveness.

The Regional Strategy is being taken at face value as representing the political will of the region. When expressing that will, the political parties function as gatekeepers, and with existing institutions they define the agenda. This is an important democratic process but does not necessarily foster competitiveness, as it is claimed to do. Competitiveness that requires innovation is connected to continuous structural change with both ‘sunrise’ and ‘sunset’ industries. The sunset industries are most likely to lobby the political process and, pointing to visible effects, can provide strong political arguments; in contrast, sunrise development is academically more difficult to discover and do not have political advocates as the visible positive effects are only gradually emerging.

In addition to industry, public administration has a strong involvement in the process. Structural changes also modify the service needs and duties of administrative actors. Experience has shown that there are strong inter-ministerial rivalries when different ministries are not *de facto* prepared to open the content of their regional programmes for consideration and when they are not prepared to discuss their budgetary resources. Additionally, when facing budget shortages there is an increasing desire from a national level to coordinate EU policies with national ones or subordinate them.

The discussion between the municipalities and the state is problematic because the actors have different competencies and will focus their interest and gain experience in different fields. Development planning, linked to programme planning and the regional implementation of the European Structural Funds, differs from municipal planning, with its strong emphasis on spatial planning. This renders the Regional Councils quite weak, as they do not possess the resources of state actors or the strong support of municipalities, except when municipal politicians also hold high state-level political positions.

This weak position can also be observed in the planning documents. The AMCER study labels the Ostrobothnian regional innovation system governance 'dirigiste', implying that the primary source of initiative lies outside the region and that the financing is centrally determined with decentralised units in the region. The planning is supposed to prepare for the local implementation of these central initiatives. Analysing the contents of the Plans of Implementation in 2005 revealed how similar the programmes were for the five regions comprising the West-Finland Alliance (Johnson & Mäkinen 2005). The role of the universities in development was a prominent feature of the agenda in all regions, but was even more pronounced in those regions lacking their own regional universities. The obvious conclusion was that the plan was seen as a way to secure funding by communicating political support for investments rather than as a sound analysis of the regional innovation system. The logic behind this action is that the development objectives would materialise via the implementation of the actors' proposals. Therefore, the role of planning is not strategic but simply to trigger funding. Nevertheless, single applicants cannot be given complete responsibility for regional development, particularly in situations when the objectives are vague.

A place-based approach would be a valuable learning journey to make better and more informed decisions. For instance, the findings of the smart specialisation project in Ostrobothnia confirm one result of the AMCER project that was already known in Ostrobothnia: The RIS in Ostrobothnia is business-driven, and not university-driven, something that requires a different approach.

Linking plans of implementation to budgetary practices hinders the development of the strategic process. Regions are encouraged to make choices in planning. Those choices are expressed in the verbal parts of the plan, but since this process includes a prisoners' dilemma, the regions will argue their case in relation to every budgetary item. This was observed in the 2005 study where each region solicited more funding on each budgetary item and thereby disqualified themselves from being serious discussion partners. However, this is an obvious outcome as there are no quotas or mechanisms through which regions might swap financing

according to strategic ambitions. The conclusion is that the planning process forms a political platform for regional political action rather than for a strategic process.

2.3 Novelties Provided by the Smart Specialisation Process

The European Commission (EC) has tied the administration of Structural Funds to regional planning. With the introduction of smart specialisation and the ex-ante conditionality for ERDF (European Regional Development Funds) financing, the EC has also introduced innovation as a target for regional planning. In the Ostrobothnian approach, this is manifested in the consideration of the most urgent gaps in the RIS and by finding appropriate measures to bridge these gaps. This differs from the traditional perspective adopted in regional planning which seeks to coordinate and mediate political desires. Coordination is important to guarantee the smooth functioning of regional administration but does not necessarily promote innovation.

The Ostrobothnian smart specialisation model is a *place-based solution*. It was created on the basis of the concrete development problems identified in the Ostrobothnian RIS by the AMCER project. It is based on a model where long-time leading exporters are assumed to be at the forefront of innovation. It is a commonly accepted fact that firms working in an international environment also tend to be more innovative. In this case it was also confirmed by counting the number of registered patents by the European Patent Office (EPO). In order words, it can be claimed that the model is an *evidence-based model*.

Previously, the export industries had been in focus when considering regional development measures but were not addressed in a systematic way. The final report of the AMCER project called for *triple helix coordination*. This has been applied and the triple helix discussion is now formalised around innovation partners and key enabling technologies. A method to measure the triple helix connectivity was introduced; and connectivity is in the model assumed to be connected with innovation. This transfers planning from a political process towards a stakeholder process focusing on bridging gaps in the innovation system. The vision of the model is one of a *connected region* which is defined as one where the helix innovation partners within and between the helixes have both high ‘experience’ and high ‘expectations’. Studying and bridging gaps forms the basis for policy, and where the regional level is not an appropriate level, the results form the basis for a multi-level dialogue on regional innovation.

The study on the regional plans of implementation was conducted in 2005, but there is no reason to believe that the meta-logic of preparing the plans has changed, even though the environment or context has changed. There is a stronger quest for innovative measures in planning just as the financial outlook is becoming dire. Available resources have diminished and this is likely to continue. This puts the focus on *entrepreneurial discovery* on spotting new opportunities. The concept should be understood as not only applying to firms but also as including new ways of working for all the helix categories. Repeating the structuralised dialogue by analysing gaps in the innovation network, combined with focus group seminars, is assumed to foster new ways of working. This will be combined with a similar analysis in partner regions where the regions can learn from one another by comparing and contrasting scoring and reasons behind the results. In addition to the dialogue among the stakeholders, the process was fitted with an interactive web-application. It is hoped that this will further benchmark the innovation discussion outside the partnerships and provide feedback for consideration.

2.4 Conclusions Regarding Novelties versus Challenges

The challenges presented above were due to the different perspectives held by various actors in regional development and the meta-logic behind the financing. The essence in the novelty provided by the smart specialisation process lies in visionary leadership. The model, with subsequent analysis, provides a vision of innovation as a process of innovation by related variety. It also provides a framework for gradual learning among the actors.

It is believed that this model will gradually influence the actors involved, depending on whether the project gains regional momentum and political support. The economy remains volatile, and the planning work is undergoing major administrative changes. In this context, actors are likely to consider new ways of working.

The method promotes horisontal coordination through an annual triple helix dialogue. The actions based on dialogue are dynamic and have a basis in identified gaps. The method will provide the means to constantly address the challenges involved in the implementation of the RIS. This problem-based approach differs from the administrative approach previously applied.

The Councils have been participating in a dialogue with the Ministry for Economy and Employment to prepare the ERDF programme and the national innovation strategy for smart specialisation. Although it has been known since autumn

2011 that RIS3 will be an *ex-ante* condition, little national attention was paid to the issue. Instead, lengthy discussions and arm twisting over the governance model took place, and the content of the innovation strategy was left to the eleventh hour. This project reverses that perspective, making learning and cooperation the centre of attention.

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3 INNOVATION, NETWORKS AND CONNECTIVITY AS A PRECONDITION FOR REGIONAL DEVELOPMENT - CONCEPTUAL FRAMEWORK OF THE STUDY

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This chapter introduces the conceptual framework of a smart specialisation study in Ostrobothnia. The key concepts are innovation, networks and connectivity. The chapter concentrates on regional innovation studies, the triple helix thesis and network analysis. While regional innovation studies emphasise business innovation, the triple helix framework points to the important and changing role of universities. The triple helix framework is used to shed light on the connectedness between actors. These two approaches are seen as complementary approaches to the problem of innovation.

First, we aim to describe the connectivity of regional triple helix actors in Ostrobothnia, and second, we introduce a regional policy method which can be used for smart specialisation in Ostrobothnia and possibly in other regions in the European Union (EU). This chapter aims to provide the theoretical building blocks for connectivity analysis and for a regional development policy model. The theoretical background of gap analysis developed by industrial management researchers is introduced in Chapter 6.

The final part of the chapter will sum up the conceptual framework and formulate research questions.

3.1 Systemic Innovation Concepts, Regional Innovation Systems, and Knowledge Typologies

Due to the challenges of globalisation, regional economies and firms have to continuously renew and reinvent themselves in order to remain competitive. Innovation has been seen both in theory and in practice as the driving force of national and regional economies, and the response to the challenge of regional renewal has been innovation and regional innovation policies. Almost every region has innovation potential but this capacity differs between regions due to the different histories and institutional and economic structures established in the past. According to Cooke, Heidenreich & Braczyk (2004), this variety of innovation potential should be recognised. Different industries innovate differently, and there are also different innovation modes.

Innovation can be defined as a new creation with economic significance. It can be seen as a process that results in new processes, products, markets or ways of organisation, according to Schumpeter. According to a broad definition, innovations are *new solutions and continuous renewal of firms, regions, and nations*. Traditionally, innovation has been conceptualised as a linear process from basic research via technology or applied research to commercialisation in the firms. However, today the world is more complex and innovation is conceptualised as a systemic and interactive process (Lundvall 1998). According to the innovation system literature, innovation processes are seen as interactions between and within firms, and between firms and other organisations such as educational and research institutes and government agencies. Innovation processes and innovation networks are the basis of economic development in the regions. The more complex the innovations are, the more firms need different types of technologies and competences, as well as knowledge produced outside the firms by research institutes and knowledge-intensive business services (KIBS) for example (Varis & Littunen 2012). Complex innovation suggests an even greater need for cooperation between firms and universities as has been conceptualised in the triple helix model.

In the theories of regional innovation or geography of innovation, the regional level is seen as the most appropriate spatial level for studying innovation processes, the critical actors involved and the factors contributing to this innovation. The emphasis on the regional level in innovation studies originated with Alfred Marshall's industrial district concept, and later expanded to include many theories and concepts such as clusters, new industrial spaces, technology districts, local production systems, innovative milieus, learning regions, regional innovations networks, and regional innovation systems. In the late nineteenth century, Marshall attributed the spatial clustering of industries to specialised labour markets, local access to specialised suppliers and large markets, and to the presence of local knowledge spillovers. These concepts share an emphasis on the region as the loci of production and innovation activities (Moulaert & Sekia 2003). In this article, we discuss two of these theories: the regional innovation system (RIS) and the triple helix framework, which can be seen as complementary approaches to the renewal of regions. While RIS points to innovations in firms, the triple helix framework emphasises the new role of universities. To be effective, innovations should draw upon the capabilities of the region.

3.1.1 Regional innovation systems

The notion of the RIS has been popular both in academic literature and in policy practice. The term has been used and interpreted in many ways. A regional innovation system (RIS) can be defined as interacting knowledge creation and exploitation subsystems linked to global, national and regional systems (Cooke et al. 2004). In this definition, the knowledge generation subsystem consists of public and private research laboratories, universities, higher educational institutes (HEIs) and technology transfer agencies. The exploitation subsystem is understood as the regional production system consisting of firms. The RIS approach emphasises the role of innovation networks as well as of intermediary organisations transferring the knowledge between knowledge institutions and firms. Firms in regional clusters or a RIS can acquire knowledge for innovation from knowledge institutions in their regions, from national institutions or from institutions in other countries. The regional firms can be embedded in national systems, and simultaneously participate in global value chains and product networks (Virkkala 2013). An RIS may take many different forms, affecting the way innovation processes and collaborative relationships are organised (Asheim & Isaksen 2002; Cooke et al. 2004). RIS normally contains and supports several clusters representing different sectors, and as an open system, RIS can generate knowledge dynamics across different sectors.

The region of Ostrobothnia was one of eight European regions that participated in a project of ESPON programme comparing different RISs and their performance. The AMCER project used a typology of regional innovation system developed by Cooke et al. (2004). In the project, RIS was defined by a governance dimension and by a business innovation dimension (AMCER Report 2012). Governance comprises public policy, institutions, and knowledge infrastructure as integrated parts of the regional innovation processes. Three types of RIS can be identified: grassroots, network, and 'dirigiste'. Grassroots is the regional level where the innovation system is generated and organised. Financial support and research competences are diffused regionally, with little supranational coordination. Regional development agencies and regional institutional actors play a dominant role (Cooke & Morgan 1998). A network RIS is likely to occur when the institutional support encompasses local, regional, federal, and supranational levels, and funding is guided by agreements among banks, government agencies and firms. The research competences are likely to mix pure and applied research, and exploration and exploitation activities are geared to the needs of large and small firms. The level of coordination is quite high, due to the existence of many stakeholders as well as associations and forums. The degree of specialisation is more flexible than dedicated, because the system hosts various firm scales and types (Cooke

1998). A dirigiste RIS is animated mainly from outside and above the region itself. Innovation often flows from central government policies. Funding is centrally determined, with decentralised units located in the region. Research competences are predominantly basic and often linked to the needs of larger, state-owned firms in or beyond the region. Since the system is state run, the coordination level is potentially quite high and the degree of specialisation is also likely to be high (Cooke 1998).

The business innovation dimension (Cooke et al. 2004) is linked to the industrial base characterised in terms of productive culture and systemic innovation. Of special interest is the role of lead firms, the emphasis given to private or in-house research over public research and the nature of the innovation milieu in which firms operate. There are three different forms of RIS resulting from this dimension: the 'localist', the interactive, and the globalist. In the localist form, RIS is dominated by smaller firms, and there will be a reasonably high degree of association among entrepreneurs, as well as between entrepreneurs and local policymakers. A localist framework will probably have few major public innovation or R&D resources, and some smaller private ones (Cooke et al. 2004). An interactive RIS is one where there is balance between large and small firms. Larger firms with regional headquarters, with the regional government, are keen to promote the innovation base of the economy. There is a mix of public and private research institutes. The association in local and regional industry networks, forums, and clubs is about average. In the globalised RIS, the innovation system is dominated by global corporations, often supported by clustered supply chains of dependent small- and medium-sized enterprises (SMEs). The research reach is more private than public, although a public innovation structure aimed at helping SMEs may have developed. Cooperation is based on the needs of large enterprises, and conducted to a significant extent on their terms. Ostrobothnia was characterised as a dirigiste and globalised RIS.

3.1.2 Knowledge typology and modes of innovation

Knowledge exists in many forms and emerges in complex systems of research, business, and public spheres as well as inside organisations. Codified knowledge consists of information that can be written in an explicit form. Tacit knowledge is acquired through experience, demonstration, and practice, requiring personal physical interactions. According to Nonaka and Takeuchi (1995) knowledge is created within and between organisations in the interaction with the tacit and codified knowledge through a 'knowledge spiral'.

According to Lundvall and Johnson (1994), knowledge is a various mix of codified and tacit elements and is defined in aspects of 'know-how', 'know what', 'know-why' and 'know-who' as follows:

- *Know-how* defines how things are going in practice, the fingertips how to perform skills.
- *Know what* is knowledge about facts (like facts on regions, inhabitants, industrial structure) and it describes what is going on.
- *Know-why* is knowledge that explains why things are done in certain ways (or theories of the reasons of development), the principles and laws of nature, in the human mind, and of society.
- *Know-who* identifies the actors and partners, and also who is authorised to make decisions. It is knowledge regarding who knows what (Lundvall and Johnson 1994).

These dimensions of knowledge will be used in the smart specialisation survey to define the depth of the relationship concerning respondent's knowledge of his/her partner. The deeper the relationship, the more dimensions the respondent knows about his/her partner's activities relevant to innovation. This knowledge taxonomy will also be used as a theoretical framework of the regional development model based on connectivity analysis.

Jensen et al. (2007) introduces two modes of innovation: science, technology and innovation (STI) and doing, using and interacting (DUI). The STI mode of learning and innovation is based on the production and use of codified scientific and technical knowledge, whereas the DUI mode is an experience-based mode of learning that relies on informal processes. The STI mode prioritises the production of 'know-why' while the DUI mode typically prioritises 'know-how' and 'know-who' (Jensen et al. 2007). 'Know-how' and 'know-who' are typically tacit, while innovations mainly focus on incremental changes in existing products and processes. In the DUI mode, crucial knowledge in innovation processes is formed through a combination of the employees' education and work life experience. The knowledge base is developed through in-house problem-solving by individuals and teams of workers, and this emerges, for example, when firms cooperate with customers who are facing new problems, and when suppliers engage in innovation activity (Jensen et al. 2007; Isaksen & Karlsen 2010; Virkkala 2013). The DUI mode is based on synthetic and symbolic knowledge (Market/user-driven) emphasising competence building and organisational innovations, but analytical knowledge is more important in the STI mode of innovation.

3.2 Triple Helix and Connected-Disconnected Regions

The triple helix model, based on close interaction between universities, companies and public institutions, was launched by Etzkowitz and Leydesdorff (2000; Leydesdorff & Etzkowitz 1998). In this article, the triple helix model is used as a heuristic for empirical study of connectivity, which is seen as a precondition for regional innovation processes. A 'helix' refers to the spiral ways in which various bodies are intertwined, as for example a double-winding staircase (Qvortrup 2006).

The operating codes of the helices are different. The scientific system communicates and functions in accordance with the code of true/false, and it uses a great deal of energy on testing its own results, academic discussion and falsification attempts for example. The research system observes itself by the development and use of methods and theories, since these are the way to generate new knowledge. New knowledge is inherently important, whether it is useful or not (Qvortrup 2006 based on system theory of Niklas Luhmann 1995).

The economic system communicates and acts in accordance with the code of profit/loss. The system is result-oriented and competition is seen as an incentive to raise productivity and to reduce costs, and the business plans are important (Qvortrup 2006). Companies make their special contributions, which are useful products and services and financial profits. However, the companies also observe the outside world via this optic: they attempt to impose targeted behaviour on both the scientific system and the public sector, encouraging both parties to focus on use-value.

The public sector communicates and acts in accordance with the code of right/wrong: services are supplied rightly or wrongly in relation to politically defined needs, meaning they are politically correct or incorrect. The public sector observes itself and its own degree of success via a politicised optic. The public sector supplies special products like welfare services. It regulates private companies' behaviour on the basis of collective welfare criteria (Qvortrup 2006). The public sector also regulates and plans the institutions supporting innovation in the regions (See Table 3.1).

Table 3.1. Three helices and their tasks according to the system approach (based on Qvortrup 2006 and Etzkowitz and Leydesdorff 2000)

Character	**Science**	**Business**	**Public sector**
The operation code	True/false	Profit/losses	Right/wrong
Way to operate	Theories, methods, Verification, falsification	Results, business plans	Governance of other sectors
Self-evaluation	Peer reviews	Profitability	Implementation of decisions and political plans according to criteria: democracy etc.
'Products'	Articles, reports, books	Products and services	Welfare services, guidance of regional development
Time horisons	Long	Short	Short/long

In industrial society, universities and business entities were more independent under the guidance of the state. Today in the knowledge society, these sectors or helices are more engaged in interaction, with overlapping domains. When the helices are overlapping, each of the helices takes the roles of others. Former boundaries between private and public research and applied research are crumbling. Research that had been previously conducted in universities has now been redefined, and new forms of cooperation and institutions for research work have been developed. Universities emphasise entrepreneurial tasks, such as creating companies, while industrial enterprises take on the academic dimensions of sharing knowledge and training employees. The third mission of economic development has emerged to supplement the earlier missions of university teaching and research (Etzkowitz & Leydesdorff 2000). According to the triple helix thesis, the potential for innovation and economic development lies in a more prominent role for the university and in the hybridisation of elements from universities, industry and government. The non-linear interactions between the helices can generate new combinations of knowledge and resources that can advance innovation at the regional level (Ranga & Etzkowitz 2013).

The institutional spheres of universities, industry and government interlink in different ways, and the triple helix model exhibits variants in different regimes (Etzkowitz & Leydesdorff 2000). In a statist regime, government plays a leading role driving academia and industry but also in limiting their capacity to initiate and develop innovative transformations (Russia, China and Latin America). In a laissez faire regime characterised by limited state intervention (USA, Western Europe) industry is the driving force, with the other two spheres as ancillary sup-

port structures and limited roles in innovation: universities acting mainly as providers of skilled human capital, and government mainly as a regulator of social and economic mechanisms. The institutional spheres have strong borders, and highly circumscribed internal relations. In the transition to a knowledge society, a balanced regime is emerging, whereby universities and other knowledge institutions play a greater role, acting in partnership with industry and government and even taking the lead in joint initiatives (Etzkowitz 2008). This variant denotes a knowledge infrastructure that takes the roles of the other and that produces hybrid organisations. The objective is to realise an innovative environment consisting of university spin-off firms, tri-lateral initiatives for knowledge based economic development and strategic alliances among firms, government laboratories and academic research groups (Etzkowitz & Leydesdorff 2000; Tuunainen 2002). According to the triple helix balanced model, the best environments for innovation are created at the intersection of the spheres (see Figure 3.1). This is where creative synergies emerge and spark the process of innovation, and create new venues for interaction and new formats (Etzkowitz & Leydesdorff 2000). In the intersection of these helices are found hybrid organisations, which in our case study are local development organisations acting as bridge builders between firms, universities and public sector, developing the regional economy and supporting local firms with knowledge of extra-regional networks.

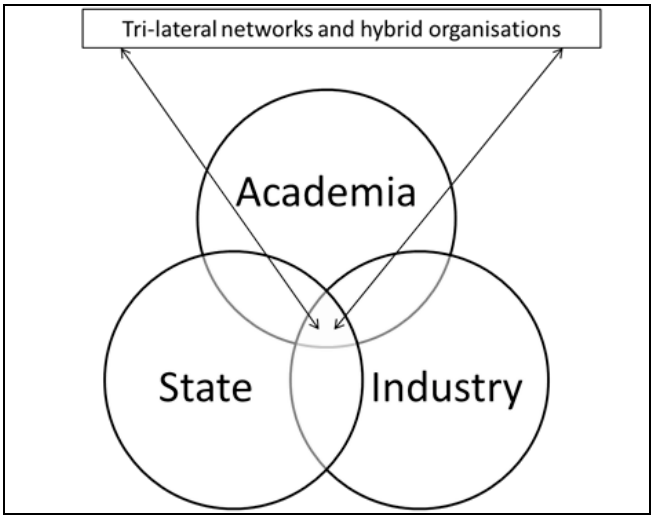


Figure 3.1. Triple helix, balanced model (Etzkowitz & Leydesdorff 2000: 111)

The notion of a quadruple helix refers to other actors besides universities, firms and public sector actors. These are users of innovations and this fourth helix can be seen as representing civil society, as well as an organisational counterpart of an open and user-centred innovation policy (Foray et al. 2012: 37). According to Carayannis and Campbell (2012: 17), the fourth helix represents media, culture and civil society. User reflections are important in producing many products and services that aim to improve living conditions. In the triple helix model applied in the Ostrobothnian survey (see Figure 3.2), media and culture sector are included but not as a separate helix; instead they are part of either the public or business sectors. The interest groups important in the Nordic corporative societies, such as trade unions, employers' unions, and farmers' unions can be counted in the public sector. In addition, hybrid organisations such as development organisations were counted as part of the public sectors whereas media was part of business sector. Caryannis and Cambell (2012) include the fifth sector representing the environment, but in our framework, the fifth sector (which is quintuple helix) was represented by the environmental authorities in the public sector. Therefore, the framework used in the survey contained elements of five helices, but empirically had three helices (Mäenpää 2014: 35–43).

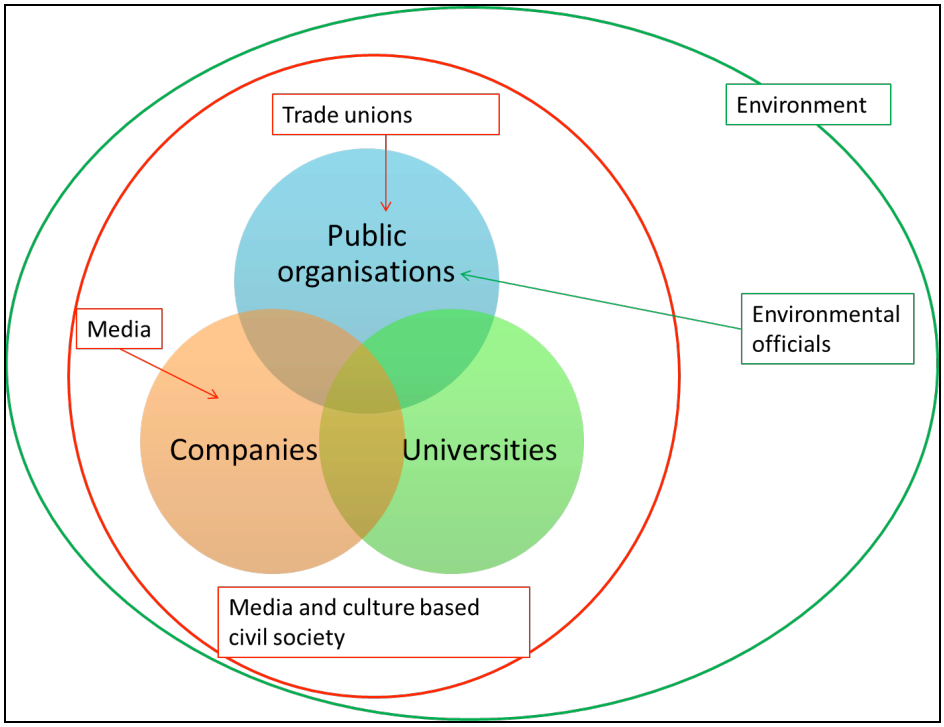


Figure 3.2. The triple helix model applied in the Ostrobothnian smart specialisation survey (Mäenpää 2014: 42)

The concepts based on notions of a triple helix and a quadruple helix, which are used in regional innovation policies, and especially in smart specialisation, are *connected and disconnected regions*. A connected region is a norm or vision according to which the actors of different helices are working in the same direction and linked to economic development and innovation. The three helices work in harmony with one another, thereby mutually reinforcing each other (European Commission 2011; Goddard, Kempton & Vallance 2013). In a connected region, the universities, industry and government coevolve and interact through an overlay of recursive networks and organisations (Dolfsma & Leydesdorff 2009).

"The public sector speaks with one voice in their understanding of the issues facing the region and how to overcome them, and has the mechanisms and political will to build consensus. The private sector has a coherent and representative voice and the willingness to work beyond the parameters of the self-interest of their business/sector. There are synergies between the intellectual asset of the region's universities and the needs of business in developing innovation capacity. The universities in the region see themselves as being for the region and not just of the region and are willing partners in the process." (Foray et al. 2012: 46).

In a disconnected region, there are no boundary spanners, the partnerships are ineffective or non-existent, and there is a lack of understanding about the changes. Entrepreneurs are locked out of regional planning. The more connected a region the more innovative it is. The regions are located along this axis of connected-disconnected, and in the study on smart specialisation in Ostrobothnia we try to discover to what degree the triple helix networks in Ostrobothnia are connected. The idea of a connected region can be seen as a vision or target that the region should achieve.

However, we have some reservations concerning the relation between connectedness and innovation. Firstly, the regions are open and they are embedded in different spatial scales. This is also mentioned in the RIS3 guide (Foray et al. 2012) that points out local embeddedness and relatedness. We later address extra-regional networks with the help of the concept of proximity. Secondly, there might be problems if helices force their own principles on the others. Thirdly, another problem is the basic hypothesis on the causality between the connectivity and regional innovativeness.

Concerning the second reservation, Qvortrup (2006) points out that the boundaries between universities, industry and state are not to be erased but that the mutual contact among them is instead to be intensified, with their relationships made more flexible and intertwined. The individual parts are at the same time both se-

parate from one another and yet closely interlinked (Qvortrup 2006). A precondition of a connected region is that it respects the relative autonomy of each of the functional systems mentioned. If one makes the research system too business minded, then one prevents it from generating new knowledge. If one places too many restrictions on companies, then one reduces their production of goods and services. If one makes public institutions effective, then they might find it difficult to meet their duty to provide public welfare. Structural couplings should be established between these functional systems, so that one system produces services that the other cannot supply. The public sector produces the general conditions for both companies and research institutions: infrastructure and public regulation, for example (Qvortrup 2006).

According to the RIS guide (Foray et al. 2012), the connected region should be considered within the framework of the influence of national policies, and a related consideration is the extent national higher education, science and technology policy have territorial dimensions. However, other policies may be spatially blind and work against building links between universities and the region (European Commission 2011: 46–47). For example, the Finnish universities are presently funded by the state through their results in education (number of bachelor's, master's and doctoral degrees) and in research (journal publications, etc.) and not through their third tasks such as their social service mission. These are the challenges of multi-level governance.

3.3 Network Analysis: Networks by Helices, Proximity Concepts and Gaps

Networks play a central role in the creation and diffusion of new knowledge (Camagni 1991). Networking reflects the growing interactivity in innovation processes. The more networks there are between the actors located in different helices, the more the helices are interacting and the more connected a region is.

In the network analysis, the starting point is a relation between the actors. The interest is both in the relations and positions of individual members in the social network as well as in the networks as a whole. When analysing these relations, concerns can include the quantity of relations (dense vs. sparse), the content of the relations and their meaning. A relation can have a direction (Johansson, Mattila & Uusikylä 1995), for example, when knowledge is transferred from one member to the other member. The networks consist of nodes and ties. In our study, the nodes are the organisations located in different helices and the ties are the relationships between the organisations. A relation in network is the basic analytical

unit in our empirical study. Our key interest is in meso-level relations, specifically the relations among and within helices.

Networks can be local and regional as well as transnational, and they can be multi-layered and multi-scalar. Networks contribute to knowledge creation and information diffusion through two mechanisms, one through networks creating buzz or flows of information within the cluster, through spatially proximate relationships among employees, firms and state agencies (Bathelt, Malmberg & Maskell 2004). Thus, the geographical proximity of actors favours an innovation process in which tacit knowledge is important, and in which knowledge and best practices are shared locally. The results are unique local competences, skills and tacit knowledge. Knowledge embedded in the local environment can diffuse spontaneously through 'local buzz'. Local buzz is transferred through personal contact and present in meetings (Storper & Venables 2004; Virkkala 2013).

Second, networks establish pipelines between local and non-local firms to exchange information and knowledge. An innovative region should be locally embedded, but at the same oriented towards a wider market. The knowledge from extra-regional networks might be valuable and complementary to local knowledge. In order to absorb useful knowledge from outside the region, local actors should have absorptive and development capacity, and there should be local or regional innovation networks. The benefits of local and extra-local ties are complementary, and with the help of extra-local networks, the local networks might develop the capacity of a regional environment and actors to avoid the lock-in situations especially in the cases of sectors or clusters with diminished global markets. Many authors suggest a mixture of local and non-local linkages to be best for firms, and combinations of a local 'buzz' and global pipelines to be best for the long-term evolution of clusters (Bathelt et al. 2004; Aoyoma, Murphy & Hanson 2011).

We are interested in both regional and extra-regional networks, and we are studying the degree to which innovation networks, based on triple helix relations, are embedded locally, nationally or globally. The content of the relations varies according to the partners involved (for details on innovation and support see Chapter 4).

We will distinguish between two properties of networks. They have a structure, which may be centralised or distributed, and relations in networks may be characterised by high and low levels of connectivity, which we measure as gaps (see Table 3.2).

Table 3.2. Network structure and connectivity

		Connectivity	
		High	**Low**
Structure	**Centralised**	'Gangs' with leaders Several strong ties combined with holes	Hierarchical, segmented (silos) some strong ties, many gaps or holes
	Decentralised/ diverse	The strength of weak ties	Fragmented (no or insignificant networks)

A centralised network structure with a low level of connectivity, measurable as observable gaps or holes (relations with no or low expectations), may be seen as a network corresponding to a hierarchical organisation with top-down coordination. Here, actors at the lower levels relate to others at the same level through the centre. For reasons of efficiency, the centre in this type of organisation prevents coordination at the same level. The criticism of this model is that it easily results in silos, with actors working on the same topic without knowing of one another.

Unlike this situation, a centralised network with high connectivity may be seen as a 'gang,' where everybody is related to everybody else, but at the same time with clear leaders in specific positions. A gang is internally integrated, but it may have weak relations to its environment. These weak relations may be seen as either gaps or holes (see Table 3.2). Typically, a gang leader might be the actor communicating out of the gang. Gangs may be seen as productive and competitive, but at the same time, one might expect that they are lock-ins, networks which are unable to search for and discover new directions.

A network with a diverse (decentralised) structure and a high level of connectivity (both weak and strong ties) is seen as an 'ecology,' where the 'strengths of weak ties' permit several combinations and re-combinations (entrepreneurial discoveries).

Building a regional network is a way of mobilising resources, especially in situations where resources are widely dispersed among public and private actors. There are different types of networks, but we are especially interested in networks among universities, businesses and public organisations. We assume that innovation networks are business driven, that research networks are university driven and that regional development networks are driven by public organisations. However, the actors of other helices can participate in all of three types of networks.

Our interest in regional development networks, defined as loose policy networks, lies in their innovation support, that is, the ways these types of networks are supporting innovation in the region. Policy networks are a specific form of governance characterised by public-private interaction in public policy. The policy network consists of public, semi-public and private actors such as local governments, political and societal groups, pressure and interest groups, societal institutions and private business organisations, all of which are dependent on each other's resources and competences. Regional development networks contribute to the production of public purpose within their particular policy field; that is, through visions, values, plans, policies and regulations aimed at the general public (Virkkala 2013).

Table 3.3 shows different networks based on the initiator and the helix. All networks also have actors from other helices. For example, if a public actor leads regional development networks then it has universities and firms as representatives. Different types of networks aim at different types of knowledge: innovation networks aim for knowledge that can be used for products and process innovation within organisations, and regional development networks aim for knowledge needed for the design and implementation of institutions at the private and public level. In their protocols, institutions include formal and informal rules and habits established to reduce uncertainty in society and in their region (North 1990). Actors in regional networks have a common discourse and common context of knowledge creation within which they as a group communicate through discourse. Networks are emerging, transforming and changing over time. They have also long-term and short-term prospects (Virkkala 2013.)

Table 3.3. Different types of networks by helices

Characteristics of network	**Regional development networks**	**Innovation networks**	**Research networks**
Main helix actor (initiating actor by helix)	Public organisation	Business driven	University driven
Type of knowledge	Knowledge needed for the design and implementation of institutions for promoting innovation and for the innovation frameworks	Knowledge to be used in products and process Codified knowledge Tacit knowledge	Knowledge needed for understanding and explaining phenomena
Codes	Regional development aims, welfare	Profit	Truth
Type of network	Loose policy network	Network based on STI or DUI innovation modes Development activity	Research teams Basic research Applied research

Based on the triple helix framework, which highlights the interconnections between the three helices, our aim is to discover the extent to which Ostrobothnia is a connected region and what the most important issues are in order to improve the functioning of the innovation network. The connectivity can be studied through network analysis:

– by identifying the partners of the actors in each helix as well as their locations in the triple helix structure and in different geographical scale,
– by evaluating the importance of these partners by helices and by geographical scales, and
– by mapping how well connected the three helices are both internally and externally.

What is needed for the presence of relations between different actors is conceptualised by the different dimensions of proximity, including geographical, organisational, social, cognitive and institutional proximity (Boschma 2005). Proximity is required in some dimensions, but not necessary all of them, to connect actors and to enable interactive learning and innovation.

Geographical proximity refers to the distance between two units in kilometres. It is relative in cost and time and may represent a constraint for economic actors intending to interact (Torre & Rallet 2005). Geographical proximity is beneficial for innovation because effective learning requires face-to-face interaction. Such interaction is easier to organise when agents are co-located. Geographical proximity may be helpful in overcoming cultural and other barriers between different types of organisations in helices with different cultures.

Organisational proximity refers to proximity along with common rules and routines of behaviour, for example the units in different locations of the same organisational arrangement. Organisational proximity is beneficial for establishing innovation networks because it reduces uncertainty and opportunism. Social proximity is based on personal linkages formed through joint education, social backgrounds or social events. Relations based on similar backgrounds are important carriers of knowledge exchange. Social proximity may play an important role in knowledge spillovers.

Cognitive proximity refers to the distance between the cognitive base (knowledge base) of actors, and some level of cognitive proximity is necessary for the emergence of interactive learning processes. People or firms sharing the same knowledge base and expertise learn more from one another than if the cognitive distance is great. Institutional proximity covers joint formal and informal rules, which

reduces uncertainty (Boschma 2005, 2009). Institutions are enabling mechanisms that provide stable conditions for interactive learning. In the triple helix context, as with the university-industry-government configuration, different helices can be seen as institutions and we find more institutional proximity among organisations inside one helix. University, industry and government actors operate in different institutional regimes that have different codes of operation.

The different dimensions of proximity can explain the formation of networks. The dimensions can be correlated and there is interplay between them. One can expect proximity dimensions in innovation networks to be substitutes rather than complements. To establish a successful relation, one needs proximity in at least one dimension to manage the uncertainty. Ponds, van Oort and Frenken (2009, according to Boschma 2009) found that geographical proximity is especially important in the establishment of university-industry-government (U-I-G) relationships (where institutional proximity is low) and less important in U-I-G collaboration, where actors operate under the same institutions (where institutional proximity is high) (see Table 3.4).

Table 3.4. Different dimensions of proximity in the relations of a triple helix framework

Dimension of proximity	**Degree of proximity**	
	High	**Low**
Geographical	Relation between actors in the region	Relation between actors in the region and abroad
Institutional (helices)	Relations between firms Relations between universities Relations between public organisations	Relations between actors in different helices
Cognitive (knowledge base)	Similar knowledge base of actors, actors in the same cluster	Different knowledge bases of the actors
Social	Relationships based on friendship and reciprocity	Formal relationships
Organisational (type of network)	Relationship between one type of network, between units of a global firm or the same public sector (like environment)	Different type of networks

A high degree of proximity is a prerequisite for forging connections among agents. However, when assessing the economic effects of networks, proximity between agents in networks does not necessarily increase their innovative performance, and may even harm it. According to Boschma and Frenken (2009), the

level of proximity between agents affects whether their connection will lead into a higher level of innovative performance or not. The success of a network relation may be related to optimal levels of geographical proximity, social proximity, institutional proximity, organisational proximity and cognitive proximity as well as to a balance between local and non-local links. Thinking in terms of the triple helix framework and institutional proximity, an optimal level requires operating simultaneously in different institutional regimes, such as local development agencies or KIBs cooperating with industry, government and academia.

The proximity concept can be used analytically in the triple helix context; the presence of a relation can be seen as a close proximity between partners independent of the dimensions of proximity. An actor has expectations of the relationship if his or her respective partner is close enough in at least one proximity dimension. The relationship can be strong or weak depending on the level of expectation and experience of the actor concerning the relationship. Furthermore, the strength of the relationship can be measured between the gap of expectation and experience on the relationship. This gap analysis originated from industrial management (seen in Chapter 6 in the report) but applied at regional level to describe and analyse the functioning of networks between and within helices.

3.4 Regional Development Policy Model Based on the Connectivity of Networks and Gap Analysis

The strength of relationships can also be used in regional development when identifying the bottlenecks and barriers of the networks. When both expectations and experiences of the relationship are high, the relation can be seen as strong, indicating a good solution in terms of regional development policy. This solution can then be highlighted as good practice by regional development actors, and other actors could learn something from the strong relationship. When both expectations and experiences are low, the relation is weak. However, when expectations are high and experiences are low there is a development challenge that should raise concerns for regional development planners. With the help of gap analysis, we can identify the relationships that should be developed in order to improve the functioning of the networks. Action should be taken through policy interventions. There can also be holes in the networks when the actors have no relation at all but the presence of a relation could be favourable for the regional innovation and development. This case is a challenge for local development organisations and boundary spanners whose task is to link different actors and create connectivity and cohesion in a fragmented system (see Table 3.5).

Table 3.5. Proximity concept of the triple helix relation: towards a model of connectivity in regional development policy

Relationship	Proximity			
	High	**Intermediary**	**Low**	**No proximity**
Expectation/ Experience	High expectation and high experience	High expectation Low experience	Low expectation Low experience	Absence of relation
Gap	Small gap	Large gap	Small gap	Absence
Role in regional development policy	Best practice in a connected region	Development challenge	Weak relationship Structural hole in the network?	Structural hole in the network?

Gap analysis can be used as a method to deliver a tailor-made policy focusing on the specific bottlenecks of the regional economies. The relations should be more detailed than just between companies, companies and universities or companies and public organisations. For example, the relation between companies and public organisations might differ in employment issues, environmental regulation, spatial planning, technological development or business development. This also requires different ways of examining and covering the gaps.

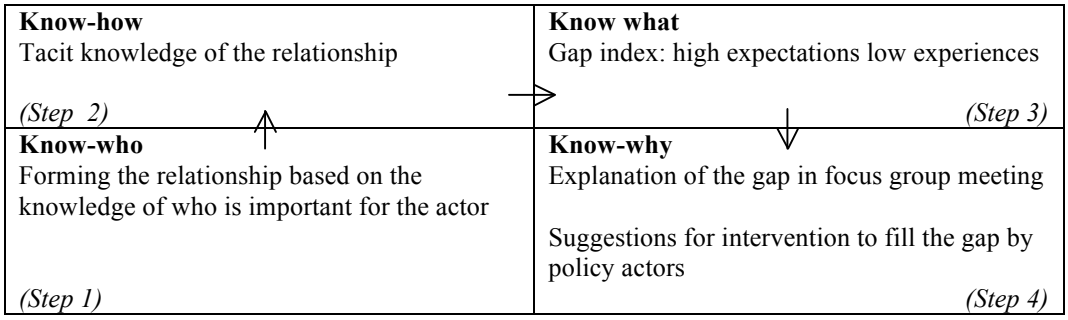
Identifying the good practices and the bottlenecks of the network is just a first step in the regional development policy. The second step is to find out how to overcome the barriers of the relationship, which includes evaluating and analysing the reason for large gaps. This can be made with relevant stakeholders in focus group meetings in which the gaps will be introduced for stakeholder discussion. The idea with a focus group meeting is to create a common understanding, and to find the way to create proximity with possible policy interventions. The knowledge taxonomy (Lundvall 1998) will be used as an analytical framework of the regional development model based on gap analysis. We can analytically differentiate phases of relation building based on the knowledge taxonomy (Table 3.6). In the first phase, actors build a relationship with their partners based on the information they possess on the importance of the relationship (the ‘know-who’ at the lower-left section of Figure 3.3). The actor has expectations of this relationship. In the second phase, there is interaction in the relationship, during and after which the actor has experience, which can be characterised as tacit knowledge (the ‘know-how’ at the upper-left section of Figure 3.3). In the third phase, a researcher is asking about the tacit knowledge on the relationship; here, the expectations and experiences will be codified, and their distance will represent the gap index describing the strength of the specific relationship (the ‘know what’ in the upper-right section of Figure 3.3). The next phase is a focus group meeting with the relevant stakeholders, regional development agencies and researchers. In the meeting, the participants look for the explanation of the gap; sometimes cau-

sal and sometimes more theoretical explanations are needed. In the meeting, the potential policy interventions available to fill the gap will be discussed (the 'know-why' in the lower-right section of Figure 3.3). Policy interventions can be either part of larger programme, just one project or investment or a change in regulation. The aim of the meeting is to reach a consensus on the reasons for the respective gap, as well as on the possible policy interventions through structured discussions with different partners, including the authority responsible for regional development. In one focus group meeting there can be a structured discussion on many gaps concerning different relations such as employment issues, environment issues or spatial planning.

Table 3.6. Knowledge types and the regional development model based on gap analysis

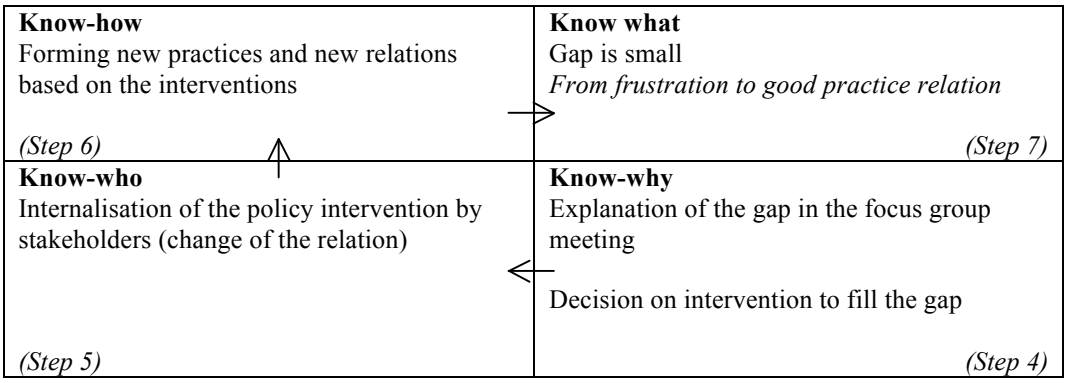
Knowledge type	**Triple helix context of the study**	**Stage of the relation and the model**	**Participants**
Know-who	Forming the relationship based on the knowledge who is important for the actor	Presence of relation based on expectation	Triple helix actors
Know-how	Actor's tacit knowledge of the relationship	Interaction in the relation – forming of experience	Triple helix actors
Know what	Strength of the relationship	The gap index: experience – expectation	Respondents to the survey, Researchers and regional development agency
Know-why	Explaining the gap Measures to fill the gap	Focus group meeting	Relevant stakeholders, regional development agency and researchers

Figure 3.3. Knowledge types, gaps and policy interventions



After the discussions in the focus group, public actors, and possibly the other stakeholders, should make decisions and prepare a policy intervention (see the step four at the lower-right section of Figure 3.4). The implementation of the policy improving the functioning of the network and filling the gaps need to be internalised by the actors (see step five of Figure 3.4) will influence their behaviour, with the respective relationship decreasing the gap between expectation and experience (see step six of Figure 3.4). After some time, perhaps one or two years, the survey should be repeated, and if a lower gap is found, the policy intervention has succeeded, and we will find a shift from frustration (high gap) to good practice relations (low gap). If the gap is still high, procedural steps one to four should be repeated. This is also a knowledge spiral inspired by organisational learning theory of Nonaka and Takeuchi (1995) and by Virkkala and Mariussen (2013).

Figure 3.4. Knowledge spiral based on the gap analysis, focus group meetings and policy interventions



This method could be one part of an experimental policy in which self-discovery is important (Foray, David & Hall 2009). Self-discovery or entrepreneurial discovery will occur through gap analysis, focus group meetings and policy interventions. The approach is based on abduction: something is lacking in the system that can be characterised as a hole or a gap, which demands the best possible explanation. Abduction is also the glue of the regional development policy model based on gap analysis since the regional policy makers are searching with the relevant stakeholders for the best possible policy intervention to fill the revealed gap.

The survey and the regional development policy model have been tested during the smart specialisation project of Ostrobothnia. The strength of relationships measured between gaps of expectation and experience of the respondent towards

his/her partner, the gap analysis and the focus group meetings aiming to fill the gaps, can all be used more widely as a regional development method, especially in smart specialisation. The model can be used as monitoring and evaluation of the policy outcomes, another crucial step in smart specialisation.

3.5 Distributed Knowledge Networks, Technology Expectations and Related Variety

Knowledge needed for innovation is increasingly complex. There is a variety of knowledge sources and inputs used by companies and organisations. Companies need different types of knowledge from different regional, national and international knowledge networks in order to innovate. There is a current shift from a firm's internal knowledge base to more open and globally distributed knowledge networks. The relevant knowledge base for many firms is not necessarily internal to their own sector or region, but is instead distributed across a range of technologies, actors and industries in global commodity chains (Asheim, Boschma & Cooke 2011).

In order to use globally dispersed knowledge, a region needs its own RIS capable of absorbing knowledge from extra-regional networks. The knowledge must be understood and interpreted. Knowledge flows and electronic databases need to be applied in the cognitive framework of the receiver in order to derive some value from this knowledge. Both absorptive and development capacities are important to the effective use of knowledge.

One important dimension of knowledge cooperation is technology. In order to acquire technology the actors need some cognitive proximity to the technology provider. We are interested in where the most important technology partners of companies in Ostrobothnia are located, in which helix and in which region. The cognitive proximity can be seen in relation to the geographical proximity (Ostrobothnia, the rest of Finland, and world) and to the institutional one (helices). Besides the relative importance of local, national and global sources of technology, we are interested in what kinds of technology are important for firms in Ostrobothnia now and in the future.

Networks are mechanisms of knowledge transfer between actors within and between helices, but they are also mechanisms between sectors. Cross-sectoral networks can induce regions to move into new growth paths while building on their existing assets. The variety of knowledge may be a key driver of economic growth. The long-term development of regions depends on their ability to diversi-

fy into new applications and new sectors through entrepreneurship and innovation, while building on their current knowledge base and competence. Therefore, it is essential for regions to transform and renew their economic base (Martin and Sunley 2006).

Regions may have many options to restructure their economies in the long run. One option is to diversify regional economies into new fields while building on regional assets. The long-term development of regions may depend on their ability to develop new sectors or new market niches with their roots in the current regional knowledge base. According to Boschma (2009) spin-offs, labour mobility and networks play a key role in this process of regional diversification.

Learning and knowledge transfer are facilitated when there is technological relatedness between sectors, so cognitive distance is neither too big for learning to occur nor too small that novelty is hampered (Boschma 2009). Sectors need to be related or complementary in cognitive terms. Regions need *related variety* in order to enable effective knowledge transfer between different (but related) sectors, and to trigger the recombining of pieces of knowledge in entirely new ways.

The term platform policies refers to bringing together different but related activities. Policymaking requires localised action embedded in a region and attuned to the specific needs of regions. The regional history largely determines the availability of options and probable outcomes of policy actions (Boschma 2009, Asheim et al 2011).

According to the RIS3 guide: *"The key to successful differentiation is to exploit related variety, which suggests that a regional economy can build its competitive advantage by diversifying its unique, localised know-how into new combinations and innovations which are close or adjacent to it. These new combinations must be feasible or accessible given the existing assets, so as to exploit the experience accumulated by regional actors."* (Foray et al. 2012: 18.)

In Ostrobothnia, we will find technologies used by the main clusters: energy technologies, boat building and fur farming. These cross sectional technologies are related to different research areas provided by research institutes within and outside the region (Figure 3.5). Regional technology platforms are networks of R&D institutions that are able to support several clusters. Well-developed regional technology platforms are likely to enable innovation of new products, industries and clusters through related varieties and entrepreneurial discoveries.

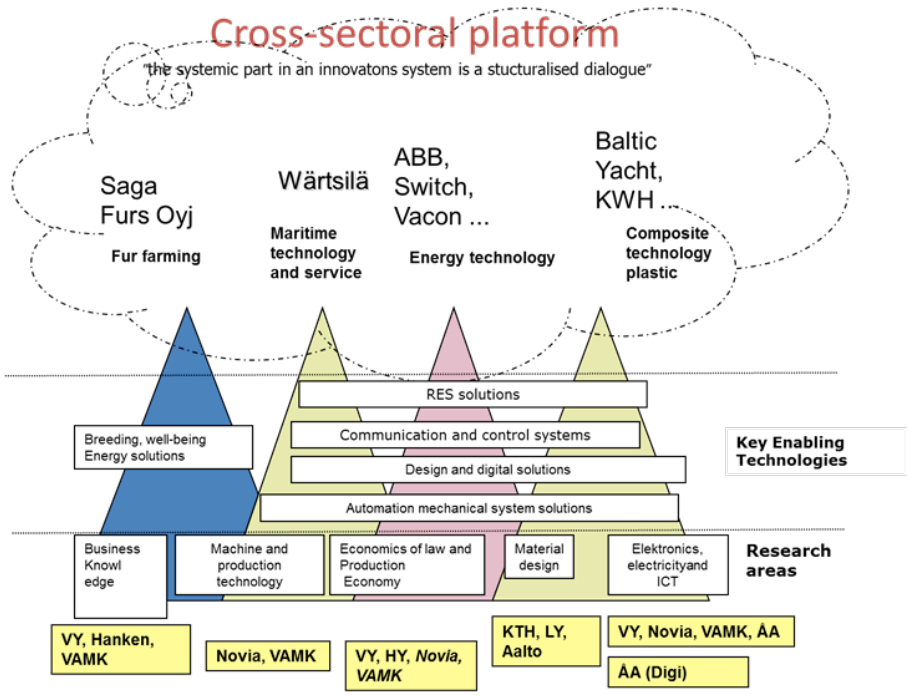


Figure 3.5. Ostrobothnian cross-sectoral technological platforms (Johnson 2012, based on the work of Johnson and Ulfvens 2012)

3.6 Research Questions

In an innovative region, the three helices work in harmony with one another and thereby mutually reinforce one another. The preconditions for the innovation are that the triple helix actors are networking. Our first research question is related to notions of connectivity and proximity in a triple helix framework. Our aim is to discover how triple helix actors, which include companies, universities and public organisations, relate within networks. This effort includes understanding their geographical reach, that is, the importance of regional, national and international contacts.

The regional actors should be connected within and between helices, but there should be also interaction among all the actors, and this level and content of interaction can be mapped with the help of elements from gap analysis. In the second question, we ask how the triple helix network is functioning, and what the bottlenecks and the effective solutions are in this network. For this purpose, we have developed and tested gap analysis and other methods including knowledge taxonomy.

The third question is related to the connectivity between actors developing technologies. The knowledge for new technologies is distributed across different sectors and regions, and to gain this knowledge a region needs absorptive capacity and a developed RIS. We are interested in where the most important technology partners in Ostrobothnia are located, especially in which helix and in which region. The three first research questions are related to connectivity, and a method was developed and empirical data gathered to answer them.

Besides the above mentioned analytical research question, we also fulfilled a normative research task: to introduce a regional development model for smart specialisation in Ostrobothnia. The model was based on the survey, and tested through the project. The operationalisation of the conceptual framework and the research questions and topics are reflected in the structure of the survey, which will be described in the next chapter (see Table 3.7).

Table 3.7. Research frame

Topic in triple helix framework	**Conceptual framework**	**Research question**	**Method and data**
Structure of the network, presence of relations	Network connectivity, proximity, network typology	1. How does the triple helix look in Ostrobothnia? (network structure) A. To what degree are the networks of triple helix actors regionally connected or disconnected? B. To what degree are the networks regionally, nationally, and globally embedded?	Mapping the number of respondents' partners by helices and by regions. Evaluation of the importance of partners by helixes and by regions
Functioning of the network, interaction in relations	Strength of the network ties	2. How does the triple helix network function in Ostrobothnia? A. What are the biggest bottlenecks? B. What are the good solutions?	Gap analysis: evaluation of the relation in terms of expectations and experience
Technology partners	Absorptive capacity, RIS, Distributed knowledge, Technology platform	3. What kinds of technologies are triple helix actors using now and in future, where are they acquired?	Mapping the technologies as well as the important technology partners by helices and regions now and in future
Regional development policy model	Knowledge taxonomy and knowledge spiral	4. What are the elements of regional development model based on the connectivity analysis?	Developing and testing the regional development model for a smart specialisation model

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4 METHODOLOGY AND RESEARCH DESIGN

Antti Mäenpää, University of Vaasa: Regional Studies

4.1 Background Information on the Ostrobothnian Region

The Ostrobothnian region consists of 15 municipalities (see Figure 4.1 below). It is the only NUTS 3 region in Finland that has a larger population of Swedish speakers (51 %) than Finnish speakers (45 %). Other notable exceptional aspects are the energy technology cluster, which is the most extensive in the Nordic countries. Many leading companies on the field (for example ABB, Wärtsilä, The Switch and Vacon) are situated in the region. Ostrobothnia also has quite a low unemployment rate compared to other parts of Finland and has lately been promoted as a prosperous region. (AMCER Report 2012.)

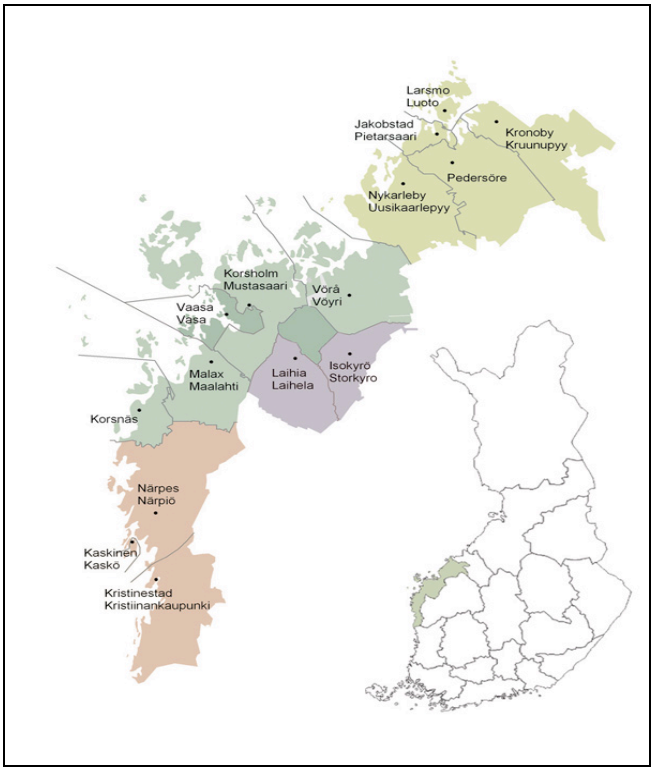

Figure 4.1. The Ostrobothnian region and its municipalities (Regional Council of Ostrobothnia 2014)

Geographically, Ostrobothnia consists of 7,749 square kilometres of land and has a population of 178 000 people. The regional capital is the city of Vaasa and it is also the main innovation centre where over 59 000 people live. The latest available information from 2008 indicates that among the Ostrobothnian workforce, 6.3 % earned their living from agriculture, 32 % from industry and 60.8 % from the service sector (AMCER report 2012). There is a disparity between the regional capital Vaasa with its more urban culture and history, and its rural hinterland. However, the export clusters chosen in the study reflect the spatial industrial structure of the region. The energy technology is particularly represented in the regional capital, boat building in the small industrial town of Jakobstad, and fur farming in the surrounding rural areas.

Economically the big multinational companies dominate. Because of this, Ostrobothnia is quite strong exporter as over 60 % of the regionally produced industrial products are sold abroad. In the case of renewable energy products, the amount exported is over 70 %. However, Ostrobothnian GDP is lower than the average in Finland, although it is higher than the European average (AMCER report 2012). This reflects the facts, that alongside the big companies are also many small ones, and for example, fur farms and boat builders are small businesses compared to the global energy field actors.

Research and development is strongly situated inside the big companies within the renewable energy field but there are also many other research entities in the region (AMCER report 2012). Besides the companies' own research units and departments, various types of universities are the biggest R&D players. There are four universities in the region: the University of Vaasa, Hanken School of Economics, Åbo Akademi University and the University of Helsinki (Law faculty). There are also two universities of applied sciences: VAMK Vaasa University of Applied Sciences and NOVIA University of Applied Sciences. In addition, there is also an industrial design department called MUOVA, which is a joint department of Aalto University and the University of Vaasa. Within these seven universities there are over 12 000 students and therefore statistically nearly every fifth person on the regional capital Vaasa is a university student. One could therefore say that Vaasa is a university city. (Havu 2013.)

In total, the funds devoted for research in Ostrobothnia are above the average in Finland. During 2009, the Ostrobothnian region spent 1619 euros per person on research when the average in Finland was 1271 euros at that time. Of all the research personnel in Finland, over 2.5 % lives in the Ostrobothnian region and it is clear that the region is quite strongly focused on research compared to the average level in Finland. (AMCER report 2012.)

Besides the universities, there are also other regional developers. The Regional Council of Ostrobothnia and many sub-regional development organisations work to support the specific needs of the region. VASEK has specialised on the development of the Vaasa region, while Merinova is developing the energy industries on the area. Concordia, Dynamo and Kristiinankaupungin Kehitys Oy are sub-regional development organisations that have specialised in other municipalities and their development needs.

4.2 Creation and Presentation of the Survey

With the basic information on the region established, we can now delve deeper into the actual survey and its logic. When the survey was created, there were several discussions about the topic of possible objectives for Ostrobothnian smart specialisation. In the end, the existing research on regional innovations and triple helix structures convinced us that knowledge transfer was critical for innovation. Cross-helix innovations in particular have been presented as extremely important for new development. According to this theoretical background one can say that connectivity between triple helix actors is a precondition of regional innovation.

The first draft of the instrument for measuring connectivity was an academic work generated in meetings where most participants represented the university helix. However, the meetings were arranged by the Regional Council of Ostrobothnia representing the public sector and it also brought in the companies' views by representing the energy, boat, fur and maritime sectors. The maritime sector was later dropped from further analysis because there was not enough key actors who answered the call to participate in the study.

We decided to measure the cooperation between the triple helix actors via nine relations. First, we had three types of organisations: universities, public organisations and companies. Then we also wanted to measure the cooperation on three geographical levels: local, national and international. This created the nine connections that we focused on (see Figure 4.2.).

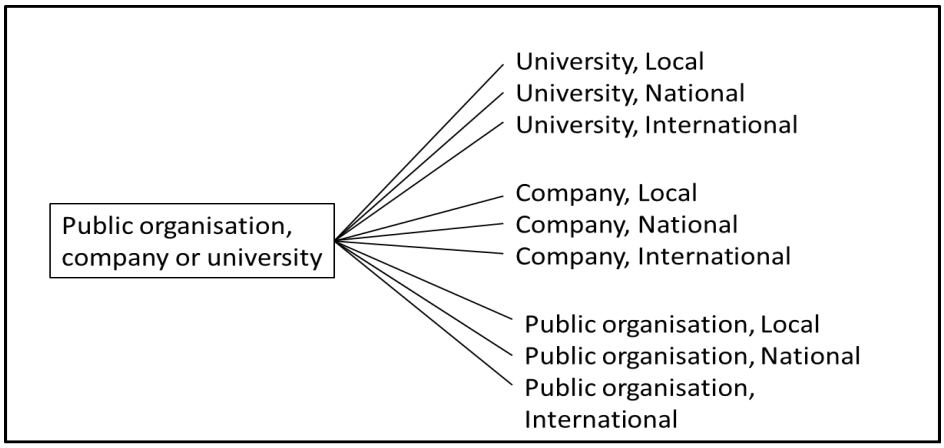

Figure 4.2. The relations in the survey by helices and by regions

Figure 4.2 demonstrates how challenging the measuring of relationships was in the survey. There are connections between three types of organisations and besides those there are also three geographical levels. When we measured the depth of cooperation, we therefore sometimes had to ask exactly the same questions nine times (See appendix 1). However, we think that this approach delivered a broad view of cooperation in Ostrobothnia.

The questionnaire has four parts reflecting the topics and the research questions of the total study. These parts are:

1. Background information
2. Mapping the location and importance of the partners of respondents
3. Measuring the depth of cooperation
4. Technologies and the location of technology partners now and in the future

The questionnaire used mainly closed questions. The background information consists of facts describing the respondent, part two of the facts to be evaluated (connections), part three of the respondent's subjective opinions on the quality and depth of the particular relationship, and part four of both facts and subjective opinions or evaluations on the sources of future technologies.

Background information included very basic questions that were the same for all respondents, regardless of the type of organisation. We asked about the respondent's name, position in the organisation, and the number of employees in the organisation. There was also a question about cooperation with specific industrial fields specifically inserted to measure the importance of the four possible smart

specialisation objects: fur farming, boat building, the renewable energy products and maritime technologies. This last specialisation did not attract a single answer that indicated its importance, and therefore only the first three were taken forward to the analysis phase.

We chose respondents who were either experts in their field (especially in the three special industrial fields and their technologies) or were working as leaders. This was due to the fact that we needed answers both regarding the cooperation of the whole organisation (or one of its functional areas, if it was huge) but also on the technologies of the future. Consequently, the role of the respondents varied slightly but we tried to choose both sorts of experts.

We also had to take some shortcuts concerning specific regional actors. Development organisations were important informants in our research, but we decided to merge them with the public organisations. There are still some questions within the questionnaire specifically asking about a respondent's connections to development organisations and thus we can still study their role within the region.

We also tried to include civil society actors in our research and selected trade union representatives to act as those respondents. We used the same public organisations' questionnaire to collect data from these civil society representatives too. We felt including trade unions and development organisations with the public sector were justified because all are non-commercial actors. The move meant we could devise three types of questionnaires that supported our analyses and especially the presentation of results within the triple helix context.

Mapping the location and importance of the partners was addressed in the next part of the questionnaire. The first question measures the scope of cooperation and also includes the geographical reach. Understandably, this was the hardest question for the respondents to answer (see the question in Table 4.1.).

Table 4.1. Question concerning the breadth of cooperation by helices and by regions

How many partners do you have?	Companies	Public organisations	Universities	Development organisations
In Ostrobothnia and Central Ostrobothnia				
In other parts of Finland				
In the rest of the world				

Of course, we did not ask for very specific numbers, as it is quite natural that people would not be able to recount all their contacts at that moment they are asked (Table 4.1). The first question however reveals many things even if the numbers are not fully accurate. First, it shows whether there is any cooperation at all with other helix actors. It also shows to some extent where there are most connections. This helps us to get a picture of the overall number of connections of the respondent's organisation and also reveals the distribution of cooperation geographically and via the type of triple helix partner.

Asking about cooperation or partners proved challenging because of the definition of the terms. Support for defining the term "cooperation" was sought from Easton and Araujo (1992) who stated that cooperation occurs when two actors have a mutual interest in joint activities. Some of these activities might also be linked to strategic issues (Gradl, Krämer & Amadigi 2010). Finally, a "partner" was defined by us as an important organisation, which facilitates and/or supports value creation for both parties.

Cooperation could be based on both formal and informal contracts and be of regular or more sporadic character. We also created some further guidelines on interaction: there must be some sort of dialogue between partners, and this would exclude trade, for example, unless there were negotiations of some sort within the process (like planning a service or such, not necessarily price negotiations). One could argue that our definition of partners and partnerships could be more precise, but we wanted to collect all the possible cooperation data that we could with our questionnaire.

We also needed to know the degree and importance of the national and international cooperation of the respondents because this may explain some of the results (see Tables 4.1 and 4.2). For example if the cooperation between companies is mostly international and there are many connections, this may explain why there are not such good regional connections between the companies et cetera.

We also added the Region of Central Ostrobothnia alongside the Region of Ostrobothnia that we are actually interested in (see Tables 4.1 and 4.2) because the boat building industry is concentrated at the border of both regions and also because some public organisations operate in both regions. It is easier for the respondents to answer questions when the regions are treated as one entity, but we still only asked questions of Ostrobothnian experts and not from Central Ostrobothnian ones.

The rest of the questions concerning cooperation varied, as we decided to create different questionnaires for different types of organisations. This helped us to

concentrate on the different aspects that were integral to the very nature of organisations. For example, we asked universities about their cooperation in teaching and research areas, whereas we had questions about strategic partnerships for the public organisations. The companies were also asked about their innovation cooperation and such like. All these differences can be seen from the original questionnaires that can be viewed in the appendix 1. One example of these questions is provided here as well (Table 4.2):

Table 4.2. Question concerning the importance of cooperation by helices and by regions

How important are these strategic partners for your organisation?	Companies	Public organisations	Universities	Development organisations
In Ostrobothnia and Central Ostrobothnia				
In other parts of Finland				
In the rest of the world				

The principles for the question are the same as before, but we are now measuring importance and therefore the scale has changed from an open field to a scale of 1–10, where 1 indicates strategic partners are of low importance to the respondent's organisation and 10 indicates they are of high importance. Zero is used if there are no answers or no importance otherwise in the partnership.

Besides the importance of the strategic partners, we also asked companies the same question about supporting partners, innovation partners and so on (see Table 4.3). When this data is combined with the former data about the scope of partnerships, we can ascertain the overall cooperation with the amounts of contacts and measures of importance. Actors representing the university sector were asked about the cooperation with research partners, partners in education and partners in development activity indicating the social service mission of universities. Public organisations were asked about strategic and supporting partners (see Table 4.3).

Table 4.3. Types of partnerships according to the type of the respondent's organisation

Public organisations	Universities	Companies
Supporting partnership	Research partnership	Supporting partnership
Strategic partnership	Education partnership	Strategic partnership
-	Social service mission/development	Innovation partnership

The final question in this section addressed the roles of different actors within knowledge production. The aim was to measure the actual role of different organisations within Ostrobothnia (see Table 4.4). The conceptual background to this question lies in the notion of a regional innovation system.

Table 4.4. Question about the role that partners have within knowledge production

Organisation	Role in knowledge production		
	They give us knowledge	**We generate knowledge together**	**We give them knowledge**
Commercial actors (companies, etc.)			
Public sector actors (development organisations, other public organisations, etc.)			
Non-commercial actors (universities etc.)			
Households			
Volunteer organisations (Red Cross etc.)			
Privilege organisations (trades unions, etc.)			

The respondent's organisation could have different role in the sharing of knowledge. This question measures which partners are the really important knowledge givers or takers. Respondents were also offered the option to answer that knowledge is created mutually, and this proved a very popular choice. Originally, we divided all organisations into three categories (public organisation, university and company) but we have since divided them into smaller groups to ascertain how important the civil society organisations are in terms of knowledge production. This categorisation is also used when measuring European GDP.

The depth of cooperation was measured in the third part of the questionnaire and this was the part our project group really pondered over. Finally, we settled on multiple questions measuring the quality or the depth of the cooperation. These differ from the former measurements of the importance of the partnership, because we were asking about experiences and expectations and thus measuring the overall feeling of contentment in the chosen field of cooperation. One example of these questions is provided below (Table 4.5).

Table 4.5. Example question about the experiences, expectations and the direction of development in the past and in the future

	Scale: 10 = high, 1= low		**Direction of development in the future** (mark with a cross)			**Direction of development in the past** (mark with a cross)		
Question	**Expectations**	**Experiences**	**Grows**	**Remains the same**	**Lowers**	**Grows**	**Remains the same**	**Lowers**
Cooperation in research								

As Table 4.5 shows, we asked the respondent's opinion about cooperation through expectations and experience. The respondents first considered the expectations that they hold for the chosen field for cooperation. We guided the respondents to think about their expectations of the ideal situation for cooperation. Then the respondents ranked their experiences of cooperation in the same field. While there is room for improvement because there are many questions, we can quite precisely locate the possible development challenges. We used same ten-point scale as in the second section of the questionnaire: where 10 is the best possible form of cooperation and 1 is the lowest ranked form. Once again, zero was used to indicate that there was no answer. Calculating discrepancy scores between expectation and experience gave us a result equating to the strength of the cooperation network.

We also asked about the direction of development under the same question. The respondent could choose only one direction for the future and another one for the past. These corresponding questions gave us more information about the state of cooperation within the chosen fields. For example, cooperation in research could be problematic and the difference between expectation and experience might be three points. If the direction of development had been worse in the past and was

expected to improve in the future, it suggested the organisations could focus on other areas of cooperation first, as in the research area the situation was improving by itself.

As mentioned previously, this section featured several questions on each relationship and these varied according to the type of organisation the respondent came from (see appendix 1 for full questionnary). For example, we had questions that measured how well the respondent knew a certain partner from each relationship (i.e. one partner from the university sector in Ostrobothnia, and/or one public organisation partner based outside Finland etc.) and these helped us to measure possible differences in the information sharing among the best partners of each possible connection. For example, if cooperation was not good in some specific fields and the respondent did not know even the best connection to the relevant helix actor well, then one explanation might be a lack of proper connections.

We asked the same question-sets three times within a single helix according to the chosen geographical division: first for the region, then for the other parts of Finland and lastly for the international connections. The only exception was public organisations, as we did not ask about their connections to companies outside the region at all. This was because in Finland, several of the public actors are regional entities and they have no jurisdiction to act in other areas. For example, the Regional Council of Ostrobothnia is focused on developing its own area as there are other Regional Councils covering other parts of Finland.

As mentioned, there were three regional question-sets within a single helix partnership (and only one between public actors and companies), but we asked about cooperation with all the triple helix actors and this meant that it was possible that the respondent answered nine question-sets in this part of the questionnaire (this happened only to university helix respondents). This was very tough for the respondents and remains a major problem within this part of the questionnaire. All the questions can be viewed in the appendix 1.

The last section of the questionnaire addressed the technologies of the future. We measured these using three different questions that were the same for all respondents. We could not have totally open questions, as the survey would be repeated in the future. The first question about technologies can be seen below (Table 4.6).

This section also used a ten-point scale where 1 indicated low importance and 10 high importance of various technological fields, products and applications. As before zero was used when the respondent did not have any answers to contribute.

We asked about the importance of technologies for the respondent now and in the future and we also asked for development ideas at this point, as it is perfectly possible that some innovations require something other than technologies (like services etc.) and that is why the section included some open questions. There was also room for the respondent to explain the importance of the technologies as it is important to acknowledge that regional developers cannot be experts on all possible technological or service innovations. The optimal situation was when respondents helped the researchers by explaining the options.

The chosen technologies are based on the EU's key enabling technologies, which EU has declared innovative additions to the current technological field. We also included renewable energy and smart grids as we were aware of their importance and they were quite frequently nominated by the respondents. The open fields gave the respondent the opportunity to tell us about any new technological or service innovations and such like.

Table 4.6. Question about the importance of various technologies for Ostrobothnia

Importance of technologies			
	Scale: 10 = high, 1= low		**Open questions**
Technologies	**Now**	**After 20 years**	**Why? How it could be developed?**
Nanotechnology			
Micro- and nano-electronics including semiconductors			
Photonic			
Advanced materials			
Biotechnology			
Advanced production methods			
Smart grids (Intelligent electrical networks)			
Renewable energy			
Other, what?			

Our next question simply asked what types of organisations and locations are important to innovation. The only difference from the former questions that were centred on the importance of partnerships was the inclusion of the respondent's own organisation. We also asked the respondents to indicate importance by mar-

king options with a cross rather than to grade options on a numerical scale. Therefore, this was a rough way to measure the technological importance of various locations and their actors. The actual question can be seen below (Table 4.7).

Table 4.7. The location of various partners in technological innovation activities

The location of technological innovators	Within own organisation	In the companies	In the public organisations	Universities and research entities	Development organisations
In Ostrobothnia and Central Ostrobothnia					
In other parts of Finland					
In rest of the world					

This question applies the same principles as the previous questions measuring the importance of various types of partnerships. It is intended to be answered quickly and quite often it was, as companies and universities were often included. Even though the question is quite basic, it still helps us to gain a better picture of the innovation partners of the organisations.

Table 4.8. Question about the future technology partners and their importance after 20 years

Where could Ostrobothnian organisations find technological development partners 20 years hence?	Within own organisation	In the companies	In the public organisations	Universities and research entities	Development organisations
In Ostrobothnia and Central Ostrobothnia					
In other parts of Finland					
In the rest of the world					

With our last question within the questionnaire (see Table 4.8) we wanted to measure how important various technological partners might be to the respondent's organisation 20 years hence. We again used a ten-point numerical measurement scale and repeated the format where ten represented high importance and

one low importance, again with zero used to record there being no answer to the questions.

The final question of the questionnaire was designed to provide a little more information about the future development of technological cooperation within the Ostrobothnian region. Quite a number of the respondents answered that the Ostrobothnian region would be important and this offered very good background information to support the Regional Council when it starts to implement the smart specialisation strategy. The region has faith in itself, which we find encouraging.

4.3 Choosing the Respondents and Implementing the Interviews

It was very important to choose the correct respondents to answer our questionnaire. Earlier we had decided that we particularly needed two types of experts. First, we needed leaders because we wanted data about organisational cooperation. Secondly, we needed technical experts, as we were gathering information on future technologies. We also needed people from the three different helices.

We started by searching for local experts via the internet and also many experts were known to our working group. We particularly wanted to have people working in fields focused on export. We were also keen to have respondents from the chosen "smart" industrial fields, so some energy industry, boat building and fur farming specialists were gathered especially for the list. We also included development organisations and trade union representatives on the list of public organisation specialists. The actual selection of respondents was made using stratified sampling according to these guidelines.

After the selection we sent the respondents an invitation letter and e-mail explaining our study and asked if they would meet our interviewer. We had to use an interviewer because our answering sheets were so large. It was also important that the respondents would be able to ask for clarification if they did not understand the questions. A good number of those we initially approached agreed to be interviewed, and we decided that 15 people from each helix would be sufficient at that point when the questionnaire was being tested. In total, we interviewed 53 people of whom 21 represented firms, 15 universities and 17 public administration. The interviews were conducted in August–October 2013, mostly by the author of this article (Mäenpää 2014).

The interviews went well. The interviewer visited the respondent's work place and explained that the questionnaire was to be used for the Regional Council's development work and academic research. Then the interviewer presented the relevant questionnaire (see Appendix 1) and asked if the respondent wanted to fill in the information themselves or if they preferred the interviewer to mark their answers for them. There were always two answer sheets available, so that the respondent could see the questions even if he or she decided to let the interviewer fill in the answers. After the respondents had answered all the questions they could, the interviewer asked if the respondent would be willing to participate in special focus group meetings.

These focus group meetings would provide an opportunity to present our initial results to the respondents and also to involve some other experts. We were keen for the respondents to assess the results and we hoped the meetings would also offer opportunities to obtain explanations of, or background information on, the responses received. Many respondents agreed to attend the focus group meetings, their schedules permitting.

4.4 Focus Group Meetings

Three focus group meetings were held. The first was on the energy industry and was held in Vaasa on 17 January 2014. The other two focused on boat building and fur farming and these were held in Jakobstad on 7 March 2014. These meetings involved presenting our results as planned and the assembled experts speculating on what our findings might indicate.

The energy industry experts were a little surprised that our results indicated that regional partners were considered highly important. Local cooperation was generally deemed to be important in the future. The energy sector representatives, however did not feel that the local universities supported the sector enough, citing too few students and projects. The reason for the failing was suggested to be that the most appropriate type of education was not directly available in Vaasa, as its providers are scattered throughout Finland. Company representatives were disappointed that the nearby regional universities were unable to meet their needs; however, there is little potential for change because higher education is controlled at central government level in Finland.

There were also large differences in the expectations and experiences of companies and their regional subcontractors (i.e. other companies). This was explained by companies having high expectations of the quality of the production from

subcontractors that have taken over the production of components. Accordingly, quality is very important and there would be no subcontractors in the first place if they did not manage to make their components more efficiently than the customer firms.

Companies were also not happy about the apparent overall fragmentation of Finnish government. The company representatives criticised building projects where, for example, one Finnish official decided on environmental issues and another on cultural issues. They thought Finnish bureaucracy too burdensome. They also mentioned that there are other countries that apply their legislation less strictly, and this attracts many international projects because things advance quickly.

Our results also indicated that cooperation at regional development level is not perfect. The companies explained that even though the energy industry is the main industry in Ostrobothnia, there are still many difficulties. One of the biggest problems is the fact that not all municipalities support the energy industry and thus its projects do not gain the support of the whole region.

When we compared the triple helix relations one could see that companies most preferred cooperating with other companies in the region. Universities were the next most important partners, and cooperation with the public sector was ranked as the least preferable option. Among the public entities, development organisations were deemed the most important partners.

The boat building industry was not content with the levels of cooperation with universities. They explained that Finnish universities do not have the resources to develop the newest technologies. Therefore, companies have to either conduct research or development themselves or buy the research from outside the country. The boat building industry was however content about the level of cooperation with public organisations and especially with development organisations. The only problem was the infrastructure of the Jakobstad harbour, which caused issues for boat transportation. The boat building industry representatives were most content about the cooperation with other companies, and that with public organisations was ranked second. Universities were the least important partners.

The fur farming industry was very pleased to see that our regional indicators mapped the industry correctly. Most of the Finnish fur farming industry is located on the Ostrobothnia region. However, local universities were not as important as national ones. The experts explained that fur farms require genetic research, which can be found only in the biggest cities in Finland. Because of that, the fur farming industry considers other companies to be the most important partners.

The next most important partners are the public organisations and universities are the least important also to this field.

The questionnaire has now been presented and the logic behind the questions should be clearer. We have also explained the implementation of the interviews, the choosing of respondents, and how the focus group seminars worked, which we hope will help clarify the results gathered. In chapter 5, we present these analyses in detail.

4.5 Validity and Reliability of the Survey

Validity means that the survey measures the phenomena that it planned to measure (e.g., the connectivity of triple helix actors in Ostrobothnia) so that we can properly answer the research questions. Reliability refers to the consistency or stability of the measurements. To meet these requirements, we took care in preparing the questionnaire and survey, and tried to take account of all relevant dimensions of the cooperation. The questionnaire was presented and tested in many project seminars, in research seminars on March 15 and May 13, and also in a stakeholder seminar on June 20, 2013. The survey plan had undergone a peer-review procedure at the S3 platform workshop in May in Vaasa 2013. The model has also been applied by University of Nordland, Norway.

Asking respondents about cooperation on innovation is a challenge for many reasons. One is that the respondents have diverse backgrounds and can have different interpretations of concepts, such as, innovations, cooperation and development. We do think that this is a problem in all research concerning partners, or cooperation in general as people have their own perspective on these terms. However, we tried to overcome this with written definitions of the concepts, and by making an interviewer available to explain the notions throughout. With regard to validity, there is also the risk of getting "the right day" as results may vary each day. Ultimately, cooperation is based upon interaction and people tend to remember the latest connections as being the strongest. This once again is integral to very nature of cooperation research and is thus unavoidable.

Another risk lays in the complexity of business structures and how innovation processes unfold into different types of networks, and actor constellations. We asked the same questions of people who have no subordinates and people who have over 300 subordinates. In all of these cases, we assumed that the respondent knew all the connections of his or her subordinates, or the whole organisation, which, in the case of the larger networks, was almost certainly not the case. Ho-

wever, the leaders should know the main structure of the cooperative arrangements, and are thus still valuable sources of information about the scale and importance of cooperation.

In any research, the accuracy of the results will be improved if the respondents are provided with clear definitions and are helped to answer the questions fully. It is also important to obtain enough answers, as they further improve the reliability of the whole research. Consequently, it was decided the presence of an interviewer was critical in the data collection phase.

It was decided the research could benefit from a quantitative research approach, founded on a structured questionnaire. However, the data were gathered through interviews that also provided qualitative data. Consequently, the study utilises both qualitative and quantitative approaches, making it a mixed-method form of research.

During the research project, a standardised instrument based on gap indexes was developed for tracking the development of connectivity and monitoring the smart specialisation strategy in Ostrobothnia. The aim is in future to acquire data that are more longitudinal on the connectivity of triple helix actors in Ostrobothnia.

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5 STATISTICAL ANALYSIS

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Cooperation for new service development and innovation is critical for business and regional development. Within the triple helix framework it is claimed that it is the number of important cooperation that is decisive for development. This chapter presents findings from a small scale quantitative study. Central actors representing companies, universities as well as, public organisations in Ostrobothnia were approached.

5.1 Companies as Triple Helix Actors

This section consists of two parts. All companies are first analysed as one sample (n = 16). Then companies representing the energy cluster is analysed (n = 6). The other two clusters scrutinised for smart specialisation, boat and fur, are not separately analysed, due to small sample sises.

5.1.1 All companies

This part reports on the triple helix structure out of a company perspective (Table 5.1).

Table 5.1. Company connectivity (all companies)

All companies			
Type of partner	**Region**		
	Ostrobothnia	Finland	International
Company	108 (25)	26 (20)	14 (4)
Public organisation	7 (2)	3 (1)	0 (0)
University	2 (2)	2 (1)	1 (0)
Development organisation	2 (2)	1 (0)	5 (0)
Number of partners, mean (median)			

Looking at the number of company partners, the companies in Ostrobothnia seems to be well connected; they have many partners locally and nationally, as well as, internationally. The dominance of local partners is somewhat surprising because of how the region presents itself, as being international and export oriented. This is certainly true, but at the same time the numbers prove how strength for international activities are founded on regional network structures. It is also obvious from Table 5.2 that the companies have prioritised cooperation with other companies. The number of partners in the public and university sector, and with development organisations is much lower.

A similar structure emerges when focus is put on the importance of the different partners and activities like support, strategy and innovation (Table 5.2).

Table 5.2. Partner importance from a company perspective (all companies)

All companies and partner importance			
Type of partner	**Region**		
	Ostrobothnia	Finland	International
Company	9.3 / 8.6 / 7.4	8.8 / 8.3 / 6.1	8.1 / 6.9 / 6.2
Public organisation	7.7 / 7.2 / 4.8	6.7 / 7.8 /4.9	3.3 / 3.7 / 2.8
University	6.5 / 5.7 / 5.2	6.9 / 5.7 / 5.5	5.8 / 4.1 / 4.4
Development organisation	6.8 / 5.9 / 5.9	6.2 / 4.9 / 4.8	4.8 / 3.2 / 4.0
Mean value, scale 1 = not at all important, 10 = very important support/strategy/innovation			

Company partners are on average more important than partners from other sectors and local partners seems to be more important than partners from other regions. There are only a couple of exceptions to this rule. For the university sector, and also to some extent for the public sector, we see that partners in other parts of Finland are as important (or even more important) as local partners. The explanation for this seems to be straight forward; companies perceive that all the necessary resources are not to be found locally. One example is the energy sector where a lot of cooperation with the university sector is done with universities in other parts of Finland.

All in all, we interpret the results as a clear endorsement for the Ostrobothnia region. Many of our companies do business globally, but they still choose to cooperate within the region and find the cooperation valuable and competitive.

The next step is to evaluate the strength and depth of the cooperation. The questionnaire gives us the opportunity to analyse several different aspects of the cooperation and in this way it is easier to isolate and identify the areas for improvements. Table 5.3 shows measures for how companies have experienced and expect cooperation to develop with a set of different type of actors and activities in different regions, and in what direction the cooperation is moving (trends).

Table 5.3. Evaluation of cooperation expectations, experiences and trends: companies – other companies

All companies – other companies							
Aspect of cooperation	Region	n	Expectations	Experiences	Gap	Trend	History
Subcontractors	Ostrobothnia	16	8.7	7.8	-0.9	2.3	2.4
	Finland	16	8.2	6.9	-1.3	2.4	2.4
	International	9	8.1	7.6	-0.5	2.3	2.2
Customers	Ostrobothnia	15	8.8	8.1	-0.7	2.4	2.4
	Finland	14	8.0	7.3	-0.7	2.6	2.4
	International	9	8.3	7.6	-0.7	2.6	2.4
In-house cooperation	Ostrobothnia	13	8.8	7.9	-0.9	2.3	2.2
	Finland	9	8.6	7.6	-1.0	2.3	2.4
	International	5	8.0	6.8	-1.2	2.4	2.4
Technology development	Ostrobothnia	12	8.2	6.9	-1.3	2.6	2.3
	Finland	13	6.8	6.1	-0.7	2.2	2.3
	International	9	8.3	7.7	-0.6	2.4	2.4
Production system development	Ostrobothnia	15	7.1	5.9	-1.2	2.5	2.3
	Finland	12	6.8	6.0	-0.8	2.2	2.0
	International	9	8.0	7.3	-0.7	2.6	2.2
Process development	Ostrobothnia	15	6.7	5.6	-1.1	2.5	2.2
	Finland	10	6.5	5.9	-0.6	2.3	2.1
	International	8	6.9	6.5	-0.4	2.4	2.3
Organisational development	Ostrobothnia	14	5.7	5.4	-0.3	2.4	2.2
	Finland	10	4.6	4.2	-0.4	2.1	2.0
	International	8	5.4	5.5	0.1	2.3	2.1
Marketing	Ostrobothnia	12	6.3	6.1	-0.2	2.3	2.3
	Finland	10	6.6	6.1	-0.5	2.2	2.0
	International	8	6.9	6.3	-0.6	2.6	2.5
Expectations / Experiences, scale 1 = low, 10 = high Gap = Experience – Expectation Trend (future)/ History, scale 1 = decrease, 2 = as before, 3 = increase							

Starting with the company-company relations we can see that there are no alarming gaps between the expectations and experiences of how the cooperation works. The mean value for the expectation is almost always bigger than the cor-

responding value for experience but this is a common outcome, everyone tend to expect (hope for) more than actually can be delivered. Generally speaking, small negative gaps are no cause for concern. The biggest gaps can be found in subcontractor – other parts of Finland and technology – Ostrobothnia but they are only of moderate sise, -1.3 in both cases. On the bright side, both areas show an expected positive trend for the future. The highest expectations can be found concerning subcontractors, customers and in-house cooperation within Ostrobothnia.

Companies have cooperation with universities. Three different types of activities were analysed in this study: education, research and development. The figures presented in Table 5.4 indicate that the companies have had best experiences when it comes to cooperation on education in Ostrobothnia, a relationship that is expected to become even more important in the future.

Table 5.4. Evaluation of cooperation expectations, experiences and trends: companies – universities

All companies - Universities							
Aspect of cooperation	Region	n	Expectations	Experiences	Gap	Trend	History
Education	Ostrobothnia	13	8.2	7.3	-0.9	2.5	2.2
	Finland	14	6.8	5.4	-1.4	2.5	2.2
	International	14	6.6	5.7	-0.9	2.1	2.0
Research	Ostrobothnia	6	6.7	6.3	-0.4	2.5	2.3
	Finland	8	8.3	6.9	-1.4	2.4	2.4
	International	8	6.9	6.5	-0.4	2.3	2.4
Development	Ostrobothnia	6	4.7	4.0	-0.7	2.2	1.8
	Finland	6	7.2	6.3	-0.9	2.3	2.2
	International	5	6.0	5.2	-0.8	2.6	2.2

When it comes to cooperation on research the region of Ostrobothnia is not quite enough. It is obvious that the companies take input from universities outside the region as well. Next we can see the results for public organisations (Table 5.5).

Table 5.5. Evaluation of cooperation expectations, experiences and trends: companies – public organisations in Ostrobothnia and other parts of Finland

All companies – public organisations, cooperation in Ostrobothnia and other parts of Finland							
Aspect of cooperation	Region	n	Expectations	Experiences	Gap	Trend	History
Infrastructure and logistics	Ostrobothnia	11	8.6	7.3	-1.3	2.1	2.5
	Finland	8	6.6	6.1	-0.5	2.3	2.3
Regional development	Ostrobothnia	14	8.8	6.7	-2.1	2.2	2.4
	Finland	9	7.2	6.6	-0.6	2.2	2.1
Technology development	Ostrobothnia	13	6.8	5.7	-1.1	2.3	2.2
	Finland	9	6.7	5.7	-1.0	2.3	2.1
Business development	Ostrobothnia	10	7.5	5.7	-1.8	2.0	2.1
	Finland	8	6.5	5.5	-1.0	2.4	2.3
Land use planning	Ostrobothnia	13	6.9	4.9	-2.0	2.0	2.0
	Finland	9	5.8	4.6	-1.2	2.4	2.2
Environmental issues	Ostrobothnia	12	6.8	5.5	-1.3	2.3	2.1
	Finland	10	5.7	5.2	-0.5	2.2	2.0
Employment affairs	Ostrobothnia	12	6.6	6.1	-0.5	2.1	2.2
	Finland	9	6.3	5.8	-0.5	2.0	2.0

Cooperation between companies and public organisations is most often linked to issues of infrastructure, logistics and regional development (Table 5.5). There is, in particular, a high pressure on regional development in Ostrobothnia.

It can be concluded, by comparing findings in Table 5.5 with those in Table 5.6 that companies are in much closer connection to regional and national policy makers than those active on an international arena.

Table 5.6. Evaluation of cooperation expectations, experiences and trends: companies – public organisations internationally

All companies - public organisations, international cooperation						
Aspect of cooperation	n	Expectations	Experiences	Gap	Trend	History
Technology and business life	5	5.2	4.2	-1.0	2.0	2.0
Environmental issues	4	6.0	6.0	0.0	1.8	2.0
Logistics	4	4.8	3.8	-1.0	2.0	2.0
Education	4	4.3	2.5	-1.8	1.8	2.3
Regional development	4	3.8	3.0	-0.8	2.0	2.0

5.1.2 Energy sector companies

This part reports findings based on how companies representing the energy sector perceive cooperation with other companies, universities and public organisations.

Table 5.7. Company connectivity (energy sector companies)

Energy sector companies			
Type of partner	**Region**		
	Ostrobothnia	Finland	International
Company	23 (21)	26 (20)	20 (4)
Public organisation	2 (2)	2 (0)	0 (0)
University	3 (3)	3 (1)	1 (0)
Development organisation	2 (2)	1 (0)	0 (0)
Number of partners, mean (median)			

As can be seen in Table 5.7, this sector has more international partners, both relatively and in absolute terms. Furthermore, these companies cooperate substantially with other firms.

This cooperation with other companies is important (Table 5.8). Especially other companies in the region of Ostrobothnia add to support, strategy and innovations. When it comes to the University sector and innovations there are indications of weak input.

Table 5.8. Partner importance from a company perspective (energy sector companies)

Energy sector companies and partner importance			
Type of partner	**Region**		
	Ostrobothnia	Finland	International
Company	9.1 / 8.7 / 9.0	8.7 / 8.4 / 7.1	8.0 / 7.7 / 6.8
Public organisation	7.3 / 7.5 / 4.8	6.6 / 7.4 / 4.8	3.5 /2.0 / 1.0
University	7.4 / 5.9 / 5.1	7.5 / 5.6 / 5.5	6.8 / 2.7 / 3.0
Development organisation	7.2 / 5.7 / 5.8	5.5 / 5.8 / 5.2	2.0 / 1.5 / 1.0
Mean value, scale 1 = not at all important, 10 = very important support/strategy/innovation			

The importance of regional companies for development is further validated in Table 5.9. Knowledge developed in cooperation with subcontractors, customers and in-house stands out as particularly important.

Table 5.9. Evaluation in the energy sector of cooperation expectations, experiences and trends: companies – other companies

Energy sector cooperation with other companies in Ostrobothnia and the rest of Finland*							
Aspect of cooperation	Region	n	Expectations	Experiences	Gap	Trend	History
Subcontractors	Ostrobothnia	6	9.3	7.8	-1.5	2.2	2.2
	Finland	6	8.7	7.5	-1.2	2.2	2.5
Customers	Ostrobothnia	4	9.3	8.5	-0.8	3.0	2.5
	Finland	5	8.6	8.2	-0.4	2.6	2.4
In-house cooperation	Ostrobothnia	4	9.0	8.0	-1.0	2.8	2.3
	Finland	4	8.8	7.8	-1.0	2.5	2.8
Technology development	Ostrobothnia	5	9.0	7.6	-1.4	2.6	2.4
	Finland	5	8.0	7.2	-0.8	2.4	2.4
Production system development	Ostrobothnia	6	7.3	6.8	-0.5	2.8	2.3
	Finland	4	8.0	7.5	-0.5	2.3	1.8
Process development	Ostrobothnia	6	6.3	6.0	-0.3	2.7	2.2
	Finland	4	6.8	6.3	-0.5	2.5	2.3
Organisational development	Ostrobothnia	6	5.8	6.0	0.2	2.5	2.2
	Finland	4	5.3	5.3	0.0	2.0	2.0
Marketing	Ostrobothnia	6	7.2	7.3	0.1	2.5	2.5
	Finland	5	7.0	6.8	-0.2	2.4	2.2
Expectations / Experiences, scale 1 = low, 10 = high Gap = Experience – Expectation Trend (future)/ History, scale 1 = decrease, 2 = as before, 3 = increase **International company – company evaluation are not reported due to low rate of response*							

The results for the energy sector are similar to the results for all the companies. In most cases we have negative but small gaps. The biggest gaps are for subcontractors and technology in Ostrobothnia. The gaps were discussed during the focus group seminar and explanations were also provided. The region has several companies that are very successful globally and they have extremely high expectations on their subcontractors. These companies must be competitive when it comes to quality, supply chain, cost level and so on. This provides a though climate for smaller, local subcontractors. They do not have enough resources to keep up with the latest developments in their sector and they are not always willing to take risks with new innovations. One possible solution could be to tie the subcontractors closer to the bigger companies.

To be noticed in Table 5.10 is the high expectations the energy sector has on research partners in Finland. The education level in Ostrobothnia is on an acceptable level. To this one has to notice the high expectation challenging the university sector.

Table 5.10. Evaluation in the energy sector of cooperation expectations, experiences and trends: companies –universities

Energy sector cooperation with universities in Ostrobothnia and the rest of Finland*							
Aspect of cooperation	Region	n	Expectations	Experiences	Gap	Trend	History
Education	Ostrobothnia	6	8.5	7.0	-1.5	2.7	2.3
	Finland**	-	-	-	-	-	-
Research	Ostrobothnia	6	8.5	6.0	-2.5	2.8	2.5
	Finland	4	9.0	7.5	-1.5	2.5	2.5
Development	Ostrobothnia	5	7.2	6.6	-0.6	2.4	1.8
	Finland	4	6.8	6.8	0.0	2.5	2.5
**not reported due to low rate of response **International company –University evaluation are not reported due to low rate of response.*							

Companies of the energy sector do not differ from other types of companies in terms of companies and public sector cooperation. Regional development has first priority, to be followed by issues of infrastructure and logistics. However one has to notice the low level of experiences, which is not a good grade for the public sector. (see Table 5.11)

Regional planning and use of land in Ostrobothnia are also problematic areas from the point of view of the energy sector. Use of land has the biggest gap but expectations are on the other hand not all that high, the expectations on regional planning are exceptionally high in combination with a substantial gap when comparing against experiences. We also find one more aspect of cooperation in Ostrobothnia with a gap of at least two that is cooperation within infrastructure and logistics.

Table 5.11. Evaluation in the energy sector of cooperation expectations, experiences and trends: companies – public organisations

Energy sector companies cooperation with public organisations in Ostrobothnia and the rest of Finland*							
Aspect of cooperation	Region	n	Expectations	Experiences	Gap	Trend	History
Infrastructure and logistics	Ostrobothnia	4	8.5	6.5	-2.0	2.5	2.5
	Finland	4	6.5	5.5	-1.0	2.3	2.5
Regional development	Ostrobothnia	5	9.0	6.6	-2.4	2.4	2.4
	Finland	4	7.0	6.3	-0.7	2.3	2.3
Technology development	Ostrobothnia	6	7.3	6.5	-0.8	2.7	2.3
	Finland	4	6.5	5.3	-1.2	2.3	2.0
Business development	Ostrobothnia**	-	-	-	-	-	-
	Finland**	-	-	-	-	-	-
Land use planning	Ostrobothnia	4	6.5	3.5	-3.0	1.8	1.5
	Finland**	-	-	-	-	-	-
Environmental issues	Ostrobothnia**	-	-	-	-	-	-
	Finland	4	5.0	4.8	-0.2	2.3	2.0
Employment affairs	Ostrobothnia	5	5.8	5.8	0.0	2.2	2.4
	Finland	4	5.5	5.8	0.3	2.3	2.0
**not reported due to low rate of response **International company – public sector evaluation are not reported due to low rate of response*							

The focus group seminar offered some insight and explanations for the questionnaire results. One possibility is that we see a wind power effect. During the recent years we have experienced a great deal of interest in the region from several wind power plant actors. From their point of view it is problematic that it can take several years to obtain permit to build wind power plants. With the rapid development in the sector, technologies may change dramatically during such a long time period. Another, more general explanation is the tendency for companies and public sector to move in different directions. While companies strive to become more and more dynamic they feel that they are held back by the public sector with increasing numbers of laws and regulations. A smoother cooperation with the different agents in the public sector is a main priority. It was also mentioned during the discussions that Ostrobothnia is a big region with good resources, but they are too fragmented. When the resources are divided between many different actors, and decisions are made at different points in time there tend to be something for everyone but not enough for anyone. In order to improve the situation we need to become better at working towards common goals.

5.2 Universities as Triple Helix Actors

The University sector was represented by 12 respondents, and as Table 5.13 shows cooperation is primarily on a regional and national level when it comes to partners with companies. Internationally, joint projects are most often with other universities.

Table 5.13. University connectivity

Universities			
Type of partner	**Region**		
	Ostrobothnia	Finland	International
Company	70 (25)	43 (10)	4 (0)
Public organisation	13 (10)	8 (2)	2 (0)
University	4 (5)	11 (5)	16 (10)
Development organisation	4 (4)	2 (0)	2 (0)
Number of partners, mean (median)			

Respondents representing the university sector find cooperation with companies as most important. One can also notice that these respondents do find contribution of regional actors more important than contributions of national and international actors (see Table 5.14).

Table 5.14. Partner importance from a university perspective

Universities and partner importance			
Type of partner	**Region**		
	Ostrobothnia	Finland	International
Company	9.1 / 8.7 / 8.6	7.8 / 7.2 / 7.0	5.7 / 5.2 / 4.8
Public organisation	8.0 / 7.5 / 8.9	6.6 / 6.7 /7.5	6.2 / 5.9 / 5.8
University	8.0 / 7.9 / 8.3	8.3 / 7.0 / 6.8	8.1 / 7.2 / 6.2
Development organisation	8.1 / 8.0 / 8.3	7.1 / 6.4 / 7.0	6.4 / 3.8 / 3.8
Mean value, scale 1 = not at all important, 10 = very important research/education/social service development			

The figures presented in Table 5.15 portray a structure, which indicate that the university sector on all three dimensions supports the regional company helix. To be noticed is the fairly low experience level.

Table 5.15. Evaluation of cooperation expectations, experiences and trends: universities – companies

Universities - companies							
Aspect of cooperation	Region	n	Expectations	Experiences	Gap	Trend	Histo-ry
Education	Ostrobothnia	12	8.1	6.9	-1.2	2.4	2.4
	Finland	12	7.6	6.2	-1.4	2.3	2.3
	International	7	8.0	7.3	-0.7	3.0	2.9
Research	Ostrobothnia	13	9.1	7.8	-1.3	2.7	2.5
	Finland	12	8.5	7.2	-1.3	2.3	2.3
	International	7	7.9	6.9	-1.0	2.9	2.7
Development	Ostrobothnia	13	9.1	7.9	-1.2	2.5	2.5
	Finland	12	7.8	6.7	-1.1	2.3	2.3
	International	6	7.7	7.2	-0.5	3.0	2.8
Expectation / Experiences, scale 1 = low, 10 = high Gap = Experience – Expectation Trend (future)/ History, scale 1 = decrease, 2 = as before, 3 = increase							

The figures in Table 5.16 signals to the university sector that improvements are to be expected, and that international universities outperform the regional ones. Big gaps are almost exclusively found among the local universities. On the other hand we observe a slightly more positive development in Ostrobothnia, both regarding past history and future trend, compared to other regions.

Table 5.16. Evaluation of cooperation expectations, experiences and trends: universities – other universities

Universities - universities							
Aspect of cooperation	Region	n	Expectations	Experiences	Gap	Trend	History
Education	Ostrobothnia	14	7.6	6.0	-1.6	2.6	2.4
	Finland	13	7.6	6.4	-1.2	2.5	2.3
	International	12	7.6	6.6	-1.0	2.5	2.3
Applied research	Ostrobothnia	15	7.7	6.1	-1.6	2.6	2.7
	Finland	13	7.6	6.7	-0.9	2.5	2.4
	International	11	7.8	6.6	-1.2	2.6	2.6
Basic research	Ostrobothnia	10	5.7	4.2	-1.5	2.6	2.6
	Finland	9	6.9	5.2	-1.7	2.2	2.2
	International	7	6.0	4.7	-1.3	2.4	2.1
Information system research	Ostrobothnia	5	4.4	3.2	-1.2	2.2	2.2
	Finland	6	4.3	4.3	0.0	2.0	2.0
	International	6	3.5	3.7	0.2	2.2	2.2
Regional research	Ostrobothnia	13	7.3	5.4	-1.9	2.7	2.6
	Finland	9	6.2	5.2	-1.0	2.7	2.2
	International	6	6.0	5.2	-0.8	2.5	2.5
Technology research	Ostrobothnia	10	7.6	6.3	-1.3	2.5	2.5
	Finland	9	6.6	5.8	-0.8	2.6	2.3
	International	8	5.9	5.4	-0.5	2.4	2.4
Production system research	Ostrobothnia	10	6.7	5.5	-1.2	2.6	2.4
	Finland	8	5.5	4.1	-1.4	2.4	2.1
	International	8	5.5	4.6	-0.9	2.5	2.5
Process research	Ostrobothnia	10	7.4	6.0	-1.4	2.6	2.5
	Finland	9	6.6	2.1	-1.5	2.4	2.1
	International	7	5.4	4.1	-1.3	2.4	2.4
Organisational research	Ostrobothnia	9	6.8	5.2	-1.6	2.4	2.3
	Finland	9	6.8	5.1	-1.7	2.4	2.1
	International	9	6.0	4.8	-1.2	2.6	2.3
Leadership research	Ostrobothnia	10	7.0	5.2	-1.8	2.6	2.4
	Finland	10	7.1	5.4	-1.7	2.5	2.2
	International	10	6.4	5.3	-1.1	2.5	2.3
Marketing research	Ostrobothnia	9	7.8	6.7	-1.1	2.4	2.6
	Finland	8	5.9	4.6	-1.3	2.3	2.1
	International	8	6.6	5.1	-1.5	2.4	2.3

Cooperation between universities and public organisations was analysed on eight dimensions. Best cooperation experiences were found on dimensions, such as, regional development and research. In general it seems that the most problematic area is cooperation with the public sector in other parts of Finland. (see Table 5.17).

Table 5.17. Evaluation of cooperation expectations, experiences and trends: universities – public organisations

Universities – public organisations							
Aspect of cooperation	Region	n	Expectations	Experiences	Gap	Trend	History
Education	Ostrobothnia	13	7.6	6.5	-1.1	2.6	2.4
	Finland	11	6.6	5.2	-1.4	2.6	2.2
	International	7	7.0	6.3	-0.7	2.7	2.4
Research	Ostrobothnia	15	8.3	7.3	-1.0	2.4	2.4
	Finland	11	7.8	6.2	-1.6	2.6	2.4
	International	8	7.4	6.0	-1.4	2.8	2.9
Employment matters	Ostrobothnia	12	6.8	5.7	-1.1	2.3	2.2
	Finland	9	6.8	5.7	-1.1	2.3	2.2
	International	5	4.8	4.0	-0.8	2.4	2.4
Environmental issues	Ostrobothnia	10	7.4	6.5	-0.9	2.6	2.4
	Finland	8	6.6	5.5	-1.1	2.4	2.1
	International	5	5.6	4.6	-1.0	2.6	2.6
Information system development	Ostrobothnia	6	5.0	3.5	-1.5	2.3	2.3
	Finland	4	4.5	3.3	-1.2	2.5	2.3
	International	5	5.2	4.0	-1.2	2.6	2.6
Regional development	Ostrobothnia	12	8.3	7.1	-1.2	2.7	2.4
	Finland	10	7.0	5.6	-1.4	2.4	2.2
	International	6	7.3	6.3	-1.0	2.5	2.5
Organisational development	Ostrobothnia	11	7.4	6.2	-1.2	2.5	2.3
	Finland	8	6.3	5.0	-1.3	2.4	2.0
	International	5	4.2	3.4	-0.8	2.4	2.4
Marketing development	Ostrobothnia	11	6.0	5.4	-0.6	2.5	2.3
	Finland	8	6.0	5.0	-1.0	2.5	2.0
	International	5	5.0	4.4	-0.6	2.6	2.4

5.3 Public Organisations as Triple Helix Actors

In this section we will examine the depth and regional focus of public sector cooperation. From Table 5.18 we can clearly see that most public sector cooperation is done together with local companies. This is not surprising since the role of the public sector at large is to serve and monitor the firms in Ostrobothnia in many different areas. In the same way it is natural to find close connections within Ostrobothnia with other public sector actors, the university sector and development organisations. There are also a significant number of public sector partners in other parts of Finland; these are a result of government contacts, for example cooperation with different ministries and municipalities. Table 5.19 reinforces the above interpretation, the most important partners are found locally. Public sector partners in other parts of Finland are also important whereas international partners are considered less important.

Table 5.18. Public organisation connectivity

Public organisations			
Type of partner	**Region**		
	Ostrobothnia	Finland	International
Company	197 (50)	26 (4)	7 (0)
Public organisation	25 (20)	27 (10)	5 (2)
University	5 (5)	3 (2)	1 (0)
Development organisation	4 (5)	6 (2)	1 (0)
Number of partners, mean (median)			

Table 5.19. Partner importance from a public organisation perspective

Public organisations and partner importance			
Type of partner	**Region**		
	Ostrobothnia	Finland	International
Company	8.7 / 7.6	7.6 / 6.8	6.6 / 5.1
Public organisation	8.6 / 8.3	8.2 / 7.0	5.9 / 5.7
University	8.1 / 7.1	7.9 / 6.5	6.4 / 4.4
Development organisation	8.0 / 8.5	7.0 / 7.1	5.8 / 5.5
Mean value, scale 1 = not at all important, 10 = very important support/strategy			

Examining the depth of the cooperation in Ostrobothnia we see (Table 5.20) that the highest expectations can be found for industry development, this is natural considering the role of the public sector. This is also the area where we find the highest experiences indicating that the cooperation within this area is on a fairly good level. Regional development on the other hand is slightly more problematic, also here the expectations are rather high but experiences do not quite match up. This is the sector where we observe the biggest gap. However, trend and history variables have mean levels above two, showing that things have improved in the past and are expected to improve in the future.

Table 5.20. Evaluation of cooperation expectations, experiences and trends: public organisations – companies in Ostrobothnia

Public organisations - companies						
Aspect of cooperation	n	Expectations	Experiences	Gap	Trend	History
Infrastructure and logistics	11	8.0	6.8	-1.2	2.4	2.3
Regional development	13	8.9	7.5	-1.4	2.5	2.5
Technology development	14	8.8	7.6	-1.2	2.6	2.4
Business life development	14	9.1	8.0	-1.1	2.3	2.4
Land use plan-ning	10	6.8	6.0	-0.8	2.6	2.3
Environmental issues	11	7.5	6.5	-1.0	2.6	2.6
Employment affairs	12	7.8	6.8	-1.0	2.3	2.3
Expectations / Experiences, scale 1 = low, 10 = high Gap = Experience – Expectation Trend (future)/ History, scale 1 = decrease, 2 = as before, 3 = increase						

Moving on to public sector – university sector cooperation in Table 5.21 it seems that education cooperation nationally is the most problematic area with the biggest gap. The expectations are not all that high but experiences even lower. Other problematic areas are research and regional development, both within Ostrobothnia. Notice also that these areas attracted high response rates, which emphasises their importance.

In the final part we examine the public sector – public sector cooperation presented in Tables 5.22 and 5.23. On the regional level the biggest gap concern infrastructure, in other parts of Finland infrastructure and environment are the most problematic areas. Regional development is worth mentioning as a positive example, very high expectations combined with decent experience levels. Looking at international cooperation we find that most of the dimensions are problematic with big gaps, this is an area with definite room for improvements. On the positive side, all areas exhibit strong positive trends so there is hope for better performances in the future.

Table 5.21. Evaluation of cooperation expectations, experiences and trends: public organisations –universities

Public organisations - universities							
Aspect of cooperation	Region	n	Expectations	Experiences	Gap	Trend	History
Education	Ostrobothnia	13	8.2	6.6	-1.6	2.5	2.2
	Finland	9	7.9	5.9	-2.0	2.3	2.3
	International	5	7.4	5.2	-1.2	2.6	2.4
Research	Ostrobothnia	12	8.5	6.8	-1.7	2.7	2.3
	Finland	10	7.7	6.6	-1.1	2.4	2.5
	International	5	7.6	6.2	-1.4	2.8	2.4
Employment matters	Ostrobothnia	9	7.6	6.4	-1.2	2.3	2.2
	Finland	8	7.3	6.0	-1.3	2.4	2.4
	International	5	5.0	4.0	-1.0	2.2	2.0
Environmental issues	Ostrobothnia	11	6.8	5.5	-1.3	2.6	2.5
	Finland	8	5.9	4.6	-1.3	2.3	2.0
	International	6	5.7	4.2	-1.5	2.5	2.0
Information system development	Ostrobothnia	6	5.8	4.3	-1.5	2.2	2.2
	Finland	6	5.0	4.0	-1.0	2.3	2.2
	International	4	5.0	4.5	-0.5	2.0	1.8
Regional development	Ostrobothnia	14	9.1	7.4	-1.7	2.5	2.4
	Finland	9	7.7	6.6	-1.1	2.1	2.0
	International	6	7.8	6.3	-1.5	2.5	2.3
Organisational development	Ostrobothnia	5	5.2	4.6	-0.6	2.4	2.2
	Finland	6	5.8	5.0	-0.8	2.3	2.2
	International	4	5.8	5.5	-0.3	2.3	2.3
Marketing development	Ostrobothnia	5	5.6	4.2	-1.4	2.6	2.0
	Finland	5	6.2	5.4	-0.8	2.4	2.2
	International	4	6.5	5.8	-0.7	2.5	2.3

Table 5.22. Evaluation of cooperation expectations, experiences and trends: public organisations – other public organisations in Ostrobothnia and other parts of Finland

Public organisations – other public organisations, Ostrobothnia and other parts of Finland							
Aspect of cooperation	Region	n	Expectations	Experiences	Gap	Trend	History
Infrastructure	Ostrobothnia	12	8.7	7.0	-1.7	2.5	2.5
	Finland	9	8.3	6.6	-1.7	2.6	2.4
Regional development	Ostrobothnia	15	9.1	8.0	-1.1	2.5	2.4
	Finland	13	8.2	6.6	-1.6	2.4	2.1
Environmental issues	Ostrobothnia	12	7.5	6.3	-1.2	2.6	2.5
	Finland	9	8.2	6.0	-2.2	2.3	2.1
Employment affairs	Ostrobothnia	14	7.4	6.6	-0.8	2.4	2.3
	Finland	10	6.4	5.5	-0.9	2.3	2.0

Table 5.23. Evaluation of cooperation expectations, experiences and trends: public organisations – other public organisations internationally

Public organisations – other public organisations, internationally						
Aspect of cooperation	n	Expectations	Experiences	Gap	Trend	History
Technology and business life development	10	8.5	7.3	-1.2	2.6	2.4
Environmental issues	8	8.1	6.6	-1.5	2.6	2.3
Logistics	8	8.2	6.0	-2.2	2.9	2.6
Education	7	7.6	4.9	-2.7	2.7	2.3
Regional development	8	7.9	5.9	-2.0	2.6	2.4

5.4 Technologies for Innovations

The last section of the questionnaire included questions about technology for innovation, with a reference to their importance today and in 20 years (Table 5.24). As can be seen from the Table, the respondents have a firm belief in renewable energy as a sector for regional innovations, and a competitive advantage founded on advanced production methods. Another important sector for innovations is smart grids.

Table 5.24. Perceived importance of technology for innovations

	Importance		
Technology	**n**	**Today**	**In 20 years**
Nanotechnology	31	4,4	7,2
Micro- and nanoelectronics including semiconductors	30	6,0	8,0
Photonic	25	3,9	5,3
Advanced materials	38	6,3	8,0
Biotechnology	34	5,3	7,2
Advanced production methods	39	7,4	8,8
Smart grids (intelligent electrical networks)	44	7,0	8,9
Renewable energy	28	7,1	9,5

It was concluded earlier that regional cooperation is important and strong. Therefor it is of interest to further analyse where the most important cooperation part-

ners are located today and in the future. As can be found in Table (5.25), the respondents have a strong belief in the region on all dimensions.

Table 5.25. For technology development where are the most important partners located

The location of technological innovators	Within own organisation	In the companies	In the public organisations	Universities and research entities	Development organisations
In Ostrobothnia and Central Ostrobothnia	28	43	13	34	22
In other parts of Finland	6	37	6	30	10
In the rest of the world	7	28	6	26	10

Looking into the future and inspiration to technology development, the respondents have a strong belief in the knowledge generation processes of the companies (the company helix). Interesting to notice is also the importance of universities, especially those located abroad, for new technology development (Table 5.26).

Table 5.26. Evaluation of own organisation and helixes for new technology development (scale 1 to 10)

Where will Ostrobothnian organisations find technological development partners 20 years hence?	Within own organisation	In the companies	In the public organisations	Universities and research entities	Development organisations
In Ostrobothnia and Central Ostrobothnia	7,5	8,8	3,9	8,0	5,7
In other parts of Finland	6,6	8,3	4,4	8,5	5,6
In the rest of the world	6,3	8,5	3,6	8,9	6,1

5.5 Summary

The findings presented in this chapter, with a focus on all actors analysed, portray a triple helix structure (Figure 5.1) which out of a:

Company helix perspective shows:
- a strong regional intra-business helix, in terms of number and quality of company interactions. To this, it can be added that companies in Ostrobothnia have extended networks, which also include national and international companies.
- negative cooperation experiences (with all actors, from all helixes) measured as Gaps of experiences to expectations, and
- a trend, which emphasise the importance of cooperation networks.

University helix perspective shows:
- well-developed network to regional and national companies and public actors.
- good connections to regional universities, as well as, national and international ones, and
- although the experiences of the connections does not meet up to the expectations, actors representing the University helix advocate the importance of the triple helix structure.

Public helix perspective shows:
- many connections to companies and other actors in the public helix as well as to regional universities.
- actors representing the public sector are most critical to existing cooperation networks in terms of experiences to expectations, and
- in particular, the experiences of public and university cooperation in terms of education and research is fairly low.

Counting the number of connections between different types of actors and based on this measure estimate a share of connectivity between the different types of helix the following structure emerges. (Figure 5.1).

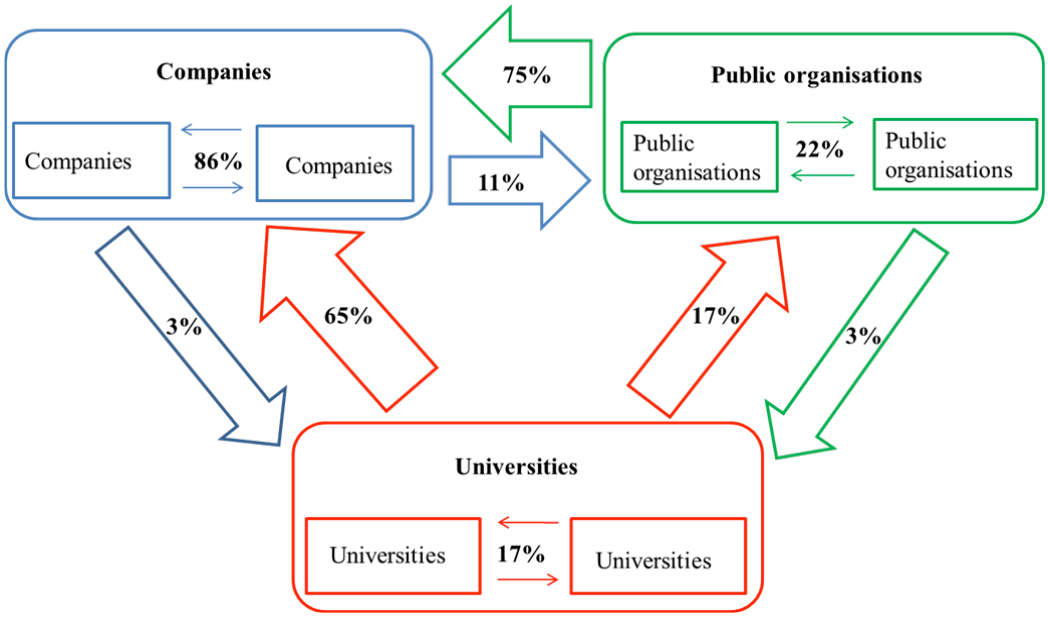

Figure 5.1. Triple helix structure in Ostrobothnia

Companies in Ostrobothnia cooperate most with other companies (86 % of the links between partners are company to company interactions). 11 percent of the companies' contacts are with the public sector and 3 percent with universities. The cooperation structure is completely different in the Public and University Helix. Here, the intra-helix cooperation is on much lower level, and the contacts with the companies dominate.

With a focus on Ostrobothnia and perceived partner importance for innovation, strategy and research it can be concluded that companies lean on cooperation with other companies, the universities find cooperation with companies as most important, and actors in the public sector take influence from all helixes in strategic issues.

Based on the identified gaps between expectations and experiences of cooperation between different helixes in Ostrobothnia (Figure 5.2) it can be argued that:

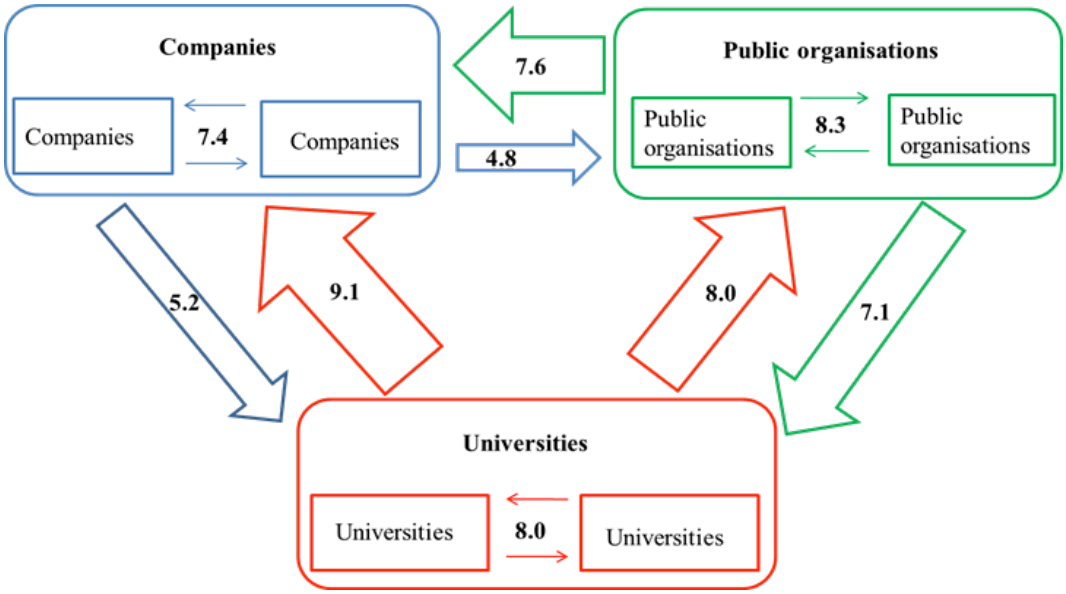

Figure 5.2. Perceived partner importance in the triple helix of Ostrobothnia (innovation for the company helix/ strategy for the public helix / research for the University helix)

In Company – University helix:

Universities have better experiences, but are more dissatisfied with the cooperation than companies.

In Company – Public helix:

Large gaps can be identified analysing companies perception on public actors in terms of regional development and land use plans in Ostrobothnia. One can also notice that actors of the public helix evaluate their cooperation with the companies as better than the company actors perceive on all dimensions but "Infrastructure logistics". A particular large discrepancy is on the "Industry development" dimension. The Public sector actors consider the cooperation as 8 in comparison to the companies which grade it as 5.7.

In University – Public helix:

The experienced cooperation is on a fairly low level on all dimensions from both perspectives. One can notice that actors of the public helix are particularly disappointed with the regional academic research.

The empirical findings presented in this chapter have many dimensions for interpretation. The summary presented in this section has had a focus on the triple helix structure of Ostrobothnia and dimensions linked innovations such as research and industry development. For further in-depth studies focus can be put on national and international cooperations, as well as, on all sub-dimensions reported in the Tables.

Respondents were also asked about technologies for innovations. Generally, they have a strong belief in all eight technologies asked for. However, they point out renewable and smart grid technologies as the two most important development areas. Furthermore, it can be concluded that partners for technology development are identified in cooperation with other companies and universities, mainly regional. Finally, the findings give reason to believe that knowledge for technology innovations, in the future, will be absorbed from universities abroad.

6 APPLYING SUSTAINABLE COMPETITIVE ADVANTAGE (SCA) METHOD FOR REGIONAL INNOVATIONS

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The growing role of technology cannot be underestimated nowadays as it brings vast number of opportunities for business development, growth and strengthen the companies' competitive advantages (Takala 2012). The advanced technology is the source of profit and competitiveness to enterprises, and at the same time, it also supports enterprises to adapt to market changes. Along with the unceasing renovation of technology, enterprises must continually adapt to the technical requirements of market.

This article concentrates on smart specialisation and especially on estimation of connectivity between companies, public sector and academic area with the help of Sustainable Competitive Advantage (SCA) method. First, background information and theory is covered in details and then analyses based on technology rankings and RAL model are performed separately. At the final stage, SCA analysis is used to see how companies, academic area and other companies are connected. The idea is that the higher connectivity leads to more successful and sustainable developments.

6.1 Theoretical Background and Methodology

Sense and Respond Model

Sense and respond strategy is used to assist in forming a picture of what might happen in the future. Using sense and respond method enables firms not only to collect data regarding expectations and experiences but also to understand how firms see themselves compared to competitors. Besides, firms are able to see the development of a certain attribute at a given time frame (Strauss and Neuhauss 1997; Bradley and Nolan 1998; Ranta and Takala 2007). The following Table 6.1 shows model of questionnaire for Sense and Respond method (Ranta & Takala, 2007):

Table 6.1. Format of the questionnaire (adapted from Ranta and Takala 2007)

Performance attribute	**Scale: 1=low, 10=high**		**Compared with competitors**			**Direction of development**		
	Expectation (1-10)	Experience (1-10)	worse	same	better	worse	same	better
Performance 1								
Performance 2								

Critical Factor Index and Balanced Critical Factor Index

"The Critical Factor Index (CFI) method is a measurement tool to indicate which attribute of a business process is critical and which is not, based on the experience and expectations of the company's employees, customers or business partners" (Ranta & Takala 2007).

In fact, the CFI method is a supporting tool for the strategic decision-making. This tool helps mangers to make decision fast and react more suitable. In the current business environment fast adaptation and development can be considered as one of the most important company strengths (Takala & Uusitalo 2012).

Balanced Critical Factor Index (BCFI), that is modified CFI, detects the most critical factors affecting the overall company's performance much more properly and reliably. BCFI method provides the company with the crucial strategic data for the approach development and correction. The easiest way for the required data collection is the qualitative questionnaire. The key issue is that the more interviews take place in the data collection phase, the results are more reliable.

The Scaled Critical Factor Index (SCFI) model is developed by Takala and Liu (2011) which adds trend research into the study (Liu 2010).

After the data collection, the formulas from 1 to 10 (Table 6.2) are used to calculate CFI, BCFI SCFI and New Scaled Critical Factor Index (Nadler & Takala 2008; Takala & Uusitalo 2012):

Table 6.2. CFIs calculation formula

Name	Model
CFI	$CFI = \frac{Std(experience) * Std(expectations)}{Gap\ Index * Direction\ of\ Development\ Index * Importance\ Index}$ (1)
BCFI	$BCFI = \frac{Std(experience) * Std(expectations) * Performance\ Index}{Importance\ Index * Gap\ Index * Direction\ of\ Development\ Index}$ (2)
SCFI	$SCFI = \frac{\sqrt{\frac{1}{n} * \sum_{i=1}^{n} [experience(i) - 1]^2} * \sqrt{\frac{1}{n} * \sum_{i=1}^{n} [expectations(i) - 10]^2} * Peforamnce\ Index}{Importance\ Index * Gap\ Index * Direction\ of\ Development\ Index}$ (3)
NSCFI	$NSCFI = \frac{\sqrt{\frac{1}{n} \cdot \sum_{1}^{n} [experience(i) - 1]^2} \cdot \sqrt{\frac{1}{n} \cdot \sum_{1}^{n} [expectation(i) - 1]^2}}{Imprtance\ index \cdot Gap\ index \cdot Development\ index}$ (4)

Parameters:

– Importance index: presents the level of importance of one criterion among others. This index reflects the actual expectations of the company regarding one criterion.

$$Importance\ index = \frac{Avg(experience)}{10} \quad (5)$$

– Gap Index: which is used to understand the gap between experience and expectations of a specific criteria

$$Gap\ index = \left| \frac{Avg(experiecne) - Avg(expectation)}{10} - 1 \right| \quad (6)$$

– Development index: This presents the information about the actual direction of the company's development.

$$\textit{Developments index} = \left| \frac{\text{Better\%} - \text{Worse\%}}{100} - 1 \right| \quad (7)$$

– Performance index: presents the value of an attribute's performance based on the real experience of the respondents

$$\textit{Performance index} = \frac{\text{Avg(experience)}}{10} \quad (8)$$

– Standard deviation of experience: represents if respondents have similar answer regarding to one attribute for what they have experienced.

$$\textit{SD experience index} = \frac{\text{Std(experience)}}{10} + 1 \quad (9)$$

– Standard deviation of expectations: reflect if respondents have similar answer regarding to one attribute for expectation in a specific future.

$$\textit{SD expectation index} = \frac{\text{Std(expectation)}}{10} + 1 \quad (10)$$

When the calculations are ready, the results of CFI, BCFI and SCFI calculation can be presented in the following bar chart (Figure 6.1). The different questions and their identification numbers can be found as an appendix 2.

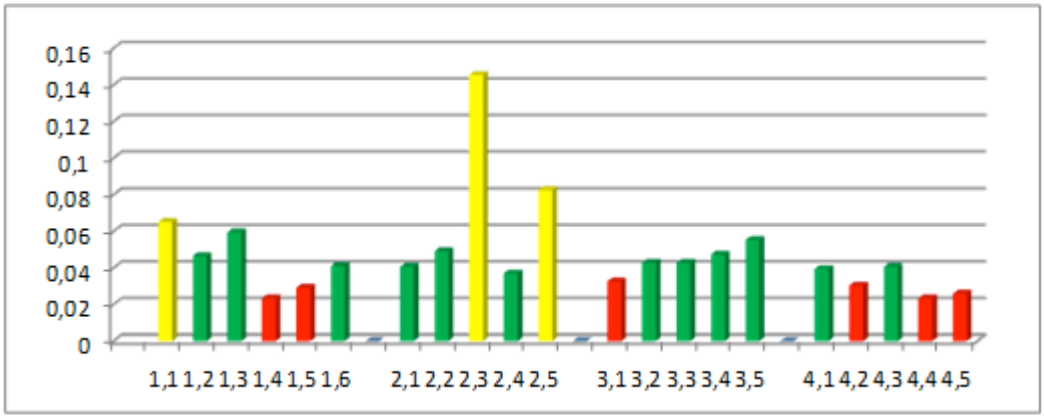

Figure 6.1. Example of the final bar chart to represents CFI, BCFI or SCFI results

Method of judgments for critical attributes

Once the bar chart is ready, three colors are used to define the level which one attribute are located: red for under resources attributes, green for normal attribute (not critical) and yellow for over recourses attributes. Both red and yellow bars (over and under resources attributes) are critical.

For defining the better resource allocation, firstly, the whole resource is counted to be 100 % and it is divided to the total number of attributes to define the average resource level. Then an attribute is counted to be balanced and takes the green color if CFI (BCFI/SCFI) value is between the range of 1/3 and 2/3 of average resource level. For the rest, if any attribute has lower value than 1/3 of average resource level then it is counted to be under resourced and takes the red color. If one attribute has higher value than 2/3 of average resource level is counted to be over resourced and takes the yellow color (Liu et al. 2011).

RAL model

The way to integrate Miles & Snow Topology (Miles and Snow 1978) into Sense and Response methodology is to use RAL Model (Figure 6.2). RAL is abbreviated from Responsiveness, Agility and Leanness. A firm can optimize the RAL model components (Responsiveness, Agility, Leanness) by prioritizing between cost, quality, time and flexibility (Takala 2012).

- Responsiveness: is firm's ability to respond and to react to the customers demand within the constraints of cost and time (Holweg 2005).
- Agility: is ability to adjust in competitive and turbulent environments. Yauch (2011) writes agility results to on time delivery with the optimal cost and quality.
- Leanness: which means to minimise waste which helps company to improve quality and reduce cost and delivery time (Senaratne 2008).

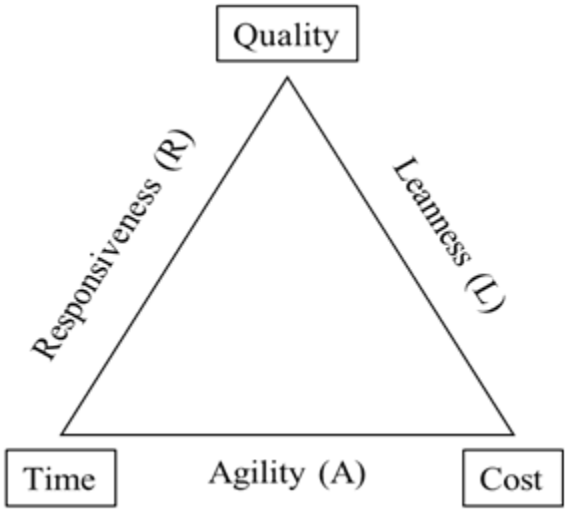

Figure 6.2. RAL model (Ranta & Takala 2007)

Methodology: case studies

In order to test the model, 21 case studies from three industry sectors in Ostrobothnia were investigated. Cases are studied with the empirical material received by the questionnaire presented in Chapter 4. The numbers of interviews regarding to each group are as follows:

1. Energy sector: 9 companies
2. Boat industry: 3 companies
3. Fur industry: 3 companies
4. Other industry: 6 companies

The SCA factors are calculated for each company, and risk levels for companies' strategy are evaluated. Also in order to evaluate the effect of Technology and knowledge on CFIs, three companies from energy sector are asked to answer the Technology/Knowledge questionnaire. All the various questions measured and their identification number can be found as an appendix 2.

6.2 Energy Sector

The following Table shows the overall situation of connectivity among companies, academic sector and public part in energy sector (see Table 6.3).

Table 6.3. Energy sector: existing relations per helices and per regions

	Company – Public sector	**Company – Academic sector**	**Company – Other companies**
Company 1	1.Ostrobothnia and Central Ostrobothnia region 2.other regions of Finland	1.Ostrobothnia and Central Ostrobothnia regions 2. other regions of Finland	1.Ostrobothnia and Central Ostrobothnia regions 2. other regions of Finland 3.international cooperation
Company 2	1.Ostrobothnia and Central Ostrobothnia region 2.other regions of Finland	Ostrobothnia and Central Ostrobothnia region	1.Ostrobothnia and Central Ostrobothnia regions 2. other regions of Finland 3.international cooperation
Company 3	No relation	No relation	1.Ostrobothnia and Central Ostrobothnia regions 2. other regions of Finland 3. international cooperation
Company 4	1.Ostrobothnia and Central Ostrobothnia region 2.other regions of Finland 3.international cooperation	No relation	No relation
Company 5	1. Ostrobothnia and Central Ostrobothnia region	1. Ostrobothnia and Central Ostrobothnia region	1.Ostrobothnia and Central Ostrobothnia region 2.other regions of Finland 3.international cooperation
Company 6	1.Ostrobothnia and Central Ostrobothnia region 2.other regions of Finland	No relation	No relation
Company 8	No relation	1.Ostrobothnia and Central Ostrobothnia region 2.other regions of Finland	1.Ostrobothnia and Central Ostrobothnia region 2.other regions of Finland 3.international cooperation
Company 9	1.Ostrobothnia and Central Ostrobothnia region 2.other regions of Finland	1.Ostrobothnia and Central Ostrobothnia region 2.other regions of Finland 3.international cooperation	1.Ostrobothnia and Central Ostrobothnia region 2.other regions of Finland 3.international cooperation
Conclusion	Cooperation all around Finland	Cooperation in all around Finland (weak cooperation)	Cooperation all around Finland along with International cooperation

6.2.1 CFI-method results of relations of energy companies

Companies – public organisations

Figure 6.3 demonstrates the average level of experience and expectation in past and future for energy sector companies (see also appendix 2). As bar chart shows the level of most criteria is improved for future.

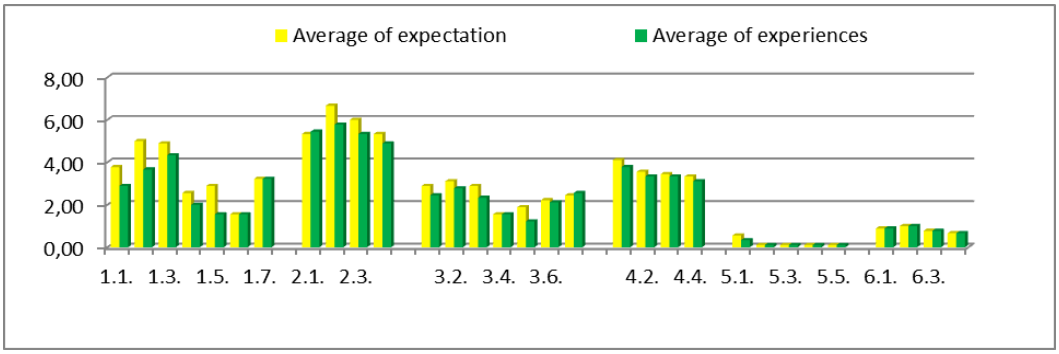

Figure 6.3. Energy industry: Average of expectations vs. average of experiences (company-public organisation)

The following bar chart (Figure 6.4.) shows NSCFI results of the relation between company and public organisation in energy sector for future.

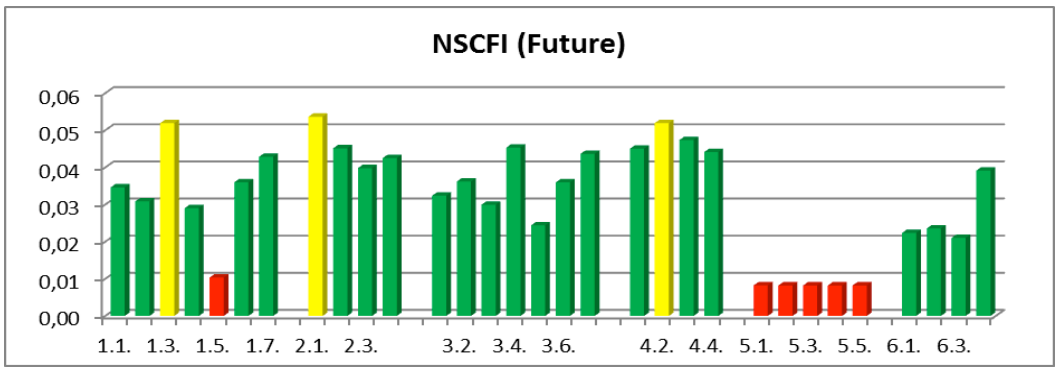

Figure 6.4. Energy industry: NSCFI (future), company-public organisation

As the bar charts shows, most of attributes are in balanced level in future but all 5 attributes of international cooperation are under resource area which means that energy sector companies in Ostrobothnia region are disconnected from international public organisations. These attributes are: cooperation on technological and business life development; cooperation on environmental issues; cooperation on logistics; cooperation on regional development; and cooperation on education.

Companies – universities

Figure 6.5 compares the average level of resources for different criteria in past and future. As the bar chart shows, the level of most criteria improves in future

which means that the companies in energy sector plan to have better connection with universities.

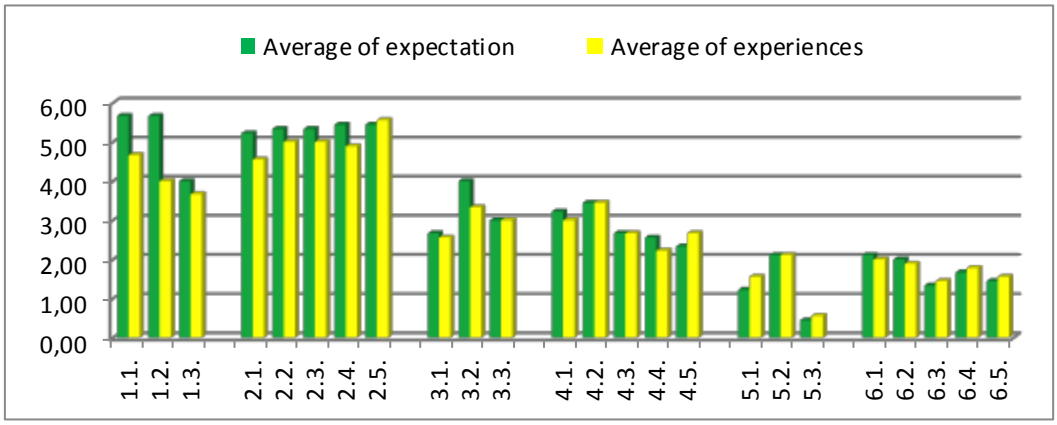

Figure 6.5. Energy industry: Average of expectations vs. average of experiences (companies- universities)

Bar chart (Figure 6.6) demonstrates of NSCFI analysis between companies and universities in energy sector for future:

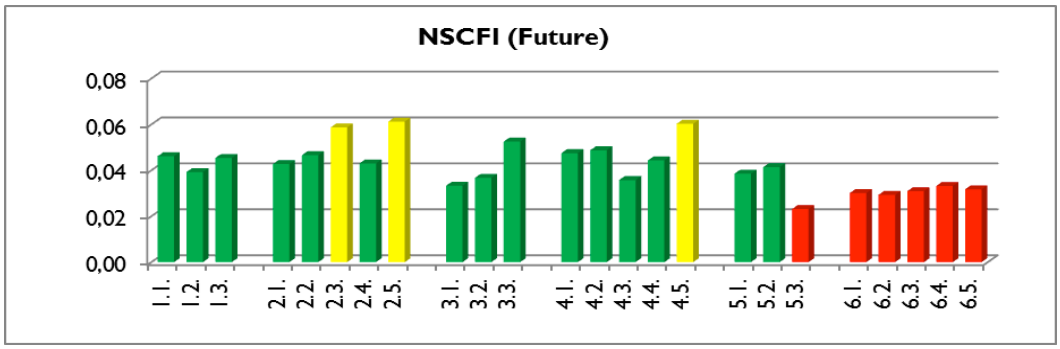

Figure 6.6. Energy industry: NSCFI (future), companies-universities

As the above bar chart shows most of the attributes are in balanced level. But companies in energy sector have problem with international cooperation. It means that their relations with their university partners should be taken in to consideration. These critical attributes are: we contact our most important partner; we know our most important partner's R&D and education methods; we know our most

important partner's work; our most important partner improves our innovation; we know our most important partner's research and education staff.

Companies – other companies

Figure 6.7. presents the average level of different criteria for past and future. Here also the level of most attributes improves in future which means companies plan to have more and better connection with other companies.

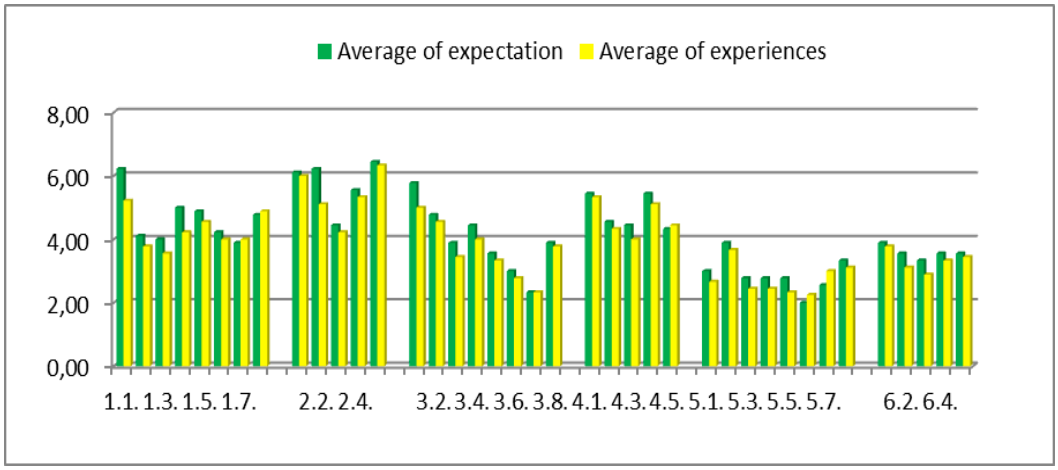

Figure 6.7. Energy industry: Average of expectations vs. average of experiences (companies- other companies)

Bar chart in Figure 6.8 demonstrates the relation between respondents in energy sector and other companies in Ostrobothnia. As the Figure shows, almost all criteria are located in balanced level which means that energy sector companies do not have serious problems in terms of different attributes of the cooperation with other companies. Only in the Ostrobothnia region there are some unclear attributes, which means that different respondents have different opinions about it. These areas are: cooperation with subcontractors; cooperation with customers; cooperation in developing production functions; cooperation on production system development and cooperation in marketing. The problematic areas in other parts of Finland are on cooperation with subcontractors and cooperation on organisational development.

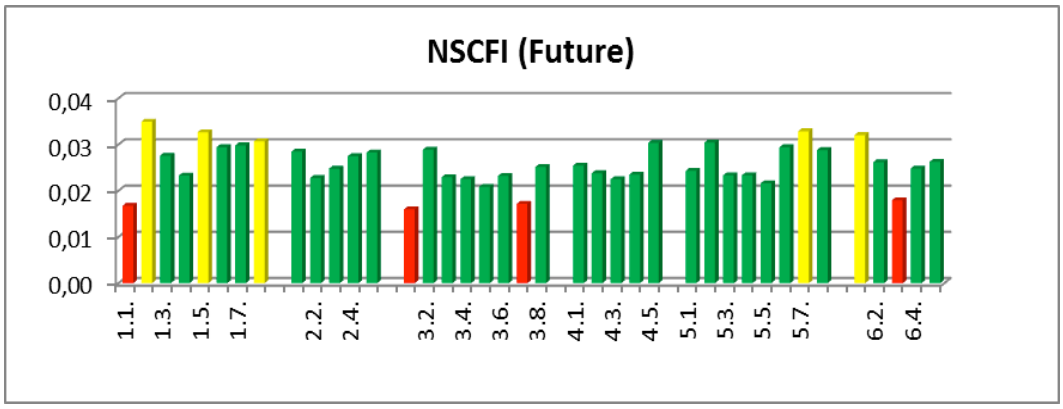

Figure 6.8. Energy industry: NSCFI (future), companies-other companies

3.2.1 SCA -risk level results

SCA -risk level for energy sector companies for past and future are demonstrated in following Tables:

Table 6.4. Energy industry: SCA -risk level, past

	BCFI	**SCFI**	**NSCFI**
Companies – Public organisations	0.98	0.99	0.97
Companies – Universities	0.89	0.87	0.89
Company – Other companies	0.94	0.95	0.95

Table 6.5. Energy industry: SCA -risk level, future

	BCFI	**SCFI**	**NSCFI**
Companies – Public organisations	0.95	1	0.96
Companies – Universities	0.89	0.88	0.89
Companies – Other companies	0.94	0.96	0.95

Comparison between Table 6.4 and Table 6.5 shows that SCA -risk level for energy sector companies remains almost unchanged in future. It means that internal resources allocation for energy sector companies supports equally companies' strategies in different sector (public sector, academia, and other companies) in past and future.

6.2.3. The effect of technology and knowledge on CFIs calculation

Besides the smart specialisation questionnaire extra information was asked from energy companies. Questions on technology and knowledge (T/K) co-operation were answered by three companies from energy industry. The following three bar charts (Figures 6.9, 6.10 and 6.11) show how T/K calculations affect on CFIs results:

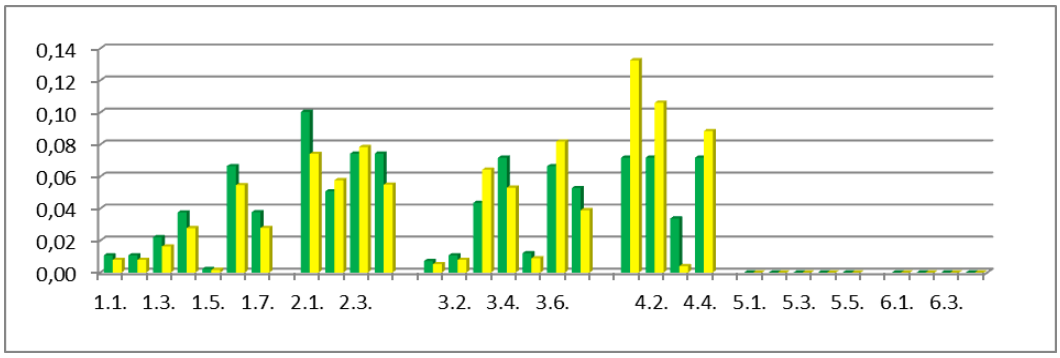

Figure 6.9. Demonstration of T/K on NSCFI – companies and public organisations

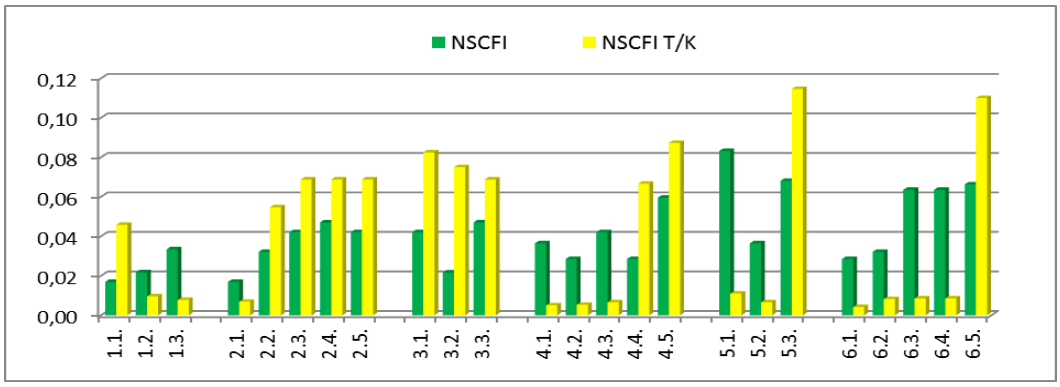

Figure 6.10. Demonstration of T/K on NSCFI – company and universities

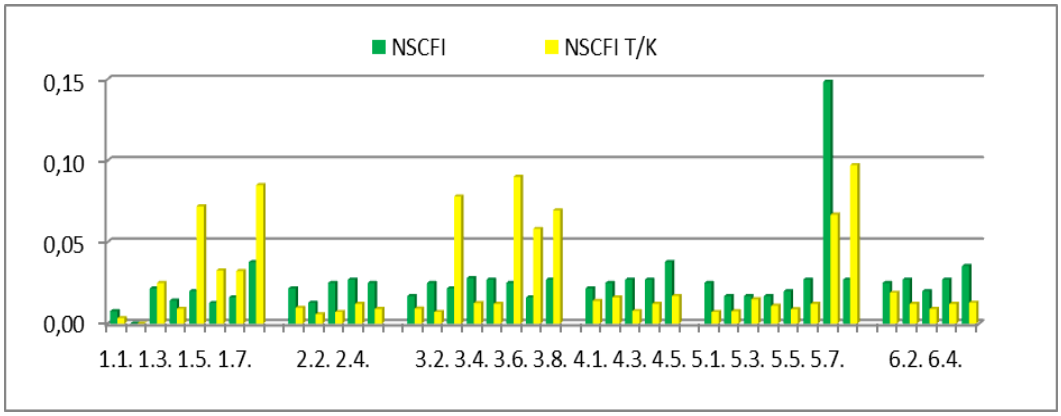

Figure 6.11. Demonstration of T/K on NSCFI – companies and other companies

As three bar charts reveal, adding T/K factor on NSCFI effects on the results but not to a fixed direction; for some attributes the revel of resources increases and for some of them decreases.

6.2 Fur Industry

Three fur industry companies were interviewed. The results show that fur industry companies and public organisations have cooperation all around Finland, and there is also strong cooperation between companies and universities in Ostrobothnia and at international level. The cooperation among companies is strong all around Finland and also in international level.

6.3.1 CFI-method results of relations of fur companies

Companies – public organisations

The following bar chart (Figure 6.12.) reveals the difference between average of expectations and average of experiences. The comparison of experiences and expectations in cooperation between companies and public organisations reveals, where the resources should or should not be put in the future period.

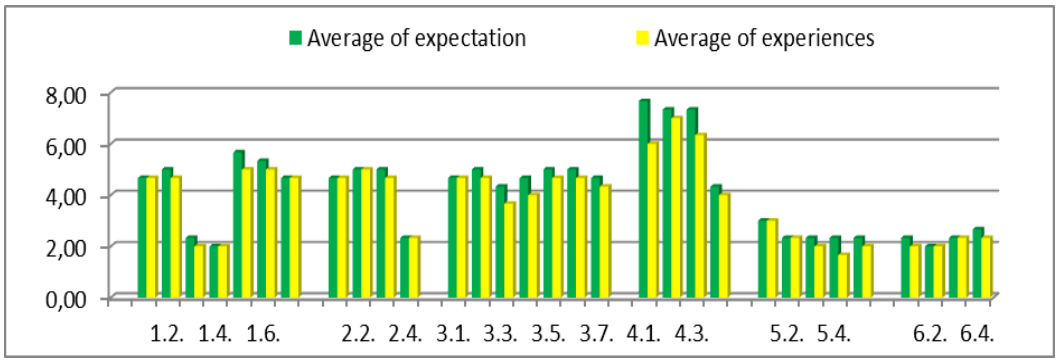

Figure 6.12. Fur industry companies – Public organisations: Average of expectations vs. average of experiences

According to this bar chart (Figure 6.12.), level of most of the attributes increases in future, which means that a company expects to have significant improvement in cooperation with public sectors in other regions of Finland and in the international level. However, the fur industry companies expect a stable development in cooperation with public organisations in Ostrobothnia region in such criteria as cooperation on infrastructure and logistics; cooperation on business development; cooperation on employment affairs; our most important partner contacts us; our most important partner knows our operations; and our most important partner knows our staff.

In order to define problematic and stable areas NSCFI method is used. The results in future period time can be seen in the following chart (Figure 6.13.).

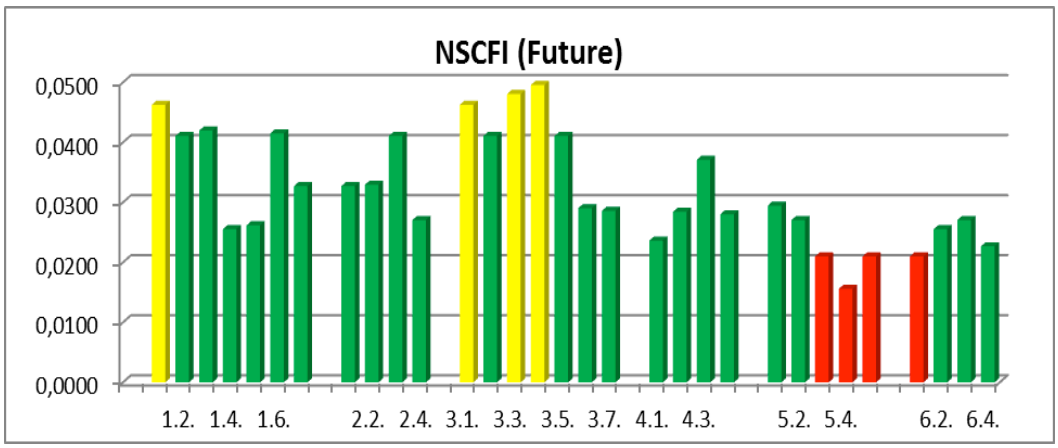

Figure 6.13. Fur industry companies – Public organisations: NSCFI (future)

The situation in future will be worsened in cooperation with public organisations in other regions of Finland. More scattered areas will be appeared as an addition to the past situation: cooperation on infrastructure and logistics; cooperation on business development; cooperation on technology development. At the same time, at the international level more critical attributes will be appeared as well additional to past period: cooperation on infrastructure and logistics; co-operation on education; cooperation on regional development; our most important partner knows our work. Nonetheless, in Ostrobothnia region cooperation on business development attribute will be stabilised.

Companies – universities

The following bar chart provides information about differences between experiences and expectations in cooperation between fur industry companies and universities. Based on this bar chart, it can be noticed that companies expect to see improvements in future in cooperation in Ostrobothnia and international level. However, in other regions of Finland most companies want to have stable development. (Figure 6.14.)

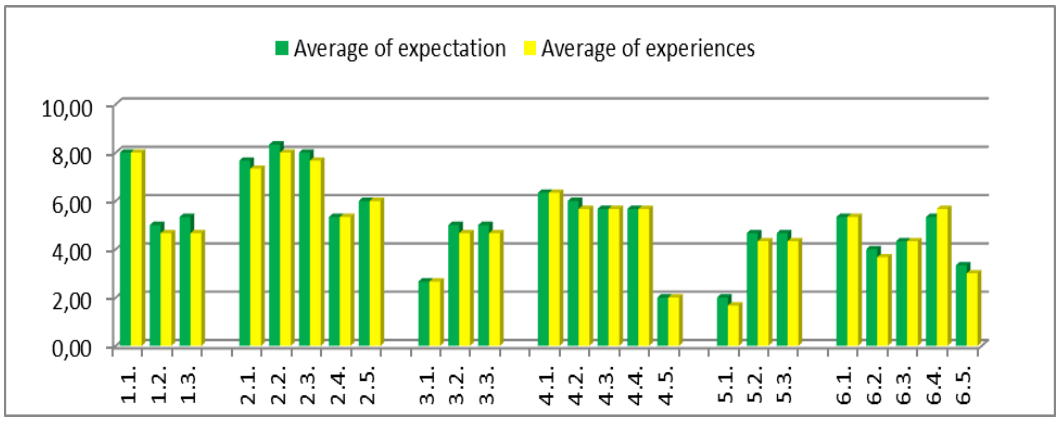

Figure 6.14. Fur industry companies – Universities: Average of expectations vs. average of experiences

Next bar chart (Figure 6.15.) shows the situation in relationship between companies and universities in future. According to this graph, the cooperation will be stable and will be significantly improved. There are no critical problems in other regions in Finland. On the other hand there is only one serious problem in the

international cooperation: educational cooperation and one scattered attribute in the same region: our most important partner improves our innovation.

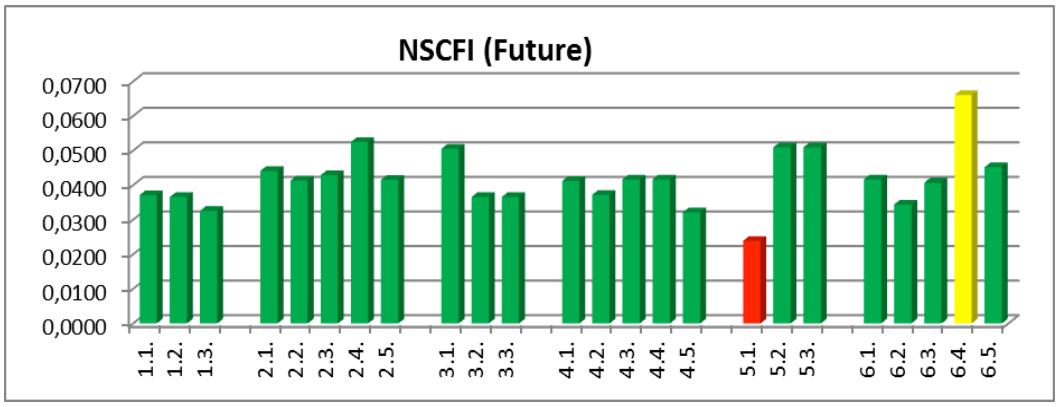

Figure 6.15. Fur industry companies – Universities: NSCFI (future)

Companies – other companies

Figure 6.16. compares the average of experience with average of expectations in companies' collaboration with other companies. It can be seen from a graph that companies would like to enhance their cooperation with other companies in future, especially in Ostrobothnia, and at international level. In other regions of Finland the improvements are not crucial and sometimes it can be even stable.

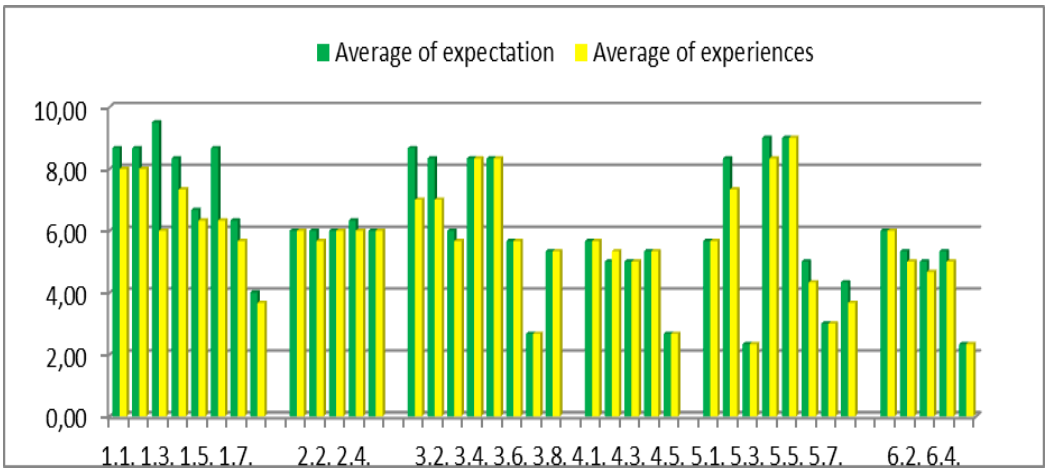

Figure 6.16. Fur industry companies – Other companies: Average of expectations vs. average of experiences

Following chart (Figure 6.17.) represents the general situation of the cooperation of fur industry companies. The results are positive and it means that fur industry companies do not have vital problems in cooperation with other companies. Only cooperation between departments of the own company in Ostrobothnia region is defined as problematic, on which attention and resources should be put on. In addition to that there are three scattered attributes in other regions of Finland and in the international level. They are: cooperation with customers in Ostrobothnia region; our most important partner in other parts of Finland helps us with our difficult problems; and we share our key know-how with our most important international partner during mutual innovation.

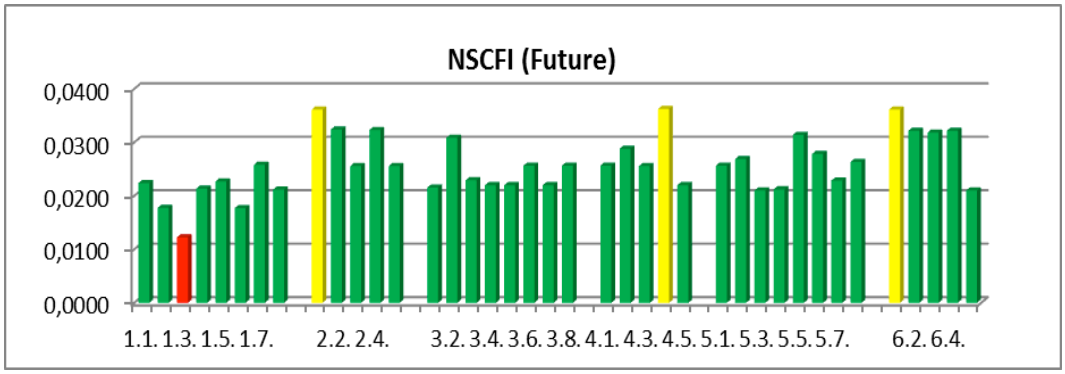

Figure 6.17. Fur industry companies – Other companies: NSCFI (future)

3.2.1. SCA -risk level results

SCA -risk level for fur sector companies for past and future are demonstrated in following Tables (6.6 and 6.7):

Table 6.6. SCA -risk level, past

	BCFI	SCFI	NSCFI
Companies – Public organisations	0.93	0.93	0.94
Companies – Universities	0.93	0.92	0.91
Companies – Other companies	0.99	0.99	0.98

Table 6.7. SCA -risk level, future

	BCFI	SCFI	NSCFI
Companies – Public organisations	0.99	0.96	0.96
Companies – Universities	0.90	0.90	0.90
Companies – Other companies	0.99	0.98	0.98

Comparison between the two Tables shows that SCA -risk level for fur sector companies will increase in future. It means that resources allocation for fur industry companies will be used in a proper way and critical areas will be changed into stable areas. However, risk levels in cooperation between fur companies and universities will decrease and resources are not allocated for developing this collaboration.

6.3 Boat Industry

Three boat industry companies were interviewed. According to the results there is cooperation between companies and public organisations all around Finland and at international level. Companies and universities have strong cooperation in Ostrobothnia. There is cooperation among companies all around Finland and also in international level.

6.3.1 CFI-method results

Companies – public organisations

Comparison of average of experiences and average of expectations is reveled in the chart below (Figure 6.18), which helps to define the areas of expected development in boat industry. It reveals that in Ostrobothnia relationships between boat industry companies and public organisations could be significantly improved while there are no crucial changes in other regions of Finland or internationally.

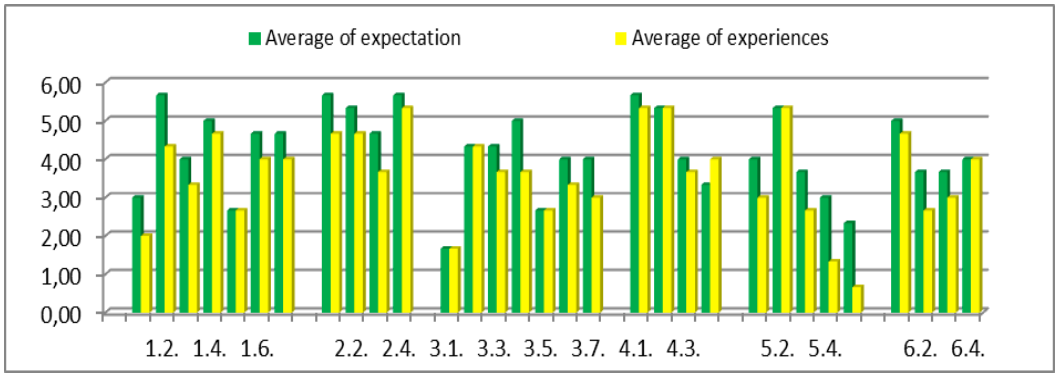

Figure 6.18. Boat industry companies – Public organisations: Average of expectations vs. average of experiences

Bar chart (Figure 6.19.) below demonstrates the cooperation situation between companies and public organisations in future. Based on this graph, it can be noticed that situation in the future is almost stable. However, there are areas in every region which should be put more attention on. They are: cooperation on infrastructure and logistics and our most important partner improves our innovation process in Ostrobothnia; cooperation in business development and cooperation in employment affairs in other parts of Finland, and finally cooperation on regional development and cooperation on education development internationally. At the same time cooperation in other parts of Finland has the biggest amount of scattered attributes: cooperation on regional development; our most important partner knows our work; and our most important partner knows our staff.

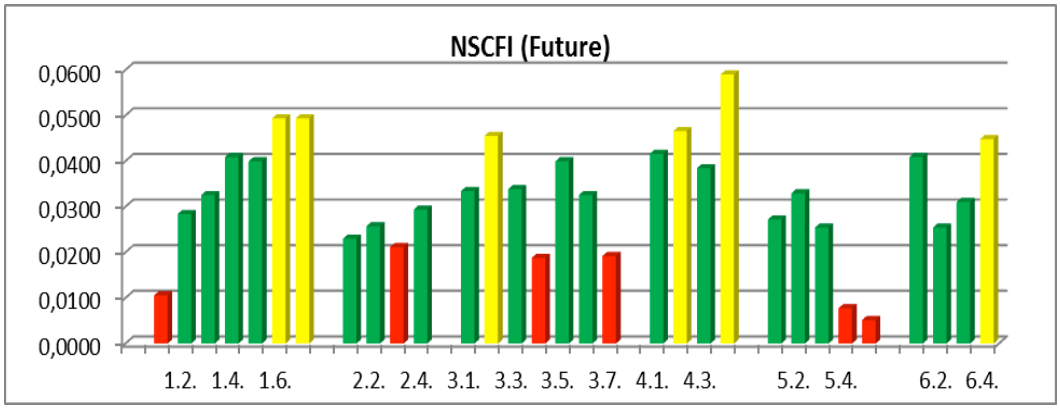

Figure 6.19. Boat industry companies – Public organisations: NSCFI (future)

Companies – universities

Following graph (Figure 6.20.) reveals the comparison between expectations and experiences among companies and universities in boat industry. Consequently, the results show that boat industry companies expect to have considerable development and big changes in future in all regions of Finland and also internationally.

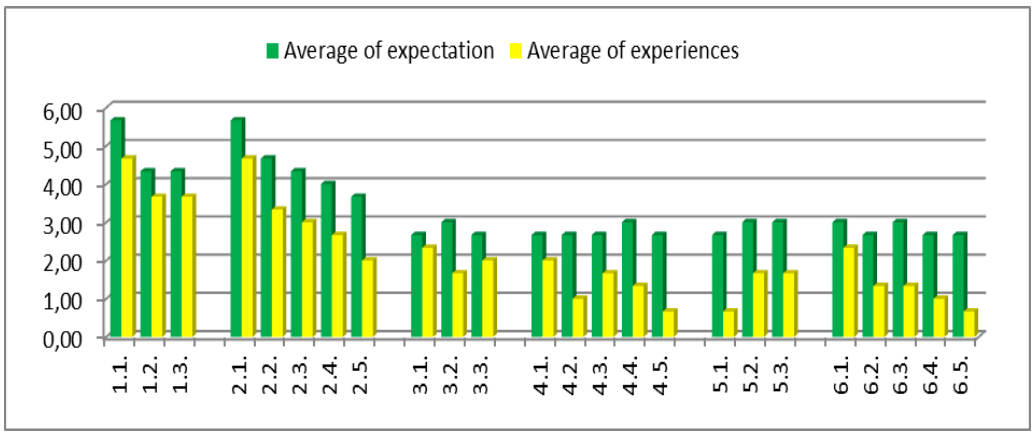

Figure 6.20. Boat industry companies – Universities: Average of expectations vs. average of experiences

Based on NSCFI-method, future situation of relationship between boat industry companies and universities is defined. Below graph (Figure 6.21) revels some areas needed to be considered above all. They are: we know our most important partner's R&D and education methods; our most important partner improves our innovation processes; we know our most important partner's research and educational staff in other parts of Finland and international cooperation on education; our key partner improves our innovational activities; we know our most important international partner's research and educational staff. Additionally, there are undefined and unclear areas in Ostrobothnia: cooperation on education and cooperation on research.

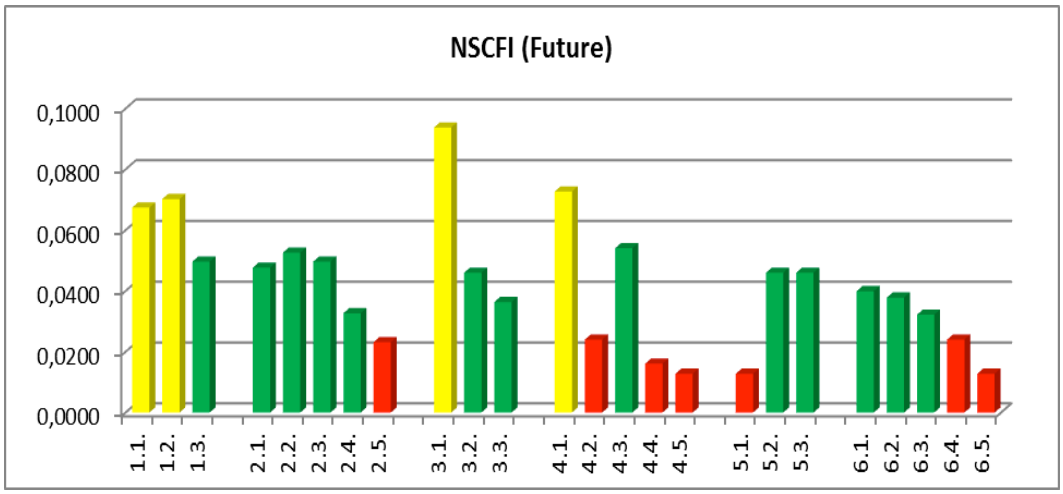

Figure 6.21. Companies – universities: NSCFI (future)

Boat industry companies – other companies

The following bar chart (Figure 6.22.) shows the average of expectations and average of experiences between interviewed boat industry companies and other companies. We find significant gaps in this kind of collaboration in Ostrobothnia, while gaps in other regions of Finland and internationally are minor.

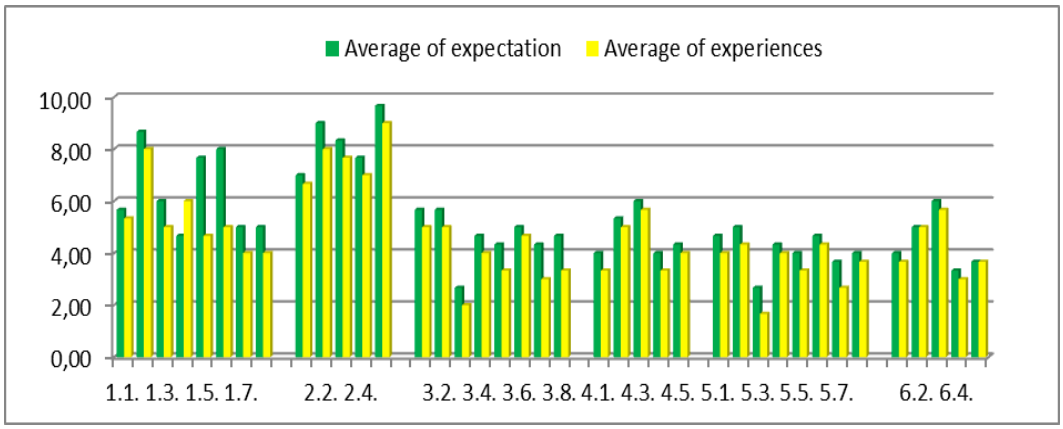

Figure 6.22. Boat industry companies – Other companies: Average of expectations vs. average of experiences

In order to define the problematic areas in future in relations between boat industry companies and other companies, NSCFI-method was used with the help of "traffic light" method (Figure 6.23.). Overall, the situation is stable, even though critical and scattered areas are observed all around Finland and internationally. Critical areas are: cooperation on production system development and cooperation on process development in Ostrobothnia; cooperation within own corporation (between departments); cooperation on organisational development and cooperation on marketing in other parts of Finland; cooperation within own corporation (between departments) and cooperation on organisational development internationally. In addition to that scattered areas are cooperation in developing technologies in Ostrobothnia region; cooperation on process development and our most important partner knows our company's standards and concepts in other parts of Finland; cooperation on technology development, cooperation on marketing and we share our key knowledge with our most important partner during mutual innovation process at the international level.

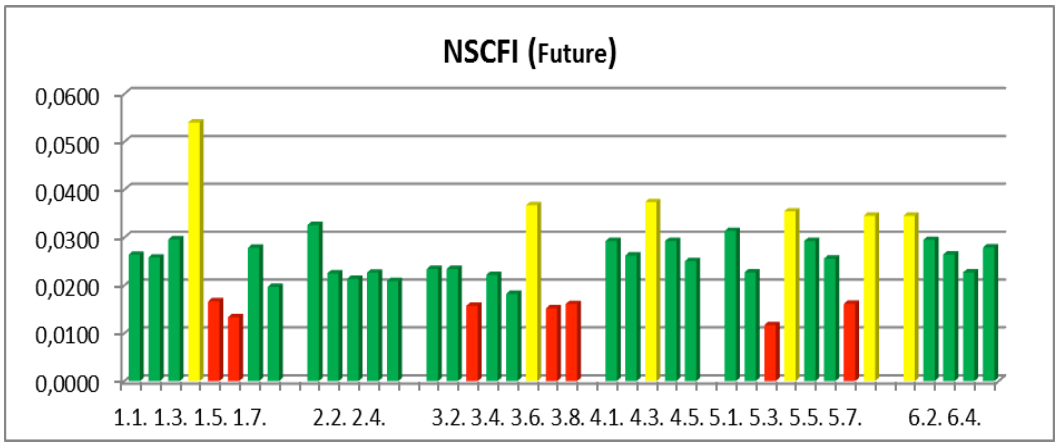

Figure 6.23. Boat industry companies – Other companies: NSCFI (future)

SCA -risk level results

SCA -risk level for boat sector companies for past and future are demonstrated in the following Tables (6.8. and 6.9):

Table 6.8. SCA -risk level, past

	BCFI	SCFI	NSCFI
Companies – Public organisations	0.93	0.93	0.93
Companies – Universities	0.90	0.90	0.92
Companies – Other companies	0.97	0.99	0.97

Table 6.9. SCA -risk level, future

	BCFI	SCFI	NSCFI
Companies – Public organisations	0.93	0.93	0.92
Companies – Universities	0.90	0.89	0.91
Companies – Other companies	0.98	1.00	0.98

Comparison between the two Tables shows that SCA -risk level for boat sector companies will remain relatively in the same level in future. It means that resources allocation for boat sector companies support equally companies' strategies in different cooperation in past and future. It is important to mention that the lowest risk levels are in company-public and academic sectors in both periods, past and future.

6.3 Theoretical and Functional Implications

User Handbook Guidelines applying SCA method

Smart specilisation survey and methodology (see Chapter 4) can be seen as a regional development policy (see Chapter 7) as well as a SCA model based more on industrial management procedure. For SCA model, it is important to repeat the survey as well as define and observe the trend of changes. Following graphic resents phases of applying SCA method (Figure 6.24).

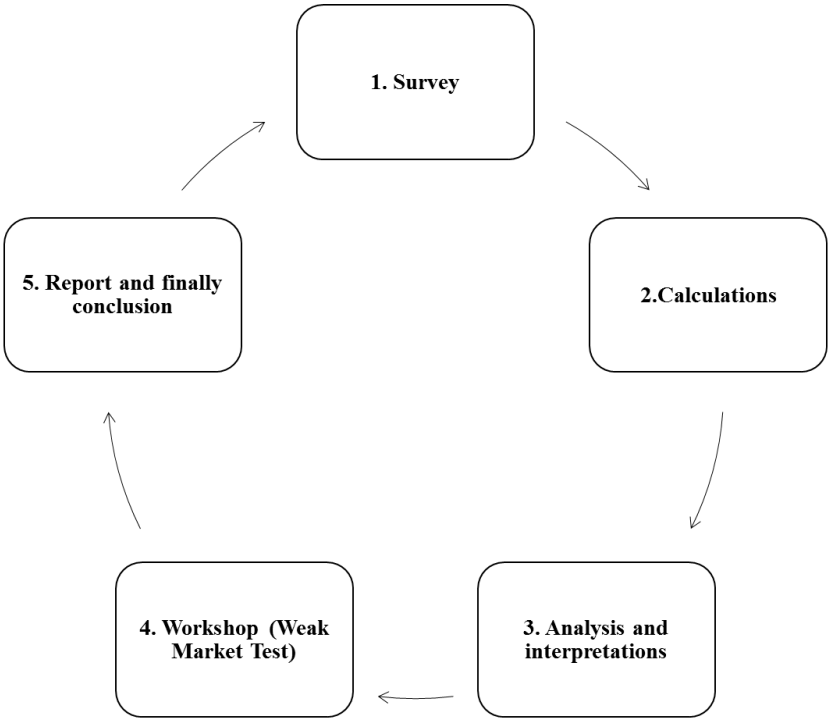

Figure 6.24. SCA stages

1. Phase: survey

This phase includes topics: mapping of location and importance of partner per helix and per region, measuring the strength of the partnership: the most important relations in the triple helix network (Sustainable Competitive Advantage analysis) and identifying and evaluating current and future technologies (see Chapter 4).

2. Phase: calculations

After receiving all the answers critical attributes and areas are defined and evaluated. In addition to that average of expectations and average of experiences are calculated in order to see the areas where resources should be put in future and what expectations companies have concerning the type of collaboration in different regions. Relationship strategy can be calculated and along with risk levels of every collaboration. The method of calculations is mentioned above in methodology part of the Chapter.

3. Phase: analysis and interpretations

Based on calculations, results should be interpreted. With the help of "traffic light" method problematic and stable areas are defined. The full picture of expectations can be seen in graphs. Moreover, existence of collaboration and its strengths can be determined and illustrated. With the help of RAL model relationship strategy can be defined and consequently risk levels of this collaboration are estimated. During this phase the first report is prepared.

4. Phase: workshop (weak market test)

During this phase interviews will be conducted which is named Weak Market Test (WMT). The interviews are needed in order to ask for a feedback from the respondents about the validity of results and how much these results present a real company situation. In order to have feedback from all respondents workshop shall be organised, where at the beginning general results and findings are presented and interpreted, after which discussion is opened for feedback.

5. Phase: final conclusions and report

After conducting a workshop with respondents, final conclusions can be made and a final report can be written. This report will be used in further projects in order to compare previous results and actual findings as well as to see the trend of changes.

Combining macro- and micro level studies

An important implication of this study is to create a system for defining the existence and strength of cooperation as well as evaluation of problematic areas of cooperation between companies and public sector, academic sector and other companies in different industries. This system is implemented by using S&R and SCA methods which are proposed above. In addition to that relationship strategy is defined by RAL model in order to specify the direction of the collaboration.

The survey could eventual be used from the whole industry perspective and separately from each company's perspective. This macro evaluation of each industry helps to see whole picture of collaboration between companies and public organinations, universities and other companies in each industry in one region. Eve-

ry industry will be evaluated separately in order to see the general performance from partnership point of view, how efficient resources are located and used, what a main relationship strategy is put to use and what the risk level is. Thus companies, public organisations and universities can make decisions about future collaboration between themselves whether they plan strengthen the existing partnerships, or connect to more partners or cancel old partnerships.

Possible benefits of such model proposed in this study include:

- Having improvements in collaboration and creating new partnerships;
- Creating a space for investing resources efficiently;
- Improving industrial situation of the region;
- Competitive increase inside and outside the region.

Validity and reliability

Validation method was organized within one industrial peak (energy, fur or boat industry) but among different companies which perform in one mutual industrial market. Number of respondents from energy peak (9 respondents equal to 9 companies) was satisfactory and acceptable in order to conclude secure statements. However, number of respondents from boat and fur industries (3 respondents equal to 3 companies to each industrial peak) was not sufficient for making conclusions and generalizing for the whole industry peak.

Equally important as the precise documentation are proper instructions so that the respondents can answer questionnaires and uncertainty can be avoided. The most effective method of data collection is conducting interviews, where explanations and answers are provided immediately. Concerning the filling the questionnaire, it is important to mention that reliable answers do not depend on the amount of respondents.

Limitations and future research

In order to have success in implementing of the analytical models mentioned in this work it is essential to eliminate and/or conquer the limitation of these models. Such as:

During calculations, it was noticed that with the help of S&R method three indexes were used in order to define problematic and stable situation in the coopera-

tion. They are BCFI, SCFI and NSCFI. These three indexes should be further tested and developed in order to have the one who can be more accurate than others. The main idea is that depending on number of respondents this or that index should be used for receiving more reliable and realistic findings.

Calculation of risk levels requires having additional information from the respondents, concerning quality, cost, time and flexibility matters. Accordingly, couple of more questions should be added to the main questionnaire.

Nevertheless, there are certain numbers of ideas offered further for future research. It is more reliable to have more companies from one industrial peak with more than one respondent from each company. It will make more precise conclusions about each industrial peak.

As it was already mentioned in limitations, S&R and SCA methods should be more developed and tested in more cases as it will help to define the accurate and the most efficient tool for detection of, for instance, problematic areas in the collaboration, relationship strategy and risk levels. Consequently, resource allocation can be divided and distributed more precisely within the companies and other institutions based on the proper decision making. Additionally, more partnerships will be created and existed one will be improved.

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7 SUMMARY AND CONCLUSION

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7.1 Summary of Findings

Innovation networks have been called the key determinants of economic development. The starting point of the smart specialisation study in Ostrobothnia was networks in the context of a triple helix framework, and our aim was to discover the extent of the connectivity among triple helix actors in Ostrobothnia. The first research question addressed the regional network structure: What does the regional triple helix look like in Ostrobothnia? The second research question addressed network dynamics, which were analysed with the help of gap indexes that provide information about the bottlenecks and good solutions among the relationships between the triple helix actors. The third research question addressed technology, specifically the nature, location and partners of present and future technologies. Finally, we also identified elements of a smart specialisation model that could be replicated. In order to answer the research questions a detailed questionnaire was carefully prepared and tested, and 53 interviews were conducted in the autumn of 2013.

The first research question, on the regional triple helix structure in Ostrobothnia, consisted of two parts: To what degree are networks of triple helix actors regionally connected or disconnected? Secondly, to what degree are triple helix actors embedded in regional, national and international networks?

From the perspective of the triple helix framework, the connections between actors are either intra-helix or cross-helix. When helices are isolated the networks are directed inside the networks' own helix. This is the case of the disconnected triple helix. The more the helices overlap and interact with one another, the more connected the region and the triple helix is. Taking account of the total number of partners (657) included in the interviews (53), we can see that only 38 % (247) of the relations are directed towards the respondents' own helices, and 62 % are directed towards the other helices in Ostrobothnia, in the rest of Finland and abroad. This can be interpreted as signifying high connectivity between the helices.

The findings indicate that both universities and public organisations in Ostrobothnia are extremely outward looking and they have many relations with company

partners. In particular, the high connectivity is reflected by the respondents of the public organisations and university actors, but the majority (87 %) of the partners of companies are other companies. This can be explained by a cluster formation among the firms. For example, the energy technology industry concentrates on core activities, and the outsourcing process leads to services and components being bought from outside the companies. A local supplier network has emerged around the key firms. Additionally, there has been and will be spin-off processes from existing firms supporting the networks (Virkkala et al. 2008). For companies, the partners for innovation seem not to be as important as the partners for support and strategy. This might indicate that innovation is still more of a core activity than an outsourced support activity.

Chapter 3 introduced different dimensions of proximity, and our data makes it possible to examine both the geographical and institutional proximity of triple helix actors. Geographical proximity is beneficial for innovation since learning requires face-to-face interaction. Institutional proximity refers to the same regime and operational codes, which means that inside the helices (companies, academia, and the public sector) the regimes are similar but still differ between the helices. High institutional proximity indicates the amount of the partners located in the respondent's own helix. Low institutional proximity means cooperation across helix borders, with cross-helix cooperation interpreted as connectivity.

Most of the partners of all companies (70 %) are based in Ostrobothnia, which indicates a high level of geographical proximity. In addition, the institutional proximity for the companies is extremely high (86.5 %), suggesting that the companies largely cooperate with other companies (which are also more important partners) as opposed to public organisations and universities. The university sector has an average geographical proximity (51 %) and a low institutional proximity (17 %). However, in this case the low institutional proximity means that universities are not living in the closed academic world; instead, they are open to the other parts of society and cooperate particularly with firms in Ostrobothnia, which the respondents also find important. Public organisations indicate a high geographical proximity and a low institutional proximity, meaning that their networks are mostly in the region of Ostrobothnia and mainly consist of companies. (Table 7.1)

Table 7.1. Geographical and institutional proximity based on the number of respondents' partners in each helix

Helix of respondents	Geographical proximity: Ostrobothnia vs. other regions	Institutional proximity: own helix vs. other helices
Companies	High (70 %; 119/171)	High (86.5 %; 148/171)
Universities	Average (51 %; 91/179)	Low (17 %; 31/179)
Public sector	High (75 %; 231/307)	Low (22 %; 68/307)
All	Average (67 %; 441/657)	Average (38 %; 247/657)
Low proximity: less than 25 % of the number of partners in the helix or in the region. Average proximity: 26–69 % of the number the partners in the helix or in the region. High proximity: More than 70 % of the number of the partners in the helix or in the region.		

The second part of the first research question addressed the degree to which the triple helix networks in Ostrobothnia are regionally, nationally and globally embedded. The networks of the companies seem to be regional, national and global. In particular, the energy sector companies were embedded in all these levels. Universities were embedded as much in national and international networks as in regional ones, but public organisations were mostly regionally embedded. In addition, these findings could be evaluated from the point of view of spatial network topologies. Considering all the actors, we could conclude, according to the notions of Bathelt, Malmberg and Maskell (2004), that there is a strong local buzz in the triple helix network in Ostrobothnia but also along global pipelines; however, we can also agree with Glückler (2007), who advances a typology of spatial networks instead of a dualistic model of local versus global links. These models can be combined differently by bridging and brokering networks at the local and global levels.

The second question related to the dynamics of the network. One view of the functioning of networks is to measure the gaps between expectations and experiences concerning an actor's relationships. This method was used by an industrial management team of University of Vaasa to measure the sustainable competitive advantage (SCA) of firms, but applied in our study to measure the strength of regional relationships. Actors have expectations and experiences in terms of relationships, and when both are high, relationships can be seen as strong, and from the perspective of regional development policy as presenting a good solution. When both are low, relations are weak. However, when the expectation is high and the experience is low there is a development challenge that merits attention from regional development planners. According to our findings, the gaps in the

triple helix network in Ostrobothnia are generally small, indicating a cohesive network. However, the gaps vary among triple helix actors.

A gap is large when the difference between expectation (on a scale of 1–10) and experience (on a scale of 1–10) is more than two. The companies we surveyed seem on average to be happy with their cooperative arrangements with other companies and also with universities. Their gaps towards public sector policies are large within four areas: regional development (-2), land use planning (-2.1), business development (-1.8), and infrastructure and logistics (-1.3). The energy sector companies had somewhat larger gaps than other companies. There is a significant gap (-2.5) between the expectations and experiences of the energy industry on research at the universities in Ostrobothnia.

University actors seem to be happiest of all the helix groups, since they had no relations with large gaps. Public organisations were happy with their partners in Ostrobothnia but frustrated with their relationships in Finland concerning education in the academic sector, as well as with environmental issues. Additionally, public organisations were unhappy with the international public organisations concerning logistical, educational and regional development (see Table 7.2).

Table 7.2. Largest gaps per helix and per region

Respondent's helix	**Partners helix**		
	Companies	Universities	Public organisations
Companies	Happy (No large gaps)	Ostrobothnia: research	Ostrobothnia: regional development, land use planning, business development, infrastructure and logistics
Universities	Happy (No large gaps)	Happy (No large gaps)	Happy (No large gaps)
Public organisations	Happy (No large gaps)	Finland: education	Finland: education International: infrastructure and logistics, education, regional development

If both expectations and experiences score at least eight out of ten and the gap is smaller than one, we find only one good practice: the relations between companies and their customers in Ostrobothnia. If we take into account the expecta-

tions and experiences scoring more than seven and the gaps smaller than one, we find more cases of good solutions (see Table 7.3). The good solutions are concentrated inside the company helix, indicating a well-functioning company network in Ostrobothnia with links to other parts of Finland and also to international actors.

Table 7.3. Good solutions per helix and per region, when expectations and experiences are more than seven and the gap is smaller than one

Respondent's helix	**Partner's helix**		
	Company	Universities	Public organisations
Company	Ostrobothnia: subcontractors, customers, in-house cooperation Finland: customers, in-house cooperation, International: subcontractors, customers, technology development, production system development	Ostrobothnia: education	No good solutions
Universities	International: education, development	No good solutions	Ostrobothnia: research
Public organisations	No good solutions	No good solutions	No good solutions

The third research question was related to the technology used presently and in the future and the location of the most important technology partners per helix and per region. In terms of technology development, the geographical and cognitive proximities overlap. According to the evaluation of all respondents, Ostrobothnia is the most important technology provider: The geographical proximity for the technology providers is 46 % (140/306). The institutional proximity for the company sector is on average 49 % (149/306), for universities it is 29 % (90/306) and for public organisations (including development organisations) it is 22 % (67/306).

The respondents assessed companies and universities to be the most important sources for future technologies. Regionally the most important technology providers reside within the company helix in Ostrobothnia as well as with universities abroad. This reflects the fact that today the key companies have extensive interests in regional research and development (R&D). Indeed, the majority of R&D expenditure in Ostrobothnia occurs in the companies (see Figure 7.1). However,

the connectivity to the global technology providers is also important. This seems to confirm that the regional innovation system of Ostrobothnia is connected to extra-regional knowledge producers, and has its own research to translate knowledge from these networks for specific use.

Figure 7.1 might also explain to some degree the functioning of the triple helix network in Ostrobothnia. Part of the research is conducted by companies, which means they have assumed some functions of universities, and the helix functions in this respect overlap. However, the research by companies is often in the field of applied research. The knowledge base in the industry in Ostrobothnia is synthetic (practical): Knowledge is created in the industrial processes of testing, experimentation, simulation and practical work. Knowledge is embodied in technical solutions or engineering in energy technology. The knowledge base of boat building is craft related and combines different technological fields. Boat building as well as the fur industry is characteristic of what is termed the doing, using and interacting (DUI) mode of innovation. The triple helices for these two sectors differ from the energy technology sector.

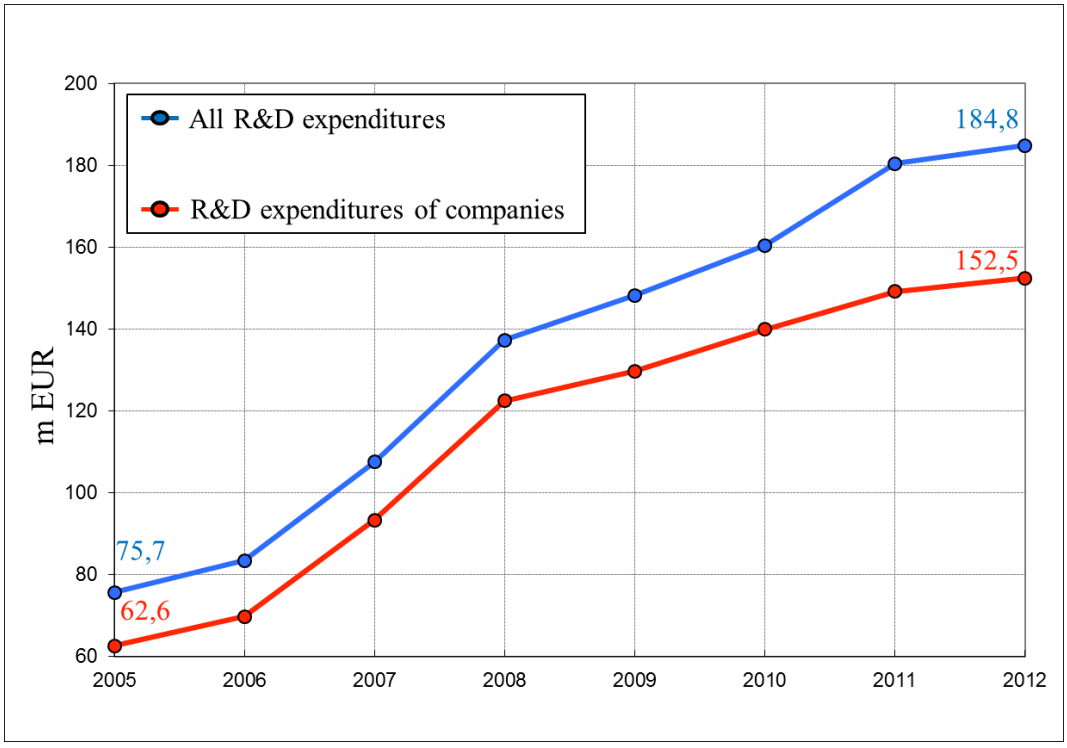

Figure 7.1. Research and development expenditures in Vaasa region (Nylén 2014)

Based on the interviews, we did not find clear research networks led by universities, or regional development networks led by public organisations. The business oriented innovation networks seem to be a dominant type of network, and all types of actors seem to rely on companies. The other type of networks might still exist but the findings do not establish they are as strong as the innovation networks led by the firms.

From a RIS point of view, a region needs a critical mass of different types of organisations, and they should be connected and interacting, so as to form a system. In Ostrobothnia, there are many different organisations, and they seem to be connected. Regional connectivity might mean local processes of search and scan to exploit localised networks. However, based on the gap index we cannot evaluate the possible lock-ins of the regional innovation system.

Smart specialisation and emerging technologies

So far the analysis indicates that research at the universities is well connected to innovation in the industry, but that it falls short of expectations. This begs the question of how well positioned the university is today, seen in relation to the needs for different research disciplines now and in the future (see Table 7.4).

Table 7.4. Perceived importance of technology for innovations, strengths and weaknesses of the university helix

	Amount of respondents	**Importance**		**Position of university helix**
	n	Now	In 20 years	
Nanotechnology	31	4.4	7.2	absent
Micro- and nano- electronics	30	6.0	8.0	weak
Photonics	25	3.9	5.3	absent
Advanced materials	38	6.3	8.0	absent
Biotechnology	34	5.3	7.2	weak
Advanced production methods	39	7.4	8.8	strong
Smart grids	44	7.0	8.9	moderate
Renewable energy	28	7.1	9.5	moderate

Disciplinary priorities of Finnish universities are based on the idea of national networks, where different universities have unique national roles, without consideration of the regional triple helix. In addition to universities, Finland has well-developed polytechnic institutions, universities of applied sciences which are spe-

cialised according to the regional labor market. This means that polytechnic institutions in Ostrobothnia are well connected to the needs of regional industries, including energy technology. However, the University of Vaasa is specialised in business studies. Research on smart grids and energy technology at the university level in Ostrobothnia, including the University of Vaasa accordingly, are to a large extent privately funded. Through this private funding, the university is able to be regionally relevant on these areas. Business studies are relevant to advanced production methods. These disciplines are also regarded as most important today from the point of view of the industry. They are at the core of the specialisation of the companies. This confirms what we have said before on close university – industry connections, both helices have the same core specialisation.

The observed gap when it comes to research relevant to the energy sector (-2.5) could accordingly be seen as a request for "more of the same", in other words increased public sector financing of energy technology research (see chapter 8).

However, if we look at "emergent technologies" or the perception of our informants on the technologies 20 years from now, the picture is somewhat different. Not surprisingly, core components of the current specialisation remain the same, renewable energy, smart grids and advanced production methods. What has changed, however, is the significance of certain technologies which are outside the core of the Ostrobothnian triple helix specialisation today. They can be summarized in two main areas of research:

1. Advanced materials, nano technology, relations between micro- and nanoelectronics and semi-conductors.
2. Biotechnology.

However, smart grids can be seen also as part of microelectronics and renewable energy as part of biotechnology (see Chapter 4). This discussion will be continued in Chapter 8 (see below).

Research challenges

The information gathered during the project makes many interpretations possible, even if 53 interviews represent a low number for statistical analysis. However, it is obvious that more empirical data are needed, especially on boat and fur clusters in order to identify the cluster specific innovation characteristics, as well as to test a more causal hypothesis on innovation networks and performance. Comparison of the sectors would provide new information. To examine the development of

the triple helix relations, and also to monitor and evaluate the success of the policy interventions, longitudinal data will be gathered that are based on the gap analysis and structured dialogues with stakeholders.

One addition to the empirical data could involve measuring the positions of different actors in the networks and by adopting the metrics of social network analysis. This would imply asking respondents to name their partners. Some actors might have more central positions than others. Social network analysis and actor network analysis could also be used to examine the emergence of different types of networks such as business-led innovation networks, university-led research networks and public-led regional development networks. These networks have different operation codes and different ways of emerging. Inside different networks, knowledge exhibits different functions and it might be transferred and translated in various ways between actors. Network analysis might also imply different functions for weak and strong ties.

Another research challenge would be to combine network analysis with the performance indicators of regional development. This is intended to test the link between connectivity and regional development. In our case, the region of Ostrobothnia has relatively high performance indicators in the Finnish context: low unemployment, a growth of the regional economy, and population growth, among other indicators. However, we know only a little about the causality between the connectivity of triple helix actors and the regional development indicators. The regional performance indicators might relate more to the export based growth of the region and to the development trajectory, as well as to the global demand for products in key sectors such as renewable-energy technology, boats, and furs to the Russian and Asian markets.

As concepts smart specialisation and entrepreneurial discovery present research challenges for regional studies. In Ostrobothnia, more research is needed on development of the sectors to identify the activities of smart specialisation inside and across the selected clusters.

7.2 The Ostrobothnian Model of Smart Specialisation– How to Use Connectivity Analysis in Regional Development Policy

Point of departure

One of the aims of the smart specialisation project was to identify the most urgent requirements in the innovations system and to build a model of regional development policy that could be used in Ostrobothnia and in similar regions. Finnish regions have relatively well constructed innovation endowments. Finland has pursued a decentralised university model as part of its regional development strategy and the regions in Finland generally compare well on innovation parameters. Nevertheless, in a rapidly changing world this does not necessarily mean that the innovation system is working optimally. On the contrary, emerging gaps in the system have to be identified and bridged to ensure continued favourable development.

Every region has some kind of innovation potential, and there are also triple helix actors. The innovation problem is often a systemic failure, involving too little or no interaction between stakeholders. There might be enough stakeholders but no knowledge transfer among them. The transfer of knowledge is assumed to take place in university campuses, science parks and the like, and in many cases, the focus when promoting interactions has been in creating social arenas. This is possible in larger centres but less viable in the peripheral regions.

The smart specialisation model of Ostrobothnia aims to promote interaction among triple helix actors organising a structured dialogue on innovation. Triple helix coordination is rather difficult as the stakeholders live in different worlds with different operation codes and functions. This requires a discussion of a model or a visionary leadership. In Ostrobothnia, the concept of connectedness has been adopted as a goal of the development measures. Thus, the challenge is first to create a shared and place-based vision; second, to create a sustainable learning organisation bridging partner, and third to build strong communication channels with the partnerships and the outside world.

The connectedness will serve to deepen the knowledge of the innovative process and to make more targeted interventions in the form of development projects. It will also serve to identify research agendas on relevant topics for innovation policies and to identify key legislation needs and missing relevant innovation parame-

ters to be communicated in a multi-framework dialogue. The justification for a triple helix model is that the partners make sometimes ill-informed decisions that will affect the innovative process in the region. Thus, a connectedness and a deeper learning of the triple helix will serve the innovative process. There is a consensus in the Ostrobothnia region on selected clusters but not on the measures that should be undertaken to promote industries.

Steps in the process

The Ostrobothnian model consists of surveys and analysis, focus group meetings, and measures to reduce gaps, followed up by repeating the procedure. The model is based on a vision of a 'connected region' along a triple helix as a precondition for innovation, and a need of structured discussion on innovation and the bottlenecks of innovations. The idea is to identify the development gaps and to concentrate development efforts and resources in the region in the direction of smart specialisation.

1) Survey and gap analysis

Gap analysis is an animation of the analysis behind the smart specialisation strategy. This analysis is expected to identify core positions in the regional economy, such as strategically important clusters, important sectors and research resources and institutions, builders in the triple helix, connecting science, politics and economy and visionary entrepreneurs. We assume that the smart specialisation strategy relates to changing relations or connectivity among these positions, such as closer contact between R&D and business and new industrial strategies. We also assume that gap analysis can be related to these changes in a relevant manner.

The analysis is used to select core positions. In each of these core positions, the measurement of gaps starts with a selection of a stratified sample of informants. The method assumes that there is an analysis explaining the complexities of the sector or cluster in sufficient detail (the "granularity principle", see Chapter 1) in order to identify relevant positions. If a cluster or sector is expected to demonstrate large internal complexity, it should be broken up analytically into several identifiable positions, with one sample for each. For instance, the set of samples for the private sector could include (a) one sample with strategic leaders in the core clusters facing international competition, (b) one sample with leaders in important

positions in the regional supply networks and (c) one sample with entrepreneurs working with new discoveries, for instance, with suppliers who are starting to export. Granulation could be carried further and it might be moving in different directions, say, if export strategies are different or if the supplier networks are heterogeneous.

In the R&D sector, the stratified samples are expected to include (a) institutional leaders, (b) leading researchers in strategically important disciplines identified by the analysis and (c) bridge builders and researchers working with regional industries. Again, the number of samples will depend upon the size and complexity of the sector, which is expected to be clarified in the analysis behind the smart specialisation strategy.

In the public sector leaders and informants with relevant industry contacts from the sectors identified in the smart specialisation strategy, or from sectors considered important by the industrial leaders, should be included.

2) Focus group meetings

There should be continuous discussion on the bottlenecks of innovation in focus group meetings with the industries and other stakeholders. The bottlenecks of innovation are the largest gaps between expectations and experiences found in the gap analysis, and it is important to discuss the possible policy interventions to bridge the gaps and solve the problems of bottlenecks. In addition, these good solutions could be discussed in the focus group meetings. However, the dialogue cannot just be open, it must be openly communicated. The stakeholders should be engaged with precise questions on partners and technologies to find a gap in the innovation structure and then to verify the results in an open process.

3) Policy measures (interventions)

Policy measures to bridge the gaps can be projects or programmes, or proposals for stakeholders to make networking between specific actors. In the case of the first round in Ostrobothnia, a Logic Framework Analysis (LFA) was applied by the Regional Council of Ostrobothnia. The gaps were observed and analysed by origin and consequences, enabling the creation of an intervention logic both for short- and long-term interventions, representing activities and investments aimed at gap bridging. The results of this analysis have now been tied to the call for pro-

posals of the Regional Council of Ostrobothnia that will occur twice a year and that will systematically address issues in the analysis.

4) Repetition of the study: following up

The policy process should be continuous and the study and measure of the success of the interventions should be repeated. Have there been improvements in overcoming the bottlenecks of the innovation system? In Ostrobothnia the first phase of gap analysis and focus group meetings were implemented in 2013 and 2014. Building on the experience of the first smart specialisation project, the data from the gap analysis will be stored continuously electronically on the web. The process can be seen in Figure 7.2:

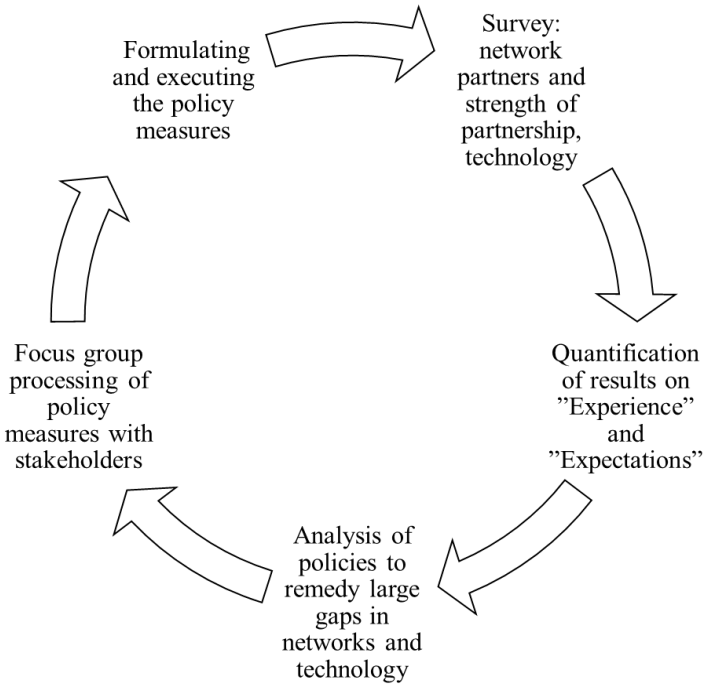

Figure 7.2 The smart specialisation process in Ostrobothnia

The approach based on gap analysis can be used as an indicator of the success of smart specialisation strategy and other interventions. It can be seen as evidence-based analysis and in terms of policy efforts based on the gaps perceived by the stakeholders. The method based on gap analysis can be used in preparing, implementing, comparing and evaluating smart specialisation strategies.

A similar methodological approach has also been applied in the Region of Nordland, Norway (Mariussen et al. 2013a, 2013b). We have used the gap analysis explaining why some gaps are smaller in Ostrobothnia than in Nordland. The application of the model enables learning between the regions because the gap analyses adopted similar analytical methods and both used focus group seminars to compare and analyse the differences in the results. Applying the methodology in different contexts will also help to test and develop the model.

Use of the smart specialisation model in transnational learning

The experience from the first round in Ostrobothnia has shown that this activity has been a learning process, first through the reflection of what are the most important innovation partners, and secondly through reflecting on the perceived gap between the experiences and expectations, and moreover on what should be done. Using the model in transnational learning would require that different regions perceive the gap in a similar way and regions with a larger gap should learn from regions with a smaller gap. The gap index can be combined with the concept of transnational learning as developed by Nonaka (see Mariussen, Midtkandal & Rakhmatullin 2014; Mariussen & Virkkala 2013).

Running the process within the regions will lead to a reflection among stakeholders on innovation partnership and will also prompt closer triple helix connectivity or a horizontal coordination within the regions. In Finland, this is expected to highlight a more problem-oriented approach to innovation policy and also to complement the current debate centred on innovation parameters. On a general level, the problems are known but the process will deepen understanding, and permit more targeted actions.

Between the regions, the process will serve to identify areas of strength, thereby forming a matrix for what a region can learn from another and vice versa. For instance, the first round did show that Ostrobothnian enterprises were more content with the local educational system than the corresponding enterprises in Nordland. This then raises the question of what is done differently in Ostrobothnia and whether this experience can be transferred. The difference between regions lies in their different historical contexts, which contribute to different solutions pursued. However, it is not only the organisation of the work but also the culture of the work that makes up the tacit knowledge of the partners involved. Through learning seminars, this knowledge can be codified, transferred and internalised between regions. Thus, the Ostrobothnian model can be useful for many development needs, today and in the future.

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8 TOWARDS A SMART SPECIALISATION STRATEGY IN OSTROBOTHNIA AND FINLAND

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The networks in Ostrobothnia are locally embedded and cohesive, such that the gaps are relatively small. The analysis shows that in particular universities and energy technology companies are well connected through their regional triple helix. At the same time, they are also well connected inside their helices, both nationally, and globally.

Research undertaken in the project also indicates that the system of innovation in fur farming and boat building are different, with weaker R&D support and different systems of innovation.

The innovation system in the energy sector in Ostrobothnia is business driven. Companies provide most of the money for research, and they are connected mostly to other companies. Universities are connected to companies, and they are well connected nationally and internationally within their helices. The privately financed technological research at the University of Vaasa and its specialisation in business studies seems to fit with the preferences of the companies. Similarly, the most important partners in technological development are:

1. The regional company helix (14 %)
2. The regional university helix (11 %)
3. The regional business helix (10 %)
4. Universities in other parts of Finland (9.8 %)
5. Own local organisation and companies abroad (9.1 %)

In total, 46 % of the partners of innovation come from the region. In addition, new technology development in the region is coming not just from the own organisation (7.5 on a scale from 1 to 10) but also from other firms in the region (8.8) and universities in the region (8.0).

This is a strong indication that there is a shared regional technology platform between the universities and the companies with advanced production, renewable energy technology and smart grids at the core. There is a gap between company

expectations and university performance, but the evidence presented here seems to indicate that what is asked for is more of the same, i. a. more technological research at the universities in the region, complementing the private contributions.

This opens three related comments.

1. First, one would have thought that this request from the companies should lead to a more pro-active relation between the public sector as a financer of research and the university sector. However, this does not take into account the aforementioned state level policies in Finland, where the triple helix is not taken into consideration when it comes to prioritisation of money to university level research.
2. The core position of the companies in the regional system of innovation gives the region an admirable advantage. In this respect, we might add, a typical characteristic of Finnish systems of innovation is that they rely on companies in the lead. However, we have to ask what the downside is. What is the risk, if any, with a system of innovation driven by companies?
3. Another somewhat surprising finding in this well-connected triple helix is the public sector, which, surprisingly, has low scores on industrial and regional policy and planning in relation to the energy industry.

These questions correspond well to the finding from the AMCER project which defined the innovation system in Ostrobothnia as state "dirigiste". They open up for some reflections on the Finnish national framework and smart specialisation in Finland.

8.1 The Finnish Smart Specialisation Strategy: Lost in Translation

"Finland is at risk of becoming a victim of its economic success. In the last decades Finnish firms in the forest products and telecommunications industries have become world leaders. Together they account for 40 percent of the country's exports and 8 percent of its GDP. They have achieved this by relentlessly refining the core technologies in their respective domains, and introducing them into successful products with the help of supply chains and marketing organizations whose discipline, flexibility, and efficiency are widely admired by their competitors. The development of the technologies central to this success has been supported by an ensemble of public research facilities which are equally widely ad-

mired. But the kinds of discipline that made possible this success, and the public policies that furthered them, are unlikely to secure it in the future". (Sabel & Saxenian 2008: 13.)

The novelty of smart specialisation is crystallised in a new understanding of certain concepts, such as entrepreneurial discoveries. As any distinguished professor of innovation can verify, these theories were known already, before the publication of the RIS3 guide (by Foray et al. 2012). This guide is a guide in policymaking, not a doctoral dissertation. What is new in terms of theory is that the publication of the guide as an official document gives certain theories, such as the theory of entrepreneurial discoveries, a higher legitimacy and a new context, because they are seen as particularly relevant in regional and innovation policymaking.

Smart specialisation defines a new framework for making innovation policies. It promotes cross-sector coordination, which links innovation and science policymaking with Structural Fund strategies of place-based regional and national development. As we will show below, this is done in a way which borrows heavily from the regional planning methods of the Structural Funds, where bottom-up processes and place-based development are high on the agenda. This means that innovation policy instruments, like cluster programs, will have to be integrated in a form of planning which is borrowed from regional planning. In the autumn of 2013, the Commission decided that compliance with these rules of smart specialisation is a condition for receiving support from the Structural Funds. The guardian of these rules is DG Regional and Urban Policy. They have a nuclear option. A failure to apply the new rules could block national allocation of Structural Funds.

This is now on the agenda in Finland, as the Commission has presented major reservations to the national innovation program INKA (Finnish acronym, innovative cities) as a point of departure for a Finnish Structural Fund strategy because it does not comply with the smart specialisation requirements of planning. INKA is an innovation policy tool for cluster development. As an innovation policy instrument, it does not comply with the guidelines for smart specialisation (The Ministry of Employment and the Economy 2014.)

The debate which led to smart specialisation has a parallel in Finland, which is trying to come to terms with the failure of its own ICT success story of the 1990s, most recently with the new Nokia strategy following the sale of its mobile phone division to Microsoft, and the following rapid downsizing carried out by Microsoft of the mobile phone divisions inside Finland. Seen in a broader context, Finland also has similar problems with another core cluster, the paper and pulp

cluster, where the corporate actors are moving out production to Asia and Latin America.

The debate leading to the initiation of INKA is about overcoming the shortfalls of the National Systems of Innovation paradigm. In this paradigm, Finland was a pioneer and example of good practice. This followed a strategic decision in 1980s to go from a raw material based economy to a knowledge based economy. The state started to encourage private firms to invest in science and research across several sectors. Appropriate institutions were built. The decision in 1990 to apply NIS in Finland contributed to the Nokia success story. A core element was a tight top-down national level coordination of investments in science policy, in partnership with large corporate actors. The policy coordination mechanism was national, the Science and Technology Policy Council. Implementation was left to the large universities in the large cities, and to the large corporations. It contributed to the development of a tightly knit and highly centralised city system of innovation, based on Nokia and state investments in science in the main universities in the major cities. Initially, the ICT value chain in the 1990s which created these regional clusters was mainly national.

However, this was going to change. This national framework for planning was caught off-guard in the early years of the 21th Century, as Nokia started to ride the waves of the global market through outsourcing of electronic manufacturing. That was only the beginning, as the entire mobile phone sector went through a brutal global concentration and monopolisation following the 2008 crisis, and the triumph of Apple. This brought the internal technological lock-in problems of Nokia on the table. The cooperation with Microsoft was a heroic attempt to solve the acute problem of lock-in inside the innovation system core of Nokia, by opening up to a wider ecosystem of innovation, provided by Microsoft. But Nokia as a corporation proved to be too closely locked into its own core business, mobile phones, created by its own success story of the 1990s. The brutal but obvious solution was to sell out this core to Microsoft and move in a new direction, networks.

The regional component of this national policy was the Centre of Expertise program. The CoE (Finnish acronym OSKE) program was closely coordinated by the state, in cooperation with the leading universities and regional development organisations. One of the core ambitions was to repeat the ICT success story in other high tech sectors, such as bio-technology, based on commercialisation of university research. The program was closed, and later continued again in a new form as INKA, a program for city development. (The Ministry of Employment and the Economy 2014.)

There are several similarities between the internal debate in Finland and the Knowledge for Growth group which discussed the shortcomings of the National Systems of Innovation policy and wrote the smart specialisation guide (Foray et al. 2012). First, national systems of innovation were likely to duplicate everything, and create micro level copies of global value chains, such as bio-tech. This insight is now taken on board in INKA, which is focusing on critical mass. But whereas the smart specialisation solution was European networking and co-specialisation, INKA is focused on advantages of scale and city networks inside Finland. Following the on-going discussion on how the ex-ante criteria of smart specialisation and how Finland should comply with the place-based criteria the Regional Development Schemes elaborated by the Regional Councils have been put forward. This solution would comply with the place-based criteria but not necessary with quest for entrepreneurial discovery. The role of the Regional Development Schemes is a large political process which is led by the Regional Councils and approved by a politically elected board. The result is taken to represent the "political will" of the region and by also encompassing state initiatives like INKA it is designed to mitigate between state and regional wills. While this is essential for an efficient working of innovation system it is not a process that will foment new innovative discoveries.

Another initial failure of the NIS paradigm was to attempt to integrate entire value chains, instead of discovering where in the value chain its competitiveness is hidden (such as choosing between phones or networks, which requires different systems of innovation), specialise on these functions, as well as related or supporting sectors, and co-specialise with others on other parts of the value chain. One might say that this is precisely what Nokia is now doing, when it is refocusing on networks rather than phones.

The major approach of smart specialisation seen as a process of planning enabling entrepreneurial discoveries is that it opens up the search for the strengths of the regional or national economy in terms of global market competitiveness, and accordingly the decisions of how systems of innovation should be constructed and reconstructed and emergent opportunities discovered. The point of departure for this analysis is place-based. As such, it is imposing a layer of analysis, monitoring and evaluation on micro-level oriented cluster programs, or other innovation policy programs. Based on the spatial perspective provided by the analysis of these strategies, the monitoring of innovation system programs may be seen in a wider perspective, and related to place-based development. Because this is done as a planning process, it is codified, accessible and open to a wider audience of institutions and decision makers than most innovation policy instruments.

In the Table 8.1 the approach for smart specialisation in Ostrobothnia is contrasted to INKA:

Table 8.1. Comparison of INKA and smart specialisation strategy in Ostrobothnia

	INKA (Innovative cities) programme	**OSTROBOTHNIA, Smart specialisation strategy**
Analysis	Desire for a critical mass and agglomeration economics. National polycentric development model. Top-down spatial hierarchy.	Place-based development building on outward orientation. Globalised cluster assumed to be innovation leaders and innovation taking place in networks. Horisontal connectedness will further foster innovation. Bottom-up network model.
Governance	Regional proposals for national selection.	Annual triple helix stakeholder dialogue based on innovation system gap analysis. Dialogue will produce stakeholder view on priorities in funding. Process governed by the Regional Council and integrated in the Regional Development Scheme.
Overall Vision	To achieve global competiveness in selected fields. To integrate Finnish stakeholders in global networks.	A connected region with a strong place-based innovation politics. A process of entrepreneurial discovery on-going thru addressing gaps in the innovations networks. Peer-review learning with European partners.
Priorities	Based on evaluation of proposals.	Most urgent gaps in the RIS identified thru dialogue.
Policy Mix	National and regional funding, steered by the legislation governing the Finnish National Technology Centre (Tekes).	Regional funding, multi-level dialogue when the regional level is not the competent authority.
Monitoring and Evaluation	External evaluations, evaluations indicators.	Repetition of the process and stakeholder perceived improvements.

The method for governance in Ostrobothnia is chosen to facilitate a process of learning through gap analysis. Within this institutional context, however, funding to support investments in innovation is largely missing. This is due to the Finnish national system of innovation that is being set up.

8.2 The Finnish National System of Innovation

Sabel and Saxenian (2008) emphasised in their analysis on the Finnish system of innovation the need to move from a centralised system of research and innovation dominated by the large actors in forestry and telecommunications to a strategy characterised by search, and learning through trial and error.

"Ideally Finland's justly vaunted national system of innovation should play an important role in addressing the shift from optimization to transverse exploration. But so far it has not. National systems of innovation, Finland's included, were often designed with the idea of closing the gap between a country's capabilities in particular areas and the respective world technological frontier. Such systems become less useful as the"boundary" begins to wander. In the worst case the national system of innovation can actually impede progress by focusing attention, and fixing resources, on the problems that would have been central to an industry's domain if unanticipated connections to other bodies of knowledge had not rendered them irrelevant. There is some risk of this perverse outcome in Finland. For example, the country's university based research in the forest products area, though indisputably the best in the world, is largely dedicated to investigating the leading edge of current production technologies, even as the technology's manifold limits as the basis for an industry in an advanced county become clear. An analogue in ICT is a research focus on radio-related cell-phone technologies or on optimization of current network software to the neglect of the technological foundations of the applications that will give distinctive value to cell-phone platforms." (Sabel & Saxenian 2008: 18.)

The 2008 report anticipated the challenges which came later, with the restructuring of Nokia. Today, the Finnish economy has challenges in adapting to the global market. Core clusters like forest industry and ICT are in deep trouble, the balance of trade is negative, and the fiscal situation is rapidly deteriorating. The response is central level cuts and austerity measures. The overall challenge is to recreate growth. In order to recreate growth, Finland needs well-coordinated smart specialisation strategies both at the national and regional levels enabling diversification through entrepreneurial discoveries.

The strength of the Finnish economy is good connections between different actors i.e. relatively high triple helix connectivity as well as very high levels of investment in private and public RDI. This is also the case in Ostrobothnia according to our findings.

Until now Finland also enjoys the strengths of a Nordic model enabling a welfare state which is able to mobilise human resources to work in an economy characterised by high level of skills, knowledge and productivity.

The weakness of the economy is too centralised network structure based on a relatively narrowly defined export base. Reliance on a few strong sectors has created the unfolding economic crisis with a negative balance of trade. The threat is social and spatial polarisation and undermining of the Nordic model of the welfare state.

The opportunity is as creative destruction at the core (ICT, forestry) opening up for diversification of the export base and broader and more decentralised spatial, cross sector, and interdisciplinary networks of innovation enabling entrepreneurial discoveries. This is an opportunity also for Ostrobothnia having export oriented clusters outside the core: a relatively strong energy technology cluster as well as boat building and fur industry.

The main objective for smart specialisation for Finland should be to use the strength of connectivity, the knowledge base and the strong RDI performance into more diversified and decentralised structures and systems of innovation, resulting in a broader export base.

8.3 Next Steps

According to our opinion, a smart specialisation strategy for Finland should be based on a strategy which is able to overcome the weaknesses of this system, as described by Sabel and Saxenian (2008). What is needed is a more decentralised system, capable of learning through its mistakes, and capable of supporting attempts to go in different directions, in order to diversify the export base of the country and recreate economic growth. This is taken on board by the Ostrobothnian approach to smart specialisation. Decentralisation doesn´t imply isolation quite the contrary, the approach builds on the economic outward orientation of the region where leading competitive enterprises are well connected internally and globally. The drivers of innovation in the Ostrobothnian context has been business networking and customer proximity combined with applied and scientific research.

There is a need to both communicate and deepen the process in the region and with European partners and provide continuity in the process. The situation facing the regions is that many central initiatives introduce regional processes and when they do not deliver on intentions they also weaken the regional ability to implement strategic processes. The reasons for this can be seen in the challenges facing the Finnish regional policy as outlined in chapter 2. Nevertheless initiatives that do not deliver on intentions weaken the stakeholder motivation to participate

and thus weaken the innovative process. This is also a challenge to the smart specialisation process in Ostrobothnia.

The European Commission has by introducing the concept of smart specialisation and by making it an ERDF ex ante condition also tied the policy on innovation to the Structural Funds. This and moreover that it is linked to the framework of finding synergies between European funding justifies that the process is tied to the regional planning process and to governing legislation. This will ensure the continuity that is vital for the stakeholder involvement and learning.

In the governance of the Ostrobothnian model of smart specialisation we may separate between soft governance and hard governance. The soft governance consists of a communication of results of the dialogue thru the web and to different stakeholders while the hard governance is the formal treatment of the process in the MYR. Finnish acronym MYR means Regional Cooperation Group that has an established function given by the Finnish law (Finlex 2014). The Regional Coordination Groups have been amended to include representatives of the triple helix to coordinate the use of funds. This is however not possible if the group does not have a common vision built on a common perception of the problems faced.

We may divide the coordination into three parts that are linked: 1) A problem oriented leadership; 2) Informal coordination and 3) Formal coordination. The problem oriented leadership would be by a gradual acceptance of the gap analysis as a base for the developing of the region and obtaining the vision of being a connected region. This would imply more horisontal coordination of the stakeholders and promote the regional coordination and synergies in the financing of different funds. The informal coordination consists of contacts and discussions between different stakeholders. The informal coordination is difficult due to the on-going centralisation trends. This makes the problem oriented leadership received thru the gap analysis and the formal coordination even more important.

The tools for the formal coordination is already existent as the changes in the Law on Regional Development and the administration of the Structural Funds have strengthened the role of the Regional Cooperation Groups (Finlex 2014). In Ostrobothnia, the MYR will make their judgments based on the Western Finland ERDF programme and on the results of the smart specialisation process. The legislation gives us the tools for the latter as it stipulates the role of the MYR and secretariat, but whatever formally is written into legislation is void if the actors do not accept the roles and works accordingly.

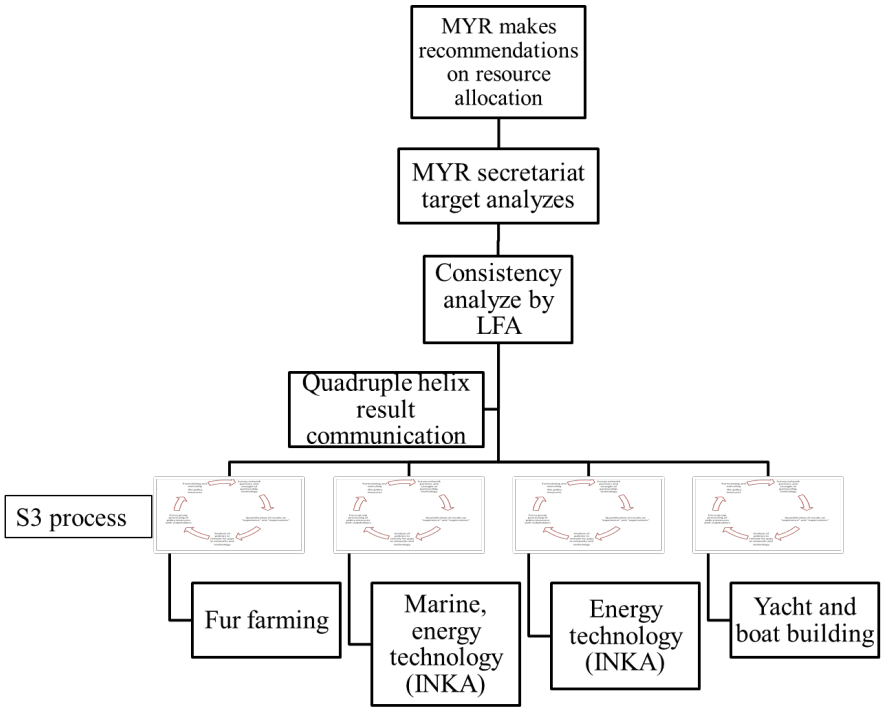

Figure 8.1. Governance of the smart specialisation process in Ostrobothnia

The smart specialisation strategy materialises through a gap analysis followed by focus group seminars in each of the selected sectors with high export performance. With respect to the energy sector the chosen priorities are that equals the INKA programme. The difference however lies in the cross-sectional horisontal approach of the smart specialisation process complementing the INKA programme and providing both an approach on the process of entrepreneurial discovery and a bottom-up approach. The main contrast presented by the Ostrobothnian approach compared to INKA lies within the "governance" and the "priorities" as presented in the previous Table 8.1.

The governance of the Ostrobothnian model of smart specialisation is based on larger participation of regional stakeholders and integration into the regional planning (see Figure 8.1). This is contrary to the INKA programme where the decisions are taken centrally by a decision group. The groups contain regional representation but the advantage of the group would be that they have a better overview of on-going national projects and their work. This may avoid duplication of efforts and thus promote coordination. The view behind this also holds a more technological perspective to innovation while the European approach represents a wider perspective on innovation.

In the INKA program the priorities are based on the evaluation of projects. This requires that you firstly have a project application and secondly that it complies with the criteria.

The priority in the Ostrobothnian smart specialisation strategy is to identify challenges through gaps in the RIS that is assumed to foster innovations. These gaps are matched to project priorities in the financing and with a combination of hard and soft coordination available funds are directed towards bridging the needs of the innovation. Gap analysis will be intermittently repeated for a deeper understanding of the needs and the results will also be communicated.

We believe that this would regionally correspond to final conclusion on the Finnish innovation policy as noted by Sabel and Saxenian (2008): *"In today's uncertain world even the best institutions cannot avoid mistakes. They can however respond to them quickly. Building such institutions is the challenge for Finnish innovations policy"*.

8.4 Suggestion for Components in a Smart Specialisation Strategy in Ostrobothnia

The above analysis has indicated weaknesses in the triple helix which may be explained with reference to the role of the public sector in three closely related areas.

Table 8.2. Problems to focus smart specialisation strategy in Ostrobothnia

Problem	Possible negative impact	Indicator
Too small public investments in R&D	Short-termism, lock-in into corporate strategies	Gap on research (-2.5)
Too little diversification/ related varieties	Technological lock-in	Monitoring of current specialisation v.s. future technological trends
Regional planning	Investment decisions	Gap on land use planning, infrastructure and regional development

Based on the Table 8.2, a smart specialisation strategy relevant to Ostrobothnia should aim to rebalance the triple helix through an improved role of the public sector in three areas:

1. Specialisation. Ostrobothnia has a strong and well-connected system of innovation in energy technology. In terms of scientific direction, research at the regional universities seems to be well positioned, but never the less it falls short of expectations from the companies, because it is under-funded from the public sector in the core area, energy technology. A core indicator which may guide work on this indicator is the gap on research (-2.5). The question for an explorative program, then, is how this gap should be closed.
2. Smart specialisation through entrepreneurial discoveries. One of the dangers of a company driven regional system of innovation is that it becomes too linked to corporate strategies, too short-sighted and not sufficiently oriented towards emerging related and potentially disruptive technologies of the future. This is why a well-functioning regional system of innovation with industries financing research has to be supplemented with public sector investments which open up for wider exploration, in other words, entrepreneurial discoveries of new paths. Our survey has revealed potential future relations to new technologies such as biotechnology – energy production and nano-technology – electro-technology which are outside the scope of the regional system of innovation today, but may have a disruptive significance on the core of this system in the future, or open up new paths. The potential challenges and opportunities, and how to relate to them, should be discussed with relevant stakeholders.
3. Regional planning. It is a challenge to close the gap on spatial and regional planning. This seems to indicate stronger regional level institutional capabilities and resources.

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APPENDICES

Appendix 1.

Questionnaire for Public Organisations, Universities and Companies

S3- Questionnaire

Background information

1. Name of organisation:_____
2. Name of respondent:_____
3. Respondent's position:_____
4. Do you work with these branches? (Please choose only the most important)
   _ Maritime industry
   _ Boat building industry
   _ Fur farming industry
   _ Energy technology industry
   _ Other, which? _____
5. Organisation's main task:_____
6. Number of employees:_____
7. Do you have a specific R&D department? Yes/No
   (question for public organisations and companies only)

Part 1. Mapping the location and importance of the partners

Partner
Partner can be any organisation or its representative that is important to your organisation's operations. Partnership provides additional benefit for both sides and it can be based on official contracts, or even on long mutual understanding. This cooperation might be regular in nature, or it might happen occasionally.

Supporting partners benefit your organisation for example through projects, whereas your organisation makes longer-term goals and plans with **strategic partners**. Usually strategic partners are easier to recognise.

Research partners are partners that undertake research cooperation with your organisation.
Education partners are partners that cooperate with your organisation on educational matters.
Social service mission partners are partners that are important to your organisation on matters other than education or research. This usually means development partners and such like.

Innovation partners are partners that help your organisation to develop new ideas for innovations (these can be new products, processes, technologies, organisational forms etc.)

In the questionnaire, we separate the various partners into four groups and these are:

- **Companies**, like service producers, subcontractors and clients, etc.
- **Public Organisations** like municipalities, ministries, civil societies and international institutions etc.
- **Universities** like universities, universities of applied sciences and other research and teaching organisations.

- **Development Organisations** like VASEK, Concordia, Dynamo, Merinova and Kristinankaupungin elinkeinokeskus oy, as well as KOSEK.

How many partners does your organisation have and where are they situated?

How many partners do you have?	Companies	Public organisations	Universities	Development organisations
In Ostrobothnia and Central Ostrobothnia				
In other parts of Finland				
In the rest of the world				

NOTE: Companies may belong to the same corporation, but record them separately.

How important are **Supporting/Strategic/Research/Education/Social Service Mission/Innovation Partnerships** for your organisation in different regions? Responses should be provided on a scale of 1 to 10, where 10 means very important and 1 indicates the partnership is of little importance.

Example question:

How important is a supporting partnership for your organisation?	Companies	Public organisations	Universities	Development organisations
In Ostrobothnia and Central Ostrobothnia				
In other parts of Finland				
In the rest of the world				

Questions asked per helix:

Public organisations	**Universities**	**Companies**
Supporting partnership	Research partnership	Supporting partnership
Strategic partnership	Education partnership	Strategic partnership
-	Social service mission	Innovation partnership

Which roles do these various actors have in terms of knowledge production in your organisation?

	Role in knowledge production		
Organisation	They provide us knowledge	We produce knowledge together	We provide knowledge to them
Commercial actors (for example companies)			
Public sector actors (for example development organisations, other public organisations)			
Non-commercial actors (for example universities)			
Households			
Volunteer organisations (for example Red Cross etc.)			
Privilege organisations (labour unions, etc.)			

Role in knowledge production = mark with a cross the role(s) that your partners usually have in knowledge production

Part 2. Measuring the depth of cooperation

2.1. Public organisations - Companies

2.2. Public organisations - Universities

2.3. Public organisations - Public organisations

2.4. Universities - Companies

2.5. Universities - Public organisations

2.6. Universities - Universities

2.7. Companies - Public organisations

2.8. Companies - Universities

2.9. Companies - Companies

NOTE: These questions are on different papers.

Example question:

	Scale: 10 = high, 1= low		Direction of development in the future (mark with a cross)			Direction of development in the past (mark with a cross)		
Question	Expecta-tions	Experi-ences	Grows	Remains the same	Lowers	Grows	Remains the same	Lowers
Cooperation in research								

Expectations = What is the level of expectations for an attribute on a scale of 1 to 10
Experiences = What is the level of experiences for an attribute on a scale of 1 to 10
Direction of development (future) = Direction of development compared to the situation expected 1 year after completing this questionnaire
Direction of development (past) = Direction of development compared to the situation 1 year before completing this questionnaire

Definitions and questions asked per helix:

Public Organisations

Cooperation here refers to activities in which both sides are genuinely interacting with one another. For example we do not consider purchasing a product, or granting assistance to be cooperation if there is not some sort of dialogue between the actors (for example planning, mutual project, etc.) In the public sector cooperation might take place for example on administration (permissions, advice etc.) or on economic activities (assistance, employment, supporting entrepreneurship etc.).

2.1. Public Organisations - Companies
Cooperation In Ostrobothnia and Central Ostrobothnia (partner may vary according to question)
2.1.1.Cooperation on infrastructure and logistics
2.1.2.Cooperation on regional development
2.1.3.Cooperation on technology development
2.1.4.Cooperation on business life development
2.1.5.Cooperation on land use planning
2.1.6.Cooperation on environmental issues
2.1.7.Cooperation on employment affairs
(Choose the same partner for these questions)
2.1.8.Our most important partner contacts us
2.1.9.Our most important partner knows our work
2.1.10.Our most important partner helps us with our difficult problems
2.1.11.Our most important partner knows our staff

2.2. Public Organisations - Universities
Cooperation In Ostrobothnia and Central Ostrobothnia (partner may vary according to question)
2.2.1.Cooperation on education
2.2.2.Cooperation on research
2.2.3.Cooperation on employment matters
2.2.4.Cooperation on environmental issues
2.2.5.Cooperation on information system development
2.2.6.Cooperation on regional development
2.2.7.Cooperation on organisational development
2.2.8.Cooperation on marketing development
(Choose same partner for these questions)
2.2.9.We know our most important partner's research and development methods
2.2.10.We know our most important partner's work
2.2.11.Our most important partner helps us with our difficult problems
2.2.12.We know our most important partner's research and educational staff working in our field
Cooperation in other parts of Finland (partner may vary according to question)
2.2.13.Cooperation on education
2.2.14.Cooperation on research
2.2.15.Cooperation on employment matters
2.2.16.Cooperation on environmental issues
2.2.17.Cooperation on information system development
2.2.18.Cooperation on regional development
2.2.19.Cooperation on organisational development
2.2.20.Cooperation on marketing development
(Choose same partner for these questions)
2.2.21.We know our most important partner's research and development methods
2.2.22.We know our most important partner's work
2.2.23.Our most important partner helps us on our difficult problems
2.2.24.We know our most important partner's research and educational staff working in our field
Cooperation in the rest of the world (partner may vary according to question)
2.2.25.Cooperation on education
2.2.26.Cooperation on research
2.2.27.Cooperation on employment matters
2.2.28.Cooperation on environmental issues
2.2.29.Cooperation on information system development
2.2.30.Cooperation on regional development
2.2.31.Cooperation on organisational development
2.2.32.Cooperation on marketing development

(Choose the same partner for these questions)
2.2.33.We know our most important partner's research and development methods
2.2.34.We know our most important partner's work
2.2.35.Our most important partner helps us with our difficult problems
2.2.36.We know our most important partner's research and educational staff working in our field

2.3. Public Organisations - Public Organisations
Cooperation in Ostrobothnia and Central Ostrobothnia (partner may vary according to question)
2.3.1.Cooperation on infrastructure
2.3.2.Cooperation on regional development
2.3.3.Cooperation on environmental issues
2.3.4.Cooperation on employment affairs
(Choose the same partner for these questions)
2.3.5.Our most important partner knows our work
2.3.6.Our most important partner helps us with our difficult problems
2.3.7.We know our most important partner's staff
2.3.8.Our most important partner knows the regulations and concepts relevant to our field
Cooperation in other parts of Finland (partner may vary according to question)
2.3.9.Cooperation on infrastructure
2.3.10.Cooperation on regional development
2.3.11.Cooperation on environmental issues
2.3.11.Cooperation on employment
(Choose same partner for these questions)
2.3.12.Our most important partner knows our work
2.3.13.Our most important partner helps us with our difficult problems
2.3.14.We know our most important partner's staff
2.3.15.Our most important partner knows the regulations and concepts relevant to our field
Cooperation in the rest of the world (partner may vary according to question)
2.3.16.Cooperation on technological and business life development
2.3.18.Cooperation on logistics
2.3.19.Cooperation on education
2.3.20.Cooperation on regional development
(Choose the same partner for these questions)
2.3.21.Our most important partner knows our work
2.3.22.Our most important partner helps us with our difficult problems
2.3.23.We know our most important partner's staff
2.3.24.Our most important partner knows the regulations and concepts relevant to our field

Universities

Cooperation here refers to activities in which both sides are genuinely interacting with one another. For example we do not consider purchasing a product, or applying for assistance to be cooperation if there is not some sort of dialogue between the actors (for example, a mutual research project, product development, education work, development work etc.).

2.4. Universities - Companies
Cooperation In Ostrobothnia and Central Ostrobothnia (partner may vary according to question)
2.4.1.Cooperation on education
2.4.2.Cooperation on research
2.4.3.Cooperation on development
(Choose the same partner for these questions)
2.4.4.We contact our most important partner concerning research
2.4.5.We know our most important partner's research and development methods
2.4.6.We know our most important partner's work
2.4.7.Our most important partner improves our educational and research abilities
2.4.8.We know our most important partner's staff
Cooperation in other parts of Finland (partner may vary according to question)
2.4.9.Cooperation on education
2.4.10.Cooperation on research
2.4.11.Cooperation on development
(Choose the same partner for these questions)
2.4.12.We contact our most important partner concerning research
2.4.13.We know our most important partner's research and development methods
2.4.14.We know our most important partner's work
2.4.15.Our most important partner improves our educational and research abilities
2.4.16.We know our most important partner's staff
Cooperation in the rest of the world (partner may vary according to question)
2.4.17.Cooperation on education
2.4.18.Cooperation on research
2.4.19.Cooperation on development
(Choose the same partner for these questions)
2.4.20.We contact our most important partner concerning research
2.4.21.We know our most important partner's research and development methods
2.4.22.We know our most important partner's work
2.4.23.Our most important partner improves our educational and research abilities
2.4.24.We know our most important partner's staff

2.5. Universities - Public organisations
Cooperation In Ostrobothnia and Central Ostrobothnia (partner may vary according to question)
2.5.1.Cooperation on education
2.5.2.Cooperation on research
2.5.3.Cooperation on employment matters
2.5.4.Cooperation on environmental issues
2.5.5.Cooperation on information system development
2.5.6.Cooperation on regional development
2.5.7.Cooperation on organisational development
2.5.8.Cooperation on marketing development
(Choose the same partner for these questions)
2.5.9.We know our most important partner's research and development needs
2.5.10.We know our most important partner's work
2.5.11.Our most important partner improves our educational and research abilities
2.5.12.We know our most important partner's staff
Cooperation in other parts of Finland (partner may vary according to question)
2.5.13.Cooperation on education
2.5.14.Cooperation on research
2.5.15.Cooperation on employment matters
2.5.16.Cooperation on environmental issues
2.5.17.Cooperation on information system development
2.5.18.Cooperation on regional development
2.5.19.Cooperation on organisational development
2.5.20.Cooperation on marketing development
(Choose the same partner for these questions)
2.5.21.We know our most important partner's research and development needs
2.5.22.We know our most important partner's work
2.5.23.Our most important partner improves our educational and research abilities
2.5.24.We know our most important partner's staff
Cooperation in the rest of the world (partner may vary according to question)
2.5.25.Cooperation on education
2.5.26.Cooperation on research
2.5.27.Cooperation on employment matters
2.5.28.Cooperation on environmental issues
2.5.29.Cooperation on information system development
2.5.30.Cooperation on regional development
2.5.31.Cooperation on organisational development
2.5.32.Cooperation on marketing development

(Choose the same partner for these questions)
2.5.33.We know our most important partner's research and development needs
2.5.34.We know our most important partner's work
2.5.35.Our most important partner improves our educational and research abilities
2.5.36.We know our most important partner's staff

2.6. Universities - Universities
Cooperation in Ostrobothnia and Central Ostrobothnia (partner may vary according to question)
2.6.1.Cooperation on education
2.6.2.Cooperation on applied research
2.6.3.Cooperation on basic research
2.6.4.Cooperation on information system research
2.6.5.Cooperation on regional research
2.6.6.Cooperation on technology research
2.6.7.Cooperation on production system research
2.6.8.Cooperation on process research
2.6.9.Cooperation on organisational research
2.6.10.Cooperation on leadership research
2.6.11.Cooperation on marketing research
(Choose the same partner for these questions)
2.6.12.We know our most important partner's R&D methods
2.6.13.We know our most important partner's work
2.6.14.Our most important partner improves our educational and research abilities
2.6.15.We know our most important partner's research and educational staff
Cooperation in other parts of Finland (partner may vary according to question)
2.6.16.Cooperation on education
2.6.17.Cooperation on applied research
2.6.18.Cooperation on basic research
2.6.19.Cooperation on information system research
2.6.20.Cooperation on regional research
2.6.21.Cooperation on technology research
2.6.22.Cooperation on production system research
2.6.23.Cooperation on process research
2.6.24.Cooperation on organisational research
2.6.25.Cooperation on leadership research
2.6.26.Cooperation on marketing research
(Choose the same partner for these questions)
2.6.27.We know our most important partner's R&D methods
2.6.28.We know our most important partner's work

2.6.29.Our most important partner improves our educational and research abilities
2.6.30.We know our most important partner's research and educational staff
Cooperation in the rest of the world (partner may vary according to question)
2.6.31.Cooperation on education
2.6.32.Cooperation on applied research
2.6.33.Cooperation on basic research
2.6.34.Cooperation on information system research
2.6.35.Cooperation on regional research
2.6.36.Cooperation on technology research
2.6.37.Cooperation on production system research
2.6.38.Cooperation on process research
2.6.39.Cooperation on organisational research
2.6.40.Cooperation on leadership research
2.6.41.Cooperation on marketing research
(Choose the same partner for these questions)
2.6.42.We know our most important partner's R&D methods
2.6.43.We know our most important partner's work
2.6.44.Our most important partner improves our educational and research abilities
2.6.45.We know our most important partner's research and educational staff

Companies

Cooperation here refers to activities in which both sides are genuinely interacting with one another. For example we do not consider purchasing a product, or granting assistance to be cooperation if there is not some sort of dialogue between the actors (for example planning, a mutual project, etc.) Companies can cooperate on for example product development, environmental consulting, research, subcontractors etc.

2.7. Companies - Public organisations
Cooperation in Ostrobothnia and Central Ostrobothnia (partner may vary according to question)
2.7.1.Cooperation on infrastructure and logistics
2.7.2.Cooperation on regional development
2.7.3.Cooperation on technology development
2.7.4.Cooperation on business development
2.7.5.Cooperation on land use planning
2.7.6.Cooperation on environmental issues
2.7.7.Cooperation on employment affairs
(Choose the same partner for these questions)
2.7.8.Our most important partner contacts us
2.7.9.Our most important partner knows our work

2.7.10.Our most important partner improves our innovation process
2.7.11.Our most important partner knows our staff
Cooperation in other parts of Finland (partner may vary according to question)
2.7.12.Cooperation on infrastructure and logistics
2.7.13.Cooperation on regional development
2.7.14.Cooperation on technology development
2.7.4.Cooperation on business development
2.7.16.Cooperation on land use planning
2.7.17.Cooperation on environmental issues
2.7.18.Cooperation on employment affairs
(Choose the same partner for these questions)
2.7.19.Our most important partner contacts us
2.7.20.Our most important partner knows our work
2.7.21.Our most important partner improves our innovation process
2.7.22.Our most important partner knows our staff
Cooperation in the rest of the world (partner may vary according to question)
2.7.23.Cooperation on technological and business life development
2.7.24.Cooperation on environmental issues
2.7.25.Cooperation on logistics
2.7.26.Cooperation on education
2.7.27.Cooperation on regional development
(Choose the same partner for these questions)
2.7.28.Our most important partner knows our work
2.7.29.Our most important partner helps us on our difficult problems
2.7.30.We know our most important partner's staff
2.7.31.Our most important partner knows regulations and concepts of our field

2.8. Companies - Universities
Cooperation in Ostrobothnia and Central Ostrobothnia (partner may vary according to question)
2.8.1.Cooperation on education
2.8.2.Cooperation on research
2.8.3.Cooperation on development
(Choose the same partner for these questions)
2.8.4.We contact our most important partner
2.8.5.We know our most important partner's R&D and education methods
2.8.6.We know our most important partner's work
2.8.7.Our most important partner improves our innovation process
2.8.8.We know our most important partner's research and educational staff

Cooperation in other parts of Finland (partner may vary according to question)
2.8.9.Cooperation on education
2.8.10.Cooperation on research
2.8.11.Cooperation on development
(Choose the same partner for these questions)
2.8.12.We contact our most important partner
2.8.13.We know our most important partner's R&D and education methods
2.8.14.We know our most important partner's work
2.8.15.Our most important partner improves our innovation process
2.8.16.We know our most important partner's research and educational staff
Cooperation in the rest of the world (partner may vary according to question)
2.8.17.Cooperation on education
2.8.18.Cooperation on research
2.8.19.Cooperation on development
(Choose the same partner for these questions)
2.8.20.We contact our most important partner
2.8.21.We know our most important partner's R&D and education methods
2.8.22.We know our most important partner's work
2.8.23.Our most important partner improves our innovation
2.8.24.We know our most important partner's research and educational staff

2.9. Companies - Companies
Cooperation in Ostrobothnia and Central Ostrobothnia (partner may vary according to question)
2.9.1.Cooperation with subcontractors
2.9.2.Cooperation with customers
2.9.3.Cooperation within own corporation (between departments)
2.9.4.Cooperation on technology development
2.9.5.Cooperation on production system development
2.9.6.Cooperation on process development
2.9.7.Cooperation on organisational development
2.9.8.Cooperation on marketing
(Choose the same partner for these questions)
2.9.9.We share our key knowledge with our most important partner during mutual innovation process
2.9.10.Our most important partner knows our products/services
2.9.11.Our most important partner knows our standards/concepts
2.9.12.Our most important partner helps us with our difficult problems
2.9.13.Our most important partner knows our key staff
Cooperation in other parts of Finland (partner may vary according to question)

2.9.14.Cooperation with subcontractors
2.9.15.Cooperation with customers
2.9.16.Cooperation within own corporation (between departments)
2.9.17.Cooperation on technology development
2.9.18.Cooperation on production system development
2.9.19.Cooperation on process development
2.9.20.Cooperation on organisational development
2.9.21Cooperation on marketing
(Choose the same partner for these questions)
2.9.22.We share our key knowledge with our most important partner during the mutual innovation process
2.9.23.Our most important partner knows our products/services
2.9.24.Our most important partner knows our standards/concepts
2.9.25.Our most important partner helps us with our difficult problems
2.9.26.Our most important partner knows our key staff
Cooperation in the rest of the world (partner may vary according to question)
2.9.27.Cooperation with subcontractors
2.9.28.Cooperation with customers
2.9.29.Cooperation within own corporation (between departments)
2.9.30.Cooperation on technology development
2.9.31.Cooperation on production system development
2.9.32.Cooperation on process development
2.9.33.Cooperation on organisational development
2.9.34.Cooperation on marketing
(Choose the same partner for these questions)
2.9.35.We share our key knowledge with our most important partner during the mutual innovation process
2.9.36.Our most important partner knows our products/services
2.9.37.Our most important partner knows our standards/concepts
2.9.38.Our most important partner helps us on our difficult problems
2.9.39.Our most important partner knows our key staff

Part 3. Technologies and the location of technology partners now and in the future

3.1. How important do you think that following technologies are to developing future innovations for the Ostrobothnian and Central Ostrobothnian regions?

	Importance		
Technologies	Now	After 20 years	Why? How it could be developed?
	scale 1-10	scale 1-10	
Nanotechnology			
Micro- and nano-electronics including semiconductors			
Photonic			
Advanced materials			
Biotechnology			
Advanced production methods			
Smart grids (Intelligent electrical networks)			
Renewable energy			
Other, what?			
Other, what?			
Other, what?			
Other, what?			

3.2. Where are Ostrobothnia's and Central Ostrobothnia's partners for innovation situated?

(Mark with crosses)

The location of technological innovators	Within own organisation	In the companies	In the public organisations	Universities and research entities	Development organisations
In Ostrobothnia and Central Ostrobothnia					
In other parts of Finland					
In the rest of the world					

3.3. Where will Ostrobothnian organisations find technological development partners 20 years hence?

(scale 1-10)

Where will Ostrobothnian organisations find technological development partners 20 years hence?	Within own organisation	In the companies	In the public organisations	Universities and research entities	Development organisations
In Ostrobothnia and Central Ostrobothnia					
In other parts of Finland					
In the rest of the world					

Thank you for your input:

Appendix 2

Questionnaire for cooperation Companies – Public organisations

	Attributes
	Cooperation in Ostrobothnia and Central Ostrobothnia
1.1	Cooperation on infrastructure and logistics
1.2	Cooperation on regional development
1.3	Cooperation on technology development
1.4	Cooperation on business development
1.5	Cooperation on land use planning
1.6	Cooperation on environmental issues
1.7	Cooperation on employment affairs
	Our most important public partner in Ostrobothnia
2.1	Our most important partner contacts us
2.2	Our most important partner knows our work
2.3	Our most important partner improves our innovation process
2.4	Our most partner knows our staff
	Cooperation in other parts of Finland
3.1	Cooperation on infrastructure and logistics
3.2	Cooperation on regional development
3.3	Cooperation on technology development
3.4	Cooperation on business development
3.5	Cooperation on land use planning
3.6	Cooperation on environmental issues
3.7	Cooperation on employment affairs
	Our most important public partner in other parts of Finland
4.1	Our most important partner contacts us
4.2	Our most important partner knows our work
4.3	Our most important partner improves our innovation process
4.4	Our most important partner knows our staff
	International cooperation
5.1	Cooperation on technological and business life development
5.2	Cooperation on environmental issues
5.3	Cooperation on logistics
5.4	Cooperation on education
5.5	Cooperation on regional development
	Our most important international public partner
6.1	Our most important partner knows our work
6.2	Our most important partner helps us on our difficult problems
6.3	We know our most important partner's staff
6.4	Our most important partner knows regulations and concepts of our field

Questionnaire for cooperation Companies – Universities

	Attributes
	Cooperation in Ostrobothnia and Central Ostrobothnia
1.1	Cooperation on education
1.2	Cooperation on research
1.3	Cooperation on development
	Our most important university partner in Ostrobothnia
2.1	We contact our most important partner
2.2	We know our most important partner's R&D and education methods
2.3	We know our most important partner's work
2.4	Our most important partner improves our innovation process
2.5	We know our most important partner's research and educational staff
	Cooperation in other parts of Finland
3.1	Cooperation on education
3.2	Cooperation on research
3.3	Cooperation on development
	Our most important university partner in rest of Finland
4.1	We take contact to our most important partner
4.2	We know our most important partner's R&D and education methods
4.3	We know our most important partner's work
4.4	Our most important partner improves our innovation process
4.5	We know our most important partner's research and education staff
	International cooperation
5.1	Cooperation on education
5.2	Cooperation on research
5.3	Cooperation on development
	Our most important international university partner
6.1	We contact our most important partner
6.2	We know our most important partner's R&D and education methods
6.3	We know our most important partner's work
6.4	Our most important partner improves our innovation process
6.5	We know our most important partner's research and education staff

Questionnaire for cooperation Companies – Other companies

	Attributes
	Cooperation in Ostrobothnia and Central Ostrobothnia
1.1	Cooperation with subcontractors
1.2	Cooperation with customers
1.3	Cooperation within own corporation (between departments)
1.4	Cooperation on technology development
1.5	Cooperation on production system development
1.6	Cooperation on process development
1.7	Cooperation on organisational development
1.8	Cooperation on marketing
	Our most important company partner in Ostrobothnia
2.1	We share our key knowledge with our most important partner during mutual innovation process
2.2	Our most important partner knows our products/services
2.3	Our most important partner knows our standards/concepts
2.4	Our most important partner helps us with our difficult problems
2.5	Our most important partner knows our key staff
	Cooperation in other parts of Finland
3.1	Cooperation with subcontractors
3.2	Cooperation with customers
3.3	Cooperation within own corporation (between departments)
3.4	Cooperation on technology development
3.5	Cooperation on production system development
3.6	Cooperation on process development
3.7	Cooperation on organisational development
3.8	Cooperation on marketing
	Our most important company partner in other parts of Finland
4.1	We share our key knowledge with our most important partner during mutual innovation process
4.2	Our most important partner knows our products/services
4.3	Our most important partner knows our standards/concepts
4.4	Our most important partner helps us with our difficult problems
4.5	Our most important partner knows our key staff
	International cooperation
5.1	Cooperation with subcontractors
5.2	Cooperation with customers
5.3	Cooperation within own corporation (between departments)
5.4	Cooperation on technology development
5.5	Cooperation on production system development
5.6	Cooperation on process development

5.7	Cooperation on organisational development
5.8	Cooperation on marketing
	Our most important international company partner
6.1	We share our key knowledge with our most important partner during mutual innovation process
6.2	Our most important partner knows our products/services
6.3	Our most important partner knows our standards/concepts
6.4	Our most important partner helps us with our difficult problems
6.5	Our most important partner knows our key staff