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The Challenges of Public Organisations in Coordinating Smart Specialisation and a Connectivity Model as One Solution

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Julkaisun nimike
Julkisten organisaatioiden haasteet älykkään erikoistumisen koordinoinnissa ja connectivity-malli eräänä ratkaisuna

Tiivistelmä
Älykäs erikoistuminen saattaa julkiset organisaatiot uuteen, haastavaan asemaan, kun ne joutuvat ottamaan eräänlaisen mahdollistajan roolin hoitaakseen. Tällöin julkiset organisaatiot astuvat edellisten innovaatiotoimijoiden, eli korkeakoulujen ja yritysten maaperälle. Siinä missä näillä edellisillä, vakiintuneilla toimijoilla on jo selkeä rooli innovaatiotoiminnassa, eli tiedon tuotannon ja jatkojalostamisen tehtävät, niin julkiset organisaatiot joutuvat hakemaan paikkaansa ja tämä luo niille haasteita.

Tutkimuksessa esitetään, että tästä aiheutuu kolme suurempaa haastetta, jotka julkiset organisaatiot joutuvat selättämään osana älykkään erikostumisen prosessia. Tunnistetut haasteet liittyvät uudessa roolissa toimimiseen ja perustuvat kirjoittajan aiempiin tutkimuksiin sekä uusimman kirjallisuuden tarkasteluun. Nämä haasteet nimetään kumppaneiden osallistamiseksi, tiedon tuottamiseksi, sekä dominoiviksi kumppaneiksi.

Tutkimuksessa esitetään connectivity-mallia erääksi ratkaisuksi, sillä se perustuu alueellisen yhteenkuuluvuuden mittaamiseen ja tehostamiseen. Juuri yhteistyö nähdään eräänä yrittäjämäisen etsimisen ja samalla älykkään erikoistumisen onnistumisen edellytyksenä. Johtopäätöksissä malli todetaan hyödylliseksi työkaluksi julkisille organisaatioille, sillä se näyttää tehostavan alueellista yhteistyötä, tarjoavan tietoa aluekehittäjille, sekä rajoittavan dominoivien kumppaneiden vaikutusmahdollisuuksia.

Asiasanat
Älykäs erikoistuminen, julkiset organisaatiot, connectivity-malli, yrittäjämäinen etsiminen, aluekehittäminen

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Abstract

This study focuses on the challenges of public organisations, as smart specialisation has put them in a mediating role in innovation activities. This change forces public actors to take their place among already established innovation agents, namely universities and companies. Whereas these previous institutions are well-established in their role in innovation as knowledge providers and users, public organisations still seek their place among the other actors and this creates challenges for them.

This study suggests that there are three major challenges, which public organisations need to face in the smart specialisation process. These are all linked to their coordinating role and are based on previous discoveries by the author as well as a current literature analysis. These challenges consist of stakeholder inclusion, knowledge generation and dominant actors.

As a response to the presented challenges, the study introduces a connectivity model, which is based on enhancing regional connectivity. This is one possibility for public organisations, as regional collaboration is one of the core challenges in managing a successful entrepreneurial discovery process. After an analysis the model is seen as a useful tool for public organisations, as it includes elements which enhance regional collaboration, provide useful knowledge for the regional developers and can limit the threat posed by dominant actors.

Keywords

Smart specialisation, public organisations, connectivity model, entrepreneurial discovery process, regional development

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This journey began during a master's thesis seminar in 2012, when Professor Seija Virkkala mentioned at the end of the session that she had a research project which was focusing on smart specialisation. During my studies I had wanted to do my thesis on a topic related to innovation and therefore this new concept was very welcome at that point. I was eventually hired to assist in the formulation of a smart specialisation strategy for the Ostrobothnia region. This participation meant everything for the completion of this study, as the connectivity model was developed as part of the process. This strategy work was followed by my thesis regarding the Ostrobothnian model for smart specialisation, as well as a job as a doctoral student, many publications and the magic of international conferences, where I discovered two of my co-authors.

Throughout all of this, Professor Seija Virkkala has constantly provided me with guidance and support, but at the same time has given me space to pursue my own research interests. She has also slowly but surely introduced me to the international research field, which has been influential for me personally, as well as for this study. For me, Seija is the definitive scholar, and has shown me how scientifically relevant research can also be evidence-based and how cooperation can make a difference. Together with Åge Mariussen, they have both shown me remarkable skills in constructing an extensive but solid theoretical basis, one of which is hopefully shown in this study. Thank you both for your guidance.

Having the support of Seija and Åge has been remarkable in itself, but there are also others who have influenced my studies in a major way. First, I would like to thank international coordinator Jerker Johnson and the other staff at the regional council of Ostrobothnia for their inclusion and input during the development of the connectivity model. Without such active cooperation the model would have been just a theory, with very limited practical use. Jerker has acted as an exemplary mediator during our projects. His phone calls have sometimes kept us busy, but they have also helped us in developing the practical aspects of the model. Thank you for your coordination.

I would also like to express my gratitude to my very first co-author and a case-study specialist, senior researcher Jukka Teräs. He has helped me in writing articles and also lent his wide knowledge of the Nordic context, which has been important to acknowledge during the writing process of this study. It was quite a coincidence that he happened to sit next to me in a conference in Piacenzia, in Italy, but I feel very lucky that he did. Thank you for your insights.

I would also like to thank assistant professor Niklas Lundström for his valuable lessons regarding university work in general, but especially regarding complexity approach and wicked games, which have provided me with an important context for this study, as well as enhanced my theoretical thinking. It has been a pleasure to participate in your development work regarding wicked game theory. Thank you for your example.

I was also very fortunate to have two experienced referees to enhance my thinking during this study. The feedback from both, Professor Vesa Harmaakorpi and Professor Kevin Morgan, has been very valuable and has increased the quality of this study by providing insights of leading experts in smart specialisation. I feel extremely privileged for their time and effort. I'm also very grateful for Professor Vesa Harmaakorpi for taking the role of opponent. Thank you both for your expertise.

During these years I have been very fortunate to work together with my colleagues in regional studies, senior lecturer Ilkka Luoto, as well as doctoral students Tuomas Honkaniemi and Mikko Karhu as well as other colleagues and experts in public management, social and health administration and public law. I would also like to thank other research and supporting staff at the University of Vaasa, and all of the many experts who have participated in our connectivity studies. Overall, I'm still a little astonished by how many people are so eager to develop the region of Ostrobothnia. Thank you all for the inspiration.

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In Vaasa 4.11.2019

Antti Mäenpää

Contents

Figures

Tables

Abbreviations

EDP	Entrepreneurial discovery process
EU	European union
RIS	Regional innovation system
RIS3	Regional research and innovation strategy for smart specialisation (a strategy to implement S3 in a region)
S3	Smart specialisation strategy (policy to implement smart specialisation)
3H	Triple helix
4H	Quadruple helix
5H	Quintuple Helix

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1 INTRODUCTION

1.1 Background to the study

European regions have prepared and are implementing their smart specialisation strategies all around Europe. The scientific concept, which was originally developed by the "Knowledge for growth" expert group has since its start developed a great deal (Foray 2015; Foray et al. 2012). Indeed, smart specialisation can be understood both as theoretical concept and as a policy. The theoretical concept relies on the entrepreneurial discovery process (EDP) and related theories, where regional specialisation is identified by mutual cooperation and inspection of regional capabilities. This theoretical concept is applied to policy when public intervention is required; i.e. when market failures happen and regions cannot specialise on their own (Foray 2015: 30–31). Policy also includes funding instruments, as it is an *ex-ante* condition for receiving ESI or ERD funding. The concept has been diffused broadly since 2014, after this inclusion.

The concept has also been contested, as there have been different understandings of the concept in some regions. For example, in some regions S3 has contributed to the renewal of regional economies, but in others the concept has been added in program documents since it has been seen as a necessary condition (Pugh 2014). As we learn from good cases and begin to understand the possible issues, we are starting to truly comprehend, what the whole process means.

The smart specialisation strategy (S3) is the latest European innovation policy approach, which aims for renewal of regional economies through specialisation and diversification. The idea is that all European regions create their own regional research and innovation strategy for smart specialisation (RIS3), in which they focus on regional strengths. The idea is to aim for global markets and therefore entrepreneurial knowledge is said to be the key (Foray 2015; Foray et al. 2012). The whole process in which regional stakeholders attempt to search for regional expertise to discover new regional specialisations or domains for future growth is called the entrepreneurial discovery process (EDP). This usually means that regional stakeholders meet, analyse and discuss as well as decide, what their region should focus on, whilst keeping in mind the global markets (Mäenpää & Teräs 2018).

One important concept is *innovation* and what it entails in smart specialisation. One of the key differences in S3 is that the focus is not only on technological

solutions, but the overall idea is to use a wide definition for innovation, and these include products, processes, services etc. As Lundvall (1998) has stated, innovations can be seen as "new solutions and continuous renewal of firms, regions and nations".

Innovations can be seen as important components in successful domains, but domains are more related to future business areas, which could be R&D, technology or market-based (Foray 2015; Mäenpää & Teräs 2018). Indeed, smart specialisation does not directly focus on creating innovations *per se*, but the aim is to open new areas for business opportunities, i.e. to discover new global markets, which might then encourage innovative solutions. These domains are expected to build on existing knowledge and industrial strengths in the regions (Foray et al. 2012). Based on this dynamic theory of growth, smart specialisation strategies coordinate the search for new business areas through EDP. I later elaborate on the change in innovation theory, where the focus has been gradually shifting from more linear models and technical innovations to include a wider base, such as end users of innovations and civil society.

Indeed, EDP can be described as "regional entrepreneurship", as regional stakeholders act like entrepreneurs (Teräs & Mäenpää 2016; Lundström & Mäenpää 2017; Mäenpää & Teräs 2018). Regional stakeholders consider what "products" they should sell and what their real "assets" are for competition. It is no wonder that the role of companies has been highlighted during EDP, as they are the ones who know the markets. This market knowledge is said to be one of the real developments in policy approach, as previous innovation strategies were too "technology-specific" and thus top-down (development-specific), whereas smart specialisation is said to be more user-driven and is thus a bottom-up approach (Foray et al. 2012).

As has been established, RIS3 is prepared and implemented in cooperation between different regional stakeholders (Foray et al. 2012: 2). In this study I will discuss the role of *public organisations* as coordinators and by this I mean:

The representatives of public will, which organise regional (or national) smart specialisation strategies. These can be any form of regional governments, such as regional councils, county officials, or people working on a national level, i.e. in a ministry, or anyone who is a member of the public (non-profit) sector and is formally responsible for the smart specialisation process. They are responsible for the strategy documents and engage in intra- as well as extra-regional dialogue with stakeholders and experts in order to accomplish their goals.

This description excludes other public organisations, which are not formally responsible for the S3 process, consultant agencies and other non-public actors, such as companies and universities. Despite this focus, it would be impossible to discuss the role of public organisations without presenting the roles of the other stakeholders in the process as well.

It is widely acknowledged that many S3 practices have already been discussed in economic geography and related research (Kroll 2015). S3 relies on concepts such as constructed advantage (Asheim, Boschma & Cooke 2011), endogenous approaches, 3H connected regions (Goddard, Kempton & Vallance 2013), place-based development (Barca, McCann & Rodríguez-Pose 2011; Barca 2009), as well as EDP and key enabling technologies (Foray 2015). It almost acts as an umbrella for different innovation theories, which are invited to join the fray. According to place-based development strategies, S3 should be tailored to the local context on the basis of the best data available, the most detailed knowledge and an explicit consideration of the realistic potential of the region (McCann & Ortega-Argilés 2013).

I approach this study from a triple helix (3H) viewpoint, because many actors are important for regional innovation (public organisations, universities, companies) and 3H theory (by Etzkowitz & Leydesdorff 2000) provides a good definition of the different institutional actors. There are however some cases, which may be difficult to categorise, and I have made my own interpretation of how they should be distributed among these categories. This interpretation is based on the selection environments (by Leydesdorff & Meyer 2006), where the focus is given on the nature of activities. Originally public organisations were categorised as normative entities, which focus on control and rules and have a stabilising effect on markets. I have included into this categorisation also tasks which develop society. Therefore, development agencies, which may be publicly and privately funded have been counted among public organisations in this study, regardless of ownership. This is because their goal is to enhance the regional development, which can be seen as a public task.

Universities form a second helix and in this study universities refer to all higher education entities. These include universities as well as universities of applied sciences. This distinction should be easy enough to make, and even though universities can be funded by national (i.e. public) entities, their role in innovation and knowledge exchange is so distinctive that they need to form their own group of regional actors. Companies form a third helix and are considered to consist of all sizes of companies, from small firms to large multinational companies.

Civil society (or the fourth helix) (see Carayannis & Campbell 2009) is also part of this study, although it is not very easy to distinguish from the previous three groups. This is because civil society members usually work among public, university or company institutions and thus already have connections with these societal actors. One of the exceptions are non-governmental organisations (NGOs) but they very often operate on tasks which can be considered to be an extension of public will and therefore can be grouped within the public sector. However, civil society members, or citizens, can also act as consumers and thus end-users of innovations, and therefore provide an interesting group of actors who need to be taken into consideration when we are discussing regional innovation activities. Some interpretations of the concept have attached media and culture-based activities (Carayannis & Campbell 2009) to the same category, but I have to disagree on this, as media can be easily categorised as business, and culture-based activities are very often publicly funded activities and therefore part of the public category.

But why are public actors important? If one inspects the S3 literature (Foray 2015; Foray et al. 2012) and compares it with the 3H literature, you might find that public actors are not the most prominent actors, at least at first glance. First of all, the S3 literature highlights the role of companies, or other entrepreneurial agents, as their knowledge of the markets is considered to be crucial for an effective entrepreneurial discovery process (EDP). In contrast, the 3H literature (Etzkowitz & Leydesdorff 2000) highlights the role of universities, as they are considered to be very important innovation mediators which combine local knowledge of related actors with extra-regional knowledge networks, and thus act like "beacons of knowledge". They also help in the acquisition and distribution of new knowledge, as they train students and local actors and thus spread the latest knowledge into the region. Additionally, start-up activities have been elaborated more as universities have begun their own start-up development or "firm farming" which combines company and university knowledge.

The role of public actors has not been put forward as much as companies and universities in the regional innovation studies. Why then do I focus on the role of public organisations? They obviously have the official role as smart specialisation advocates and especially regional governments are seen to have the primary responsibility for key policy identification and strategy formulation (Rodríguez-Pose, di Cataldo & Rainoldi 2014). I also see them as key enablers of genuine regional collaboration, as their public status allows for more "interest-free" discussions. This is obviously not totally true in all cases, as it has been demonstrated that individual actors can play a role in the proceedings (Lundström & Mäenpää 2017; Benner 2014), but this discussion is something which is hard to

imagine without public organisation participation. Furthermore, public actors are (the only ones) responsible for practical RIS3 work and are therefore "forced" to do something in order to come up with solutions. Edwards, Pertoldi and Morgan (2016: 41) have summarised this by stating: "Different types of leadership are needed for S3 implementation. Political leadership is the critical ingredient, because it has the capacity to mobilise all other ingredients." Political leadership does not refer to public organisations directly, but it includes the idea that representatives of society are involved heavily in the process. By using funding from the European Regional Development Fund (ERDF), public organisations can provide incentives for other regional actors to join on the discussion regarding development activities or issues (Teräs & Mäenpää 2016).

The discussion on regional priorities needs to be focused and prepared. Different actors should be widely mobilised in participating in the discussion. Public organisations should be the regional experts in organising these events. They should be able to identify the main regional stakeholders and what they are working on, on a very basic level, at least. This knowledge about the stakeholders is crucial for the proper establishment of EDP, which forms the basis for domains and future specialisation (Mäenpää & Teräs 2018). There are several studies, which indicate that wide participation provides the best outcomes, and, for example, theories around quadruple helix, emergence and connectivity, all highlight the need for proper discussion during knowledge generation, especially on a regional level (Lundström & Mäenpää 2017; Virkkala, Mäenpää & Mariussen 2017; Foray et al. 2012: 21).

EU-level knowledge is also something which the relevant public actors should be aware of. Indeed, besides subject knowledge (generated via EDP), there should also be someone who acts as a figurehead towards the EU, and public organisations (especially the S3 coordinators) are ideal for this task, as they are usually aware of EU policies, specific projects and the ideas which generally stem from the EU level. Public organisations are just the right actors to include a wider dialogue alongside the regional one and can act as figureheads for the whole region at international events. This is also important during collaboration, as public organisations can act as neutral regional representatives, which seek new opportunities for extra-regional collaboration. This is also a trend, which we believe will increase with the establishment of domains (Mäenpää & Teräs 2018).

Many studies present cases and describe the S3 process within a regional context, where they also describe how regional governments have managed to prepare and implement their strategy (see for example: Roman & Nyberg 2017; Teräs & Mäenpää 2016; Georghiou et al. 2014). Usually this process is based on the

guidance given in the RIS3 guidebook (Foray 2015; Foray et al. 2012), which represents six steps for a successful S3 process. One of the steps is governance and in practice this step promotes wide participation of stakeholders and includes the idea of the inclusion of civil society. It also expresses the idea of rotating leadership during the strategy process, where companies and universities might be in charge in some cases, to guarantee that everybody is involved (Foray et al. 2012: 21).

However, it is important to note that the role of public organisations is not always clear and may vary. Kevin Morgan's (2017a) study has shown that there are differences in public participation, even among similar types of (old industrial) regions. His studies have indicated that often public intervention is related to the public actor's subject knowledge regarding ongoing activities and if they know little, they are less keen to interfere (Morgan 2017a, 2017b). Capello and Kroll (2016) demonstrated that public organisations are not a single entity, with a common goal, but have a limited and fragmented structure. This is based on the different aims and agendas of different public entities and their approach to implementing S3 (Capello & Kroll 2016: 1397) and further elaborates how challenging the formulation of S3 is.

Markku Sotarauta (2018) has lately represented five major traps, which can be considered to be challenges for public organisations in the S3 process. These include institutional conflict traps (organisations do not necessarily get along), the governance trap (local autonomy and power is needed to make things happen), the capability trap (regional governments do not have enough expertise or rely on external help too much), the mobilisation trap (how to activate and engage the right people) and the shared vision trap (when we know that self-interest is involved).

This study agrees with the findings regarding public organisations' activities in RIS3, as mentioned by Foray, Morgan and Sotarauta and acknowledges that the role of public organisations is a challenging one. The previous literature also raises an important issue. This relates to the background knowledge of the public actors and how they need to participate in order to "survive" the smart specialisation process. Whereas universities and companies have been forced to innovate in order to exist, public organisations have largely lacked a proper incentive for getting heavily involved in innovation activities. This has now changed on a European level with the establishment of smart specialisation. The time of passive support through allocating funding reactively according to proposals and financing of the biggest candidates is over. Now public organisations have to be open for ideas and present their chosen specialisation on international forums. They should also be able to reflect, learn and conduct experiments (Morgan 2017a), which is a

very different task from the allocation of resources or funding. The S3 Platform in Seville, in Spain, is one important forum where different regions present their strategies in order to acquire feedback from peer-reviews (S3 Platform 2019).

However, how can public organisations become more active innovation players and true innovation mediators? This will not happen in an instant and requires a lot of work, but one way to open the regional dialogue might be the utilisation of a connectivity model. This study focuses on how public organisations might benefit from utilising this model and how it answers some of the main implementation issues which the regional actors face during the S3 process.

1.2 Research problem and objectives

The study focuses on regional development in the S3 context and applies both theory-based and practical views by describing and analysing the challenges of public organisations. The aim for this study is to understand what the main challenges are which public actors have to face in order to successfully develop S3 for their region. It is also important to look for solutions to these challenges and attempt to identify good practices which may further enhance regional innovation activities. The connectivity model can be seen as one solution, but its utilisation should be studied in a wide context in order to see the potential benefits and also the challenges. The research questions in this study are the following:

1. What are the main challenges regarding public organisation coordination in the S3 process?

2. What is the contribution of the connectivity model in overcoming these challenges?

The study also aims to analyse possible barriers which the regional actors face during the utilisation of the connectivity model. By acknowledging the challenges and benefits it becomes easier to study whether the model is applicable or not and what possible benefits it brings. This study can be considered to be exploratory in its approach for developing and testing the connectivity model. Because the study aims to solve the challenges found in current literature, it needs to be self-reflective regarding the solutions and possible limitations; in order to describe a proper learning process, which is typical in exploratory study (Reiter 2017: 139).

The approach of this study differs from the approaches of the six publications this study is based on. However, knowledge generation, wicked problems and wicked game theories provide an important background for understanding the challenges

that public organisations face. For example wicked game theory highlights the complexity of regional development and how its aims can be seen as impossible to complete, as different actors, or players, are constantly changing the region (playing field) and playing by different rules (depending on their legal status etc.) as they utilise their own interpretation and active participation in trying to solve development issues (Mäenpää & Lundström 2019; Lundström & Mäenpää 2017). One of the conclusions is that civil society should be included in S3 in order to enhance the problem identification issues and this aspect has been included in the challenges which public organisations need to overcome in S3 process.

Although various theories are discussed in the attached publications, this study mainly focuses on the challenges for public organisations in searching for solutions to the perceived problems of S3 implementation with the help of the connectivity model. Therefore, I focus on triple/quadruple helix cooperation and the coordinating role of public organisations in this especially.

1.3 My research process and methodology

This study focuses on the challenges for public organisations in the smart specialisation process. However, the focus of the study has been in motion throughout the process. This open´s up an interesting discussion regarding the methodology.

I start my inspection by acknowledging the role that methodology has for me. Firstly, it is an important guideline for research, as it acts as a strategy for approaching the object of the study, what methods we may use and how do we verify our discoveries. It also helps in explaining why our discoveries should be treated as scientific discoveries, which are reliable and truthful. However, one can also approach methodology from various perspectives. According to Hammersley (2011:20) most often used approaches to methodology look at it as technique, or as a description of the methods; or as a discussion on science philosophy; or through autobiography, or explanation of one´s study process.

Based on this understanding of the different aspects in methodology, I try to look at all of them. However, whereas many studies advance from science philosophy to methods and process, I have to view them the other way around. I will, therefore, first look at the research process and explain how I have made some of the choices which contribute to the study. This inspection will then help in defining used methods and my interpretation of science philosophy.

First of all, the subject of this study was quite clear from the beginning of the writing process, or at least the smart specialisation –part. My masters' thesis focused on smart specialisation and how it could be measured via a connectivity model. I therefore was fairly confident to keep on advancing this method and finally publish my study with a clear analytical focus. However, this idea changed a little during the process, as I discovered new aspects of smart specialisation and encountered new people along the way.

I started my journey into regional development by participating in a meeting of the Regional Council of Ostrobothnia in December 2012 and was greeted by international coordinator Jerker Johnson as well as development manager Niklas Ulfvens. Soon after, I attended all the meetings, as we were preparing suggestions for the focus of the strategy. In this respect we got help from the University of Vaasa's industrial management team, which was led by Professor Josu Takala and also from Professor Peter Björk and senior lecturer Christian Johansson from Hanken School of Economics. Professor Josu Takala's gap analysis (Ranta & Takala 2007) provided a framework for the connectivity model (originally named the Ostrobothnian model for smart specialisation) which was further developed by Seija Virkkala, Åge Mariussen and myself, and then implemented as part of the strategy during the autumn of 2013.

Our very first publication "The Ostrobothnian model for smart specialisation" (Virkkala, Mäenpää & Mariussen 2014) wrapped up the whole strategy writing process, and this also allowed us to write down the foundations for the connectivity model. After editing and writing the report, we had a solid basis for the model. We then continued to carry out more analyses and used the data to help in developing the region.

At the beginning of my study process, my focus was primarily on the model itself and I did not focus on the role of public organisations. This aspect I have gradually developed alongside my studies concerning S3 as I have understood, especially through my case studies (Mäenpää & Teräs 2018; Teräs & Mäenpää 2017), that public organisations are facing a new kind of demand for activities, which are not perhaps totally clear to them. Especially our discovery concerning the use of domains (Mäenpää & Teräs 2018) clarified that public organisations need clear instructions on what to do in order to establish some mutual understanding throughout Europe. Otherwise there will be individual approaches and understandings, and these might prove to be challenges in the future, when the same concept can mean different things in different regions. At the same time, however, I have been impressed by how the public organisations have been able to

come up with individual ideas and innovative solutions as well, which may be used to develop these concepts.

Another important addition to this study came through the inclusion of complexity science. Our publications concerning the wicked game (Mäenpää & Lundström 2019; Lundström & Mäenpää 2017) opened up more realities behind the implementation processes, which further highlighted the role of public organisations. Especially our observation that public organisations are the only ones that can actively participate in the whole RIS3 process (Mäenpää & Lundström 2019) has made their role more prominent and justified in S3 implementation, alongside the importance of civil society inclusion. Both of these practical and theoretical additions to my knowledge regarding S3 and the connectivity model made this study possible.

The concrete idea of focusing on the challenges of public organisations started to develop as I attended the 5th Master Class on European Cohesion Policy in October 2017 in Brussels. I prepared my presentation and during this time I came up with the idea that my dissertation could describe the background which has led to this development in the role of public actors, the challenges which this provides, and some means to solve them. I intended to focus on the connectivity model especially, because I know it very well and I also aim to prove that it has a lot of potential as a future tool for smart specialisation. I realised that all of my previous work could be attached to this overall framework and after that I had a direction for this study.

Next we can look at the used methods. Here one can see how the study process has affected on the articles, as they have different methodological approaches like comparative research (Teräs & Mäenpää 2016; Mäenpää & Teräs 2018) , action research (Virkkala, Mäenpää & Mariussen 2017), statistical analysis of empirical data (Mäenpää & Virkkala 2019) and conceptual analysis based on literature view (Lundström & Mäenpää 2017; Mäenpää & Lundström 2019). All of the used methodology was chosen pragmatically, i.e. based on the research questions of articles and therefore they lack a unified perspective on methodology. This approach can be described by the concept of triangulation, which means that multiple sources, approaches and methods have been used to enhance the study process (Robson 2011: 158). Overall this study is also looking at the method of connectivity analysis, which combines quantitative (stakeholder and gap analysis) and qualitative research (interviews, focus groups) approaches into one. Therefore, the methods used in the study are both quantitative and qualitative. So the arguments in this summary study are based on mixed methods.

As can be seen, the research process and used methods make it rather difficult to pinpoint this study into a certain school of scientific philosophy. In this study I´m looking at public sector innovation activities in S3 context and explain how connectivity model might help in its design and implementation. I see myself as somebody doing this active process and generating the knowledge in a similar view that is often seen to be characteristic for constructivism. However, I also understand, that by mentioning constructivism and its views, I open up *hermeneutical* discussion on the nature of understanding, as well as discussion on the nature of knowledge, or *epistemology*, and also need to address my views on understanding of reality, or *ontology*, as well (Robson 2011: 151; Cresswell 2013: 4, 224).

In constructivism the main ontological idea is that knowledge cannot exits on any "pure" form, but knowledge is created by craftsmen; i.e researchers. It is also basic epistemological assumption, that researchers get involved and have an effect on the subject of their study and therefore focus needs to be put not only on the findings of the study, but also on the role of the researcher in this process. One can also widen this approach to include not only the researcher and his or her person, but the surrounding society as well, which may have an effect on the researcher and his or her views on the subject matter, as well as interpretation of the study findings. Hermeneutically this means that a researcher is conveying his or her view of the results and acts as an interpreter. This view is often associated with social sciences (Hammersley 2011:130.)

The views expressed in constructivism differ from science philosophical views, associated with empirism and positivism, where researchers are seen as discoverers of knowledge. The epistemological and ontological idea is that knowledge is existing before observation and simply needs to be observed and discovered to become generally known. This view also highlights that a researcher needs to be neutral observer, so that he or she does not effect on the results. The researcher is just a messenger, as this view dictates that knowledge is absolute and therefore cannot be altered by the researcher in any way. This is the general view, especially in natural sciences (Hammersley 2011: 125.)

The approach used in the study is more inductive, than deductive or abductive, as development work has ensured that decisions and new solutions have been needed along the study process and focus on validation has not been enough. Inductive approach is more fitting to get a close understanding of the studied phenomena and is based on the idea that a researcher is part of the research process and things may change during this process (Saunders, Lewis & Thornhill 2009: 127), which describes the research process quite fittingly.

This study is using a holistic view in developing regions through the connectivity model and can be considered normative in nature, as it tries to establish a policy suggestion, or model, in order to explain, and also have a desired effect on the development of regions. The creation of models is also pointing towards constructionism, as models can be seen as constructions in this sense (Harmaakorpi 2004: 22).

However, I recognise the issue with constructivism, which implies, in its extreme form that all knowledge is constructed and therefore always dependent on the interpretation of the researcher and his or her audience, which means that knowledge in itself does not exist, but there only are beliefs, which are shared among people. This thinking has been criticised by simply comparing the meaning between "knowledge" and "belief" and by stating that we "by instinct" know the difference between these two concepts. (Hammersley 2011: 133.)

I also do not believe that knowledge is only constructed, as I consider it to be based on reality. Constructs are based on observations from reality. They try to establish and explain the events and phenomena of reality. I do recognise that as a researcher I have affected on the study subject, as I have been part of the policy process. This further validates the point that I have not simply made a construct, but been part of the reality, that is being studied as well. This view, as well as my pragmatic approach to methodology in different papers could position this study into the field of pragmatism. It has been stated that pragmatists define truth as something "what works" (based on the research question) and "favour action before philosophising" (Robson 2011: 28).

As this study can be classified as development study or study of planning process which has the norm to develop the region and regional economy, pragmatism seems to be a fitting science philosophy. This definition stems from the context in which connectivity model as a planning approach has been developed and in which it can be used and applied. Even if I aim to a generalised planning model which in this study is connectivity model for S3, I emphasise the context-dependent conditions in the development, application and use of the model. Indeed, this study could be most fittingly described as exploratory research, as well as a development study.

The main difference between exploratory research and, perhaps more traditional, confirmatory research is the way it approaches methodology and especially the findings of the study. In confirmatory research one develops a theory and uses different methods to test the hypotheses; in order to see whether the theory remains true. Confirmatory research assumes that the researcher is capable of asking the right questions and is able to provide a neutral analysis of the study

subject. The main focus is on the reliability of the methods and not perhaps the actual findings. (Reiter 2017: 134.)

In an exploratory study the assumption is that the researchers are part of the surrounding world, which they study and therefore also impact the subject of the study itself. Therefore, one is not able to test hypotheses as there can be no neutral way for studying a subject without affecting it during the process. This especially applies in the social sciences, where one is not able to isolate certain parts of reality in a laboratory-environment. Explorative research therefore focuses, instead of using perfect methods, on how well the pre-assumptions take place after completing the study. Instead of validating one, certain-like truth, the focus is on the learning process and where the pre-assumptions take us. (Reiter 2017: 136–138.). This also justifies mixed methods instead of focusing on just one method throughout the process.

This description of a learning process can be applied to my research process, as this has been a learning experience. However, I consider my study to also be developmental research, as alongside the new information and learning about the role of public organisations in S3 I have been participating in developing the connectivity model, based on our experiences of using the model in 2013, 2015 and 2017 as well as in the LARS project implementing Interreg Baltic sea programme. I will describe this process later, when describing the model.

According to the description of Richey and Klein (2005: 24): "developmental research seeks to create knowledge grounded in data systematically derived from practise", which describes the function of the connectivity model very well. This is why I consider this study to be mostly cross-sectional, rather than longitudinal, as I see this as an attempt to study regional collaboration, which of course can have longitudinal data as well, but focus is on present activities.

It should also be clearly expressed that the dissertation also develops the connectivity model, as it explores its possibilities and challenges in helping the practical development work of public organisations. This has been categorised as type 2 developmental research, as it is centred on a model and discovery of conditions that facilitate its successful use. Type 1 research is more focused on developing existing processes. (Richey & Klein 2005: 24–25.)

Both confirmatory and exploratory research processes start by introducing an explicit theory and some hypotheses or research questions, as they help to define the focus for the study and help to frame the focus on a certain level. However, when confirmatory research starts testing the hypothesis, exploratory research asks how the role and background of the researcher affects the chosen theories and

formulated research questions. The focus is on why the researcher does things and for whom he does the study, instead of explaining just how he does it. (Reiter 2017: 143–144.)

According to Reiter (2017: 145) an exploratory study requires two important qualifications: self-criticism and acknowledgment of the potentially endless process which derives from the idea that the researchers affect the subject of their studies. This calls for proper inspection of the role and background of the researcher and also for the use of theory and hypotheses, in order to force the endless process to a certain frame. According to these two qualifications, I gradually introduce the overall theoretical background in the study and how I have used different theories in order to narrow my viewpoint. I also express self-criticism and have split it into two different sections in the study: One, which focuses on the limitation of the study itself; namely the chosen literature and approach as well as the geographical dimension and Nordic context, which has affected my views regarding the role of public organisations and overall governance. The second limitation focuses on the limitations of the connectivity analysis itself as a method, as it does not necessarily provide input for specialisation directly and faces challenges due to the subjective nature of collaboration, which it measures.

Due to the nature of explorative research I considered it to be important to include my research process, as it helps to define my position, or background for the study. I am one of the developers of the connectivity model and I have seen it in practice, which has encouraged me to study it further. I started this process with a very narrow view of smart specialisation and without knowing much about the role of public organisation in the S3 process. My former research taught me different ways to approach my study area and through this learning I discovered a path that lead me here.

1.4 Limitations of the study

The limitations of the study are linked to the context of my publications and relevant literature analysis, as well as to a specific geographical area (the Nordic countries), and its political, social and even historical background, which has affected on my views and understanding of the role of public organisations in S3 process. Other major limitations relate to the connectivity model itself, but these limitations are expressed later, after presenting the model.

In the context of the study, validity means how much the methods and data are aligned with the research questions. It refers for the quality of the study and means

that my findings are backed by evidence and reflect the true situation of the studied phenomenon (Eriksson & Kovalainen 2008: 292). Reliability means that one should be able to draw similar conclusions, when studying the same phenomenon through similar knowledge and consistent research process (Eriksson & Kovalainen 2008: 292). One way for ensuring the validity and reliability in this study is the analysis of relevant literature, since it helps to contextualise the research questions through wider angle. This was crucial in outlining the major challenges for public organisations in S3 process. I have also tried to uncover the connectivity model by explaining its history and origins besides presenting the publications and theories behind it, in order to be as open as possible about it.

The relevancy of literature analysis is of course based on the focus of the used research. Some of the sources are official EU publications regarding smart specialisation and its requirements. This has been backed up by studies, which look for good practises and also by criticism of the current process. However, focus has been on the literature on practical implementation of S3 and EDP, as I have considered this to be most relevant regarding the issue of coordination in S3 process.

Criticism could also be raised to the literature analysis as a method, when conducting a development study. However, some of the publications which are part of the study have been written based on practical development work and action research method, which has been conducted in the region of Ostrobothnia since 2013. Without this practical development and strategy work it would have been impossible to study the subject in a similar way. This is one major limitation, since this practical work is difficult to convey without having to experience it. I have tried to explain the processes which has led to the development of the model, in order to minimise the impact of this limitation.

This focus on more practical development has left out some branches of literature, and some good practises or challenges might not have been covered. Literature used in this study does not include extensive knowledge generation discussion and could have focused more on knowledge exploitation as well, thorough policy evaluation and overall criticism of place-based and regionally based development policies. Connectivity model has been assessed via Harmaakorpi´s (2006: 1089–1090) evaluation criteria for sunrise regional innovation policies in conclusions, but could also have been compared more with other policy models, which might have added value for understanding its possible limitations or possibilities. The used literature also lacks criticism on the role of public organisations in general, since public sector is not necessarily able to provide neutral input for development processes (Morgan 2017b). More discussion could also have been raised on the role

of public organisations in innovation activities, although I feel that this issue is addressed in the later sections of this study.

One should not forget also geographical limitations. Even though the connectivity model can be presented as a very general tool to enhance S3 processes in regions, the cases where the model has been previously applied and developed (Ostrobothnia and Nordland) are from the Nordic countries and therefore there may be some differences in their innovation networks compared to other regions in Europe. One example is the overall Finnish innovation system, which Reid and Maroulis (2017) have described as having "…good connections between triple helix actors and high levels of investment in private and public RDI compared with some other EU countries". Another example might be the role of universities, as in the Nordic countries universities may be more eager to be involved in solving societal challenges, as they are legally and economically obliged to contribute to society (their *third task*). As has been demonstrated (Blažek & Morgan 2019; Goddard & Kempton 2011: 39), there are countries and institutions in which the universities have acted more or less as "ivory towers" and have just lately participated in more concrete collaboration.

Another Nordic condition which affects RIS3 is good governance, for example, Finland was estimated to have the best governance in the world in 2018 and Norway is ranked in 3rd place on the Legatum prosperity index (Legatum Institute 2018). Finland and Norway are both known for being among the less-corrupted countries with Finland having the 3rd and Norway having the 7th place on the corruption perceptions index (Transparency International 2018). Both countries also have transparent governance and legislation. For example, Finland ranks 4th and Norway first on the world press freedom index (Reporters Without Borders 2018). Finland has the most independent judicial system in the world and Norway ranks 11th, based on the global competitiveness report (World Economic Forum 2018). One might say that the governance in both countries has a high degree of legitimacy among the citizens. This societal and political background has created historical trust towards public entities and allows for their participation in many tasks, which would not be preferred in other parts of Europe. Ultimately the presumption for utilising the connectivity model is based on this sort of willingness to cooperate between stakeholders and effective governance, which is not a reality in all regions (Blažek & Morgan 2019; Morgan 2017b).

This societal limitation regarding the formal use of the connectivity model is, however, countered to some extent on inspection of the current literature. I also explain how initial findings from the LARS project (Mariussen, Mäenpää & Virkkala 2019) might indicate that the regions are not that different in many parts

of Europe, and connectivity analysis is currently implemented in central and eastern parts of Europe as well. Despite these early efforts to overcome the limitations, it is important to acknowledge the possible effects of the cultural and societal background in the study and in my views as a researcher.

1.5 Structure of the study

The study first presents the articles and describes their main outputs, and provides a compilation based on their main findings. After that the study further elaborates the challenges for public actors in coordinating S3 processes, based on current literature. The articles and the current literature thus provide a solid basis for understanding the main issues which public organisations must overcome in order to fulfil their S3 requirements.

After establishing the challenges, it is time to look for solutions and the connectivity model is analysed as one possibility. The idea is to describe the phases of the model and then examine how it provides solutions to the established challenges. With this knowledge it is possible to provide conclusions and a discussion regarding future research avenues.

2 ARTICLES AND BOOK CHAPTERS

Four articles and two book chapters are part of this study and provide a quite broad view of the challenges and solutions which the public organisations must face in order to prosper in S3 formulation. I have written all of the articles with co-author(s) and therefore present my role and practical participation in these articles as an Appendix (1). At the end of this chapter I also provide a summary and synthesis of the papers in order to explain their role as part of this study.

I have grouped the articles based on three thematic perspectives for the study. The first group consist of two articles, which focus on the implementation of S3 (Teräs & Mäenpää 2016; Mäenpää & Teräs 2018). The second group consist of publications regarding the connectivity model (Virkkala, Mäenpää & Mariussen 2017; Mäenpää & Virkkala 2019), and the last group consist of publications regarding the complexity of S3 and civil society inclusion (Lundström & Mäenpää 2017; Mäenpää & Lundström 2019).

2.1 Implementation of smart specialisation

2.1.1 Smart specialisation implementation processes in the North: Lessons learned from two Finnish regions

This paper looks at the S3 processes and implementation in Ostrobothnia and Lapland via a six-step approach, which was suggested in the original RIS3 guidebook (Foray et al. 2012). The two cases provided different views on how to "complete" the process and thus provided examples for implementation. Our analysis included the written strategy documents and unpublished material such as timetables, but also relied heavily on the practical knowledge gained during our participation in the local RIS3 strategy work.

The main finding highlights the amount of time which is needed for a proper implementation of RIS3. The second finding relates to the importance of proper company participation in the RIS3 process. The last finding points out that the differences in ESI funding may be one reason for the utilisation of different methods and views regarding the strategies.

2.1.2 In search of domains in smart specialisation: Case study of three Nordic regions

This paper aims to discover how the concept of domain is understood in the literature and how it has been implemented in practice in three Nordic regions: Lapland, Värmland and Nordland. The main methods are qualitative, as these include an analysis of official strategy documents, as well as interviews with regional experts regarding the utilisation of the domain concept within the regions.

The main findings indicate that even though the concept is very difficult to approach (especially as there are no proper translations for the term in some cases), the regions have still managed to think of domains alongside the ideas presented in the RIS3 guidebook (Foray et al. 2012) and therefore have managed on this task. We stated in the article that domains can be understood as thematic constructs which are implemented into practice by mutual collaboration on both intra- and extra-regional levels. This precondition seemed to match our findings.

2.2 The connectivity model

2.2.1 A connectivity model as a potential tool for smart specialization strategies

This paper focuses on introducing the connectivity model and its practical use in the region of Ostrobothnia. The main methods used in the study are quantitative, as the paper provides some results regarding connectivity analysis, which is used to measure cooperation in 3H setting via various methods such as network structure mapping and gap-analysis. However, the analysis also includes findings of focus group meetings and thus includes qualitative methods as well. The overall results are shown as an example of which sort of issues the connectivity analysis is capable of revealing. This knowledge is then used to describe the connectivity model and how it could be utilised in practice.

The main findings indicate that the connectivity model might be utilised as part of RIS3 in regions. It provides an indirect way to enhance EDP and therefore would work alongside other methods which focus on the actual specialisation within the regions. However, the connectivity model can be part of RIS3, especially if the region aims towards a collaboration, or inclusion-based vision.

2.2.2 The role of proximity in less-favoured regions: Smart experimentation between triple helix actors

This chapter explains how connectivity and proximity can be seen as important preconditions in innovation and how less-favoured regions especially might benefit from connectivity analysis. The chapter also introduces a new way for measuring cognitive and social proximity, with the help of a knowledge taxonomy developed by Lundvall and Johnson (1994) and demonstrates its practical application by focusing on a case study from Ostrobothnia with data gathered in 2013.

The results show that a high cognitive proximity is a possibility even when a region might lack some key stakeholders and therefore highlights the possibility to use extra-regional connections to substitute local connections, thus verifying the idea of using other actors to gain market knowledge, as suggested by Foray et al. (2012). However, this may be due to personal connections, rather than systematic networking. Additionally, social proximity seems to be facilitated by geographic proximity, so different proximities might be overlapping to some extent. It was also suggested that public governments should establish and promote EDP by focusing on connectivity and proximity in order to enhance regional innovation, which is especially important in less-favoured regions. A connectivity analysis and new proximity calculations can be seen as one useful tool for helping in this respect.

2.3 Complexity of smart specialisation and civil society inclusion

2.3.1 Wicked game of smart specialization: A player's handbook

This paper first introduces complexity sciences and explains that wicked game theory is based on the complex nature of regional development and explains how individual actors or players are able to constantly effect the surrounding region (playing field) with their subjective views of the issues and solutions (rules of the game), which makes the goals of development impossible to achieve. The paper also highlights complexity literature and its ideas of inclusion as a means for discovering solutions. This is followed by an introduction to S3, and after this the two are combined in order to understand how S3 can be seen as a wicked game and what implications or suggestions arises from this comparison. The paper is theoretical in nature and is mainly based on the literature.

Main findings include the idea of individual players and their ability to effect the strategy process. This highlights the importance of proper inclusion of all relevant stakeholders, such as civil society members. The ability to recognise the relevant players is thus raised as an important issue for RIS3 formulation. The findings also highlight the importance of proper tools for monitoring and evaluating RIS3 processes.

2.3.2 Entrepreneurial discovery processes through a wicked game approach: Civil society engagement as a possibility for exploration

This chapter focuses on explaining the wicked elements in EDP and how civil society actors and even individuals could help in EDP exploration. This is done by separating EDP exploration into three sections: existing capabilities, stakeholder activation and goals for S3. These three stages were explained through current literature and how different cases seem to have approached EDP. However, the chapter also highlights that quadruple helix cooperation has not worked out on all occasions and aims to discover why this is the case.

The findings indicate that many regions still consider civil society engagement as an after-thought and even successful cases seem to have done so with varying success. Some explanation might be the fact that there are numerous methods for engaging with civil society and these should be used according to the three phases in the EDP exploration process. The findings also highlight the need to develop more methods as well as proper resources for engagement through EDP exploration. Development projects (by Kuznetsov & Sabel 2012) are suggested to be one possible way to do that.

2.4 Summary of articles

All of the articles and book chapters focus on S3 implementation and this is one major theme of this study also. Other major themes include EDP, triple helix and quadruple helix. The articles and book chapters focus mostly on the core tenets of S3 with less known approaches such as the connectivity model and wicked game, which have thus contributed to the S3 literature.

The methodology varies between papers, as traditional literature reviews and strategy analyses are enhanced with both qualitative (interviews, focus groups) and quantitative (gap analysis) methods. This utilisation of multiple methods is important in order to gain insights into both the theoretical context as well as on the practical formulation of S3. This knowledge has helped in making comparisons

between various S3 models and in developing the connectivity model as a policy model for S3.

One way to look at the publications is to see them from the previously established challenge and solution viewpoint, which this study focuses on. As can be seen (Table 1), the articles and book chapters present both challenges and solutions and therefore the combination of these provide important input for the overall study.

Even though the subjects of the publications have been varied, one can see that the outcomes regarding them have some similarities. The articles and chapters seem to highlight stakeholder inclusion in both triple helix and quadruple helix settings (as civil society). This overall inclusion is also stretched to extra-regional collaboration, so inclusion on all geographical levels and helices can be seen as one challenge for public organisations.

Another challenge arises from knowledge generation, which is partly linked to stakeholder inclusion. With more stakeholders, there are more possibilities that somebody is left out and therefore proper EDP as well as domain formulation remains a challenge. Additionally, the inclusion of intra-regional knowledge is crucial for EDP, but for domain formulation, extra-regional knowledge becomes another important factor.

The third challenge lies in the potential dominance of strong actors, which may greatly affect the S3 process and therefore needs to be taken into consideration (Mäenpää & Lundström 2019; Lundström & Mäenpää 2017; Benner 2014). This is one reason why proper tools need to be established for monitoring and evaluating the strategies, as this allows for a more open process and keeps dominant stakeholders at bay. However, even though there are some tools already for evaluation and monitoring regarding S3, there still remains a need to evaluate and monitor the actually established domains themselves. This is a subject which has only been touched upon (Mäenpää & Teräs 2018) but needs more studies.

Table 1. The input of articles to the study (source: own compilation).

Article	Input				
	Themes	**Material and methods**	**Challenges**	**Solutions**	**Overall study**
1.Smart specialisation implementation processes in the North: Lessons learned from two Finnish regions	S3 implementation, six steps, EDP, thematical & functional specialisation, triple helix	Analysis of strategy documents, participation in the S3 work	S3 process and its require-ments	Proper time-frame for S3 implementati on, company inclusion, resources	Introduces S3 and triple helix literature and implementation practices, as well as thematical and functional specialisation
2.In search of domains in smart specialisation: Case study of three Nordic regions	S3 implementation, EDP, domain formulation	Analysis of strategy documents, interviews	Domain formulat-ion	Intra- and extra-regional collaboration to transform domains into practice	Highlights intra- and extra-regional collaboration as well as stakeholder inclusion in knowledge generation
3.A connectivity model as a potential tool for smart specialization strategies	S3 implementation, triple helix, EDP, connectivity model, gap analysis	Connectivity analysis, gap analysis, focus group meetings	Triple helix connectiv-ity in S3 formulat-ion	Connectivity model	Introduces connectivity analysis, gap-analysis and connectivity model
4.The role of proximity in less-favoured regions: Smart experimentation between triple helix actors	S3 implementation, triple helix, proximity, knowledge taxonomy, EDP, connectivity model, gap analysis	Gap analysis, including new way to measure cognitive and social proximity	Triple helix connectiv-ity and proximity in S3 formulat-ion	Connectivity model as a proximity measurement tool, public government should lead EDP cooperation	Explains how regional connectivity can be a focus for less-favoured regions, and introduces additional calculations for measuring different types of proximity
5.Wicked game of smart specialization: A player's handbook	S3 implementation, triple helix, quadruple helix, wicked problem, wicked game	Literature review, theoretical analysis	S3 as a wicked game, quadruple helix inclusion	Recognition of wicked game stakeholder inclusion (civil society especially), proper monitoring and evaluation tools	Highlights the role of individual players and especially civil society inclusion in EDP formulation and calls for monitoring and evaluation tools
6.Entrepreneurial discovery processes through a wicked game approach: Civil society engagement as a possibility for exploration	S3 implementation, triple helix, quadruple helix, civil society, role of individual actors in S3, EDP, wicked problems, wicked game	Literature review, theoretical analysis	S3 as a wicked game, quadruple helix inclusion	More resources and recognition for civil society inclusion in S3, more tools for engagement	Explains how EDP can be seen as a wicked game and introduces the benefits of utilising civil society engagement, with a focus on tools for engagement

Overall the three main challenges arising from the articles and book chapters (see Table 1) regarding public organisations role in S3 can be described as:

1. Stakeholder inclusion
2. Knowledge generation
3. Dominant actors

One recent study by Sörvik et al. (2018: 5) seems to acknowledge these challenges, as they discovered that: "There are challenges in mobilising stakeholders and managing multilevel governance processes, with conflicting regional and national interest, and it can be difficult to involve national level actors in regional processes". Mobilising stakeholders may be interpreted to refer to challenge 1, managing multilevel governance process can be seen to relate to challenge 2 and conflicting regional and national level could point towards challenge 3.

The presented challenges are to some extent overlapping; as more stakeholders are included, there will be a more fragmented knowledge base and it will be more difficult to generate a common vision and knowledge based on the ideas of individual stakeholders. Furthermore, a fragmented knowledge base may improve the chances that one strong actor becomes dominant in the S3 process. Indeed, stakeholder inclusion adds challenges to knowledge generation and issues regarding dominant actors, and *vice versa*. However, the challenges also have many distinctive characteristics as stakeholder inclusion is all about who should be involved and how (to involve them), while knowledge generation concerns how the stakeholders should work together and what knowledge they should produce, and a focus on dominant actors ensures that both are done in a manner which allows for genuine interaction between regional stakeholders.

As one solution to the challenges presented above, this study presents the connectivity model. This has been described in detail in the publications linked to this study, but requires some explanation of how it tackles these challenges. Before this, however there is a need to analyse the challenges presented in the articles and review the latest studies in order to embed the challenges and solutions in the emerging literature of smart specialisation. In the next chapter the aim is to utilise the latest literature in order to build an understanding regarding the three issues presented here.

3 THE CHALLENGES OF PUBLIC ORGANISATIONS IN COORDINATING SMART SPECIALISATION

3.1 Theoretical background

3.1.1 Smart specialisation concept and literature

This chapter introduces the concepts of smart specialisation. The public organisations' role has changed in regional innovation policy and in the development literature and this new role has been highlighted in the S3 context. This study relates to the S3 literature, as well as several key theories of S3 (EDP and 3H/4H), which are presented in this chapter, but also relates to the notions of connectivity and proximity in chapter 4. Thus, network theory provides a starting point for explaining the connectivity model and how it works in an S3 context. Since its development and introduction by the Knowledge for Growth group (2005-2009) the concept of smart specialisation has become a research focus for a number of economists, policy makers, consultants and innovation geographers (Foray 2015). Many studies have either presented case studies or theoretical contributions on EDP as well as 3H/4H collaboration.

Some of the most notable publications have included a handful of books, which have focused on smart specialisation as a whole (Foray 2015), as well as on the governing of smart specialisation (Kyriakou et al. 2017), empirical and institutional aspects of smart specialisation (McCann, van Oort & Goddard 2017), advances in the theory and practise of smart specialisation (Radosevic et al. 2017), smart experimentation in less-favoured regions (Kristensen, Dubois & Teräs 2019), and the entrepreneurial discovery process through knowledge emergence, exploitation and conversion (Mariussen et al. 2019). There are also several European Commission publications which have mostly focused on practical policy making issues, from the very first RIS3 guide (Foray et al. 2012) to some of the latest implementation handbooks (by Gianelle et al. 2016) and entrepreneurial discovery practises (Marinelli & Perianez-Forte 2017) as well as several case studies, industrial focuses and regional comparisons.

Many recent articles have focused on similar themes and include cases of EDP (Mäenpää & Teräs 2018; Santini et al. 2016; Mieszkowski & Kardas 2015; Foray & Goenaga 2013), triple/quadruple helix (Virkkala, Mäenpää & Mariussen 2017; Kolehmainen et al. 2016; Pugh 2014; Carayannis & Rakhmatullin 2014), strategy preparation (Teräs & Mäenpää 2016; Kroll 2015; Georghiou et al. 2014; Foray, David & Hall 2009), strategy implementation (Sörvik et al. 2018; Kroll 2016; Foray

& Rainoldi 2013) or governance/leadership issues (Sotarauta 2018; Morgan 2017a; Muscio, Reid & Leon 2015) in S3 contexts.

One very important distinction is the difference between smart specialisation as a policy and as a theoretical concept. Smart specialisation refers to the theory of economic transformation, while S3 is a policy model that is based on this theory and RIS3 is a regional strategy document that aims to fulfil the requirements of the policy. Usually the theoretical properties of smart specialisation are addressed through EDP, but smart specialisation itself can also be seen as theoretical concept. Dominique Foray (2015: 20–21) has demonstrated that smart specialisation can indeed happen without a policy and presents several cases to prove his point. One of these focused on a Swiss-French border case in the town of Morez in 1796, where nail production transformed into glass production when one entrepreneur noticed the similarities in their manufacturing. After his efforts, many local companies followed him, and this led to the creation of a glass production cluster. The case demonstrated the core idea of smart specialisation well according to Foray (2015: 21) as it clearly presents three distinctive phases which occur in a successful smart specialisation process: entrepreneurial discovery and spill-overs (the discovery of similarities in nail and glass production), entry and agglomeration (other companies followed and formed a cluster), as well as structural changes (nail production changed into glass production within the town).

Out of the three phases it is easy to see, why entrepreneurial discovery plays such an important role in smart specialisation. Successful EDP provides the basis for all the phases, as can be seen in the Morez case. Better than that, the process happened spontaneously after the discovery, without any major public funding or interference. This is the optimal case, as markets guide the companies towards better profits by themselves and the risk is carried by the entrepreneurs. Foray's (2015: 21) demonstration of the Morez case, however, also highlights the fact that the process is not done or ready after entrepreneurial discovery alone. As has been suggested (Mäenpää & Teräs 2018) domains are the outcomes of successful EDP and provide a starting point for regional transformation, which is an ongoing process. This is the optimal process, but *alas*, has not been achieved in all cases.

Indeed, smart specialisation becomes policy issue (and transforms into S3) when this sort of economic renewal becomes a focus of public policy; i.e. when market failures occur. Foray (2015: 30–31) explains that the need for specific RIS3, and public intervention, arises when smart specialisation meets market failures and cannot happen on its own. One example of such a market failure would be a lack of funding which may stop an otherwise successful smart specialisation process.

Other issues include, for example, lack of coordination, which may mean that public actors do not meet the needs of the local actors. (Foray 2015: 30–31).

One way to approach smart specialisation is through the two very words. First, "smart" may mean that region is looking for empirical studies and research to form the basis for its strategy (European Commission 2013: 10; Foray et al. 2012: 8). This sort of practical focus may also help the implementation process, as evidence-based approach helps decision makers and citizens alike to accept the focus for future development (Mäenpää & Virkkala 2014: 4).

Secondly, the "smart" concept refers to a policy process which is smart. It focuses on a bottom-up approach and regional collaboration. The focus is no longer on certain technologies but includes wider views of innovation. It also includes the idea of transnational cooperation through the S3 platform, which allows for peer reviews and more organised strategic collaboration (Foray et al. 2012: 22, 25).

Thirdly, "smart" may also refer to different regional research facilities, such as universities or laboratories. Universities' important role in knowledge generation and brokering has been lifted up in related research, as they are seen as "beacons" which connect regional actors to international research networks through their everyday activities. (Foray et al. 2012: 40; Etzkowitz & Leydesdorff 2000: 109–110).

Research is also important when considering the "specialisation" part of a smart specialisation strategy (Mäenpää & Virkkala 2014: 4). Overall idea for regions is to discover their domain and compete on global markets. Staying on top usually requires extensive testing and development capabilities, which research facilities possess. This is also one way to ensure that regional specialisation is reaching its full potential (Virkkala & Mäenpää 2014: 4; European Commission 2013: 10; Foray et al. 2012: 8).

Mäenpää and Virkkala (2014: 4) have also described specialisation to be: "… 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 advantage of scale, more scope and spill-overs during the formulation of knowledge (Foray & Goenaga 2013: 4; Foray et al. 2012: 11, 14–15; Midtkandal & Sörvik 2012).

One important distinction should be made regarding the concept of specialisation and how it relates to diversification. According to Balland et al. (2018): "the goal of smart specialisation is not to make the economic structure of regions more specialised (i.e., less diversified), but instead to leverage existing strengths, to identify hidden opportunities and to generate novel platforms upon which regions can build competitive advantages in high value-added activities". It is important to realise that the focus is on the discovery of new combinations and not in cementing existing activities. Those only provide a starting point.

It´s also important to focus on export-oriented activities, in order to renew the regional economy. Usually this sort of knowledge requires understanding of the global markets and therefore emphasis is put on entrepreneurial expertise in smart specialisation strategies. If the region is lacking companies, then knowledge of the possibilities and challenges of the markets may come from public organisations or universities through their expertise. (Mäenpää & Virkkala 2014: 4; Foray et al. 2012: 12, 92; Midtkandal & Sörvik 2012.)

Indeed, entrepreneurial knowledge is important in S3 implementation, because without EDP the strategies "…would have an entirely different character" (Foray 2015:5). This bottom-up, collective reflection process of the regional assets and possibilities distinguishes S3 from the traditional industrial innovation policies and allows a bigger role for private stakeholders, which hopefully translates specialisation strategies into both economic and social outcomes (Ahlqvist, Valovirta & Loikkanen 2012). According to Mäenpää and Virkkala (2014: 4):

> *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.*

Nauwelaers et al. (2014) have categorised specialisations into two categories, thematic and functional. Thematic specialisation is based on R&D capabilities, technologies or markets, and can be seen to be more "in-line" with the overall description of specialisation in S3. Thematic specialisation is also essential for formalising domains, as the thematic element is the basis for their structure (Mäenpää & Teräs 2018). Therefore, some sort of thematic specialisation is much more common and a necessity in RIS3. Functional specialisation focuses on the regional innovation system itself and, for example, connectivity. It is not widely used but some cases of its implementation are Nordland and Ostrobothnia (Teräs

& Mäenpää 2016). This categorisation makes it possible for regions to focus on either thematic priorities or include some functional aspects into their strategy.

Extra-regional coordination is also an important aspect in S3. Regional actors should work together to strengthen their abilities for innovation, and this includes regional cooperation as well as networking nationally and globally with the best possible actors. The regional discovery process with the help of extra-regional actors includes peer reviews of mutual learning. One coordinator of these peer-reviews and extra-regional dialogue is the S3 platform, which is located in Seville, Spain and funded by EU. Since its establishment in 2011 the platform has organised several conferences and seminars for peer-reviews, where regional representatives may present their strategies and get feedback for their work from other regions. (S3 Platform 2019; Teräs & Mäenpää 2016; Mäenpää & Virkkala 2014: 5.)

Indeed, it seems that the major difference between smart specialisation as a theory on transformation and S3 as a policy model aiming on transformation is in the supporting instruments, which transform smart specialisation from being a place-based innovation theory and process into becoming a practical and extra-regional EU policy. These supporting elements include the S3 Platform in Seville as well as the ERD and ESI funding instruments. In this study I take smart specialisation into consideration both as a theoretical innovation process (through EDP) and as a policy for innovation.

Based on previous literature, I would describe smart specialisation as follows in the context of regional development:

Smart specialisation is global market-orientated regional development based on transformative capacities of local, evidence-based activities with focused, vertical R&D and innovation goals. Due to market failures smart specialisation cannot happen efficiently in all cases without some sort of regional governance and public intervention. Preparation and implementation of smart specialisation strategy happens via stakeholder interaction.

This description summarises the concept of smart specialisation, but also highlights the quite distinctive role of public organisations. Smart specialisation literally cannot properly function without a public presence when market failures are present. This opens up the discussion concerning the “formal” role of public organisations and what they should do during the S3 process.

3.1.2 Public organisations' role in S3 process

As has been presented by Foray (2015: 30–31), smart specialisation can become a policy, when public organisations feel the need to enhance regional specialisation and this usually happens by establishing S3. One way to look at this role in S3 is through the six steps –analogy (as originally presented by Foray et al. 2012: 17). These six step are the following:

1. Analysis of the regional context and potential for innovation.
2. Set up of a sound and inclusive governance structure.
3. Production of a shared vision about the future of the region.
4. Selection of a limited number of priorities for regional development.
5. Establishment of suitable policy mixes.
6. Integration of monitoring and evaluation mechanisms.

The steps can be described briefly (in order to discover their essence) as follows: The analysis of regional context is designed to form a basis for the overall S3 process, as it focuses on the existing regional assets, such as different actors and their connections. Usually the focus is on exploring the current situation and mapping some future possibilities (Foray et al. 2012: 18–20). The governance structure suggests the idea of wide participation of stakeholders and therefore promotes the idea of civil society inclusion. It also expresses the idea of rotating leadership during the process, in order to guarantee that everybody is involved (Foray et al. 2012: 21).

The shared vision refers to establishing a future scenario about the direction the region should take. It should be mentioned that the shared vision is especially important for maintaining the stakeholder's interest (Foray et al. 2012: 22). Priority selection should then combine top-down EU policies with more practical bottom-up findings within the region in order to establish areas where the region has realistic chances to excel. There should be only limited priority areas in order to maximise the chances of success (Foray et al. 2012: 22).

Policy mixes are then designed to meet the overall S3 goals and these also include action plans (objectives, timetables, resources) as well as pilot projects, which are designed to allow policy experimentation. These pilot projects should also include valid evaluation mechanisms to see whether the projects work accordingly or not (Foray et al. 2012: 23). Monitoring and evaluation mechanisms refer to the overall inspection and monitoring of the S3. Monitoring refers for assessing the S3 implementation whereas evaluation refers for assessment about whether and how

the strategic objectives are met. It's also mentioned that S3 is an ongoing process so monitoring and evaluation should be used in order to further enhance the S3 process also in the future. Peer review is also mentioned as a good practise as it allows learning processes and can be used to establish cooperation between similar types of regions (Foray et al. 2012: 24).

The idea of the six steps is to follow the guidelines in any order, and if necessary, the steps can be repeated in the process. Teräs and Mäenpää (2016) focused on the utilisation of the six-step process in two Finnish cases (Lapland and Ostrobothnia) and revealed that the steps can be very varied indeed. However, both case study regions followed the six steps in their S3 process, and this proves that it has been used as a framework for practical S3 formulation.

Basically, the six steps are used in order to enable a comprehensive S3 implementation, as it takes into consideration several key issues for a proper smart specialisation process. However, one can also notice several tasks which ideally are work for public organisations. Analysis refers to evidence-based and thus stakeholder activation, governance is a direct nod towards public involvement in the process, vision refers to strategy work in general but also highlights public will in the process. Priorities represent pilot projects, which should be linked to regional development (i.e. public will), while the policy mix refers to the tools that public organisations can use in order to fulfil their S3 targets and relevant pilot projects. Monitoring and evaluation refer to public control of the strategy process as well as ex-post evaluation after the strategy; in order to discover what has been established and whether there should be new projects/ideas for future development.

Public organisations are the main implementors and developers of the regions' relevant S3 targets. Even though there have been suggestions for a mix and rotation of leadership (Aranguren, Navarro & Wilson 2017: 172) during the S3 process, it remains evident that public organisations are more suited to the governing role, as they are usually the only ones who are able to follow through for the whole of the process (Mäenpää & Lundström 2019). The role of regional governments has been especially raised, as they are primary actors for formulating strategy and identifying key policy objectives, as Rodríguez-Pose, di Cataldo & Rainoldi (2014:9) have stated on their conclusions:

> *The RIS3 logic is by definition more ambitious and more complex than the one-size-fits-all intervention. It assigns an important role in the policy-making process to regional actors and puts them at the very heart of the strategy design and implementation process. This makes regional public authorities a central pillar of the innovation mechanism and implies a*

> *significant reliance on their capacity to deliver. Local and regional authorities become key players in the promotion of the interactive collaboration between all relevant regional stakeholders for the collective identification of key innovation assets and long-term strategic priorities.*

It is understandable to utilise universities and companies in the analysis phase and make them part of the governance as well, but as Kroll (2016: 8) has demonstrated, even universities often focus on their own interests. Universities and companies might indeed have other ambitions, and S3 formulation and governance should therefore be the task of regional public organisations and especially the regional government.

Public organisations can also act as neutral mediators, as their facilitating role has been raised in several Schumpeterian streams of thinking, such as in new structural economics, where the idea is that public entities help develop industries based on the comparative advantages determined by the current economic structure. S3 shares this idea of active self-discovery based on current strengths (EDP) and can also be seen to support the idea that public organisations take the role of enablers and supporters in a multi-actor framework. Indeed, public organisations can resolve coordination problems and develop frameworks which allow for these broad-based partnerships (Muscio, Reid & Leon 2015: 5).

Public organisations have to face many challenges during the strategy process and Sotarauta (2018) has identified five major issues, or policy traps, which regional governments have to tackle during the S3 process. These include the institutional conflict trap, governance trap, capability trap, mobilisation trap and shared vision trap.

The institutional conflict trap refers for the general well-being and consensus between regional institutions, because sometimes there is conflict which makes the S3 process a lot harder. This has been also noticed by Grillitsch (2016: 29–30), who has stated that "if the degree of integration is high, conflicting interests can be better mediated and a consensus built". It is important to have supporting organisations and equally important that they get along (Sotarauta 2018).

The governance trap, which is linked to previous trap, refers to strong governance capabilities within the region, because sometimes there may be lacking resources. Indeed, it has been stated that sub-national-level actors require autonomy and power to make choices and decisions for setting collective objectives, finding a shared vision and achieving place-based objectives (Sotarauta 2018; Tomaney 2010; Barca 2009). More localist governance systems are prone to be more place-

sensitive than centralist systems of governance (Sotarauta 2018; Bentley, Pugalis & Shutt 2017; Beer 2014).

The capability trap is linked to the previous trap and emphasises that regional governments need to have sufficient personnel and expertise in order to formalise the S3 process (Sotarauta 2018). Interestingly, Laasonen and Kolehmainen (2017) have observed that knowledge-based regional development and related innovation policies lack studies which focus on the required capabilities. Marques and Morgan (2018) have also highlighted the abilities of public officials to implement rather than suggest policies.

The mobilisation trap highlights the difficulties which relate to acquiring active and interested stakeholders and how they might be kept involved (Sotarauta 2018). The wide participation of stakeholders is often the goal (Tomaney 2010; Barca 2009), but the practical mobilisation of these relevant stakeholders is a delicate art. This issue is also linked to previous issues, such as governing, capabilities and institutional conflicts (Sotarauta 2018).

The shared vision trap is linked to cooperation, as different stakeholders have to adapt their own agendas in order to come up with a truly mutual, regional vision and this may prove to be a challenge that cannot be overcome. Sotarauta (2018: 197, based on Horlings and Padt 2011) has described the trap further by stating that: "There are often difficulties in combining abstract visionary thinking with operational matters that leave space for self- or party interests to hijack a collective arena." Sotarauta (2018) suggests that rather than strive towards a single vision, it might be more fruitful to respect the differing views and work towards mutual understanding gradually.

Morgan (2013; Virkkala, Mäenpää & Mariussen 2017) argues that smart specialisation presents three challenges for EU regions: conceptual challenges concerning the concept and what it implies for the theory and practice of regional innovation policy; operational challenges related to the ability of regions to translate the concept into a coherent policy agenda; and political challenges regarding how to ensure that regional stakeholders are mobilised to meet the operational challenge. This is similar to the mobilisation trap by Sotarauta (2018) and stakeholder inclusion challenge suggested in this study. In Morgan's (2013; Virkkala, Mäenpää & Mariussen 2017) view, the smart specialisation process will force regional governments to recognise innovation as a collective effort in which the capacity to work in coordination will be a decisive success factor.

Morgan (2013: 106) also links good governance to networks by stating that: "…the ideal governance structure would include new stakeholders from the worlds of

business and civil society, selected for their competence in the network rather than their status in the hierarchy, and this is a radical innovation in its own right because it runs counter to everything we know about how regional elites usually deploy their power and patronage, especially in the face of novelty."

Navarro, Aranguren and Magro (2011) also suggest that regional governments should actively seek a future vision for smart specialisation. They even suggest that governments should play a more central role in situations where regional actors lack scientific and technological knowledge or do not otherwise manage to generate a systemic vision. In regions where there are enough capable stakeholders, governments may take a more facilitating role instead. Edwards, Pertoldi and Morgan (2016: 58) have summarised this by stating that: "The public sector has a vital role as leader, facilitator and enabler of innovation."

Indeed public organisations should act as mediators and enablers of S3 process, as they should be the experts regarding regional actors and activities. I am also suggesting that this is exactly the role which suits the specific skill sets of public organisations, as they should know the regional actions and actors well. However, Kevin Morgan's (2017a) case study has shown that there are differences in public participation, even between similar types of (old industrial) regions. One of his final conclusions is that (based on new industrial policy theory) more network-based collaboration should be and could be done in order to enhance regional innovation activity. It may have been one prominent actor in the success of the Basque Country, which he compared with Wales. Morgan (2017a) citates the role of public actors via Rodrik (2004) as: "less about omniscient planners and more about an interactive process of strategic cooperation". Public actors play a key role in achieving this, as they can manage the process.

Kevin Morgan (2017b) also later elaborated how there are different views regarding the public sector's involvement and "control" in innovation activities. His Hayek vs Rodrik comparison reveals that whereas Hayek believed in the capacities of companies to understand and predict the markets, Rodrik questioned this ability altogether and believed in public participation. Virkkala and Mariussen (2019: 15–17) have also addressed the differing views of Hayek and Rodrik and identified Hayek as more of a micro-economist, whereas Rodrik was focusing on macro-level interactions and this may have explained the reason for the differing views.

This can be turned into a question of public intervention, as there can be no "right" solutions, because not even the companies know it all when it comes to the future of innovations. This means that others can try too.

However, Morgan (2017b) sees this unpredictability as a good thing regarding public entities, as public actors usually want more control over those matters which they do understand. He explains that the lack of tacit knowledge (and small financial budget, which may be related) may have been one reason the Welsh government left room for wider participation in their latest innovation programme. The focus is once again on networks and a participatory approach for public actors. Morgan (2017a) also calls for more elaborated studies regarding the public participation.

Kroll et al. (2014) have addressed many practical challenges regarding the formulation of S3 in a development agency context. First, they explain that there may be a lack of competent staff. Secondly, regions may utilise external consultants who lack the necessary regional knowledge regarding the local stakeholders, resources and known challenges. Thirdly, regional officers may lack sufficient training to manage and organise S3, as they may have backgrounds in law, public administration or spatial planning. Sotarauta (2018) has named this type of challenge as a competence trap.

It seems, based on previous studies, that quite many challenges for public organisations are due to networking issues. These findings will further prove that the presented challenges are relevant. Stakeholders and their interaction are important for proper EDP and as Morgan (2017a) has elaborated, there should be more actual interaction and less public control. This is the main challenge for establishing a proper EDP and S3 process. One way to look at this challenge is through networks and their role in S3 and how public organisations should govern them, in order to maximise fruitful interaction in the S3 process.

3.1.3 Networks and governance in smart specialisation

One way to understand public organisations' role in the S3 process is to first look at the smart specialisation process as a network forming process. Smart specialisation and especially EDP should be studied with a more actor-orientated and dynamic approach. Secondly, governance is required to influence the networks. Based on previous studies it would seem evident that regional collaboration is a crucial issue for successful EDP. This means that understanding the processes regarding networks in S3 would be insightful.

Regional innovation system (RIS) theory provides us with a solid background for understanding S3 from the theoretical point of view. However, RIS theory alone cannot properly capture the changing dynamics in innovation activities, where new types of innovation practises, such as user-driven innovation take place.

Due to these limitations there has been a need to address more user-driven theories, such as the quadruple helix (4H) model of innovation, which is also the official theory for the background to S3 and is an extension of triple helix (3H) theory. These two theories are linked to network-based thinking, where knowledge flows between different types of actors and therefore provides the basis for the theoretical thinking expressed in this study. However, the challenges presented here are not entirely related to networks and their dynamics, but also require some governance related theories as these open up the role of public organisations in affecting the established knowledge flows.

This study is about innovation networks and how public organisations can make them more effective via S3 related governance, with the help of the connectivity model. These governance-related theories present themselves in the form of EDP as well as connectivity. Figure 1 explains how the theories relate to each other.

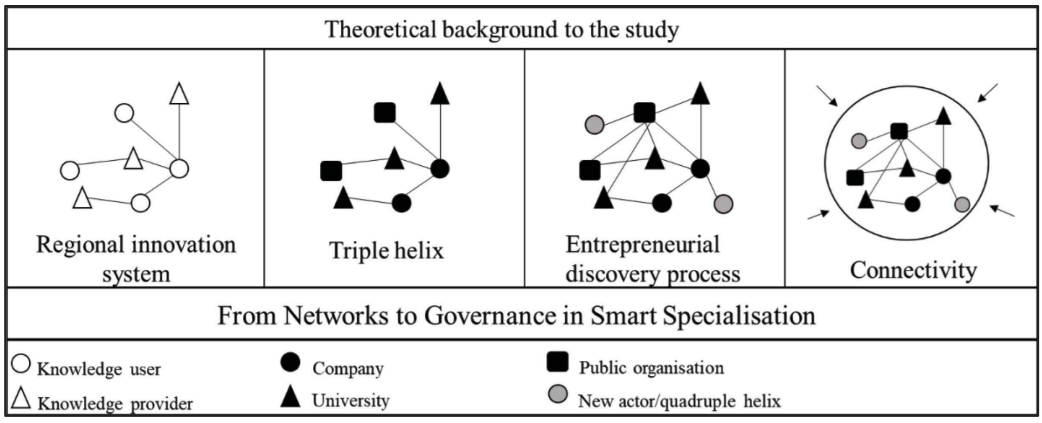

Figure 1. Theoretical background to the study (Source: Own compilation).

Figure 1 explains the reasoning behind the theories related to this study. First of all, RIS provides the framework, where actors (knowledge producers and users) and linkages are important for understanding regional innovation activities. Triple helix-theory enhances and describes the regional stakeholders, adding institutional differences (between companies, universities and public organisations) and the entrepreneurial discovery process adds governance, which helps in finding new stakeholders and can also be utilised for enhancing quadruple-helix (civil society) activity. Connectivity then combines all these processes by enhancing regional collaboration. The connectivity model is designed especially for this purpose.

As the figure demonstrates, different theories complement each other. They are used here as inputs and background information for the connectivity model. Next I will present regional innovation system, triple/quadruple helix and EDP theories.

The regional innovation system

Regional innovation system theory (RIS) is very important background for smart specialisation, as it provides (actor-based) regional innovation theory, as can be seen in comments by Asheim, Smith and Oughton (2011: 878): "At the core of the RIS approach is an emphasis on economic and social interactions between agents, spanning the public and private sectors to engender and diffuse innovation within regions embedded in wider national and global systems". RIS focuses on the suppliers and users of knowledge and traditionally this may have led to a more university- or company-based focus, which may not be realistic in all fields and regions. Later the RIS literature has, however, addressed the role of regional learning processes and institutional change in an evolutionary framework (Asheim, Smith & Oughton 2011).

Moulaert and Sekia (2003) have criticised RIS (alongside other territorial innovation theories) for its tendency to focus only on markets and not on other relevant innovation activities. They have spoken for a more multi-dimensional view of innovation, economic dynamics and community governance (Arnkil et al. 2010). Territorial development should enable the market economy, but also empower other parts of the economy (such as the public sector, social economy, cultural sector, and low-productivity artisan production) as well as community life in general. This absence of clear distinctions for different user and societal involvement in the innovation process has also been noticed by Schuurman, Baccarne and Mechant (2013: 19).

Smart specialisation can be seen as a continuation of regional innovation systems thinking (McCann & Ortega-Argilés 2016), and therefore the history and background to it provides a valid starting point. A defined historical view regarding the background theories of RIS has been conducted by Asheim, Smith and Oughton (2011: 877). They discovered that there have been several other innovation theories, such as the original theory of industrial districts (Marshall, A. & Marshall, E. 1897; Marshall 1930), national innovation systems (NIS) (Freeman 1984) and finally clusters (Porter 1998a, 1998b; Baptista & Swann 1998; Swann & Prevezer 1996) which have affected the background of RIS. There have also been discussions regarding broader innovation theories, such as learning regions (Asheim 2012) and the innovative milieu (Crevoisier 2004; Camagni 1995) which

have broadened the "focus" of innovation theories towards more multi-actor cooperation. RIS has been defined (by Cooke, Uranga & Etxebarria 1997: 1573) as a system, where "firms and other organisations are systematically engaged in interactive learning through an institutional milieu characterised by embeddedness".

When the previously mentioned background theories are compared to RIS, one can find several differences, for example global networks in RIS differ greatly from geographically limited, local connections of industrial districts, or nationally based constructions (such as NIS). Differences can also be found regarding the actual and active networks of RIS, where networks are based on actual flows between actors compared to the possible spatial "club membership" of cluster actors, or an innovative milieu, which may not necessarily mean active collaboration between the related actors, or it may be more market-orientated collaboration (Asheim, Smith & Oughton 2011: 879). However, clusters can of course include universities and other non-business partners, such as cluster organisations by definition. RIS can still be considered to be wider in its approach, as it contains system-based as well as geographical tendencies and is not therefore limited to local collaboration but also acknowledges global knowledge flows.

This regional aspect of RIS, which has been described by Asheim (2007: 229) as an "institutional infrastructure supporting innovation within the productive structure of a region" is also shared in S3. Indeed, the regional level has been seen increasingly as the proper level for fostering economic, social, cultural and political activities through different types of policy measures (Uotila & Ahlqvist 2008). According to Cooke, Uranga and Etxebarria (1997; see also Arnkil et al. 2010) RIS consists of a regional production structure or knowledge exploitation subsystem, which consists mainly of firms often displaying clustering tendencies. This forms one part of the system, which communicates through an informal institutional context (through norms, trust and routines) to the second part of the system. This second part consists of regional supportive infrastructure or a knowledge generation subsystem, which consists of various types of research organisations and actors.

Cooke (1998) distinguished three different types of RIS. In the first, firms base their innovation activity on local learning processes between other firms without interaction with R&D institutes or universities. Geographical and relational proximity are very important. Cooke (1998) calls this type a 'grassroots RIS', because these are bottom-up processes and they perhaps show early signs of cooperation. The second, focuses on networks and local, interactive learning. In difference to the first type of RIS, in this type the regions have R&D facilities,

vocational training organisations and other local organisations which are involved in firms' innovation processes and therefore include public–private cooperation. The networked system is commonly regarded as the ideal type of RIS (Arnkil et al. 2010), which Cooke (1998) refers to as 'network RIS'. In the third type of RIS, innovation activity takes place primarily outside the region and is linked to both national and international innovation activities. Cooke (1998) describes this type as a 'dirigiste RIS', where R&D is primarily done by universities, research institutes and corporations.

However, there are also several RIS-related theories, which focus on the type of knowledge and therefore have a wider focus, which extends beyond actors or networks. These include the notion of related variety (Boschma & Frenken 2009; Frenken, van Oort & Verburg 2007), which states that knowledge must be near the same level, not too far away and not too close in order to create new combinations. The theory of a differentiated knowledge base (Asheim 2007; Asheim & Gertler 2005; Asheim & Coenen 2005) can be seen as an attempt to formulate this related variety, as it divides knowledge into analytic (research-based), symbolic (cultural) and synthetic (practical, engineering-based) knowledge. On the other hand, policy platforms (Harmaakorpi, Melkas & Uotila 2017; Cooke 2007; Cooke et al. 2007) encourage open responsiveness to different ideas, which can be seen as one trait in smart specialisation as well, especially if one considers the myriad of approaches, which the concept has seen in recent years.

RIS theory provides us with an understanding of how network thinking and different flows of knowledge can be seen to affect knowledge production and that indeed, such networks do exist. However, even the wider applications of RIS leave out important logics, which guide knowledge production and to discover this, we need to understand another background theory behind S3 that is triple helix theory.

Triple helix

Triple helix theory can be seen as another core theory of S3 and it is especially important in the connectivity model context. Whereas RIS related theories focus on networks and knowledge production in a more categorised way (*i.e.* universities provide knowledge and companies use it), 3H takes into consideration the evolution of the different institutions and also focuses on hybrid-organisations (Etzkowitz & Leydesdorff 2000). This applicability provides a good categorisation for understanding how cooperation in regions works.

Triple helix theory was originally developed by Henry Etzkowitz and Louet Leydesdorff (2000; Leydesdorff & Etzkowitz 1998) when they combined their interests regarding three societal actors: industry, academia and the state. Etzkowitz was originally interested in university-industry relations and noticed that the role of the universities was changing. Universities no longer just produced knowledge and trained personnel, but were also more closely involved in the wider knowledge economy; creating knowledge-based start-ups and other services which were influencing the regional economic growth. Development activities or the "third mission" of universities slowly started to emerge besides the more traditional tasks of teaching and research. Soon the concept of the entrepreneurial university was developed to describe the change (Etzkowitz & Dzisah 2008).

Traditionally the three main societal actors (industry, academia and the state) had very distinct institutional roles, and fell under the state-led system, where the state controlled the two other actors, or helices. As economies and markets evolved into global and technology-driven constructs so did the system, and soon the helices acted independently as the state "released" the other helices. Universities became knowledge producers, and educated personnel and long-term innovations were their products for some time. However, things started to evolve as new technological areas developed. Biotechnology and computer science among others were closing the former gap between the industry and academia because they were more knowledge than technology-driven. Soon universities were developing more "concrete projects" where they no longer necessarily produced theories and long-term visions, but also practical and up-to-date applications for the use of these new areas. This transformed the institutional aspect into a neo-institutional approach. (Etzkowitz & Leydesdorff 2000; Leydesdorff & Etzkowitz 1998.)

This trend has been continuing as knowledge society is becoming more interactive, and there are overlapping domains. Through this development helices have begun to take on the roles of the other helices (Etzkowitz & Leydesdorff 2000). This can be seen especially in research field, where boundaries are hard to draw between private, public and applied research. There are company R&D departments as well as start-up companies inside universities. Different combinations of knowledge and interaction between helices may spur new ideas for innovation. (Virkkala 2014: 27; Ranga & Etzkowitz 2013.)

As previously mentioned, Etzkowitz originally took a more institutional view of the matter by first focusing on the institutional roles of the different helix actors (institutional approach) and slowly turning his attention to the changes happening within helices, or evolution in the actors (a neo-institutional approach) whereas Leydesdorff was interested in the systematic aspect of the relations between the

three societal helices, which he saw as different social systems, or as overlaying communications. Therefore, the triple helix concept can be viewed from both institutional and systematic perspectives. (Etzkowitz & Leydesdorff 2000.)

Indeed, Leydesdorff's (1997; Leydesdorff & Etzkowitz 1996) systematic approach to 3H provides us with distinctive factors between the helices. Whereas RIS was all about knowledge production and usage, a systematic perspective adds goals and logic, which underline the distinctive ways the helices operate. According to Leydesdorff and Meyer (2006) different helices operate in different selection environments. The activities of public organisations are based on normative control and established rules, and they have a stabilizing effect on other helices. Universities' activities are based on novelty production and the discovery of technological opportunities, and they act in a global context. Companies aim to generate wealth and operate in markets. They provide a selective force of discovery. (Leydesdorff & Meyer 2006.)

This distinction is important for this study, as some hybrid organisations are difficult to categorise based on their institutional attributes, but then one can examine their functions through a systematic approach and categorise them this way. For example, publicly and privately-owned development agencies can be categorised through their development activities. Their institutional attributes point towards public organisations and companies, but their activities are directed towards mutual good (development), which may categorise them as public organisations.

This "mindset" of the different actors is important to understand, as it ultimately makes the actions of the different helix actors more understandable. 3H theory opens up the logic of knowledge producers and users and now also public organisations can be seen as knowledge producers or users. Leydesdorff's (1997) systematic goals, however, also provides a logic regarding how and why the knowledge is used. Whereas RIS focuses on the flow of knowledge, 3H focuses on the nature and reasons for this flow, as well as its aims. This is the reason why triple helix model is used as a heuristic in this connectivity study. It can be seen as a precondition for regional innovation processes (Virkkala 2014: 26).

However, 3H theory has also been criticised, and its applicability towards different types of regions has raised questions. As an example, 3H is easier concept to understand when discussing about Nordic countries, or university cities, than in less effective governance systems in regions and countries where different helices are not accustomed to cooperate or are simply lacking from the region altogether.

Some recent studies have, however, demonstrated that even less-favoured regions can utilise 3H concept as a basis for understanding the regional innovation system (Mäenpää & Virkkala 2019). Also, in RIS3 guidebook (by Foray et al. 2012: 12) it has been stated that public organisations can take the role of other actors, if some important helix actors are lacking from the region. As an example, it is suggested (by Foray et al. 2012: 12) that public development agencies can take the role of entrepreneurs, if there are only few present in the region.

Another critique is aimed towards the rhetoric of 3H, whereas practises are often centred on dyadic relationships, i.e. practises between two helices instead of all three. One example of this is also connectivity model, as it is based on measuring the collaboration between helices (from one helix to another) instead of somehow incorporating all helices into one figure. One way to solve some of these limitations is through utilisation of proximity approach, in order to clarify the different types of relationships (Virkkala, Mäenpää & Mariussen 2017: 677). However, this issue is still present and also affects this study.

In addition, the general categorisation into just three helices has been challenged. For example Carayannis and Campbell (2012) have suggested that civil society should also be a part of the knowledge production and deserves its own helix. Environmental discussion has also spurred an idea of including nature or environment as its own helix. From these additions one might state that quadruple helix (4H) has seen more use in innovation literature than quintuple helix (5H). The growing demand for user-driven innovation has highlighted the importance of fourth helix, as can be seen in the next chapter.

Quadruple helix

The reasoning behind 3H reveals why 4H is a difficult concept. Whereas 3H actors and their reasoning can be categorised quite distinctively, the fourth helix is not such an easy case. Indeed 4H may be described as "something other than company, university, or public organisation". Often it is described as civil society, which includes various actors with varying goals. 4H also represents open and user-centred innovation policy. (Foray et al. 2012: 37.) This is why 4H is the original theory to be endorsed in S3 and not 3H. In fact, the RIS3 guidebook (by Foray et al. 2012: 37) states the following:

> *In particular, in order to guarantee a livelier and truly place-based entrepreneurial process of discovery that generates intensive experimentation and discoveries, it is imperative that new demand-side*

> *perspectives, embodied in innovation-user or interest groups of consumers, are represented along with intermediaries who offer a knowledge-based but market-facing perspective. This means that the traditional, joint-action management model of the triple helix, based on the interaction among the academic world, public authorities, and the business community, should be extended to include a fourth group of actors representing a range of innovation users, obtaining what is called a quadruple helix. This is the necessary organisational counterpart of an open and user-centred innovation policy, because it allows for a greater focus on understanding latent consumer needs, and more direct involvement of users in various stages of the innovation process. RIS3 processes can develop environments which both support and utilise user-centred innovation activities also with the aim of securing better conditions to commercialise R&D efforts.*

The 4H theory introduces new layers and actors into innovation theories. There has been a discussion regarding broad-based innovation policies (for example Harmaakorpi, Melkas & Uotila 2017; Edquist, Luukkonen & Sotarauta 2009) and how changing business logics and ways of doing things (innovation ecosystems, development platforms, value networks, crowdsourcing etc.) are challenging the previous views on innovation activities. This overall transition of innovation theories could be described as moving from a traditional science, technology and innovation (STI) mode towards the mode of doing, using and interacting (DUI) (Harmaakorpi, Melkas & Uotila 2017; Jensen et al. 2007). Indeed, interaction and user involvement are also key characteristics of 4H.

Arnkil et al. (2010) studied the definition of the 4H and stated it has not been well-established, but different 4H theory concepts acknowledge the role of the three original helices (industry, academia and state) but add a fourth helix, e.g. civil society, or culture and media-based public and civil society (Carayannis & Campbell 2009), linking organisations or innovation-enabler-organisations (Liljemark 2004), public representatives (Yawson 2009), or consumer/end users of innovation (Eriksson, Niitamo & Kulkki 2005; Lundvall et al. 2002; Thomke & von Hippel 2002; Schienstock & Hämäläinen 2001).

Carayannis, Grigoroudis and Pirounakis (2015:24) have later explained the need for this sort of additional helix inclusion by stating: "This Quadruple Helix model puts innovation users at its heart and encourages the development of innovations that are pertinent for users (civil society). Users or citizens here own and drive the innovation processes." This idea of individuals and their potential for participation has also been presented by Benner (2014) as well as Lundström and Mäenpää (2017) in the S3 context.

However, the reasoning and logic of fourth helix can be as varied as the participants it consists of. For example, if civil society members are *de facto* working within companies, universities or public organisations, they usually bring some of this "mindset", or systematic logic (Leydesdorff 1997) with them. This is one of the reasons why I consider civil society to be an important addition to S3 but not as a wholly fledged helix which operates as systematically as the other three helices. This reasoning is explained in the following figure (Figure 2) regarding the usage of different helices in Ostrobothnian S3 processes.

This figure shows how the issue of utilising the fourth helix and even fifth helix (environment) (see for example Carayannis & Campbell 2012) was applied in the strategy work for the region of Ostrobothnia in 2013-2014 and how it relates to 3H theory. All helices are present, and their actors are wholly involved, but the fourth helix actors have been divided between companies and public organisations, respectively. This was because some civil society actors were working on development, which can be considered public work by nature (i.e. non-profit, regional development work), and the media (originally suggested to be part of fourth helix by Carayannis & Campbell 2009) is usually represented by media companies.

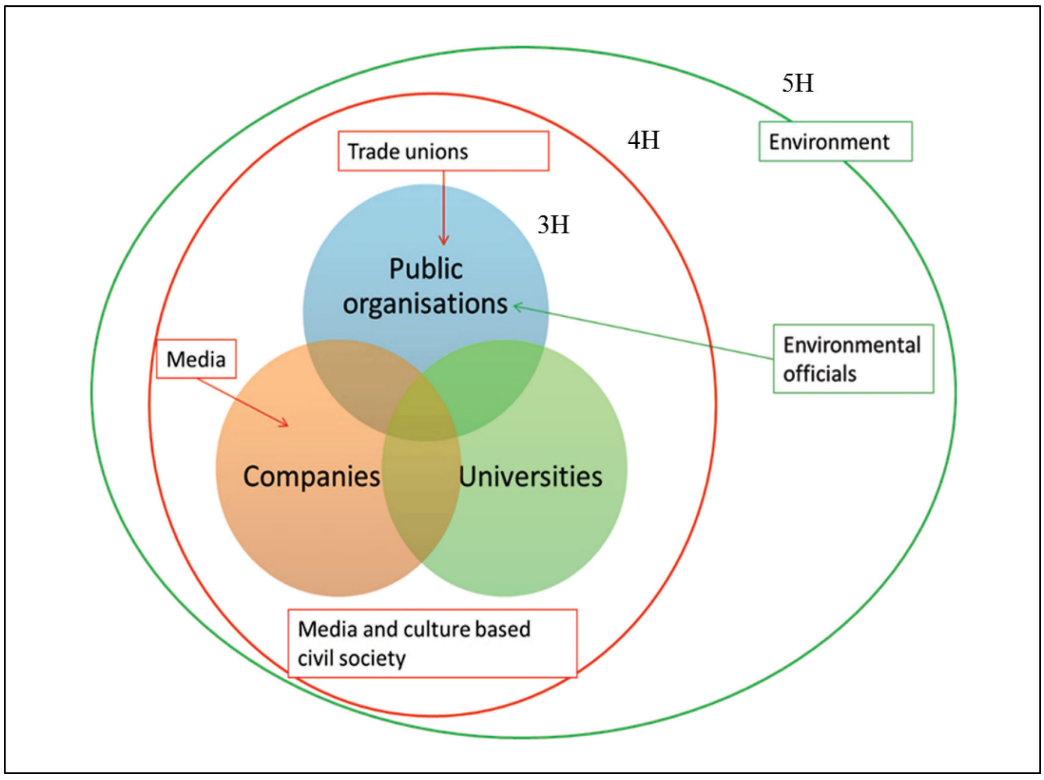

Figure 2. Different helix configurations (based on Mäenpää 2014b: 42).

Indeed, even though there might be a need to categorise 4H institutionally, the systematic differences (based on Leydesdorff & Meyer 2006) divide different functionalities into a 3H structure. If the institutional details are somewhat vague, then activities can be categorised, instead of institutions. Especially hybrid-organisations (mutually owned by public and private actors) are very difficult to categorise into the helices. Whereas companies or universities are easy to categorise, the fourth helix remains vague. This may also explain why a recent study by Marinelli and Perianez-Forte (2017: 8) states, that: "EDP largely emerges as 3-ple helix business". There are also other studies which indicate that 4H collaboration has not been very comprehensive, even when the focus has been on living labs (Vallance 2017), or when it has involved EDP steering group participation (Aranguren, Navarro & Wilson 2017). Often civil society actors have been included in a monitoring role, whereas companies and universities are approached to formulate and assess proposals (Marinelli & Perianez-Forte 2017: 10). This could be interpreted to mean that the fourth helix is engaged only after the major decisions have been made (Mäenpää & Lundström 2019).

There is also one noticeable and even contradictory feature in 3H/4H theory when it is examined in the smart specialisation context; the role of universities in the innovation process. As has been stated, 3H theory promotes the idea that universities should act as regional innovation mediators due to their connections with local actors (through research activities) and global research networks (other universities and research facilities). Furthermore, universities are seen as organisations which combine continuity with change, as new ideas and students flow through them, but the organisation remains in one spot (Etzkowitz & Leydesdorff 2000; Leydesdorff & Etzkowitz 1998). Universities indeed can be described as "beacons" of knowledge due to this. However, S3 does not directly promote the central focus of universities but highlights the role of companies (via their market knowledge) and even public organisations to some extent due to their needs and abilities for S3 process governance.

I have now introduced innovation network theory via RIS and 3H and 4H theories. This allows us to understand the theoretical background for smart specialisation. Next, I will introduce concept of EDP, in order to explain how S3 aims to govern this playing field and its players (Lundström & Mäenpää 2017).

The entrepreneurial discovery process (EDP)

EDP can be understood as governance concerning the networking process (Reek 2013: 3). What are the different phases in EDP and how should different actors be

involved throughout the process? I have earlier suggested that EDP consists of three major phases: gathering regional knowledge, stakeholder participation, and the analysis of regional capacity (Mäenpää & Lundström 2019; Lundström & Mäenpää 2018), but have added a fourth phase regarding domain formulation: objectives for the domain formulation, *i.e.* vision (Mäenpää & Teräs 2018: 7). This idea of EDP phases is based on the assumption of EDP as a problem-solving process, where there is an issue (smart specialisation) and it is studied (analysis) and discussed (stakeholder participation) before providing some thought-out solutions (vision). However, the real issue lies not only in the process *per se*, but also in the participation of different stakeholders throughout the process. It raises the question of who should do things and what should be done.

One answer to the question of who and what has been addressed by Rodríguez-Pose and Wilkie (2017: 35, 38) by explaining the role of institutions in EDP. They recognised the key actors in EDP as entrepreneurial actors, policy makers and other members of society. They also suggest that EDP consist of three key components; entrepreneurial actors, experimentation and discovery, as well as interaction between relevant actors and policy makers.

One might argue that these key components are overlapping, as experimentation and discovery probably also include aspects of interaction, as well as entrepreneurial actors. For example, Mäenpää and Lundström (2019: 81) have instead highlighted a categorisation outline of EDP by recognizing the potential stakeholders more accurately. Indeed, it seems necessary to make the overall EDP "clearer" by recognising the precise organisation types which should be ideally suited to perform and participate in EDP.

Firstly, we have public organisations, who are in charge of the S3 process. One might assume, that this means participation throughout the process. Even though there have been studies proclaiming that a mix of leadership (Aranguren, Navarro & Wilson 2017) might be more effective for EDP, especially regarding the different phases, some studies (Kroll 2016:8) have shown that stakeholders are not necessarily able to participate in a neutral way. This is a real issue for the public organisations in charge of the S3 process, and they should be in charge of the S3 process effectively from the beginning to the end (Mäenpää & Lundström 2019). However, EDP requires participation by other stakeholders as well and their more profound subject knowledge. This limits the opportunities for the dominant public organisations, if they suddenly appear during the process. It would indeed seem that S3 itself is a partial solution for controlling over eager public organisations (Morgan 2017b).

Universities, companies and civil society on the other hand should be involved in the S3 process as much as possible, but due to the realities of these other actors, it would seem wise to utilise their expertise only when their output provides maximum impact. In other words, participation should be based on their subject knowledge and this may mean a highly varied participation process regarding the actual actors. For example, if a region has a university which is specialised in the subject matter, or has knowledge regarding the region itself, then its participation is valuable and might even help in the analysis phase of EDP. Or if the region has some R&D-based companies, then their inclusion in the analysis phase might be very useful. If the companies or universities do not have subject knowledge, then their inclusion should aim for ideas and this might mean more restricted participation. Companies, overall, tend to be busy, so very often their participation has been more limited (Teräs & Mäenpää 2016; Kroll 2016: 7).

Civil society actors might be contributors through the process, but in varying ways (Mäenpää & Lundström 2019). Different participatory methods work better in different phases of EDP and therefore require an understanding of the nature of the inclusion of civil society. If civil society actors are used as idea generators (which they might excel at) then more casual methods, such as world cafes might be a good idea. If more profound ideas or subject knowledge are required (for example from end users of innovations), then citizen juries might be more appropriate methods for their inclusion (Mäenpää & Lundström 2019).

If one compares the quadruple helix categorisation by Carayannis and Campbell (2009) with the categorisation by Rodríguez-Pose and Wilkie (2017) then one can see, that their categorisations are also overlapping. For example, entrepreneurial actors may not always be company people, but can be also be public servants, or decision-makers. This overlap also applies to quadruple helix categorisations, as some public organisations may be responsible policy makers, whereas others are simply entrepreneurial stakeholders or represent other members from society. This also explains why EDP can be seen as a wicked game, as the roles of the players can be hard to recognise and may change during the process (Mäenpää & Lundström 2019; Lundström & Mäenpää 2018).

As the examples demonstrate, there may not always be a relevant stakeholder available for the S3 process and the original RIS3 guidebook (by Foray et al. 2012: 12) highlighted that other actors might act as substitutes if the region lacks these connections. For example, knowledge of the markets can also be generated by universities or public development agencies; companies are not the only possible source of this sort of knowledge.

Lacking knowledge can be found in networks. There may be missing or only partial linkages between different types of stakeholders (as substitutes can be considered) within the region, and this needs to be considered as well. This is a challenge especially for public organisations, who need to organise a comprehensive, evidence-based S3 process. Any missing links may challenge the outcomes of S3, and these issues highlight the role of networks and their proper governance in the S3 process.

We have now studied and explained the theoretical background to RIS, 3H, 4H and EDP. The last remaining theoretical perspective, concerning connectivity, has been left to the beginning of chapter 4 where it opens the discussion regarding the connectivity model and forms a solid basis for explaining its ideas. Based on the literature one can distinguish several key challenges which the public organisations in charge of S3 processes must face and overcome in order to launch a successful RIS3 process. Next, I will explain these major challenges based on my findings and relevant literature.

3.2 Challenges

3.2.1 Stakeholder inclusion

Based on the previous literature regarding smart specialisation and EDP one can understand why stakeholder inclusion is critical for a solid S3 process. However, it has been stated that: “Due to the imperfect communication and coordination between many parties, it is not easy to assemble and pool scattered expertise in a concentrated working group.” (Capello & Kroll 2016: 1398). Stakeholders should act as representatives of the regional activities instead of industries or sectors (Foray 2015:41–42) and thus have a slightly “wider” view regarding their field of expertise (this focus is known as granularity in the S3 literature, see, for example, Foray 2015). Choosing the right respondents is therefore critical. Stakeholder identification and inclusion is a task which should ideally suit public organisations, as they should be neutral regional experts. Some of the issues regarding stakeholder inclusion are:

-Who to ask?

-Why would they participate?

-How would they participate?

-What does their participation bring to RIS3?

Stakeholder inclusion is obviously more than simply choosing the respondents from a list. In fact, it is ideally an ongoing relationship between the knowledge providers and knowledge users (Rodríguez-Pose & Wilkie 2017: 41). It requires actual collaboration with stakeholder and dialogue regarding the aims of S3 as well as a great deal of clarification regarding the "EU-dialogue". Some stakeholders may be very active contributors whereas some will only collaborate in order to gain something out of it (Rodríguez-Pose & Wilkie 2017). For example, the stakeholders may see the collaboration as a networking process, or as a way to meet new people. Some see it as an opportunity to get to know specific people, for example, other representatives from one's own field etc. The stakeholder's motivation to participate in the S3 process should be studied further, but some studies have shown (Kroll 2016) that personal benefits may also be one motivation.

This is an important challenge for public organisations, as they cannot usually make large promises but still wish to give the respondents "something" for their efforts. Rodríguez-Pose and Wilkie (2017: 44) have stated that technical support, and incentives are important for establishing solid EDP, especially if one is to overcome institutional inefficiencies. In an ideal situation, the S3 process may become a wider regional innovation platform and this is a very good opportunity to start or develop such a dialogue. In this case, how can public organisations participate with stakeholders without promising them too much? Usually this boils down to contacts, or knowledge. Either they provide contacts within the region or related field or knowledge regarding the region or field. Sometimes personal contacts may seal the deal, or a promise of future projects may suffice, which obviously benefits the participating stakeholders when they are part of the ongoing process.

However, stakeholder inclusion is not just about identifying willing participants, one must know how to utilise their knowledge without wearing them down. Even the most eager stakeholders are usually only interested in participating when necessary, and even then, very briefly. Companies, for example, are keener on their day-to-day activities than regional development, which may explain some results regarding their participation (see for example: Teräs & Mäenpää 2016; Kroll 2016: 7). Therefore, one must know when the right time to ask for their help is. The depth of inclusion obviously relates to the willingness of the stakeholders and depends on their timetables.

These challenges also relate to the methods concerning how the stakeholders are involved. Our previous study indicated (Teräs & Mäenpää 2016) that companies especially are very often included via surveys and this is probably due to time constraints. Universities on the other hand, have been sometimes part of S3

processes, even from the very beginning in some cases (Virkkala, Mäenpää & Mariussen 2017; Teräs & Mäenpää 2016; Virkkala, Mäenpää & Mariussen 2014). Other public organisations (i.e. not the S3 organisers) are also very often involved through interviews, so the actual communication and dialogue can be quite restricted. If one utilises questionnaires or surveys one usually receives short answers. Interviews can be very thorough, but many times the respondents wish to remain anonymous, which does not encourage or even make it possible to engage in further dialogue, especially with a wider audience. One reason for this restriction may be the subject matter, as innovation issues are not always close to individuals' day-to-day activities (Lundström & Mäenpää 2017: 1370).

This may be one major challenge for civil society inclusion as well. Even though there are situations where civil society inclusion may be highly relevant regarding the discussion of regional activities (for example tourism industries may benefit from the locals' ideas and suggestions), civil society is not necessarily made of experts, especially regarding highly technological fields. This makes their inclusion very subject-specific, unless their ideas are used for more general suggestions regarding the future of regional specialisation. They may discover sunrise industries or spot future trends, but this requires resources and the utilisation of proper tools for engagement, such as world cafes, or idea competitions (Mäenpää & Lundström 2019). Indeed, the inclusion of civil society may be a highly effective way for gathering fresh ideas, as civil society members are not aware of all the restrictions which may affect the region. If one is able to motivate them to participate, then their knowledge regarding the day-to-day activities of the region may be very useful.

However, civil society inclusion has often been done at the very end of the S3 process, which means that many decisions regarding the region have already been made. This is not a very motivating or effective utilisation of civil society, as the local residents, or customers are not able to influence the strategy. It has been suggested that civil society could also be used for verifying S3 (Mäenpää & Lundström 2019; Lundström & Mäenpää 2017), and this requires very early inclusion of civil society members.

Companies, universities and public organisations very often know their own fields well but are not necessarily willing or even able to share their knowledge. This may be due to patents, or other legal reasons, or simply because the respondents think that they may share too much information without receiving any major benefits. Obviously the S3 process is not about highly detailed business knowledge, but it does require knowledge regarding regional activities and what the region is basically about. This knowledge may be easy to gather, especially if the region is

known for its major clusters or big multinational companies and their suppliers etc.

This sort of knowledge transfer may be a challenge and it is reasonable to suppose that one meeting will not prove to be very informative regarding this matter. On the other hand, multiple meetings and actual dialogue will provide a better understanding of the regional activities. Optimally regional actors should be able to engage each other and these discussions could hopefully turn out to be future collaboration projects.

But how should public organisations organise this dialogue and proper stakeholder inclusion? This would require something to discuss, a reason to meet and some sort of incentive for the willing participants. Ideally these regional discussions should be organised in a manner which the stakeholders consider to be interesting and easy to participate in. This usually means holding limited meetings and avoiding long timetables for the discussions. So, in order to include the stakeholders, there should be discussions which are short, interesting, and easily accessible.

3.2.2 Knowledge generation

Besides the issues of who should participate and how they should do it, there is also the issue of what sort of knowledge should be generated and who would generate it. First of all, it has been established that companies should know the markets (Foray 2015), universities should know the latest research (Etzkowitz & Leydesdorff 2000), public organisations should know the relevant actors (Morgan 2017b) and civil society should have useful personal experience (Lundström & Mäenpää 2017) either based on knowledge of products or by knowing the different actors. However, how can one efficiently gather this sort of knowledge? Especially as there are a lot of stakeholders in the region and they are not perhaps willing to share everything. The longitude of the process may help, as mentioned in the previous chapter, but the S3 process needs some sort of basis which can be used to start this process. Even at the outset of the RIS3 formulation, the regional stakeholders' knowledge would be very useful in order to guide the region in the right direction.

If the public organisations know the regional stakeholders well, then they can invite different representatives to participate in wider discussions or arrange interviews or surveys in order to gain insights regarding future areas of specialisation. If the regional stakeholders are not known, then the public organisation may seek the help of local development agencies or universities in

order to better understand the regional activities. One useful way of gaining knowledge regarding regional activities may also be via the inclusion of civil society (Lundström & Mäenpää 2017; Benner 2014).

For example, civil society members may spot future sunrise-industries or point out otherwise interesting entrepreneurs or products which may help in defining the direction for future specialisation. If we take Foray's (2015: 20–21) example of the Morez region's glass manufacturers, then one citizen may have pointed out the "new glass-making company" and this might have spread interest among other local practitioners such as entrepreneurs, who subsequently followed the path to become glass manufacturers themselves. The glass cluster might have emerged this way. Nowadays one kick-starter video or YouTuber can spread the word to thousands of people in an instant.

These speculative examples also demonstrate another specific ability of civil society members. Whereas companies and universities operate in their own spheres of excellence (markets and research fields), civil society can give feedback to both of them via their behaviour. More than that, they can spread good ideas and thus make the regional specialisation better known (Lundström & Mäenpää 2017). Overall, there have been studies indicating that individuals can make a difference in innovation (Benner 2014) and this highlights the role of wide participation in regional projects.

There are three key issues which help in acquiring the necessary knowledge for future specialisation. These are:

-knowledge of the scale and nature of activities

-knowledge of products/services

-knowledge of future trends

An important aspect regarding this knowledge is the scale and nature of activities. The main focus naturally is on regional innovation activities, but these may very well include (both intra- and) extra-regional activities. A single stakeholder might have several linkages, and this creates a quite complex and dynamic structure for understanding what is happening in the region. Only by understanding the wider picture can one start to understand the regional innovation activities and how important the different actors are and how they can contribute to the future.

Besides this, there needs to be an understanding of the actual regional products or services. Only by understanding the background conditions or necessities can one truly start to ponder what the reasonable options might be. This sort of knowledge

is very often limited to the end users of innovations or inside companies regarding products and/or services and therefore can be very challenging to acquire. Universities may also have this knowledge, but usually it relates more to policies or individual properties of the products/services and therefore it is not on the right "scale".

A future orientation is obviously important, and this shows stakeholders, who are internationally interesting, or have the ability to reach global markets sometime soon in the future. One area of knowledge might relate to the ideas or views of a particular field and how it will change in the future. One way to look at the future is by studying key enabling technologies (Foray et al. 2012) and their adaptation.

Foray (2015: 27) has demonstrated a number of ways on how to reach for future domains. For example, transition, modernisation, or diversification may be ways to achieve this. Transition refers for new activities that emerge from existing industrial commons as new ideas/trends etc. emerge. Modernisation refers for new technologies (such as key enabling technologies), which transform existing products or services. Diversification refers to new activities that emerge alongside an existing activity, as synergies (economies of scope) make new markets attractive and profitable. Examples might include specific service companies or sub-contractors. Foray (2015: 28) has also suggested that there may be a possibility for radical foundation which means regional specialisation without existing knowledge. Obviously this is not intended directly, but may turn out to be a side effect of mutual innovation activities.

By focusing on the knowledge regarding activities, products/services or future trends, it is possible to ask the right questions in order to look at the existing activities and forecast their future. By analysing this knowledge, one is able to see whether existing activities could be a focus for future specialisation or whether there would be a need for totally new sorts of activities. This is something that the regional stakeholders ought to think about.

3.2.3 Dominant actors

Wide participation and strong subject knowledge can be a blessing but also a curse, especially if one stakeholder takes a dominant role in the planning process. Usually dominant stakeholders either have valuable knowledge or are important due to their sheer size. Huge, multinational companies are one example, especially if they are the region's largest employer or otherwise play a crucial role in local innovation activities. Dominant stakeholders can be harmful to public organisations, as they may reduce the interest of other stakeholders. One can only imagine how eager the

regional actors would be if they felt that the whole S3 process was basically about promoting the biggest or loudest stakeholder. It would hardly be a good recipe for open dialogue and mutual trust.

As has been established (by Benner 2014) even individuals can play a major role in innovation discussions and this is especially true with dominant stakeholders. They may derail the analysis phase or ask for major contributions through the S3 process funding. At the very worst, they may steer the process towards highlighting the role of their individual organisation and make it the sole focus of the regional S3 process. If this happens, domains may be impossible to establish as individual organisations are usually not that diversified and other stakeholders are not necessarily there to help in this process. Even if this occurs, the overall idea of regional specialisation may be lost as the regional economic transformation becomes the transformation of a single organisation.

There are ways for making the risk of dominant actors less of an issue. These include:

- sound and fair governance

-objectively set monitoring and evaluation tools

-civil society inclusion

Sound and fair governance should be a basic premise for S3 processes. According to Morgan (2017b), public organisations can also play an overly dominant role and this may happen if the public organisation knows the subject too well. This should not happen in the S3 process, as public organisations (or at least the regional governments) should not be true experts regarding the future domains, which require a lot of input also from companies and universities, as well as from civil society members. In this regard wide participation can also act as shield against any individual stakeholder, as there are many others who can challenge the dominant stakeholder's views and thus prevent the "elite" capture of EDP (Rodríguez-Pose & Wilkie 2017: 39).

Objectively set monitoring and evaluation tools are also one way to guide the stakeholders in the right direction (Foray et al. 2012). By having some sort of expectations or standards, public organisations in charge of the S3 process can guide the other stakeholders to focus on central issues. For example, if there is a problem in discussions regarding education in the region, then some sort of work-experience-based projects might be interesting suggestions for both academia and companies. Then one might set some objective measurements, such as the number

of students in work-experience training and thus have a solid measurement for assessing the process during (monitoring) and after the pilot stage (evaluation).

Civil society inclusion is also one way of controlling the process, especially if citizens' opinions are asked in the early stages of the S3 process. By asking for ideas, regional governments gain understanding of what the people would like to see happening and this might prove to be important feedback when pilot projects are considered. If civil society members wish the region to be known as a tourist destination or promote the idea of some future technology, these suggestions should be at least considered and discussed with other regional stakeholders. There is also the possibility that civil society members would not consider the S3 to be inclusive enough. This sort of verification of potential S3 plans can act as a good filter so that otherwise dominant stakeholders may be more willing to engage in cooperation. Civil society members can also promote the chosen specialisation afterwards and this may be very useful for the stakeholders if they can find some common ground. This may also enhance local ownership of the process (Rodríguez-Pose & Wilkie 2017: 39).

In an ideal situation all willing and able stakeholders would be part of the S3 process, but usually real-life challenges make this very difficult to organise. One way of ensuring that different potential fields are represented is to ask the largest organisations in each field. However, this may also be problematic if the stakeholder turns out to be very dominant. One way of limiting this in the S3 process is by inviting a number of smaller organisations in the field to join the project group, because this way the possibly dominating big organisation will not be the only partner in the process. If a need arises, public organisation can even leave the dominant organisation out of the process, especially if the smaller organisations seem to have similar subject knowledge.

One important aspect to discuss is also the fact that big does not necessarily mean innovative. As Foray (2015: 48) has demonstrated with his agro-food sector categorisation of "sleeping giants", large industries may be difficult to wake from their slumbers and may not necessarily turn out to be the most innovative ones in the first place. Usually a large size hinders the capacity for agility (due to bureaucracy etc.) which can transform into a low innovative capability. Indeed, big organisations may even be against innovations in their field, especially if they are the current market leaders.

Indeed, Foray's (2015: 48, 79) characterisation of different types of actors (sleeping giants, excited goblins and hungry dwarfs) is a good reminder that there are different types of actors and industries which operate at a very different pace. Sometimes the "excited goblins", or high-tech clusters, are the first to grab funding

opportunities because they have contacts, and this can also transform into one sort of domination. Additionally, these can indeed be small, but still dominating companies. Another type of misstep is to focus on "hungry dwarfs" or low-tech SMEs, which may be full of characterful entrepreneurs and interesting ideas but are simply not big enough on their own to have a major impact on regional transformation. Actors are needed from all types of sectors in order to make an impact.

As has been demonstrated (Lundström & Mäenpää 2017; Kroll 2016), stakeholders are prone to enhancing their own positions and they have their own agendas as well. This is something which the public organisations need to understand, and this does not necessarily contradict the overall goals of S3. It is a true benefit for all in the region if the regional stakeholders can learn from each other and collaborate to become more innovative. Openness in the process and broad participation may be the best possible protection against dominant actors.

All of the mentioned challenges (stakeholder inclusion, knowledge generation and dominant actors) also create transaction costs for the public organisations, as they need to negotiate with multiple stakeholders. However, this may not be considered to be such a major challenge in S3 process, as this is aided by EU funding, which follows a thorough S3 process. Therefore, transaction costs can be considered to be investments for the future rather than major limitations, even when they are restricting some of the possibilities.

4 THE CONNECTIVITY MODEL AS ONE SOLUTION

4.1 Theoretical background

4.1.1 Network theory as a basis for understanding connectivity

RIS3 guidebook (Foray et al. 2012: 15) describes regional connectivity as follows:

> *Smart Specialisation should link emerging knowledge-based industries to other actors within and outside the region, but it does not always lead to good outcomes so needs to be assessed. Firstly, we know that face to face interaction in particular places can be crucial in nurturing innovation and there are many examples of regions that have used what can be described as social capital to create knowledge based growth. Nevertheless, local interaction can also be negative when it creates protectionism and rent seeking. Interaction is most beneficial between different groups and across classes and power structures. Secondly, connections to outside the region are only beneficial when ideas are internalised to the benefit of local firms. Being connected to the outside, both digitally (with ICT) and physically (with transport infrastructure) may lead to a flow of human capital out of the region (in a process labelled 'brain-drain').*

As can be seen, the description reveals many of the previously addressed challenges which public organisations have to face during S3 processes. Sometimes connections enhance the regional innovation and sometimes they do not. Indeed, new knowledge is often created and diffused in networks (Camagni 1991). This means that innovation performance depends on the capabilities of the stakeholders but also on the ways these stakeholders interact (Muscio, Reid and Leon 2015). Higher number of networks between actors located in different helices enhances interaction and this makes the region more connected (Virkkala 2014: 31).

According to Virkkala (2014: 31), in a network analysis: “The interest is both on the relations and positions of individual members in [a] social network as well as [on] the networks as a whole.” Relations can be studied by both quantitative (quantity of relations, i.e. dense vs. sparse), or qualitative methods (i.e. the meaning and content of the relations) (Virkkala 2014: 31). Relations may also have a specific direction (Johansson, Mattila & Uusikylä 1995), for example cooperation may look good from university perspective, whereas companies may see the same cooperation very differently.

Usually networks are formed around nodes and ties. In the connectivity model Virkkala (2014: 31) has stated that "...the nodes are the organisations located in different helices and the ties are the relationships between the organisations." She (Virkkala 2014: 32) continues by describing the relations through their role: "A relation in the network is the basic analytical unit...". Individual relations thus represent institutional ties between helices on the meso-level and are one main focus in connectivity model, as they open up regional collaboration (Virkkala 2014: 31–32.) These concepts have been illustrated in Figure 3.

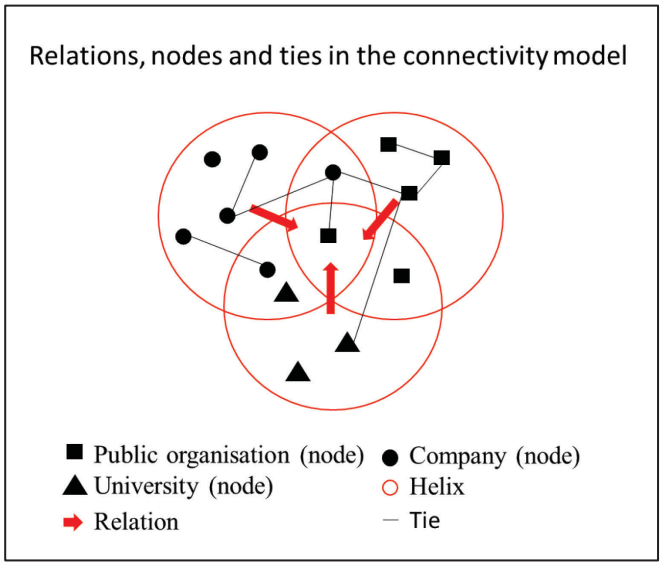

Figure 3. Relations, nodes and ties in the connectivity model (Source: own compilation).

Networks can be intra- and extra-regional, and they can be multi-layered and multi-scalar (Virkkala 2014: 32). According to Bathelt, Malmberg and Maskell (2004), networks help in creation and diffusion of knowledge through two major mechanisms: First, by creating a buzz or flows of information within a region, and secondly, through spatially proximate relationships between employees, firms and state agencies. It has been suggested that geographical proximity favours tacit knowledge-based innovation processes, where knowledge and best practices are shared locally, or even in a specific place (Virkkala 2014: 32; Nonaka, Toyama & Konno 2000) . This interaction may produce local competences, skills and tacit knowledge (Bathelt, Malmberg & Maskell 2004). In the end this sort of local buzz emerges in meetings, through personal contacts (Virkkala 2013; Storper & Venables 2004).

According to Bathelt, Malmberg and Maskell (2004), networks also help in knowledge exchange between local and non-local organisations. This is important because regional actors should have both "absorptive and development capacity", which requires intra- and extra-regional linkages (Virkkala 2014: 32). One needs to look inside and outside the region in order to gain an understanding of what works and what else might be done.

The benefits of these ties are complementary, as networks might help the regional actors in avoiding lock-in situations, as they may be used to develop the capacities of the regional environment (Virkkala 2014: 32). For example, networks may provide information regarding new opportunities or diminishing future markets. Regional and extra-regional linkages are often described to be best for companies and are also useful for the evolution of future clusters (Virkkala 2014; Aoyoma, Murphy & Hanson 2011; Bathelt, Malmberg & Maskell 2004).

These benefits can also be understood through the concept of structural holes (by Burt 2004). Whereas Burt (2004: 354) considers close collaboration useful, one is able to increase "social capital from brokerage" by making new connections in networks, especially by connecting different types of groups into one´s own network. These different groups may be seen as different helix actors or actors from different geographical levels, depending on the situation.

Burt (2004: 354) describes the benefits of having these sort of extra-helix connections by stating that: "People whose networks bridge the structural holes between groups have an advantage in detecting and developing rewarding opportunities. Information arbitrage is their advantage. They are able to see early, see more broadly, and translate information across groups. Like over-the-horizon radar in an airplane, or an MRI in a medical procedure, brokerage across the structural holes between groups provides a vision of options otherwise unseen."

Connectivity model is focusing on these aspects of networks, and analyses to what degree innovation networks are embedded locally, nationally and globally. Relations depend on the actors, who are involved in the process (Virkkala 2014: 32).

4.1.2 Proximity as a basis for a connected region

One way to describe policy models which are based on triple or quadruple helix theory and their connectivity, is through the idea of connected or disconnected region. Virkkala (2014: 30) has described a connected region as 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." Different helices are expected to work together and reinforce each other (Virkkala 2014: 30; Goddard, Kempton & Vallance 2013; Goddard & Kempton 2011). In a connected region, the three helices coevolve and interact through various networks and organisations (Dolfsma & Leydesdorff 2009).

According to Virkkala (2014: 30), in a disconnected region: "…the partnerships are ineffective or non-existent, and there is a lack of understanding about the changes. Entrepreneurs are locked out of regional planning." There are also no boundary spanners (Virkkala, Mäenpää & Mariussen 2017: 665; Goddard, Kempton & Vallance 2013). The presumption is that greater connectivity enhances innovation capabilities. For example, Amin and Thrift (1995; Rodríguez-Pose & Wilkie 2017: 39) have highlighted this idea by stating that "institutional thickness" is very useful for efficient innovation activities. Connected region has been described as a vision or target that the region should aim to achieve (Virkkala, Mäenpää & Mariussen 2017; Virkkala 2014: 30).

However, the relation between connectivity and innovation is not always clear. Firstly, regions operate on different geographical levels and are open in nature (Virkkala 2014). Similar thinking is in the RIS3 guide (Foray et al. 2012), that points out the importance of local embeddedness and relatedness. Foray et al. (2012: 15) warn that "by concentrating only on embeddedness, a regional development strategy may risk increasing vulnerability to changing economic conditions." Therefore, it is important to focus on the relatedness as well, which helps in diversifying regional stakeholders into related areas based on innovative techniques or processes (Foray et al. 2012: 15). In this study, relatedness refers to extra-regional connections, and the embeddedness of regional connections.

Secondly, helices should not dominate other helices (Virkkala 2014: 30). Qvortrup (2006) points out that different helices need to have their own roles and rules, but there should be more interaction between them. This means that helices should be separate from one another and yet closely interlinked (Qvortrup 2006). In a connected region there should be different helices, which operate in harmony. They should produce services that the other helices cannot arrange. For example, public institutions create the rules and regulations and thus provide general conditions for both companies and research institutions. (Virkkala 2014: 31; Qvortrup 2006.)

Thirdly, the causality between connectivity and regional innovativeness is not in itself clear. Boschma and Frenken (2013) have discovered an aspect known as the proximity paradox. If the cognitive proximity is low, then their collaboration might not increase innovation performance; on the contrary, it might give rise to lock-

ins. An intermediate level of differences in knowledge bases is needed for innovative cooperation. Another issue relates to the idea that strong ties are preferable, which is not necessarily true. According to Granovetter (1973) weak ties are important since they can connect different social groups and serve as bridges. Therefore, one cannot state that strong connections to everywhere is the solution, but there must be an optimal balance of socially proximate and socially distant relations. (Virkkala, Mäenpää & Mariussen 2017.)

This is why the potential of a relation depends on optimal levels of proximity, and on a balance between local and non-local ties (Virkkala, Mäenpää & Mariussen 2017: 677). An innovative region should be locally embedded, but at the same time oriented towards global knowledge and wider markets (Virkkala, Mäenpää & Mariussen 2017: 666).

Relations between different actors can be described through different dimensions of proximity, including geographical, organisational, social, cognitive and institutional proximity (Boschma 2005). Proximity is mandatory in some dimensions, where it connects actors and enables interactive learning and innovation. However, this may not always be the case (Virkkala 2014: 57). Harmaakorpi, Melkas and Uotila (2017) have demonstrated this regarding broad-based innovation policies, and they have formulated them into three different categories based on various differences regarding, for example, economic logics, knowledge bases (based on Asheim & Coenen 2005) and fuel for innovation. This latter category is especially interesting as it suggests that the role of proximity (especially cognitive proximity) can vary in different types of innovation policies. The categorisation of Harmaakorpi, Melkas and Uotila (2017) is summarised in Table 2.

However, if one inspects the categorisation made by Harmaakorpi, Melkas and Uotila (2017) more closely, it is possible to think also of other proximities (such as social proximity and institutional proximity) which may affect the logic of different innovation policy modes. For example, the first mode, based on agglomeration, could also mean high geographical, social and institutional proximity besides the cognitive proximity. On the other hand, the second mode (2a) might require a certain cognitive distance but might also benefit from geographical and especially social proximity in order to establish knowledge fertilisation. The third mode (2b) might require social and institutional proximity besides cognitive proximity. Harmaakorpi, Melkas & Uotila (2017) have highlighted the role of cognitive proximity especially and even though Virkkala (2019; Virkkala, Mäenpää & Mariussen 2017) agrees with the importance of cognitive proximity, she claims (Virkkala 2019: 168) that other dimensions of proximity may contribute, to some

extent, to the lack of cognitive proximity: "…some degree of cognitive proximity is needed so that people can learn from each other and collaborate successfully, and other dimensions of proximity, such as the social, institutional, and organizational forms may facilitate that".

Table 2. Innovation policy categorisation (based on Harmaakorpi, Melkas & Uotila 2017).

Innovation policy categories	Logic for knowledge generation	Theoretical basis	Innovation process requirements	Innovation outcomes	Role of proximity
Science-based innovation (STI, Mode 1)	Scientific knowledge production at a high level, in a very narrow field	Agglomeration – Economies of scale Analytical knowledge base	Critical mass of experts	Scientific knowledge and technical innovations	Proximity (especially cognitive)
Practice-based innovation (DUI, Mode 2a)	Intellectual cross-fertilisation; knowledge from different knowledge bases	Innovation platforms – related variety Synthetic knowledge base	Systemic process, where scientific and practical expertise are combined	Products, technological system innovations	Distance (especially cognitive)
Practice-based innovation (DUI, Mode 2b)	Heterogeneous long-term development of organisations	Value networks – dynamic Capabilities Symbolic knowledge base	Learning by doing in communities of practice	Organisational, social and service innovations	Near distance

According to Virkkala (2014: 36) different types of proximity can explain the formation of networks, as they may overlap and there also can be an interplay between them. Furthermore, different dimensions of proximity may act as substitutes rather than complementary in innovation networks. Proximity is required in at least one dimension to form a successful relation. (Virkkala 2014: 36.)

Indeed, Ponds, van Oort and Frenken (2009, according to Boschma 2009) have discovered that geographical proximity is particularly required during the establishment of triple helix relationships (where institutional proximity is low)

and less important in collaboration among organisations with similar institutional backgrounds (where the institutional proximity is high). This discovery seems to verify that different aspects of proximity are important for different types of innovation systems and can indeed act as substitutes.

High proximity can be considered to be mandatory for forging connections between stakeholders, regardless of its nature (Virkkala 2014: 36). However, proximity between stakeholders may sometimes even harm the innovative performance (Virkkala, Mäenpää & Mariussen 2017: 666). According to Boschma and Frenken (2009), the level of proximity between agents has an effect on their innovative performance. Success of a relation depends on optimal levels of geographical, social, institutional, organisational and cognitive proximity as well as on a balance between regional and extra-regional links (see Table 3). This may also mean that an optimal level requires operating simultaneously in different institutional systems, especially in triple helix setting (Virkkala 2014: 37). This means that institutional proximity needs to be balanced regarding all three helices; as high institutional proximity in one might mean that the two others are neglected. Virkkala (2014: 31) has described this with an example: "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 wide public welfare."

Table 3. Different dimensions of proximity in the relations of a triple helix framework (Virkkala 2014: 36).

Dimension of proximity	Degree of proximity	
	High	Low
Geographical	Relations between actors in the region	Relations 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 (such as the environment)	Different types of networks

The proximity concept can be used analytically in the triple helix context, as has been demonstrated by Virkkala (2014: 36) in the Table 3. In this case, a relation acts as an indicator for close proximity between partners regarding at least one aspect of proximity. Stakeholder has expectations regarding cooperation if his or her partner is close enough in at least one proximity dimension. (Virkkala 2014: 37.) The strength of the relationship depends on the figures for expectations and experiences. Furthermore, the quality of the relationship can be measured in the gap between the expectations and experiences (Virkkala, Mäenpää & Mariussen 2017). If the gap is high, then expectations have not been met.

4.2 The connectivity model as a tool

4.2.1 Introducing the model

First, we need to clarify what the connectivity model actually is and what it entails. First of all, the connectivity model is a policy model for S3, and even though it does not address the issue of specialisation directly, it includes an overall vision of a connected region. The idea is that cooperation enhances the strategic thinking in the region/nation and cooperation between different helices is especially beneficial because of the varied institutional views and logic. The connectivity model not only provides a basis for analysis but can also be used for monitoring and evaluation as its analyses can be repeated annually or bi-annually to measure the regional collaboration process and the direction it takes.

The connectivity model was originally developed during 2012-2014, as a method for a smart specialisation strategy project in Ostrobothnia. Jerker Johnson from the Regional Council of Ostrobothnia was leading the project, and was responsible for the project plan and selected the project's participants. There were several others who took part in the strategy process: Niklas Ulfvens and Irina Nori (Regional Council of Ostrobothnia), Seija Virkkala, Åge Mariussen and Antti Mäenpää (University of Vaasa, Department of Regional Studies), Josu Takala, Daryna Shylina and Sara Tilabi (University of Vaasa, Department of Industrial Management), Peter Björk and Christian Johansson (Hanken School of Economics, Department of Marketing), Kenneth Norrgård and Kimmo Paulaharju (Vaasa University of Applied Sciences, Department of Information technology) and Åsa Hagberg-Andersson (Novia University of Applied Sciences).

The original ideas for the connectivity model were the outcome of several researchers. Industrial management team led by Josu Takala had previously utilised sustainable competitive advantage (SCA) methods inside companies and

these analyses included also gap analysis. Virkkala, Mäenpää and Mariussen then applied the original gap analysis in the context of a regional triple helix and planned the model and questionnaire that was eventually used in the project. A statistical analysis of the results was done by Peter Björk and Christian Johansson from Hanken School of Economics. The industrial management team did a full SCA analysis on the same data as well.

Two external experts, Håkon Finne (Sintef, Norway) and Elias Carayannis (George Washington University, USA) also commented on the model during seminars, which were held in Vaasa in May 2013. The survey and the "Ostrobothnian model for smart specialisation" were presented by Jerker Johnson in a S3 platform peer review seminar in Vaasa on 14.5.2013. The findings of the survey have been presented at many scientific conferences afterwards (see Table 4).

Table 4. History of the connectivity model (source: own compilation).

Year	Connectivity model utilisation in Ostrobothnia	Connectivity model utilisation in a global context	How the model has been developed
2013	Energy, boat and fur farming sectors analysed	The model was used in Nordland County in Norway. Comments from peer review and external experts	The basis for the model was developed
2014	A report regarding the model was published	Project was documented on open access –basis	The theoretical basis was clarified, and the process described in detail
2015	An online survey was conducted for new analysis (same sectors)	The model was presented in Italy	The questionnaire was simplified to get more answers
2016	An article regarding the model was written	The model was presented in Austria and Wales (UK)	The role of connectivity in innovation was examined in more detail
2017	A new analysis was conducted for companies	The model was presented in Belgium	The questionnaire was shortened and a focus on discovering future technologies was added
2018	An analysis was conducted on LARS (energy technology cluster) as was additional analysis on boat building and fur farming industries	The same analysis was conducted in Finland, Sweden, Norway, Germany, Latvia and Lithuania. The model was also presented in Switzerland and the UK	The model was developed to analyse various industries in various countries
2019	LARS project continues	Data can be compared regarding various countries and industries	Stakeholder analysis is added to the model

As can be seen from the Table 4, the model has been tested through several rounds of questionnaires. One very interesting experience has been the LARS project. The idea of the project is to apply the connectivity model in multiple Baltic Sea regions (LARS 2019). The project is ongoing, but it has provoked thoughts concerning the applicability of the model and is a very good opportunity to test the model in various countries and regarding different industries.

The basic concept of the triple helix theory has provided the guideline for measuring connections between the three main regional helices. The model also includes three spatial levels (regional, national and international) in order to gain some insights into how intra- and extra-regional cooperation looks and from these inclusions the model concentrates on measuring nine connections, or relations between the regional actors (Figure 4).

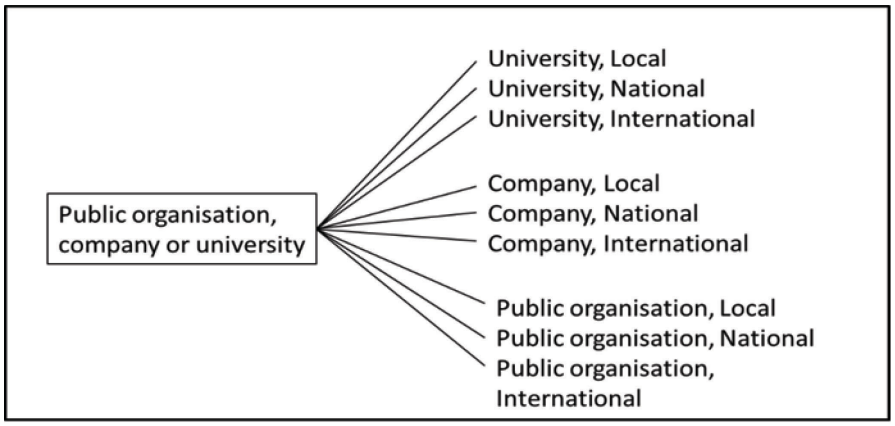

Figure 4. The relations in the survey by helices and by regions (Mäenpää 2014a: 52).

With each of these relations the focus is on measuring the number and importance of the connections (network structure analysis) and the depth of these connections (gap analysis). For this task there can be a specific questionnaire or interviews, which provide numerical data on these relations. Each helix could have its own questionnaire which reflects the unique features of the helices and would contain specific questions, or there could be a single, more generally defined questionnaire for all helices (Virkkala, Mäenpää & Mariussen 2017: 671).

The connectivity model consists of multiple analyses and focus group meetings (Figure 5). Analysis is only small part of the model, as there is greater emphasis on

the practical discovery of gaps in innovation activities and discussions which may provide more concrete ideas how to improve connections.

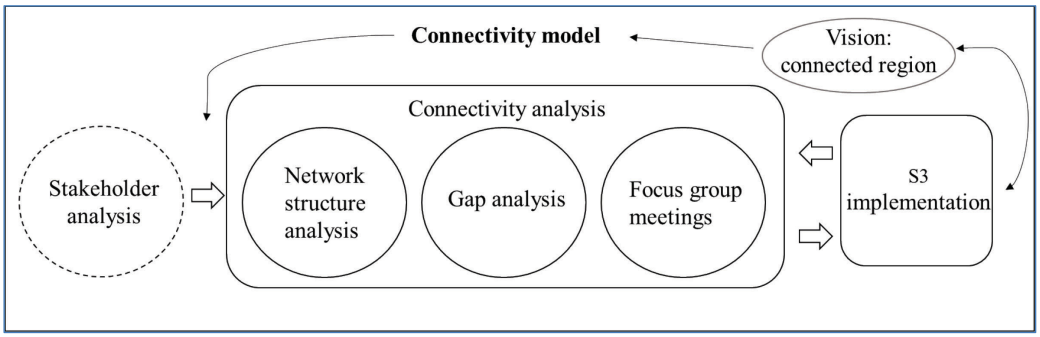

Figure 5. Connectivity model and its components (Source: own compilation).

Stakeholder analysis

A stakeholder analysis is the first step in implementing the connectivity model and includes the recognition of possible stakeholders, who are later interviewed in order to obtain data for the actual connectivity analysis. The need to recognise and categorise possible stakeholders is very important, and a systematic method is therefore useful, as the stakeholders are not necessarily well known in different regions.

A stakeholder analysis has been developed in the context of the connectivity model by Virkkala and Mariussen (2018) but it is based on article by Mitchell, Agle and Wood (1997). The idea is to analyse the power, legitimacy and urgency of the potential stakeholders (see Mitchell, Agle & Wood 1997) and recognise suitable partners, who might participate in pilot projects, i.e. are heavily involved in the RIS3 process (Table 5). Power reflects the stakeholders' ability to influence the development of the region. According to Virkkala and Mariussen (2018:4) these powerful stakeholders may consist of "companies or institutions which control money, knowledge, rules, decisions, or other crucial resources".

Table 5. Example of a stakeholder analysis question (source: own compilation).

Stakeholder	Stakeholder's role in innovation network (scale from 1-2, or 0 if no role)			Reason
	Urgency	Legitimacy	Power	

Legitimacy has been categorised by Suchman (1995: 574) as "a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions." Basically, this means that legitimised stakeholders are those, who are expected to serve the interests of the region. These may include public organisations or NGOs, but also the largest employers, such as companies, might be included (Virkkala & Mariussen 2018). Urgency represents the claims of the stakeholders towards regional development. Some stakeholders benefit more from cooperation than others and may be more eager to participate to gain control of the process. Urgency calls for immediate attention or pressing action (Virkkala & Mariussen 2018; Mitchell, Agle & Wood 1997).

After the analysis, some background information can be collected regarding the respondent's name and the organisation's name and size. Questions should be sent to leaders of organisations who could know to some extent about the connections of their whole organisation or department. It is also important to ask the right people, because the number of connections within organisations might vary tremendously between its personnel and therefore one should discover a respondent who could provide data regarding overall connections. (Mäenpää 2014a: 52–53.)

Network structure analysis

A network structure analysis forms the basis for measuring connectivity and provides an overall view of the connections within the region. The most basic question is about the number of partners within the nine relations. This is measured by asking for the exact number of partners, or it can be categorised into different sized groups. This same simple template can also be used for asking about the importance of the nine relations in various fields of co-operation (see Table 6).

The importance is measured on a scale from one to ten, where one indicates low importance and ten represents high importance. A zero is marked if there is no cooperation. (Virkkala, Mäenpää & Mariussen 2017; 2014.)

Table 6. Example of a network structure analysis question (based on Virkkala, Mäenpää & Mariussen 2014: 147).

How many partners do you have (exact number)/How important do you consider the following partners for your innovation work? (scale: 1-10, or 0)	Companies	Public organisations	Universities
Regional partners			
National partners			
International partners			

These questions provide an overall view regarding the number and importance of partners and as such provides a simple means of viewing the regional collaboration and its strength (see Table 6). This includes regional, national and international levels, so S3 mediators may quickly discover whether their region needs more connections or deeper connections to other geographical levels or helices. It can be applied via a survey or preferably in interview, alongside questions used for the gap analysis. (Virkkala, Mäenpää & Mariussen 2017: 668.)

Gap analysis

The gap analysis (based on Ranta & Takala 2007) measures the gap between two values: expectations and experiences. Both are measured on a scale from one to ten (1–10) and the difference between expectations and experiences represents the gap. This analysis is conducted regarding specific aspects of cooperation, in order to specify what sort of activities need more cooperation (see Table 7). These aspects of cooperation can be general in nature, for example one might ask about expectations and experiences regarding regional development, or sub-contractors. Or the questions could be more thematic and focused, for example on cooperation regarding products/service development, or future ventures etc. (Virkkala, Mäenpää & Mariussen 2017; 2014).

Table 7. Example of a gap analysis question (based on Virkkala, Mäenpää & Mariussen 2017; 2014).

Cooperation with universities						
Aspect of cooperation (scale 1-10, or 0)	Regional cooperation		National cooperation		International cooperation	
	Expectations	Experiences	Expectations	Experiences	Expectations	Experiences
Cooperation in education						
Cooperation in development						
Cooperation in research						

In the questionnaire expectations mean the ideal level of cooperation. Respondents are asked to mark a value from one to ten to indicate what the cooperation might or should be in an ideal situation. An adjustable value is utilised, because the respondents might already know that the cooperation is not working well because of low resources etc. and this has nothing to do with the partners' will to cooperate in general. (Virkkala, Mäenpää & Mariussen 2014.)

Experiences measure what the cooperation is in reality. It utilises the same scale in this figure and by comparing the difference between the expectations and experiences one can see how content the respondent is with the cooperation. This is done simply by subtracting the values of experiences from the values for the expectations. A zero is marked in the figures if there is no cooperation, or if the cooperation is very minimal and impossible to describe. (Virkkala, Mäenpää & Mariussen 2014; 2017.)

Expectations and experiences can be asked concerning a one-year period before the questionnaire, because not all types of cooperation occur regularly and the idea is to create a tool for measuring cooperation on an annual level (Virkkala, Mäenpää & Mariussen 2017: 674). Nine sets of gap-analysis questions are asked regarding all the different relations (Mäenpää 2014a: 51). These sets of questions may include very specific questions concerning certain aspects of cooperation that fit that relation, or they may be more general and focus more on overall cooperation with different helix partners. Similar questions can be used for the relations, as this provides results from both sides of the relation (Virkkala, Mäenpää & Mariussen 2017: 671). For example, the respondents from the university helix might view cooperation with companies in research as good and have high

expectations and good experiences, but companies might not have such a good view of this cooperation. In teaching this might be the other way around etc.

These sets of questions can be analysed on a single question level, separately, to focus on certain issues of cooperation. For example, one might look at how good research cooperation between regional companies and universities is, or how good regional development cooperation is between regional companies and national public organisations. However, an analysis can also be made regarding all the aspects of co-operation to see the overall depth of relation (Mäenpää 2014a: 51), i.e. overall cooperation between regional universities and national companies etc. The connectivity model analyses the entire relations by firstly calculating the averages concerning the expectations and experiences regarding all the specific aspects of cooperation. The emphasis is not simply put on the gaps, because the values of the expectations and experiences are also important. A summary of the possible indications that the gap analysis results may reveal can be seen in the Table 8.

Table 8. Relationship between gaps and proximity in regional development (Virkkala 2014: 38).

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?

Focus group meetings

Focus group meetings are an important addition to the two previous analyses, as they provide a mutual forum for discussion regarding the discovered gaps. In these meetings the respondents of the previous analyses and other regional experts comment on the discoveries from network structure and gap analyses and give concrete ideas and suggestions on what the biggest gaps might mean and how they would bridge these gaps. This phase transforms abstract figures concerning the network structure and the analysis results into concrete development ideas and suggestions, which is very important for establishing a functional connectivity model. (Virkkala, Mäenpää & Mariussen 2017: 667; Virkkala 2014: 38–39.)

These ideas/suggestions can then be considered by public organisations responsible for the implementation of the S3 process and some of them can be chosen as a focus for future development. Usually resources limit the possible choices (Virkkala, Mäenpää & Mariussen 2017: 674). Consideration of possible future pilot projects should be taken by the S3 mediator, based on the focus group discussions, because as a public organisation, it should be able to make interest-free regional development based decisions. This requires understanding of the region and its future trajectories. It is also important to consider which activities might benefit the overall goals of regional specialisation. For example, if the region specialises in sustainable energy, then a gap in research between local universities and energy companies might be a good focus for a pilot project.

A connectivity analysis can be part of a policy model if a region chooses a vision of itself as a connected region and utilises the model annually or bi-annually, in order to discover the biggest gaps in regional cooperation and starts to bridge them in order to achieve the development objective (Virkkala, Mäenpää & Mariussen 2017: 676). By repeating the study the region can also carry out its own monitoring and evaluation (Virkkala, Mäenpää & Mariussen 2017: 670).

4.2.2 Limitations of the model and the importance of stakeholder selection

Even though the model can be considered to offer many solutions for public organisations, one also has to study the limitations of the model. Validity means that the connectivity analysis measures the phenomena that it has planned to measure (e.g., cooperation between different stakeholders) so that we can properly provide data concerning connectivity. Reliability refers to the consistency or stability of the measurements (Mäenpää 2014a: 64). To meet these requirements, the analysis and the related questionnaire have been tested and developed based on previous discoveries, as well as by presenting the model, its principles and an example of questionnaire in several scientific seminars in order to develop the principles further.

As with many methods, the model relies a lot on proper data. However, regional cooperation is hard to measure because the concept of cooperation is subjective. One related limitation is that the respondents have diverse backgrounds and can have different interpretations of concepts, such as, innovations, cooperation and development. This has been notified to be a common problem in all research concerning partners, or cooperation in general as people have their own perspectives on these terms. However, attempts have been made to overcome this lack of understanding via written definitions of the concepts, and by mostly using

an interviewer who is able to explain the notions throughout (Mäenpää 2014a: 64). This being said, it is still preferable to use a somewhat vague description to define the characteristics of cooperation. In the study from Ostrobothnia it was decided that the main features of cooperation should include some sort of benefit for all the partners and also it should include an actual dialogue between the participants. This helped to remove some mutual actions from the concept, such as buying a simple product outright etc. (Virkkala, Mäenpää & Mariussen 2014: 149). Still the definition can be considered to be more inclusive than exclusive as we wanted to get a broad view of cooperation for better understanding its patterns in the region.

This wider view regarding the terms is also useful, as we can provide all the possible definitions to the respondents about good or bad cooperation, but the respondents may still feel differently because of the multiple forms of cooperation and also because of human elements. While conducting the surveys in 2013, I came across this very clearly, as some respondents considered only cooperation with official contracts as actual cooperation and others emphasised more the personality of the partner. Indeed, some of the respondents were good friends with the other helix partners and therefore the cooperation had an altogether different meaning for some people. This is an issue, which affects both the validity and reliability of the study.

It should also be considered as a second limitation that the model does not measure 3H connectivity directly, but looks at dyadic relationships through measuring collaboration activities between two helices in different geographical levels. Even though we are able to show the results in a 3H figure, the model is not able to make comparison on all three helices simultaneously, but looks at collaboration between just two helices at a time.

Third limitation, especially concerning validity, is that there is also the risk that cooperation and one's own views regarding it are in constant flux. This is understandable, as cooperation is based on interaction and people tend to remember the latest connections as the strongest. This once again is integral to very nature of cooperation research and is thus unavoidable. (Mäenpää 2014a: 64.)

Fourth limitation lays in the assumption that the respondents know all the connections and cooperation practices their organisations are participating in. During the interviews some of the respondents answered regarding few people whereas some have answered for over 500 employees. This large number of employees makes it impossible for individual respondents to know all the possible connections that their organisation has. However, 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. This means it is

important to obtain a sufficient number of answers, as these will further improve the reliability of the research. For example, larger organisations may have several representatives, and this provides more realistic responses regarding cooperation. (Mäenpää 2014a: 64.)

Fifth limitation concerns the results of the analysis; the figures themselves. The analysis is able to provide quite exact quantitative figures regarding cooperation, but their meaning might differ between different cases and even between different respondents (Mäenpää 2014a: 64). This proves to be a very important issue to be considered when a connectivity analysis is recommended. For some respondents, a figure of 4 is moderate (as scale is from one to ten), but another may consider it bad, as in Finnish school system 4 is the minimum result for tests and some respondents may consider it through this logic. Some of the respondents have also stated that they would never give anyone a ten as a result, as "there is always something to improve". Thus, subjective views also affect the figures. This is one reason why focus group discussion is mandatory; as these sorts of issues could be both notified and discussed there. This once again affects the reliability of the study.

Sixth limitation is that the connectivity model could be considered a lacking tool if one considers the specialisation aspect in S3 as it does not provide direct answers for what the region should specialise in. Even though Nauwelaers et al. (2014) have explained, how specialisation can be categorised into thematic (technology or market driven) or functional (system or connectivity driven) specialisations, the connectivity model still offers no direct input for choosing thematic specialisation or identifying the most important development challenges through evaluation or cost calculation (Virkkala, Mäenpää & Mariussen 2017: 676), although these should be discussed in focus group meetings. I later explain how it might be utilised in order to encourage certain structural changes towards specialisation (diversification etc.), but it still leaves some important regional inputs to be considered between the regional actors.

This also allows for possibilities for dominant stakeholders, and therefore needs to be acknowledged as seventh limitation (Virkkala, Mäenpää & Mariussen 2017: 676). This does not affect the reliability or validity of the analysis, but the wider use of the model and its possible benefits.

Eight limitation concerns the regional governance, or the capabilities of regional insititutions to build a common vision, or organise a survey or focus groups meeting (Virkkala, Mäenpää & Mariussen 2017: 676). This relates to the ability to attract local stakeholders, as well as the transaction costs of negotiating with multiple actors.

All of these limitations are reasons that make it very important to choose relevant respondents to answer the questionnaires. Firstly, the analysis requires answers from all three helices and hopefully also some environmental and civil society representatives. It is important to interview leaders of units or entire organisations because the analysis requires data about organisational cooperation. Secondly, there might be a need to interview some technical experts, as they have subject knowledge which is also very important to take into consideration. (Virkkala 2014: 29; Mäenpää 2014a: 53.)

The search for respondents could be conducted for example via an Internet search, but some experts hopefully are already well known to the public organisations responsible for RIS3. The focus should be mostly on fields of export, which limits the possible stakeholders. It is also important to search for people from possibly known "smart" fields, in order to reach experts who may play a role in the overall specialisation of the region. The actual selection of the respondents can be carried out, for example, by using stratified sampling (Virkkala, Mäenpää & Mariussen 2017: 671).

A stakeholder analysis is obviously one example of a more systematic tool for selecting possible stakeholders. The three aspects of power, legitimacy and urgency allow for more detailed analysis of the possible stakeholders, as various combinations of these attributes open more possibilities for recognition (See Figure 6). The first of these stakeholder categories are of course the definitive stakeholders who have power, urgency and legitimisation. These are ideal partners because they are willing and able to cooperate with plenty of resources of their own. These may be national governments or large companies who are willing to develop their region. (Virkkala & Mariussen 2018; Mitchell, Agle & Wood 1997.)

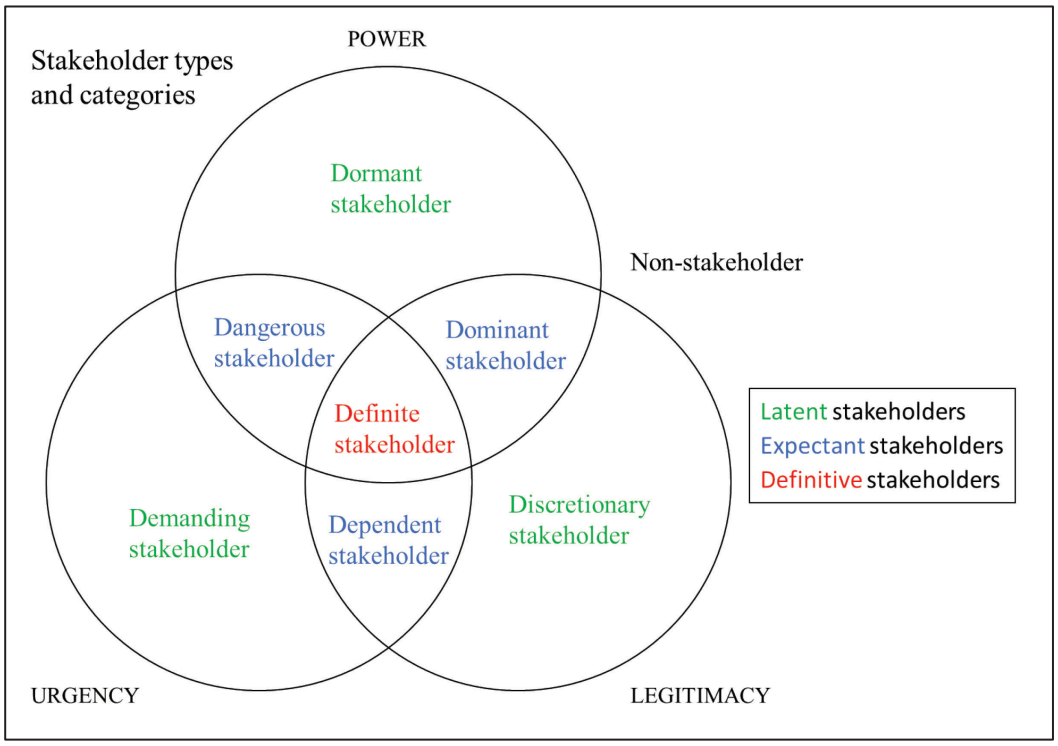

Figure 6. Stakeholder types and categories (based on Mitchell, Agle & Wood 1997).

The second category focuses on expectant stakeholders. Dependent stakeholders may have legitimacy and urgency but may lack power. These stakeholders are often dependent on the decisions made by more powerful stakeholders. They have the willingness to participate but often lack resources and therefore cannot cooperate to the fullest extent. Dominant stakeholders have power and legitimacy but may lack urgency. One example are big corporations who are not too focused on regional activities but tend to stay on their own. They are important stakeholders, who may be major employers but tend to focus on their core activities. (Virkkala & Mariussen 2018; Mitchell, Agle & Wood 1997.)

Dangerous stakeholders may have power and urgency, but lack legitimacy. They may be competing companies or public authorities which are challenging the regional development work and trying to influence its stakeholders. One example might be a corrupt government who tries to gain access to regional funding or a competitor who tries to intervene in order to demolish the development of their competitor. (Virkkala & Mariussen 2018; Mitchell, Agle & Wood 1997.)

Whereas the previous categorisations were based on two or three aspects of power, legitimacy or urgency, the last category, latent stakeholders, only includes one of them. Dormant stakeholders have power, but lack legitimacy and urgency. These

may be multinational companies who may not have any interest in developing the surrounding region but focus more on their core activities. Discretionary stakeholders may have legitimacy but lack power and urgency. These might be public organisations, which should develop the region but are focusing on certain fields and therefore are not interested or obligated to participate in the RIS3 process. Demanding stakeholders on the other hand have urgency but lack power and legitimacy. These stakeholders are eager to be involved but lack the resources and stature to be heard. Smaller companies might be such stakeholders. Furthermore, of course there is also a possibility that a stakeholder has no power, legitimacy or urgency and is a non-stakeholder (Virkkala & Mariussen 2018; Mitchell, Agle & Wood 1997). These are unknown actors. This approach to selecting the respondents can improve the overall process of RIS3 as public organisations can explain that they have used a clear method to choose the respondents.

However, even though the stakeholder analysis seems neutral it leaves open the possible candidates and these are once again based on the knowledge of the RIS3 mediators. It should also be stated that if one only selects powerful stakeholders, then the overall inclusion of the stakeholders is not very broad and useful ideas may be left out because of this. One possible way to avoid this is to include civil society participants in the selection process. A stakeholder analysis could be applied to triple helix stakeholders and civil society could be used more for gathering ideas and analysing as well as verifying the decisions (Lundström & Mäenpää 2017).

4.3 Solutions

4.3.1 Stakeholder inclusion

The connectivity model is based on idea that public organisations, together with regional stakeholders first decide upon the main fields of specialisation, based on their experiences and knowledge of the region. After this broad definition is made, a stakeholder analysis is carried out, which categorises the possible stakeholders. After this analysis, the actual connectivity analysis starts, and it is conducted either via interviews or surveys. This analysis can be conducted by the local public organisation responsible for the S3 process, or it can be outsourced to a local research facility or even a consulting agency. A crucial issue is to decide the potential specialisation fields and after that the number of respondents needed to form the analysis. This obviously differs between regions and the number of

respondents may contain all of them, or a sample of the relevant experts. It should be expressed that more respondents is usually better than having just a few.

One possibility is to conduct a specific stakeholder analysis, as described in the previous subchapter. A thorough stakeholder analysis provides the possibility for a more systematic inclusion and thus enhances the possibilities of the different actors to participate. More than that, the respondents are selected based on merit, so besides the largest or loudest players, there should also be other interesting organisations who either agree or disagree with the views of these more dominant organisations. Obviously other methods are also possible and can be based upon input from any or all of the helices, including members of civil society.

Indeed, the inclusion of civil society enhances and legitimises the whole S3 implementation as a more inclusive and open process. If civil society members are organised, then they can be included in the overall connectivity analysis either as their own helix (making 16 relations instead of 9) or they can be integrated within the public organisation helix or company helix, as was done in the region of Ostrobothnia during the 2013 analysis. One option is also their inclusion via specific tools (presented by Lundström & Mäenpää 2017), in which case they are not analysed as a helix but asked for more general ideas regarding the future of the region. Civil society inclusion is likely to improve the overall S3 process (Lundström & Mäenpää 2017; Benner 2014) and the connectivity model provides ways for making this happen in a more codified way.

Stakeholder inclusion also benefits from the logic of the connectivity model process. It is not just about the interviews but includes a gap analysis as well as focus group meetings. This creates a sense of involvement for the stakeholders and more than that, they can have an open forum for discussing the verified results regarding the largest issues in regional collaboration. There are probably some stakeholders who are interested in seeing the results of the analysis and many others may wish to join the meetings to see what the region is aiming for and whether their views are included in the process. This opens up regional discussions which focus on established issues and therefore provides a good starting point for future collaboration and projects.

For public organisations responsible for the S3 process, the connectivity model provides a solid innovation related forum which allows for gaps in cooperation to be presented and the possibility to discuss them with regional stakeholders. Even though the connectivity model does not contribute directly towards any specific specialisation, it still opens up future possibilities for wide regional collaboration. This obviously requires that public organisations are committed to the model and also work together with regional stakeholders in order to make them happy to be

part of the process. This is something which public organisations should be good at from the very beginning of the process, especially if they are regional developers. If they are not, then the connectivity model is a way to prove their willingness to engage the wider community and to provide their own input for others to comment on.

Universities and companies can gain research projects or can even conduct the connectivity analysis and arrange the focus group meetings. They also have the opportunity to participate in regional planning, which helps them in setting the objectives and allows room for their suggestions for projects, which might benefit the region in the future. Even if the respondents are not that interested in regional planning *per se*, it might provide them with an opportunity for networking.

Civil society either gets a chance to participate as one helix or become involved via different methods, such as world cafés etc. More organised civil society members, such as environmental groups etc. are able to access some of the people in charge of regional planning and are given a chance to gain visibility in an official arena. To those people who are interested in regional activities as individuals, it provides a forum through which one can suggest future ventures or simply reveal some interesting companies, products, or services (Mäenpää & Lundström 2019; Lundström & Mäenpää 2017).

The connectivity model is also an interesting tool for maintaining already established domains, as it allows monitoring and evaluation for understanding how well the cooperation within a domain is going and what the biggest structural challenges are that the stakeholders currently face. As such, it also adds more credibility for maintaining the domains, which is crucial in the future of smart specialisations activities (Mäenpää & Teräs 2018).

One way to describe stakeholder inclusion in the connectivity model is by stating that it forms an open innovation platform (or strengthens an existing one), which requires active participation from the local stakeholders. They are encouraged to participate by providing some concrete issues to deal with (gap analysis), a possibility to comment on these and the possibility to participate in future collaboration, which may arise based on their propositions. The connectivity model aims to establish codified and structured discussions regarding the biggest issues in cooperation and thus aims to strengthen the cooperation between different types of actors (Virkkala, Mäenpää & Mariussen 2017).

4.3.2 Knowledge generation

A connectivity analysis provides both quantitative and qualitative data regarding regional collaboration. It also works as a way for monitoring and evaluating the overall S3 process, especially if the regional stakeholders are willing to participate on a yearly or bi-yearly basis (Virkkala, Mäenpää & Mariussen 2017). This repeatability of the analysis provides a solid framework for creating a long-term process, where new projects are developed in order to breach the established gaps. This sort of codified data allows for a very thorough analysis and the results can be referenced.

One can learn about the overall network structure of the regions, as simple questions regarding the number and importance of different stakeholders paint a picture of what the regional collaboration is all about. It might be useful to see how important regional or international collaboration is for different types of actors and this in itself is a useful tool for public organisations, because then they know whether they should enhance local or international collaboration. In some cases, national collaboration, or the lack of it might also be an issue.

Gap analysis is an important part of the connectivity analysis, as it provides input regarding both quantitative (calculations) and qualitative (focus groups) aspects. Data regarding the largest gaps in regional collaboration can in itself be used for focusing on projects or it can also be used to seek out possible extra-regional partners. If the largest gaps are somewhat similar in different regions, then both regions could learn from each other regarding what could be done in order to bridge these gaps. These sorts of similar regions could also look for collaboration with regions who do not have large gaps in the same issues and therefore already have found a way to overcome such issues. However, this sort of extra-regional comparison would require matching sets of questions in order to work properly. One example of this is the LARS project which is based on mutual questionnaires in order to be able to compare different regions in Europe (Mariussen, Mäenpää & Virkkala 2019).

Another important sort of data are the notes from focus group meetings, as local stakeholders provide their thoughts regarding future collaboration. This may also contain very concrete ideas for future development projects, especially if they relate to one or several of the biggest gaps in collaboration. Focus group meetings are a forum where abstract figures become practical suggestions and therefore a crucial addition to the gap analysis. They also act as temporary learning organisations or *ba*'s, where tacit knowledge can be interchanged between different stakeholders (Virkkala 2019: 156, 160; Nonaka, Toyama & Konno 2000).

The connectivity model can provide public organisations with an annual or bi-annual tool, which can stimulate regional innovation discussions and reveal, as well as suggest how the largest gaps might be solved. It allows for a regional forum to be established and can prove to be very useful for enhancing the collaboration in the region. This is especially true because the analysis in itself does not necessarily require any statisticians and can be easily done by the public organisation's employees themselves, if necessary.

One important issue needs to be addressed though; the connectivity model does not provide direct input regarding any specialisation itself. However, discussion with relevant experts during the focus group meetings may prove to be very useful regarding the aims for the future thematic specialisation, so the connectivity model can also indirectly enhance the search for future specialisations. Nauwelaers et al. (2014) have previously defined this sort of specialisation as functional in nature.

If the emphasis is put on functional specialisation, then a connectivity analysis can be utilised to enhance structural changes in the region (see Table 9). One way to utilise this is to measure the overall connectivity in the region. This creates opportunities for transition (regional re-structuring of current activities) and radical innovations (new ideas, without existing activities), and with help from civil society more radical ideas can be considered (Mäenpää & Lundström 2019; Foray 2015). A connectivity analysis can also be conducted especially regarding specific technology activities, or industries. This creates opportunities for diversification (regional re-structuring together with new activities), as questions can be aimed towards possible future activities or industries (Foray 2015). If the focus in the connectivity model is completely on some future technology, then one might use it as a tool for modernisation (re-structuring based on general purpose technologies) (Foray 2015). The overall idea is that by discovering gaps in regional cooperation towards these new or existing activities, the S3 mediators are able to start pilot projects which bridge the gaps and thus provide possibilities for future collaboration ventures.

As can be seen in Table 9, I have also included options for civil society inclusion that would enhance the utilisation of connectivity model. This also demonstrates how I view civil society as an important asset for regional innovation, but I would not apply the connectivity model to it directly, as civil society is in constant motion and may lack official representatives. Therefore, it is not well suited for the connectivity model's more organisational inspection of connectivity. This separation does not mean that civil society inclusion should be done in any less capacity. On the contrary, I believe that the civil society element should be used to aid the work of the connectivity model and should be applied accordingly. I would

suggest that besides this there could be additional, civil society activation tools in use through the S3 process.

A connectivity analysis is also a good way for both monitoring and evaluating the overall S3 process, as it provides codified knowledge on the state of regional collaboration. These quantitative tools have largely been missing in S3 and therefore it would seem to be a worthwhile addition to the public organisations' tool set.

One way to describe knowledge generation in the connectivity model is by stating that it is an open innovation platform, where different stakeholders are welcomed to participate and where the discussions are formulated based on codified knowledge (gap analysis). This allows for structured and empirically interesting discussions regarding topics which require subject knowledge but are not too detailed to reveal any copyright or patent-related issues. However, as has been suggested (Virkkala 2019: 156, 160; Nonaka, Toyama & Konno 2000), these meetings can also form temporary knowledge creation spaces, or *ba*'s and transform codified knowledge (gap analysis figures) into tacit knowledge (regional learning activities in focus groups) during knowledge exchange. This allows for inclusive and also, effective discussions regarding the future innovation ventures.

Table 9. Utilisation of the connectivity model to enhance structural change in the S3 process (source: own compilation, specialisation types from Foray 2015: 28–29).

Connectivity model as enabler of structural change in smart specialisation					
Type of specialisation	**Focus on geographical levels**	**Focus on gap analysis questions**	**Focus on activities/ industries**	**Possible civil society inclusion**	**Logic**
Diversification	Extra-regional (national and inter-national)	Questions regarding possible future industries/ technologies and how good collaboration currently is regarding them	All	Used to gather ideas and suggestions for the future (world cafes, competitions, pop-up innovation offices etc.)	The analysis aims to discover what new activities are needed and where the gaps in the region currently are (what sort of expertise is needed). Civil society is used to gather fresh ideas
Transition	Intra-regional	Questions regarding regional fields of expertise and how good collaboration currently is regarding them	All regional activities	Used to gather ideas regarding development of current activities (customers/ end users)	The analysis aims to discover how current activities are working and what the bottlenecks for innovation are. Civil society helps in development
Modernisation	Extra-regional (national and inter-national)	Questions regarding general purpose (or key enabling) technologies	Specific regional activities	Used to gather ideas regarding new possibilities for current activities (citizens juries, competitions for workers)	The analysis aims to discover, which general purpose technologies are relevant and what the biggest bottlenecks preventing their use are. Civil society helps in discovering new opportunities
Radical innovations	Intra- and extra-regional	Questions regarding regional fields of expertise and how good collaboration currently is regarding them	All	Used to gather suggestions for sunrise industries or interesting customer experiences (competition, customers/ end users)	The analysis aims to discover current activities and look for missing services etc. The model mainly relies on civil society inclusion

4.3.3 Dominant actors

A connectivity analysis can also work as a mechanism against dominant actors in RIS3. The sole focus of the model is on regional collaboration and not on individual connections, which somewhat limits the role of individuals, even though their ideas are heard in the focus group meetings. A gap analysis, for instance, focuses on the largest gaps in the region, and in the analysis large organisations usually have the same amount of weight as small organisations. This limits the influence, which big organisations have and instead of focusing on whose problem it is, the focus is on the helices and how, for example, companies and universities might find new ways to collaborate. By focusing on the helices, the analysis turns the focus in a more general direction and this helps to reduce the role of dominant actors.

As has been established in previous chapters, selecting the respondents is one of the key issues in the S3 process and a stakeholder analysis, for example, helps in codifying the core capabilities of potential respondents. Stakeholders should have a degree of subject knowledge (regarding innovation activities or specific technologies; depending on the focus of the model) and a leading position, because the focus is on organisations, not individuals. Equally important is the addition of smaller as well as larger organisations, in order to maximise visibility and stakeholder involvement. This larger number of stakeholders also limits the influence of dominant actors, because they are not the only ones who are heard.

Civil society members can be used for verifying the results and their guidance and comments can enhance the visibility and legitimacy of the S3 process. They can also ensure that organisations are treated fairly and with proper weight throughout the process. This sort of monitoring might enhance the overall impact of the S3 process and help to spread its ideas concerning specialisation into the region itself. If the citizens or consumers wish their region to specialise in something plausible, then dominant organisations cannot probably subdue this “more general” view.

The connectivity model works towards generally enhanced collaboration. This in itself should mean more open discussion and therefore less competition between the local stakeholders. Grillitsch (2016: 29–30) has described that higher integration allows for more consensus between the stakeholders. Indeed, by integrating the different stakeholders the region can enhance regional innovation processes, as different actors are more aware of the bigger picture and know which sorts of issues are relevant for the well-being of the region. They may also discover with whom they can work together with in the region. It may also benefit the region if they discover that some relevant help is needed from outside of the region, and

perhaps even collaborate together in establishing these missing "links" in the local innovation network.

The general focus of the connectivity analysis also lends itself well for open project proposals, which do not limit the funding to solely the largest actors but can be tailored to fit different types of actors. For example, enhancing cooperation between universities and companies can mean heavily funded research projects, or simply include work exchange, or student idea competitions etc. Overall it is equally important to enhance collaboration between smaller as well as larger entities and this wider focus helps in selecting the prime candidates with the best proposals, instead of the actors with the greatest influence.

A connectivity analysis also allows for public organisations to protect themselves from the influence of the largest stakeholders, because it is not directly about picking or choosing. If a large company, for example, wishes to get funding, then it is limited to the found issues which stem from the connectivity analysis; *i.e.* the largest gaps. Funding is directed to solve those issues and those issues alone. This is an important leverage for public organisations because they can point towards the pre-set process, which gives all of the regional actors a fair chance.

Obviously, the connectivity model cannot make everyone happy, but it also encourages different stakeholders to participate in the next round of interviews or surveys. If the stakeholders feel that their issues need solving, then they are able to participate more actively during the next annual or bi-annual round and hopefully this creates a positive cycle of interest in participating in connectivity-model-based regional development.

One way to describe the prevention of dominance by strong actors in the connectivity model is by stating that the whole of its process limits the possibilities of individual stakeholders to gain a dominant position. Even possibly corrupted public organisations need to present some calculations in order to make the process work and this requires trust from local stakeholders, who they need to interview. If the public organisations cannot present themselves in a cooperative manner, then stakeholders will not necessarily wish to participate in the process. The connectivity model requires mutual trust and cooperation in order to work and this limits the possibilities for dominant actors, as the process simply does not work properly if they gain the upper hand.

5 CONCLUSIONS

My aim was to understand what the main challenges for public organisations in S3 process are; *i.e.* what public organisations have to face in order to successfully develop an RIS3 process for their region. I also considered it to be important to look for solutions to some of these challenges and try to come up with good practices which may further enhance regional innovation activities. The connectivity model can be seen as one solution, and its utilisation has been studied now in a wider context in order to see the possible benefits and also the limitations of its use. All this is also important due to the explorative nature of the study, and I am now able to describe the findings of my learning process (Reiter 2017: 139).

Responses to the presented research questions were partially answered already in the previously published articles, and their themes have been updated with this study's inspection of the current literature. Next, I will answer the research questions and conclude my study with some final remarks.

What are the main challenges regarding public organisation coordination in the S3 process?

During my study I noticed the changing role of public organisations, as S3 has put them in a new, mediating role in regional innovation activities. There are many different approaches to preparing and implementing RIS3, as public organisations have probably never participated in similar innovation processes, especially in the EU context (Morgan 2017a: 569). Overall it is important to notice that the S3 literature recognises the importance of public organisations and explains their coordinating role as establishers of RIS3, but the literature seems to offer very limited advice regarding the EDP and how it should be conducted. There have been cases where the establishment of RIS3 has been explained very clearly, but learning experiences of the mediating role of public organisations are still lacking to some extent (see Mäenpää & Teräs 2018).

I approached this question by considering what sort of knowledge is needed in order to make EDP work properly. The required knowledge seems to be focusing on the knowledge of the stakeholders (know who), and I consider this to be the main asset of public organisations. They should know the regional actors and activities, at least to some extent in order to establish the EDP and organise the related discussions. Public organisations not only need to invite local stakeholders for EDP but they also need to make them think and reflect on regional activities. This knowledge generation can be very challenging, especially if the public

organisations do not know what sort of data should be collected in the first place. How should they formulate the discussions and how should they make most out of them? There is also the possibility that some stakeholders will not be willing to cooperate or may attempt to own the process. Therefore, there should be some way to ensure that the EDP is a fair process, where everybody is invited, but public organisations still control the discussion and keep it centred on regional, not individual needs.

Based on the existing literature, I discovered three main issues to be stakeholder inclusion, knowledge generation and dominant actors, which face the public organisations throughout the RIS3 process. These issues do not stop after the RIS3 implementation is done, and the strategy has been written, but also reoccur during the establishment and maintaining of domains.

My findings also seem to resonate with the existing literature. For example, Markku Sotarauta's (2018) findings regarding policy traps is similar to my disposition regarding the major challenges for public organisations in the S3 process. These two approaches are compared in Table 10. The comparison reveals several similarities and also shows areas where the connectivity model could help in solving the issues.

Stakeholder inclusion relates to finding the proper stakeholders, contacting them, and getting their involvement for a mutual innovation process. Many regions have been struggling with this, as they have lacked the participation of important stakeholders (Teräs & Mäenpää 2016) or even the fourth helix in general (Mäenpää & Lundström 2019). Public organisations are not necessarily very used to this sort of mediating and taking an active role in facilitating RIS3. Furthermore, they should now be involved in innovation related ventures, which has been the *forte* of universities and companies for the most part until now. Stakeholder engagement indeed takes time and requires some sort of compensation, otherwise the stakeholders might not find the time to be a part of the process. This is a legitimate issue and requires some resources to establish mutual and beneficial cooperation for a longer period of time, as the establishment and running of domains would require (Mäenpää & Teräs 2018).

The *knowledge generation* issue relates to the necessary discussion regarding what the public organisations know about the regional innovation processes and what they should know, in order to manage the RIS3 process. This also relates to what they should try to know in order to work as mediators and facilitators in the RIS3 process. This includes knowledge of the stakeholders and what they are working on (at a basic level at least) in order to contact the relevant stakeholders in the EDP. As Morgan (2017b) has suggested, sometimes it may be better, if the

public organisations do not know too much, as they can otherwise interfere with the process.

Table 10. Policy traps compared to the focus of this study (source: based on Sotarauta 2018 and my own compilation).

Policy traps (as presented by Sotarauta 2018)	Main challenges	Corresponding challenge for public organisations	Solutions suggested by this study
Institutional conflict trap	Institutional collaboration.	Stakeholder inclusion.	Gap analysis reveals possible gaps in cooperation.
Governance trap	Autonomy and power of regional governance	Stakeholder inclusion, knowledge generation, dominant actors	The connectivity model offers a scientific method for regional development. This may provide more EU/national funding and more legitimacy
Capability trap	Expertise of regional government staff	Stakeholder inclusion, knowledge generation	The connectivity model provides a tool for understanding how the region works
Mobilisation trap	Mobilisation of relevant, active and interested stakeholders	Stakeholder inclusion	A stakeholder analysis provides one solution for identifying important actors. The connectivity model offers an annual or bi-annual arena for discussions
Shared vision trap	Possible promotion of self or party interests	Dominant actors	A gap analysis is a scientific method for identifying the regional issues and leaves less room for individual interests

This may also lead to *dominant actors*, as public organisations themselves (Morgan 2017b) or other stakeholders may try to take hold of the process and direct it in a more self-centred direction. This issue has been raised at the very beginning of the S3 process (Benner 2014), as there is a possibility that individual stakeholders may try to own the process. This can be an issue for example, if the largest employer or the biggest company in the region is participating and

considers itself to be the most important beneficiary of the RIS3 process. This also affects the willingness of others to cooperate.

All of these challenges are also linked. A valid S3 process requires wide participation, which opens opportunities for dominant stakeholders. This wide participation also makes knowledge generation more challenging and possible dominant stakeholders may diminish the whole knowledge generation process by forcing others to discuss their individual challenges instead of regional challenges. This may then become a negative spiral as stakeholders lose their interest if they feel that the whole process is just about promoting a single actor, and not the region.

In reality all of these challenges and the attempts to solve them are present and constantly change throughout the S3 process. Wide participation may bring in some dominant actors, which may have an impact regarding knowledge generation. Indeed, mutual cooperation can be a challenge even if regional stakeholders are all willing to participate, as they are not usually able to share every practical detail of their work. This highlights the challenges which public organisations face and also forces us to seek solutions, such as the connectivity model.

What is the contribution of the connectivity model in overcoming these challenges?

All of the previously presented challenges could be coped with if regional actors could cooperate more smoothly and have more open discussions (see Figure 7). Clearly connectivity between stakeholders could enhance participation, as everybody would feel themselves to be accepted. Discussions would be wider and the inclusion of civil society members especially might prove to be a pathway towards new thoughts and ideas. A tightly working group would also provide very little room for any dominating stakeholders, as these organisations would eventually fall out of the process. However, this is a challenging task for those public organisations which are responsible for the S3 process.

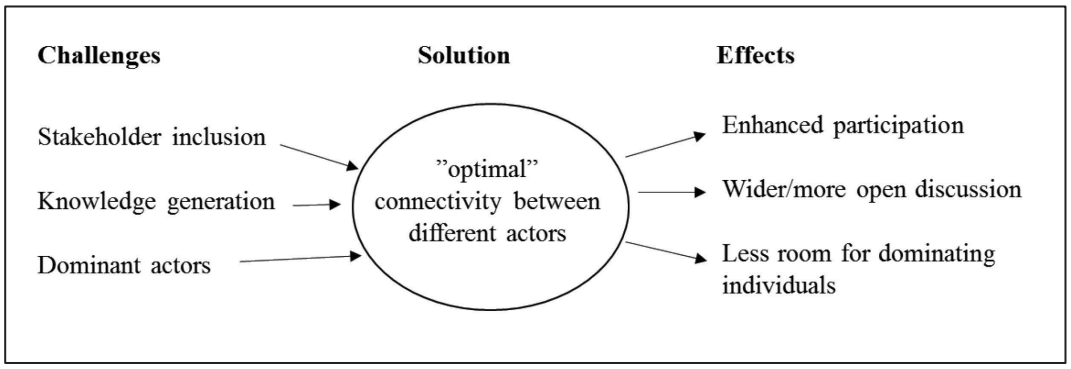

Figure 7. Optimal connectivity as a solution to S3 challenges (source: own compilation).

Indeed, Grillo and Landabaso (2011: 548) highlight the need for regional innovation policies which are based on strong partnerships and inclusive planning and implementation processes. They also mention the need for a shared vision for the region. Muscio, Reid and Leon (2015: 160) speak of empowerment, as these policies are helping regions to help themselves. The focus seems to be on "levelling the "playing field" from the start rather than equalizing the outcomes."

Muscio, Reid and Leon (2015: 168) also call for an: "investment in the machinery of governance to increase regional innovation capacity". They continue by explaining that: "This includes the "upgrading" of ministries and agencies to strengthen their strategic management capacity (notably a shift from direct financial aid to demand side policies), as well as fostering the emergence of partnerships to manage "innovation platforms" and structure fragmented business capacities that can deliver on the smart specialisation priorities". The connectivity model provides assistance on this, as it is based on an inclusive process in which cooperation is a necessity if one wants to influence the decision-making. It can be considered a demand-driven tool, which also helps in financial distribution as it offers a solution for picking suitable cases: identifying the largest gaps.

Indeed, the connectivity model could be utilised to both measure and enhance regional connectivity. The connectivity model also provides a solid basis for regional cooperation, which allows the formation of cooperation to represent itself via simple figures. This makes the understanding of the regional cooperation easier for the public organisations in charge of RIS3 and also offers something to discuss with regional stakeholders. For many public organisations it offers a good start towards more in-depth discussions and can therefore be suggested as a tool for enhancing regional cooperation and also EDP.

One also has to consider that alongside the idea of a connected region there might be a different, or more specific focus for the actual specialisation of the region. For example, there could be a region which has a history to do with aviation mechanics. Although a connectivity analysis does not focus on this specialisation exactly, it can be utilised to measure overall connectivity. In this way the connectivity model would support general collaboration in the region and not aviation technology directly. This creates possibilities for transition (Foray 2015: 27). A connectivity analysis can also be tailored especially regarding aviation technology, by changing the questions towards this activity. This creates opportunities for diversification (Foray 2015:27). If the focus in the connectivity analysis questions is more towards some future technology, or key enabling technology, then it could be used as a tool for modernisation (Foray 2015:27). Overall the idea is that by discovering gaps in regional cooperation the S3 mediators are able to start pilot projects which bridge the gaps and thus provide possibilities for future collaboration ventures. Therefore, there could be a more general or specific focus for the utilisation of the model and it could be utilised first on certain industries or types of stakeholders before using it to measure the entire region.

However, the model requires a lot from its users. For example, public organisations wishing to utilise the model need to:

1) be non-corrupt and development-focused,

2) be free enough to be able to decide themselves on the utilisation of the model,

3) have resources for the interviews and focus group meetings, with preferably at least one person who would take care of the process,

4) acquire some sort of funding for future pilot projects,

5) search for relevant and eager stakeholders (perhaps with power, legitimacy and urgency),

6) and discover participants for a long process consisting of interviews, focus group meetings and possible mutual projects.

Even though some of the steps could be outsourced, for example, the interviews and focus groups could be organised by university or consultant company etc. it is still crucial that public organisations are themselves also involved. Without taking control of the connectivity model, public organisations will have a hard time trying

to search for willing participants, if they themselves are not able to express their eagerness in utilising the method.

Why then should public organisations utilise the model? Even though my earlier remarks concerning the largest challenges that public organisations have to face during the process are in providing quite profound incentives, there are also more practical reasons for choosing the connectivity model as a tool for regional development. *It is preferable for public organisations who do not know how to proceed with their RIS3*, for example. Because the model is "pre-made" and does not require extensive funding (resources for one person for a couple of months is the minimum and some other transaction costs for a meeting room etc.) it could be utilised in very different types of regions. We have already demonstrated that it could be utilised in less-favoured regions, for example (Mäenpää & Virkkala 2019), so it could also be utilised in more advanced regions. Despite the model's previous utilisation, which has been mostly in Nordic cases, it has currently been utilised in different regions and nations from Northern to Eastern and Central Europe, and it seems to be a tool suitable for different types of development needs (Mariussen, Mäenpää & Virkkala 2019).

It also offers an *evidence-based and thus more interest-free way for distributing development funding*, as the model is based on methods in which regional stakeholders have a chance to get involved via interviews and are offered another chance to comment on the initial results before deciding together with other regional stakeholders on what should be done in the region. It is by nature a more bottom-up approach and this offers a good explanation for why public organisations have decided to fund specific types of projects. For example, if the region seems to have large gaps between companies, then it seems natural to fund projects where companies are cooperating regarding developing products which are manufactured in the region, etc. This is important especially if the region lacks funding, as the method may help to choose new projects.

If the model is utilised annually or bi-annually, this hopefully also affects the local stakeholders, as they know that regional development funding is based on broad collaboration. This *may encourage wider regional collaboration*, as smaller companies can apply for the funding together, or search for local universities to participate with them. This effect can be further enhanced by organising different events and by promoting the vision of a connected region.

The model also offers a possibility to *encourage regional learning, both as an intra- as well as extra-regional exercise*. If regional actors become involved, they are able to discuss the biggest issues in local cooperation, together with stakeholders from multiple helices and exchange different types of knowledge. It

is also possible to search for global partners who either have similar issues, or who have already discovered solutions to the issues. The connectivity model can indeed be utilised for transnational learning, as *it offers a possibility to define different types of regions, based on the biggest gaps and strongest collaborations*. We have previously demonstrated how both intra- and extra-regional collaboration is important for the establishment and maintenance of domains (Mäenpää & Teräs 2018), which further highlights this benefit of the model. This possibility for a regional typology can be used for various purposes and can be relevant also outside the S3 context, for example as a purely regional development exercise.

The connectivity model can be considered one of the first concrete suggestions for a *tool for monitoring and evaluating RIS3* (Virkkala, Mäenpää & Mariussen 2014), which has been addressed in many studies, but still lacks good suggestions. As monitoring and evaluation can be considered to be one of the core tenets of S3, (and the last of the six steps) it seems important to highlight this fact (Foray et al. 2012). Our previous study also demonstrated that the model can be used to *measure proximity* (Mäenpää & Virkkala 2019), which opens up new potential uses for it in the future.

The connectivity model also offers the public organisations a *good discussion opener*, as it helps in engaging local stakeholders and both interviews and focus group meetings can provide a forum for wider regional discussion. This can lead to future projects and mutual collaboration, as the stakeholders and their work become better known within the region. It also enables discussions to start regarding the future specialisation of the region, even if the initial focus is on overall connectivity.

One way to look at the model is also by testing it. Harmaakorpi (2006: 1089–1090) has discussed the challenges which sunrise regional innovation strategies and policies have to take into consideration in order to properly help regional innovation systems. The original list consists of nine aspects, which are important to notice. I have included the nine aspects and also replied to them according to how connectivity model relates to them (see Table 11).

Table 11. Challenges for sunrise innovation policies and how the connectivity model takes them into account (based on Harmaakorpi 2006: 1089–1090 and my own compilation).

Challenges for sunrise innovation strategies and policies (as presented by Harmaakorpi 2006: 1089–1090)	How the connectivity model relates to these challenges
Understanding the effects of the changing techno-economic-paradigm on the regional innovation environment	It helps in discovering new opportunities and in sharing new ideas through enhancing cooperation
Understanding the phenomena of regional path dependency and agglomeration	It may be used for enhancing current activities or provide help in discovering new combinations
Avoiding regional lock-ins	It may be used to enhance diversification
Defining competitive regional resource configurations	It enhances EDP
Forming multi-actor innovation networks to exploit the resource configurations	It enhances regional collaboration by discovering the biggest gaps in cooperation
Enhancing the absorptive capacity of the innovation networks	By bridging the gaps the cooperation may become stronger
Creating sufficient creative social capital	Focus group meetings bring people together
Promoting regional dynamic capabilities, for example, innovative, learning, networking, leadership and forecasting capabilities	It is a regional learning activity based on networking which aims to contribute towards strengthening the regional cooperation, which may help in forecasting future issues and funding needs
Understanding the multi-level governance environment in forming innovation policies and strategies	The model measures multi-level cooperation and can be used to describe the regional challenges. It may also be used for establishing a regional typology, for transnational learning

Even though Harmaakorpi (2006) made the categorisation before the S3 concept was developed, the model seems to respond quite well to these general requirements for a proper innovation policy. It seems to recognise the current trends in innovation activities and the realities of the changing networks in innovation and aims to bring these links closer to each other in order to enhance the whole system.

Future research and final thoughts

Any type of policy model requires experience and practical testing, and the connectivity model is no different. Therefore, more empirical research would enhance and contribute to its use (the LARS-project is an example of multi-national cooperation, which will hopefully continue also after the project comes to an end in 2020). More research would also be welcomed regarding the knowledge generation aspect and stakeholder inclusion, as these are obviously very important core mechanisms in this model. Generally, I would welcome more research regarding the model itself and hopefully done by others as well.

Some interesting new ventures for the model would be its utilisation inside an organisation. This would require that the focus would shift away from helices and would examine single departments inside an organisation. This may sound like radical thinking, but the development of gap analysis (by Ranta & Takala 2007) is based on measurements inside companies, and now the gap analysis could go back to its roots in this slightly altered form. This would help to measure and enhance cooperation between individual organisations and could also enhance overall regional cooperation if it could find issues in extra-regional collaboration etc. This would be an interesting new possibility.

I would also see more thought-out applications for civil society inclusion in RIS3 in general and this could also benefit from the connectivity model, as new ideas could be gathered. This is already a possibility to some extent, as for example, ideas for questions or future activities could be sought from civil society actors. The model itself can be too "heavy" for measuring the connectivity between individuals, but there could and should be other tools to encourage civil society inclusion. Especially the connectivity analysis and S3 implementation would benefit from this sort of contribution, as the analysis would get new ideas to consider as questions and there might be also new issues to discuss with focus groups. S3 implementation would benefit from verification from civil society, as this would generalise the RIS3 and make it an even more of a bottom-up approach. We have

already established that radical innovations could emerge more easily due to this (Mäenpää & Lundström 2019; Lundström & Mäenpää 2017).

The model could also be studied further regarding its ability to contribute towards structural change. It would be beneficial to see what types of specific questions could direct the discussion towards future ventures and how well the model would work in this capacity. Even though the Ostrobothnian case (Virkkala, Mäenpää & Mariussen 2014) included these sort of questions regarding future technologies etc. there still could be a more specific questionnaire directed towards establishing specialisations. However, specialisation can also occur "naturally" as the connectivity increases, and respondents talk more to each other.

It should also be stated that the connectivity model can be considered very current, as some of the latest studies have highlighted an institutional approach in S3 lately (Blažek & Morgan 2019; Rodríguez-Pose & Wilkie 2017). It is also relevant regarding its approach to domains, as the model can be utilised to maintain and enhance the activities in domains which require both intra- and extra-regional cooperation in order to function properly (Mäenpää & Teräs 2018). As Nauwelaers et al. (2014) have stated, it is possible to focus on connectivity as a specialisation and this could be a very good way to strengthen the cooperation between stakeholders in future domains. This highlights that the connectivity model can be utilised also after RIS3 has been established, and thus could be used in future measurements in S3 contexts as well.

Overall one could state that public actors are now facing new challenges in innovation settings and that these issues are enormous for the already thinly spread public entities. However, in the end, it is just about contacting the local people. Whereas methods and resources, as well as results may vary, the overall idea of inclusive governance (by Morgan 2017a: 572) comes to the fore. There should be more general discussion regarding the direction the region is heading and where it should go, and I generally think that public organisations are best suited for organising and facilitating this discussion. The gathering of new ideas and their development into regional opportunities through RIS3 is a new, exciting opportunity for public organisations and they really need to step up to their new role in contributing towards innovation.

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Appendix

Appendix 1. The responsibilities of the author concerning the four articles and two book chapters.

1. *Smart specialisation implementation processes in the North: Lessons learned from two Finnish regions*

My co-author Jukka Teräs wrote the majority of the literature review and provided knowledge on Lapland's S3 process. I provided the description of the Ostrobothnian S3 process, made the tables, and, together with Jukka Teräs, analysed the two cases, wrote the introduction and drew conclusions.

2. *In search of domains in smart specialisation: Case study of three Nordic regions*

My co-author Jukka Teräs interviewed the case study regions of Lapland and Värmland, as well as worked on the methodology and questionnaire. I interviewed representative from Nordland, drew the figures and formulated the tables and provided the majority of literature review regarding domains. We both provided the analysis and conclusions, as well as the introduction.

3. *A connectivity model as a potential tool for smart specialization strategies*

This article is based partly on our previous publication "The Ostrobothnian Model of Smart Specialisation" (Virkkala, Mäenpää & Mariussen 2014). Due to this reason, it is difficult to differentiate the work which has been partly redone in the article. I however, participated in the analysis and case-study sections, as well as the S3 literature review. My co-authors Seija Virkkala and Åge Mariussen provided the majority of the conceptual framework as well as a comparison of connectivity model in an RIS3 –setting. Together we formulated the literature review, introduction and conclusions.

4. *The role of proximity in less-favoured regions: Smart experimentation between triple helix actors*

My co-author Seija Virkkala was responsible for the research design (knowledge taxonomy as proximity) –section, whereas I focused on the conceptual background (especially RIS and triple helix) section and introduced the case study and calculated the analysis. We wrote the introduction and conclusions, as well as a summary of the analysis, together.

Appendix 1 The responsibilities of the author within the four articles and two book chapters (continued).

5. *Wicked game of smart specialization: A player's handbook*

My co-author Niklas Lundström provided the theoretical background and concepts of complexity, wicked problems and wicked games. I provided literature regarding S3 as well as understanding of the EDP. Together we combined smart specialisation with wicked games and formed the concept of a regional innovation game (RIG) and wrote the analysis as well as the conclusions and the introduction.

6. *Entrepreneurial discovery processes through a wicked game approach: Civil society engagement as a possibility for exploration*

My co-author Niklas Lundström wrote the sections concerning wicked problems and wicked games, as I focused on the EDP exploration section. Together we theorised civil society inclusion in EDP and also wrote the introduction and conclusions.

All four articles and two book chapters.

It is impossible to differentiate the exact amount or nature of work done, as all authors worked on various parts during the review process. The order of the authors' names should parallel with the writing responsibilities.

Smart Specialisation Implementation Processes in the North

Lessons Learned from Two Finnish Regions

*Jukka Teräs, Antti Mäenpää**

The smart specialisation concept, aimed at generating unique assets and capabilities based on a region´s industry structure and knowledge base, is currently widely implemented across Europe. The literature on the implementation of regional smart specialisation strategies is not, however, abundant. This article introduces the practical implementation of smart specialisation processes in two Finnish regions: Ostrobothnia and Lapland. The article analyses similarities and differences in the smart specialisation implementation processes in different regions within the same national context, and also analyses what is really new in the two smart specialisation strategies. The findings indicate that implementing regional smart specialisation strategies is a challenging and time-consuming exercise. They also suggest that the key concepts associated with smart specialisation have not yet been fully adopted by the regions. In order to fully implement the smart specialisation strategies, regions need to dedicate enough time and resources to the implementation phase.

I. Introduction

Europe 2020 is the European Union's ten-year jobs and growth strategy. It was launched in 2010 to create the conditions for smart, sustainable and inclusive growth.[1] Regional policy plays an important role in the Europe 2020 strategy. Former innovation strategies focused on the national or sectoral level,[2] diminishing the possibilities for participation at a regional level. The current approach to regional innovation policy is based on a new "understanding of the role played by innovation in economic development and in particular its relationship with geography".[3]

The basis of the new bottom-up approach to regional innovation policy in the European Union is smart specialisation strategy (S3). The S3 concept was first developed to address the gap between Europe and other global competitors (namely USA and Japan) in R&D investment.[4] Despite its sectoral origins related to its RIS predecessors with focus on science based R&D and innovation, the concept was able to accommodate the place-based approach as advocated in the Barca Report.[5] The S3 approach is being promoted by the EU as the basis for the programming period 2014-2020 and, in order to receive ESI Funds, EU Member States and their regions must have a S3 strategy (*ex-ante* condition).[6]

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1 European Commission, Europe 2020: Commission proposes new economic strategy in Europe. <http://europa.eu/rapid/press-release_IP-10-225_en.htm?locale=en> accessed on 22 March 2016.

2 S. Iammarino & P. McCann, *Multinationals and Economic Geography. Location, Technology and Innovation* (Edward Elgar Publishing, 2013).

3 P. McCann & R. Ortega-Argilés *Transforming European regional policy: a results-driven agenda and smart specialisation* (2013) Oxford Review of Economic Policy, Vol. 29 (2), pp. 405-431.

4 D. Foray. & B. van Ark *Smart specialisation in a truly integrated research area is the key to attracting more R&D to Europe* (2007) Knowledge for Growth. European Issues and Policy Challenges, Vol. 1, pp. 24-26.

5 F. Barca *An Agenda for a Reformed Cohesion policy: A Place-Based Approach to Meeting EU Challenges and expectations* (European Commission, 2009).

6 D. Foray, D.Goddard, J. Beldarrain *et al. Guide to Research and Innovation Strategies for Smart Specialisation (RIS3)* (European Commission, 2012).

Smart specialisation is a strategic approach to innovation policy development, which is fundamentally based on a process of *entrepreneurial discovery* in fostering specialised diversification across related sectors.[7] This diversification aims to transform the structures of existing regional economies into knowledge economies.

It is widely acknowledged that entrepreneurs are in the best position to discover the areas, or *domains* of R&D and innovation in which a region is likely to excel, given its existing capabilities and productive assets.[8] Dominique Foray defines a domain as the level at which S3 priorities are identified, assessed and supported which should "neither be too high (an entire sector) nor too low (individual firm)".[9] A domain stretches across several sectors, without covering them entirely. It should be noted that from a S3 perspective entrepreneurs encompass all actors including individual entrepreneurs, companies, universities, technology transfer offices and regional development agencies that have the capacity to discover the specialisation domains.[10]

Research literature on the implementation of S3 is emerging. The research on regional smart specialisation would benefit, however, from more studies on the practical implementation of S3 in the regions. In this paper, we explore the application of the S3 concept in two non-metropolitan Finnish regions: Ostrobothnia and Lapland. We focus on the following key research question: What are the main similarities and differences in the implementation of regional smart specialisation strategies between different regions within the same national context and what lessons can we learn from them? We also examine the novelty of the S3 by comparing the current strategies to regional development strategies preceding the S3 process in the case study regions.

Our paper is structured as follows. First, we provide a literature review focusing on the implementation of the S3 and describe the methodology. This is followed by the empirical part of the paper, which presents a comparative analysis of the implementation of S3 in the Ostrobothnia and Lapland regions. Finally, a concluding analysis with recommendations is provided.

II. Literature Review

Before introducing the research literature on the implementation of smart specialisation, it is relevant to briefly present the major guidelines given by the European Commission to prepare the regional S3 documents. The overall structure of the S3 process is presented in the European Commission's RIS3 guide.[11] The six key steps for developing a regional S3 are:

(i) analysis of the regional context and potential for innovation,
(ii) governance by ensuring participation and ownership,
(iii) elaborating an overall vision for the future of the region,
(iv) identification of priorities,
(v) policy mix, preparation of policy mix, roadmap, and action plan,
(vi) and integration of monitoring and evaluation mechanisms.

The order of the steps may vary, and at some point in time a region may need to, for example, return to the first step and conduct further analysis before adopting the final version of the strategy.[12] It is worth mentioning that the EU's S3 Platform (Seville, Spain), designed to promote the implementation of S3 in the EU regions, uses the six-step structure as a framework for the participating regions to present their regional strategies and their implementation at the S3 Peer Review events.

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7 D. Foray, P.A. David & B.H. Hall *Smart specialisation. From academic idea to political instrument, the surprising career of a concept and the difficulties involved in its implementation* (Lausanne Management of Technology & Entrepreneurship Institute, 2011); B. Asheim & M. Grillitsch *Smart specialisation: Sources for new path development in a peripheral manufacturing region* (Lund University, 2015).

8 D. Foray, P.A. David & B.H. Hall *Smart specialisation. From academic idea to political instrument, the surprising career of a concept and the difficulties involved in its implementation* (Lausanne Management of Technology & Entrepreneurship Institute, 2011) pp. 7.

9 D. Foray *Smart Specialisation – Opportunities and Challenges for Regional Innovation Policy* (Routledge, 2015).

10 D. Foray, X. Goenaga *The Goals of Smart Specialisation* (2013) S3 Policy Brief Series, 1, pp. 1- 14.

11 See <http://s3platform.jrc.ec.europa.eu/ris3-guide>.

12 D. Foray, D.Goddard, J. Beldarrain *et al. Guide to Research and Innovation Strategies for Smart Specialisation (RIS3)* (European Commission, 2012); Å. Mariussen *Smart Specialisation: Reinventing Regional Systems of Innovation* (2013) Botnia Atlantica -Institute Newsletter, 1, pp. 1–3.

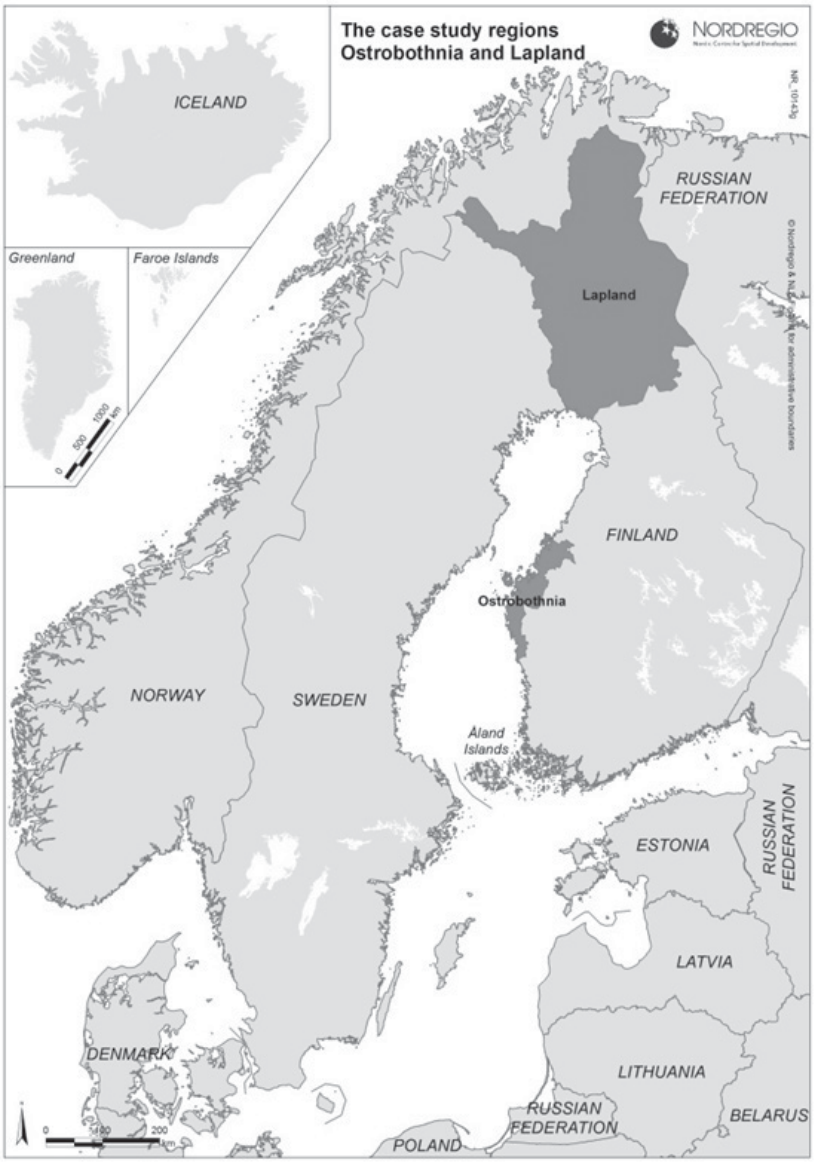

Figure 1: Case study regions.
Source: Made by Julien Grunfelder from Nordregio for this article.

There is an emerging research literature on the implementation of smart specialisation, including, for example, studies analysing of the smart specialisation processes undertaken in Malta and Wales.[13] We have also learned about vagueness around some of the key concepts regarding S3, and differences in its implementation in European regions.[14] However, early indications also suggest potential for S3 to improve regional development strategies.[15]

Some studies claim that the rush created by the *ex-ante* condition to the regions to receive ESI Funds might have affected the deficiencies that can be inspected from the local S3. It would also seem that entrepreneurial discovery has not been integrated prop-

13 L. Georghiou, E. Uyarra & R. Saliba Scerri, *et al. Adapting smart specialisation to a micro-economy – the case of Malta* (2014) European Journal of Innovation Management, Vol. 17, pp. 428-447; R. E. Pugh *Old Wine in New Bottles? Smart Specialisation in Wales* (2014) Regional Studies, Regional Science, Vol. 1, pp. 152-157.

14 D. Iacobucci *Developing and implementing a smart specialisation strategy at regional level: some open questions* (2012) 15 c.MET Working Paper pp. 1-19; A. Reid & P. Stanovnik, *The Develop-*

erly into the strategy work.[16] Nicola Bellini provides an analysis of the S3 processes in a number of regions in Italy and Spain, highlighting, for example, its role in challenging regional governments and giving a concrete dimension to the relationship between local development and globalisation.[17]

Henning Kroll studied the understanding and implementation of regional S3 in Europe via surveys and concluded that Southern European regions have managed to gain new policy practices from the overall S3 process, which has benefitted the regions greatly. However, Central and Northern Europe have not found the S3 processes as useful. Their representatives mainly felt that they contributed to the wider strategy work and theories behind it, instead of directly benefitting from it. Interestingly from the perspective of our paper, Kroll did not interview any representatives from the Northern Europe (*i.e.* the Nordic countries) in the phone interviews, which followed-up and deepened the survey analysis.[18]

III. Methodology

The findings reported in this paper are based on a qualitative research methodology, which utilises action research approach. The relevant literature on S3 has been reviewed, with a focus on the implementation processes. The empirical research data consists of relevant reports and interviews in the case study regions. One of the authors participated in the planning and implementation of the Ostrobothnia's S3 exercise and the other was part of the Lapland's S3 team. Our knowledge of the strategy process and its implementation in the case study regions is thus not only based on regional S3 strategy documents,[19] but also includes tacit knowledge gathered in the respective regions.[20]

The authors selected Ostrobothnia in Western Finland and Lapland in Northern Finland as case study regions (see *Figure 1*) for several reasons. Firstly, both regions have prepared their smart specialisation strategy work at a relatively early stage compared to many other regions in Finland. Secondly, both regions have a similar sized population. Thirdly, the innovation performance of the case study regions, as indicated by the regional innovation scoreboard, fell under the same category of leader-medium before the smart specialisation work started.[21] Fourthly, the regions share the same national setting. Finally, and equally important, the authors had excellent access to information on smart specialisation process in both regions.

IV. Empirical Analysis

1. National Innovation Context

Before introducing the case study regions, it is relevant to consider the national, in our case Finnish, context for smart specialisation. The Finnish innovation system can be considered as a centralised system. Science, technology, innovation and university policies are coordinated at national level and regional actors have limited possibilities to affect them. At the regional level, the Regional Councils are the responsible authorities regarding S3. In total, there are

ment of a Smart Specialisation Strategy (S3) for Slovenia, Report to the European Commission (European Commission 2013); R. Capello *Smart specialisation strategy and the new EU cohesion policy reform: Introductory remarks* (2014) Scienze Regionali, Italian Journal of Regional Science, 13, pp. 5-15; N. Komninos, B. Musyck & A. Reid *Smart specialisation strategies in south Europe during crisis* (2014) European Journal of Innovation Management, 17, pp. 448-471.

15 E. Baier, H. Kroll & A. Zenker, Templates of smart specialisation: Experiences of place-based regional development strategies in Germany and Austria. <http://www.isi.fraunhofer.de/isi-wAssets/docs/p/de/arbpap_unternehmen_region/ap_r5_2013.pdf> accessed on 22 March 2016.

16 J. del Castillo, J. Paton, B. Barroteta *Smart Specialisation for Economic Change: The Case of Spain* (2015) SYMPHONYA Emerging Issues in Management, 1, pp. 30-43.

17 N. Bellini *Smart Specialisation in Europe: Looking Beyond Regional Borders* (2015) SYMPHONYA Emerging Issues in Management, 1, pp. 22-29.

18 H. Kroll *Efforts to Implement Smart Spesialisation in Practise – Leading Unlike Horses to the Water* < http://dx.doi.org/10.1080/09654313.2014.1003036> accessed 15 December 2015.

19 Ostrobothnia lacks an official strategy document, but the Ostrobothnian smart specialisation model and process has been published as: S. Virkkala, A. Mäenpää & Å. Mariussen (Eds.) *The Ostrobothnian Model of Smart Specialisation* (Proceedings of the University of Vaasa 196, 2014).

20 Regional Council of Lapland, Lapland´s Arctic Specialisation Programme. <http://www.lapland.fi/en/lapinliitto/c/ document _library/get_file?folderId= 53982&name=DLFE-21455.pdf> accessed on 15 December 2015; Regional Council of Ostrobothnia, Preliminary results. <http://www.obotnia.fi/regional-development/smart-specialisation/preliminary-results/> accessed on 15 December 2015.

21 European Commission, European Innovation Scoreboards. <http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/index_en.htm> accessed on 23 April 2016.

18 Regional Councils in Finland and they operate on NUTS-3 size regions.[22]

The Finnish Regional Development Strategy 2020 considers regional specialisation as an important mean through which to promote regional development and innovation.[23] The Strategy 2020 aims for a specialised role for Finland in the global economy, based on regional competences and continuous development.[24] The latest national innovation program, Regional Innovations and Experiments (AIKO) is planned for the years 2016-2019. It includes the idea of regional expertise and experimentation and the focus on regional strengths (similar to S3), but it also includes elements of the former national policies, such as smart city development and specific (city-driven) growth areas.[25]

2. The Region of Ostrobothnia

a. Overview

Ostrobothnia consists of 7,752 square kilometres of land and has a population of over 181,000 people. The regional capital is the City of Vaasa with over 66,000 inhabitants. Vaasa also has the biggest concentration of innovative activities in the region. The region's energy technology cluster is the most extensive in the Nordic countries. Besides the multinational energy technology companies, the region also possesses many smaller companies, especially in the surrounding countryside. Among the Ostrobothnia´s workforce, 6.1 % earn their living from agriculture, 29.6 % from industry and 63.5 % from the service sector. Ostrobothnia is quite a strong exporter, with over 60 % of the regionally produced industrial products going abroad. When it comes to renewable energy products, the export share is over 70 %. The Ostrobothnia´s GDP is € 5.9 billion and its GDP per capita is 127.7 % higher than the average EU-27 equivalent.[26]

Within the renewable energy field, R&D activities are strongly concentrated in the big companies. This is largely due to the fact that over 80 % of researchers in the region are working for companies. The regional campuses of four universities (University of Vaasa, Åbo Akademi, Hanken School of Economics, University of Helsinki [Law School]), two universities of applied sciences (VAMK – Vaasa University of Applied Sciences, NOVIA - Novia University of Applied Sciences), and a mutually owned industrial design agency (MUOVA) are also located in the region. These universities host over 12,000 students. In total, the region of Ostrobothnia spends approximately 2.6 % of its GDP on research. Of all the research personnel in Finland, over 2.5 % lives in the region. Ostrobothnia has a strong focus on research compared to the Finnish average.[27]

b. Smart Specialisation Process in Ostrobothnia

Table 1 illustrates the development of the smart specialisation process in Ostrobothnia in 2012-2014 by presenting the major S3 activities, or steps, over time. It also gives information regarding the length of the process and is based upon project documentation (unpublished emails and calendar markings). Interestingly, the S3 planning in the Ostrobothnia region began when researchers from the University of Vaasa contacted the Regional Council of Ostrobothnia and informed their staff about the S3 platform in Seville, and its potential to improve innovation processes. Ostrobothnia was the first Finnish region to join the S3 platform in 2012. This contact also initiated a six-month planning period where knowledge was transferred between the partners and a research plan to produce regional S3 was prepared. The S3 research project was coordinated by the Regional Council of Ostrobothnia and included personnel

22 Research and innovation council, Uudistava Suomi: tutkimus- ja innovaatiopolitiikan suunta 2015–2020 [Renewing Finland: Aims for research and innovation policy]. <http://www.minedu.fi/export/sites/default/OPM/Tiede/tutkimus-_ja_innovaationeuvosto/julkaisut/liitteet/Linjaus2015-2020.pdf> accessed on 17 November 2015.

23 Ministry of Employment and the Economy (2010), Aluekehittämisstrategia 2020 [Regional Development Strategy] <http://www.lamk.fi/projektit/enne/materials/Documents/23_2010_web.pdf> accessed 23 March 2016.

24 M. Lindqvist, L. Smed Olsen, L Perjo, H. Claessen *Implementing the Concept of Smart Specialisation in the Nordic Countries* (2013) Nordregio Working Paper, 1, pp. 1-46.

25 Ministry of employment and the economy, Innovation clusters and regional innovation activities. <http://www.tem.fi/innovaatiot/innovaatiokeskittymat>-- accessed on 27 November 2015.

26 Regional Council of Ostrobothnia, Ostrobothnia in numbers 2015. <http://www.obotnia.fi/assets/1/Publikationer/Pohjanmaa-lukuina2015-webb.pdf> accessed on 23 March 2016; AMCER report, Regional report - Ostrobothnia. <https://www.espon.eu/export/sites/default/Documents/Projects/TargetedAnalyses/AMCER/FR/Ostrobotnia_regional_profile_AMCER_FR.pdf> accessed on 15 December 2015.

27 AMCER report, Regional report - Ostrobothnia. <https://www.espon.eu/export/sites/default/Documents/Projects/TargetedAnalyses/AMCER/FR/Ostrobotnia_regional_profile_AMCER_FR.pdf> accessed on 15 December 2015.

Months	Six steps in Ostrobothnia					
Preparation	*Preparation for the strategy process took 6 months*					
1	Analysis	**Governance**	Vision	Priorities	Policy mix	Monitoring and evaluation
2	**Analysis**	**Governance**	Vision	Priorities	Policy mix	Monitoring and evaluation
3	Analysis	**Governance**	Vision	**Priorities**	Policy mix	Monitoring and evaluation
4	Analysis	**Governance**	Vision	Priorities	Policy mix	**Monitoring and evaluation**
5	Analysis	**Governance**	Vision	Priorities	**Policy mix**	Monitoring and evaluation
6	**Analysis**	**Governance**	**Vision**	Priorities	Policy mix	Monitoring and evaluation
7	**Analysis**	**Governance**	Vision	Priorities	Policy mix	Monitoring and evaluation
8	Analysis	Governance	Vision	Priorities	Policy mix	Monitoring and evaluation
9	Analysis	**Governance**	Vision	Priorities	Policy mix	Monitoring and evaluation
10	**Analysis**	Governance	Vision	Priorities	Policy mix	Monitoring and evaluation
11	**Analysis**	Governance	Vision	Priorities	Policy mix	Monitoring and evaluation
12	**Analysis**	Governance	Vision	Priorities	Policy mix	Monitoring and evaluation
13	**Analysis**	Governance	Vision	Priorities	Policy mix	Monitoring and evaluation
14	**Analysis**	**Governance**	Vision	Priorities	Policy mix	Monitoring and evaluation
15	**Analysis**	**Governance**	Vision	Priorities	Policy mix	**Monitoring and evaluation**
16	Analysis	**Governance**	Vision	Priorities	Policy mix	Monitoring and evaluation
17	**Analysis**	**Governance**	Vision	Priorities	Policy mix	**Monitoring and evaluation**
18	Analysis	**Governance**	Vision	**Priorities**	Policy mix	Monitoring and evaluation
19	Analysis	**Governance**	Vision	Priorities	**Policy mix**	**Monitoring and evaluation**
(Major steps of the S3 process are marked by bold text)						

Table 1: The development of smart specialisation in Ostrobothnia in 2012-2014
Source: Authors' own compilation.

from several local universities and development agencies.

Official work on the regional S3 process began at the end of 2012 with extensive regional analysis. The members of the research group analysed previous regional development reports and collected data on the important specialisation fields. In the end, three main industries were considered regional fields of specialisation regarding technologies and products: (i) energy technology, (ii) boat building, (iii) fur farming. All these fields have strong export activities and global connections and are a good reflection of the various activities occurring in Ostrobothnia. Energy technology is strongly represented in Vaasa, boat building in the nearby city of Pietarsaari and surrounding areas. Fur farming is a regional speciality in the surrounding countryside.

After the selection of key industries the discussion about the focus and vision of the strategy continued. Based on these discussions, it was widely acknowledged that regional cooperation or connectivity would be beneficial for the region. At an early stage, the Regional Council decided that a specific evaluation and monitoring tool on cooperation would help the strategy process. Originally, the idea was to develop a tool to analyse technological cooperation in the region (*i.e.* measure the technological domains) but the scope of the tool soon widened to other types of innovation cooperation and thus included activities such as fur farming, services etc. This also meant that the framework for the tool was consistent with triple helix theory,[28] as the cooperation of three main

28 L. Leydesdorff & H. Etzkowitz *The Triple Helix as a model for innovation studies* Science and Public Policy, 25, pp. 195–203; H. Etzkowitz & L. Leydesdorff *The dynamics of innovation: from National Systems and 'Mode 2' to a Triple Helix of university–industry–government relations* (2000) Research Policy, 29, pp. 109-123.

regional sectors (universities, companies and public organisations) provided a solid theoretical background as the theory was also a part of the original RIS3 guide.[29] The tool became central to the strategy because it enabled objective calculations regarding the innovation field and thus provided a good method for evaluating the distribution of ESI Funding (€ 10 million for the programming period 2014-2020).

After receiving and analysing comments about the tool from international research experts, Elias Carayannis at George Washington University and Håkon Finne at SINTEF in Norway, the strategy, concentrating on the connectivity tool, was presented at the international S3 Platform conference in Vaasa in May 2013. After the Vaasa conference, it was decided that connectivity and the measuring tool should be focal issues of the Ostrobothnia´s strategy. Alongside this, the region decided that it should evaluate the connections of the selected industries as well as the future technologies that involve them.

In late 2013, three questionnaires on cooperation were sent to respondents from the different helices (public organisations, universities and companies). The respondents were all in leadership positions, meaning that they were well placed to answer questions regarding cooperation. Following the data collection (53 respondents in total) and analysis, the respondents and other regional experts were invited to focus group meetings to comment on the findings. The outcome of the focus group meetings was then used as background for planning policy interventions in order to bridge the gaps in cooperation between regional actors. The aim is to repeat the S3 connectivity study annually or biannually in order to analyse the development of regional connections. This helps to address monitoring and evaluation step, which is considered to be very important in the S3 concept. Regional Council of Ostrobothnia can utilise the connectivity tool for reporting their progress with the strategy.[30] It should be noted, that the first regional measurement was *ex-ante* monitoring by nature. The forthcoming further analyses shall be compared to the baseline values for full effect.

Following the development of the Ostrobothnia´s connectivity model in the years 2013–2014, the Regional Council has arranged a logical framework analysis (LFA) with local stakeholders. Its main aim is to address issues in cooperation between companies and their suppliers as these were the biggest issues in cooperation according to the first measurements. The Regional Council decided to support three projects with this specific aspect of cooperation as the main focus. During the year 2015, the Regional Council also organised additional data collection via network survey and the results were once again presented to the focus groups. The Regional Council is currently working on similar new LFA analysis where they try to gather proposals for projects. The regional officials also continue writing of the official S3 document. There are also plans for new cooperation with international regional partners, who want to hear more about Ostrobothnia´s method and utilise it on their own regions. The region of Nordland in Norway, for example, also utilised the connectivity tool. An international comparison between Nordland and Ostrobothnia would be a good practise to further develop the model and also share good practices transnationally.

3. The Region of Lapland

a. Overview

Lapland in North Finland consists of an area of 92,665 square kilometres, which is 25.7 % of Finland's land area. There are 181,748 inhabitants in Lapland, which is 3.4 % of Finland's population (situation in 2014). The largest residential centres are Rovaniemi (61,551 inhabitants), Tornio (22,322 inhabitants) and Kemi (21,929 inhabitants).[31] Among the Lapland´s workforce, 5.2 % earn their living from agriculture, 20.0 % from industry and 73.1 % from the service sector.[32]

The major higher education institutions of Lapland are the University of Lapland and the Lapland University of Applied Sciences. Moreover, Lapland´s research and education network includes regional

29 D. Foray, D.Goddard, J. Beldarrain *et al. Guide to Research and Innovation Strategies for Smart Specialisation (RIS3)* (European Commission, 2012).

30 A. Mäenpää, S. Virkkala *Introduction* (2014) Proceedings of the University of Vaasa, 196, pp. 1-15: p. 11.

31 Regional Council of Lapland, Väestö [Population], <http://www.lappi.fi/lapinliitto/195> accessed on 15 March 2016.

32 Regional Council of Lapland, Työpaikat ja työllisyys [Jobs and Employment], <http://www.lappi.fi/lapinliitto/194> accessed on 15 March 2016.

units of *e.g.* the Geological Survey of Finland, the Finnish Environment Institute and the Natural Resources Institute Finland (Luke).

b. Smart Specialisation Process

Lapland's smart specialisation strategy was prepared by the Regional Council of Lapland between October 2012 and November 2013 as part of the ERDF project "Lapland - A Strong Arctic Expert". The S3 in Lapland was called as Arctic Specialisation Strategy.[33] From the beginning, the six-step approach was adopted as the main approach to the strategy. Moreover, the strategy development process included intensive cooperation with the EU S3 Platform. Lapland was registered in late 2012 as a member of the S3 Platform. The Arctic Smart Specialisation Draft programme for Lapland was presented at the S3 Peer Review event in Mallorca, Spain, in February 2013. The Peer Review event provided valuable input to the S3 process in Lapland, including the introduction and preliminary analysis of the six-step presentation format, which was a prerequisite for the Peer Review presentation.

Lapland's S3 document, which was published in late 2013, contains 50 specific proposals for action for the period 2014-2020. The proposals are divided into three main categories: (i) the refining of Arctic natural resources, (ii) utilisation of Arctic natural conditions and (iii) cross-cutting development enabling Arctic growth. The programme is linked with Lapland's Arctic Specialisation roadmap, which sets out the phasing of the various actions for the period 2014-2020. *Table 2* illustrates the development of the S3 process in Lapland during the years 2012-2015.

The Smart specialisation project group at the Regional Council of Lapland analysed the existing regional development programmes in Lapland, in particular the ERDF Programme 2007-2013 for the Lapland region. Moreover, the national Arctic strategy in Finland was analysed, as well as the recent regional development documents by the Regional Council of Lapland. Governance issues and ensuring participation and ownership were given a high priority from the beginning of the Arctic specialisation project. The Steering Group of the project, headed by the Director of Regional Council of Lapland, consisted of representatives of institutions such as *e.g.* universities, Chamber of Commerce, and major cities in Lapland. Broad participation of public and private actors was secured through a combination of active dissemination, workshop, and surveys. A specific survey was undertaken with key companies in order to include their opinions and ideas in the strategy development process. The overall vision of the Arctic Specialisation programme was formed based on the work of the Project Group and the stakeholder meetings, in 2012-2013. The draft version of the S3 document was disseminated to major stakeholders in Lapland in 2013 for their remarks and additions, which were taken into account in the final version of the strategy.

In setting the regional priorities, the following themes were selected for use as the starting point of the Arctic Specialisation Programme: Business Lapland, Expertise Lapland, International Lapland, Sustainable Lapland, and Citizen´s Lapland. In order to identify the key regional priorities, the authors of the Arctic Specialisation Programme organised, and participated in, regional workshops in 2012-2013. The programme work resulted in the following list of major Arctic spearhead fields in Lapland: the mining and metal industry, tourism and bio-economy. Much emphasis was put into preparing a roadmap for the period 2014-2020, including identification and listing of 50 specified proposals for action for the period.

Lapland's Arctic Specialisation Programme provided wide framework and guidelines for the future S3 monitoring and evaluation work. According to the document, the implementation of the programme will be monitored and assessed "taking into consideration the needs of different target groups and beneficiaries of the proposals for action and strategic objectives, and monitoring the financing programmes used in the implementation and assessment practices".[34]

As illustrated in *Table 2*, the regional smart specialisation strategy process in Lapland took place in three major phases: (i) the strategy formation (2012-13), (ii) the preparatory phase prior to S3 implementation (2014), and (iii) the implementation

33 Regional Council of Lapland, Lapland´s Arctic Specialisation Programme. <http://www.lapland.fi/en/lapinliitto/c/document_library/get_file?folderId=53982&name=DLFE-21455.pdf> accessed on 15 December 2015.

34 Regional Council of Lapland, Lapland´s Arctic Specialisation Programme. <http://www.lapland.fi/en/lapinliitto/c/document_library/get_file?folderId=53982&name=DLFE-21455.pdf> accessed on 15 December 2015, pp. 62-63.

Months	Six steps in Lapland					
Preparation	*Preparation for the strategy process took 1 month*					
1	**Analysis**	**Governance**	Vision	Priorities	Policy mix	Monitoring and evaluation
2	**Analysis**	**Governance**	Vision	Priorities	Policy mix	Monitoring and evaluation
3	**Analysis**	Governance	**Vision**	Priorities	Policy mix	Monitoring and evaluation
4	**Analysis**	Governance	Vision	Priorities	Policy mix	Monitoring and evaluation
5	**Analysis**	Governance	**Vision**	**Priorities**	Policy mix	Monitoring and evaluation
6	**Analysis**	Governance	Vision	Priorities	Policy mix	Monitoring and evaluation
7	Analysis	**Governance**	**Vision**	**Priorities**	Policy mix	Monitoring and evaluation
8	Analysis	**Governance**	**Vision**	**Priorities**	Policy mix	Monitoring and evaluation
9	Analysis	**Governance**	**Vision**	**Priorities**	Policy mix	Monitoring and evaluation
10	Analysis	Governance	Vision	Priorities	Policy mix	Monitoring and evaluation
11	Analysis	**Governance**	**Vision**	**Priorities**	Policy mix	Monitoring and evaluation
12	Analysis	**Governance**	**Vision**	**Priorities**	Policy mix	Monitoring and evaluation
13	Analysis	**Governance**	Vision	**Priorities**	**Policy mix**	Monitoring and evaluation
14	Analysis	**Governance**	Vision	**Priorities**	**Policy mix**	**Monitoring and evaluation**
15	Analysis	**Governance**	Vision	Priorities	**Policy mix**	**Monitoring and evaluation**
Preparatory phase before S3 Implementation projects during 2014						
28	Analysis	**Governance**	**Vision**	Priorities	Policy mix	Monitoring and evaluation
29	Analysis	Governance	Vision	**Priorities**	**Policy mix**	Monitoring and evaluation
30	Analysis	Governance	Vision	**Priorities**	**Policy mix**	Monitoring and evaluation
31	Analysis	Governance	Vision	**Priorities**	Policy mix	Monitoring and evaluation
32	Analysis	**Governance**	Vision	**Priorities**	**Policy mix**	Monitoring and evaluation
33	Analysis	**Governance**	Vision	Priorities	**Policy mix**	**Monitoring and evaluation**
34	Analysis	Governance	Vision	Priorities	Policy mix	Monitoring and evaluation
35	Analysis	Governance	**Vision**	Priorities	Policy mix	Monitoring and evaluation
36	Analysis	Governance	Vision	**Priorities**	Policy mix	**Monitoring and evaluation**
37	Analysis	Governance	Vision	**Priorities**	Policy mix	Monitoring and evaluation
38	Analysis	Governance	Vision	**Priorities**	Policy mix	Monitoring and evaluation
39	Analysis	**Governance**	Vision	Priorities	**Policy mix**	**Monitoring and evaluation**
(Major steps of the S3 process are marked by bold text)						

Table 2: The development of smart specialisation in Lapland in 2012-2015
Source: Authors' own compilation.

project phase (beginning in month 28 and currently ongoing). Following the completion of the S3 document in late 2013, the Regional Council of Lapland began preparatory activities for the S3 implementation project. In 2014, the preparatory activities included a workshop in Rovaniemi, Finland on the topic of Research and Innovation Strategies for Smart Specialisation (S3) in Sparsely Populated Regions, arranged in partnership with the S3 Platform in Seville.[35] The Rovaniemi workshop inspired the Regional Council of Lapland to start a specific project

35 As a follow-up of the workshop, see: J. Teräs, A. Dubois, J. Sörvik and M. Pertoldi *Implementing Smart Specialisation in Sparsely Populated Areas* (2015) European Commission. Joint Research Centre. S3 Working Paper 10/2015.

Table 3: Comparison between smart specialisation processes in Ostrobothnia and Lapland

Region	Ostrobothnia	Lapland
Initiative to the regional S3 process and participation	S3 process started by Regional Council but the contact between local researchers and EU S3 platform was of crucial importance. Steering group by public sector and university representatives. Companies as respondents, some companies in focus groups. Some civil society connections and international experts involved	S3 process started by Regional Council. Steering group by public sector and university representatives. Companies as respondents, some companies participating the workshops. Some civil society connections. Commentary remarks to strategy by municipalities in Lapland. International experts engaged especially during the implementation phase 2015-2016
Main fields of S3 intervention and strategy	Energy technology, Boat industry, Fur industry Triple helix connections	Refining of natural resources (timber, livestock, mining etc.), utilisation of Arctic natural conditions (tourism), cross-cutting development enabling arctic growth (e.g. arctic vehicle testing)
Implementation process	Focus on governance and analysis, S3 process of 19 months. Follow-up process by annual checking of the S3 strategy	Focus on governance, vision setting, priority selection and policy mix. S3 process of 15 months. An additional S3 implementation project currently ongoing
Outcomes and next steps	Analysis of the regional innovation network and concrete suggestions to bridge the gaps in it. Next steps involve selection of targets to focus on and annual repetition of the analysis. Ostrobothnia also lacks official strategy document	Official strategy document prepared and published, with engagement of a broad group of actors. Implementation as a separate follow-up project under way. Smart clusters (domains) identified after the S3 phase, during the follow-up phase. Focus on evaluation & monitoring as the next step
Estimated ESI Funds in 2014-2020	Over € 10 million	Over € 130 million

Source: Authors' own compilation.

in late 2014 to catalyse the implementation phase of the Lapland Arctic Specialisation Programme. In 2015, an implementation project of the Arctic Specialisation strategy was carried out by the Regional Council of Lapland. Five local smart clusters were identified in 2015: Arctic Industry, Arctic Rural Networks, Arctic Design, Arctic Security, and Arctic Development Infrastructure. A regional development project Arctic Smartness Portfolio (ASP) was implemented in the second half of 2015 to coordinate the broad range of actors in Lapland to the Arctic Smart Specialisation Programme, with focus on the identified smart clusters, with international experts engaged.

V. Cross-Case Analysis

Now that we have presented the smart specialisation implementation processes of Ostrobothnia and Lapland, we will move on to comparative analysis regarding the S3 implementation in the two case study regions. *Table 3* illustrates the comparison between Ostrobothnia and Lapland on relevant implementation issues.

The key actors behind the strategy processes in both Ostrobothnia and Lapland gained basic knowledge of the key S3 concepts at an early stage of the strategy development process. The regions built their strategies based on accumulated knowledge as well as evidence-based documents related to the regions. The S3 in Ostrobothnia and in Lapland also have a clear overall vision: Ostrobothnia wants to be regarded as "Connected Region" and Lapland aims to be a region with "Arctic Expertise". Both regions continue their support for existing industries, and completely novel industrial and/or business directions are not proposed in the strategies. The regions seem to have followed their former regional strategy frameworks. Ostrobothnia is still aiming to en-

hance regional innovation capabilities and Lapland aims to become known for its arctic knowledge.[36] Both regions have significant export activities and tourism and as a result they already interact with international markets in accordance with the aims of S3.

Ostrobothnia and Lapland both valued the S3 as a way to strengthen the region. They presented their strategy suggestions on the S3 Peer Review events early in the preparation process in order to get external ideas for the strategy work. Interestingly, both regions relied heavily on public sector and university experts in the preparation of the strategy. Companies were mainly involved as survey respondents only. The S3 processes of the two case study regions so far largely lack concrete examples of entrepreneurial discovery with significant involvement of actual companies and entrepreneurs.

Even though there are similarities between the S3 processes in Ostrobothnia and Lapland, major differences can also be identified. Ostrobothnia created a model which measures the regional connectivity via triple helix concept, which is rather theoretical approach and also not absolutely place-based. The overall strategy has some focus on the development of local industries as well, but one could argue that this development plays a minor role when compared to the connectivity model. This was a deliberate initiative by Ostrobothnia, as the region intentionally emphasised international comparison and learning between regions – both of which were assisted by the model development. Lapland's S3 strategy is directly attached to regional arctic infrastructure and thus is not transferrable to other places directly. This seems appropriate because of the relatively unique arctic environment. Lapland´s strategy focuses more on thematic specialisation instead of traditional sectors, which fits well to S3 guidelines.

One of the biggest differences between the regional processes in the two case study areas is the overall length of the strategy work. In Ostrobothnia the strategy process took 19 months, but still lacks the official strategy document. In Lapland the strategy process was completed in 15 months, which was followed by separate implementation process which is still underway. The implementation process complements Laplands smart specialisation strategy, including a section on smart clusters, following largely the domains introduced by the S3 concept and engaging more company involvement. The Lapland case with a preparation phase before the actual implementation of the S3, or "cognitive break" and its later work on smart clusters demonstrates the importance of adequate time being allocated into the S3 process, especially the implementation phase. Ostrobothnia's strategy involves yearly measurements of connectivity, so the duration of the S3 process might be difficult to compare between the regions. Lapland seems to have been slower in formulating the structure of the programme, whereas Ostrobothnia proceeded rapidly with the S3 process from the outset, but has not yet completed it with official documentation.

Ostrobothnia spent more time on governance and analysis steps during the overall strategy process whereas Lapland had a considerable focus on priority selection and policy mix as well as vision of the strategy. This can largely be explained by the focus on the connectivity model in Ostrobothnia, including lots of testing and analysis. Lapland, on the other hand, focused more on themes and concepts which included additional work on development paths and various scenarios for the chosen specialisation fields. Regarding monitoring and evaluation, Ostrobothnia presents concrete measurements and thus has developed a solid tool for evaluating the regional strategy in the coming years, whereas Lapland has, for the most part, left the details of monitoring and evaluation for future work.

One could conclude that Lapland has written its strategy largely following the EU's RIS3 guide, whereas Ostrobothnia puts specific focus on international comparison and direct measurements via the developed connectivity model. One important factor that may have an influence on different S3 approaches by Ostrobothnia and Lapland is the difference in the allocation of ESI Funds between the regions. Ostrobothnia's estimated total share of these funds for the period 2014-2020 is slightly over € 10 million and the measuring tool gives important analytical data for prioritising its distribution to projects, whereas Lapland´s estimated share of ESI Funds is over

36 Ministry of Employment and the Economy, Pohjanmaan maakuntaohjelma 2011-2014 [Ostrobothnian Regional Strategic Program] <http://www.tem.fi/files/27983/15_Pohjanmaa_MAO_07062010_muutoksin.pdf> accessed 23 March 2016; Regional Council of Lapland, Lapin maakuntaohjelma 2011-2014 [Laplands Regional Strategic Program] <http://www.lappi.fi/lapinliitto/c/document_library/get_file?folderId=26465&name=DLFE-11190.pdf> accessed 23 March 2016.

€ 130 million for the period 2014-2020.[37] This is partly because of Lapland´s peripheral and arctic location, as majority of Finnish ESI Funds is directed for rural development.[38]

VI. Conclusions and Recommendations

In this article we analysed the smart specialisation implementation process, using two Finnish case study regions in Ostrobothnia and Lapland as empirical material. We began by presenting background information regarding the S3 process and unpacking the various steps of the implementation process. This revealed the similarities and especially the differences in S3 implementation processes between the regions. Our main conclusions and lessons learned largely focus on the following issues: the time needed for the S3 process, the balance between the old regional development plan and the new S3 approach, especially regarding entrepreneurial discovery, and the role of funding.

Firstly, we conclude that the implementation of S3 requires a considerable amount of time in order to be effective and inclusive. The new regional innovation policy concept of S3 seems to require far more time and communication activities than initially estimated by the European Commission and the regions. In some regions, a "cognitive break" may even be needed between completion of the strategy document and its actual implementation across the region.

Secondly, the regions face the risk of not fully utilising the regional capacity for entrepreneurial discovery with the S3 approaches because of limited participation by companies and entrepreneurs in the region. The increased participation of companies is crucial for establishing more significant results and, as a result, strategies for involving the private sector require further improvement. Even when the concept of entrepreneurial discovery is understood, the practical involvement and engagement of companies in the S3 implementation remains a challenge.

Thirdly, the ESI Funds allocated to the regions to realise their smart specialisation strategies may appear to be in a considerable role in preparing and implementing the regional strategies. The regions are motivated to participate in the S3 work largely because of the *ex-ante* condition related to the strategy. The allocation of ESI Funds to the regions naturally effects the engagement of regional actors in a long-term regional S3 development and implementation process and raises an interesting question about the correlation between funding and implementation.

Future research about the implementation of S3 will be vital in determining whether specialisation efforts actually produce new value-added activities and processes with a larger impact to the regions. It appears that more research is also needed to better understand the practical challenges the regions face. It would be interesting to compare the length of the regional S3 processes in the European regions, and to analyse the ways the regions have implemented, as opposed to just prepared, their smart specialisation strategies to meet the *ex-ante* condition of funding. Another important issue for further research is entrepreneurial discovery and how it is approached in the actual strategy work. Good practices and examples in European regions are worthy of increased research and dissemination because of the difficulties that regions face regarding the concept. It should be noted, too, that possible changes in the S3 concept after the programming period 2014-2020, already under discussion, are likely to have an implication to the regions and their S3 processes.[39] This further validates studies concerning practical S3 implementation processes.

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37 Structuralfunds.fi, Kestävää kilpailukykyä ja työtä 2014–2020. Suomen rakennerahasto-ohjelma [Sustainable competitiveness and work 2014-2020. Finnish structural funds programme]. <http://www.rakennerahastot.fi/documents/10179/43217/rr_2014_2020_yleisesittely.pdf/958a5c3f-7a1f-471d-9bfb-27f8cd423818 > accessed 23 March 2016.

38 W. Petzold *What if Cities and Regions Governed EU Regional and Urban Policy?* (2015) EStIF European Structural and Investment Funds Journal, Vol. 3, Nr. 1, pp. 12-20: p. 16.

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In Search of Domains in Smart Specialisation

Case Study of Three Nordic Regions

Antti Mäenpää and Jukka Teräs

Abstract

The European Union has promoted regional smart specialisation strategies for some years, and several studies on this topic have focused on key concepts such as the entrepreneurial discovery process and good implementation practices. However, the definition and the role of the domain in regional smart specialisation settings is largely missing, despite it being an important outcome of a successful entrepreneurial discovery process. This article aims to fill this research gap by establishing what a domain entails as a theoretical concept, its role in the entrepreneurial discovery process and how it has featured in regional smart specialisation strategies. Our study analyses and compares three smart specialisation strategies in the Nordic regions of Lapland (Finland), Värmland (Sweden) and Nordland (Norway), focusing on the understanding and adaptation of the domain concept. The results indicate that the regions have managed to establish domains, even though the concept itself has not been adopted in the regions because of insufficient clarification of the term.

Keywords: *smart specialisation, entrepreneurial discovery process, domain, innovation policy*

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1. Introduction

In recent years, European regions have been preparing smart specialisation strategies. A smart specialisation strategy was developed as part of the European innovation strategy approach by the European Commission's Knowledge for Growth expert group, with the aim of promoting European innovation activities (and competing against the United States and Japan) by focusing on regional strengths (McCann & Ortega-Argilés 2013; Barca 2009; Foray & Van Ark 2007). The overarching idea with smart specialisation is that regions identify their evidence-based innovation activities and attempt to combine them in new ways to provide products and services that are attractive in the global market (Foray & Goenega 2013; Foray et al. 2012). The entrepreneurial discovery process, or "regional entrepreneurship", is promoted by highlighting the knowledge of the markets. In fact, entrepreneurial discovery processes form the very core of smart specialisation (Foray 2017).

Although entrepreneurial discovery processes have been widely studied in terms of different case studies and good practices (see, e.g. Dubois, Kristensen & Teräs 2017; Ylinenpää, Teräs & Örtqvist 2016; Periañez Forte, Marinelli & Foray 2016; Kroll 2015), there has been little interest in another key concept of smart specialisation, namely the domain, despite the fact that it is the outcome of successful entrepreneurial discovery processes. One way to measure this lack of interest is to search for how often the term "domain" is used in the relevant literature. For example, in the smart specialisation strategy documents of the case study regions discussed in this paper, the term "specialisation" is mentioned 134 times, but the term "domain" is mentioned only once. Even in the official smart specialisation guidebook (Foray et al. 2012), "domain" is only mentioned 14 times, whereas "specialisation" is mentioned 175 times.

According to the Smart Specialisation Platform (RIS3 Platform 2017a), a smart specialisation domain is an "R&D or innovation area characterised by distinctive knowledge". The domain concept is a crucial part of the entrepreneurial discovery process and, in our view, it should be properly addressed in regional smart specialisation strategies. Strategy implementation that ignores this concept may result in problems in the future; therefore, the clear research gap in this area indicates that the concept deserves closer examination. In this paper, we present our findings regarding the exact nature of domains and their practical use, thus adding to the literature on smart specialisation.

Many Nordic regions have followed the Southern European regions by actively participating in the RIS3 platform of the European Union (EU), which is located in Seville, Spain. This platform was established in 2011 to give European regions guidance on strategy formulation. The Nordic countries are especially interesting in terms of their strategy implementation processes because they began their regional innovation processes for smart specialisation relatively early and, therefore, have already tackled some of the related practicalities (see Ylinenpää, Teräs & Örtqvist 2016; Lindqvist et al. 2013). In his analysis of European-

wide smart specialisation strategy practices, Kroll (2015) states that Northern European regions have added to the overall strategy process and, therefore, we consider that their views regarding the establishment of the domain concept are worthy of further examination.

In this paper, we explore the adaptation of the smart specialisation concept from the viewpoint of the domain in three non-metropolitan Nordic regions: Lapland (Finland), Värmland (Sweden) and Nordland (Norway). Thus, we include case studies of EU and non-EU members—whereas Finland and Sweden are EU members, Norway is not. It is interesting that Nordland, as a region of a non-EU member state, has also developed a smart specialisation strategy, even though it cannot receive EU structural funds. This highlights the practical use of smart specialisation strategies in regional development.

The article focuses on analysing domains in the smart specialisation literature and interpreting domains in the regions applying the smart specialisation concept. The aim is to gain a better understanding of domains on a theoretical and a practical level. We achieve this by focusing on the following research questions:

- What are the key characteristics of domains based on the smart specialisation literature?
- How are domains translated into practice in regional smart specialisation strategies?

The paper is structured as follows. First, we provide a literature review on the concept of the domain in relation to smart specialisation. Then, we establish domains as structured themes for regional development, which are established in practice through implementation processes. Thus, we emphasise the actual use of the domain concept in practice. The empirical part of the paper tests our interpretation of the domain concept and consists of a comparative analysis regarding understanding and adaptation of the domain concept of smart specialisation in the case study regions. This is conducted by studying the official smart specialisation strategy documents in the regions and by interviewing the regional stakeholders and experts who have been participating in developing their local smart specialisation strategy. The last part of the paper consists of a concluding comparative analysis and discussion.

2. The concept of the domain in smart specialisation

There are several definitions of "domain" in dictionaries, but the most fitting in our context is the description of a domain as "a specified sphere of activity or knowledge" (Oxford English Dictionary 2016) or as "an area of interest" (Cambridge Dictionary 2017). To study the concept of a domain in smart specialisation, it is crucial to pinpoint what it actually entails and how it works in relation to other key concepts. Domains can be described as "end results" of entrepreneurial discovery processes. Therefore, to understand domains, it is important to first understand how an entrepreneurial discovery process works.

An entrepreneurial discovery process and the ability to examine regional activities through an entrepreneurial lens is crucial in smart specialisation, because traditional innovation policies have often lacked knowledge of markets and aimed for top-down, technology-heavy policies (Periañez Forte, Marinelli & Foray 2016: 15). Foray (2015) describes entrepreneurial knowledge as a key enabler of domains that consists of knowledge about technology, markets and competition. Entrepreneurial knowledge is knowledge of the possibilities and hidden potentials of the region and, as Foray (2015) highlights, it is impossible to obtain such knowledge completely without a proper understanding of the perceptions of key actors.

An entrepreneurial discovery process can be described as the collective entrepreneurship of a region, as regional stakeholders gather to discuss and decide what realistic markets potentially exist for regionally produced products. Companies play a crucial role in regional development and are considered important partners in acquiring entrepreneurial knowledge. In addition, it should be noted that universities and various public organisations (especially development organisations) may also possess entrepreneurial knowledge. These sources of knowledge and expertise are especially important for regions that lack significant export-oriented activities (Foray 2015; Foray et al. 2012). It is not surprising that stakeholder activation and good governance have been highlighted in the recent official smart specialisation policy literature (see, for example Radosevic et al. 2017; Gianelle et al. 2016).

Entrepreneurial discovery processes vary by region, but we argue that they include the analysis of existing capabilities and the facilitation of stakeholder meetings, in which regional stakeholders examine and verify the possibilities (Figure 1). Then, smart specialisation strategy objectives and projects implementing the strategy are initiated based on the analysis of regional capabilities and the outcomes of the stakeholder meetings. Most of the regions appear to follow this pattern. Sometimes, regional processes require several iterative rounds before the preparation of the smart specialisation strategy (Vallance 2017; Teräs & Mäenpää 2016).

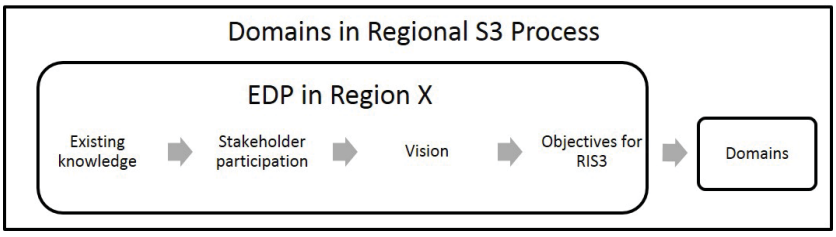

Figure 1: *Phases of the regional S3 process.*

According to Foray (2015), entrepreneurial discovery processes are required to determine the possibilities for domains. He states that the appropriate number of actors for establishing domains is somewhere between single actors and entire sectors (including clusters). In addition, domains may be centred on technological solutions or on new

markets. For example, digitalisation may provide new solutions for the modernisation of existing technologies and new ways to approach global consumers. Regardless of the actual scale or form of activity (transition, modernisation, diversification or radical foundation), the focus of a domain is decided via an entrepreneurial discovery process whereby regional actors present their ideas on specialisation and shape the domain according to local needs and limitations (Foray 2015).

We suggest that one way to understand domains is to view them as "themes" for the region. Collective intra- and extra-regional opportunities/projects are added to these "themes" that direct the emphasis of specialisation, and innovations and activities come out of this "thematic construct". These are the main outcomes of the process for regions, as new resources will be generated and new jobs established. Entrepreneurial ideas are presented by single actors (organisations or individuals) and not by dominating clusters or industries. These different views further enhance the regional innovation process and may lead to further discoveries, which in turn may prompt new domains. In summary, to prepare a regional innovation strategy for smart specialisation, the region, with its companies, clusters and other regional actors, will be initiated into an entrepreneurial discovery process, which stimulates the creation of domains (see Figure 2).

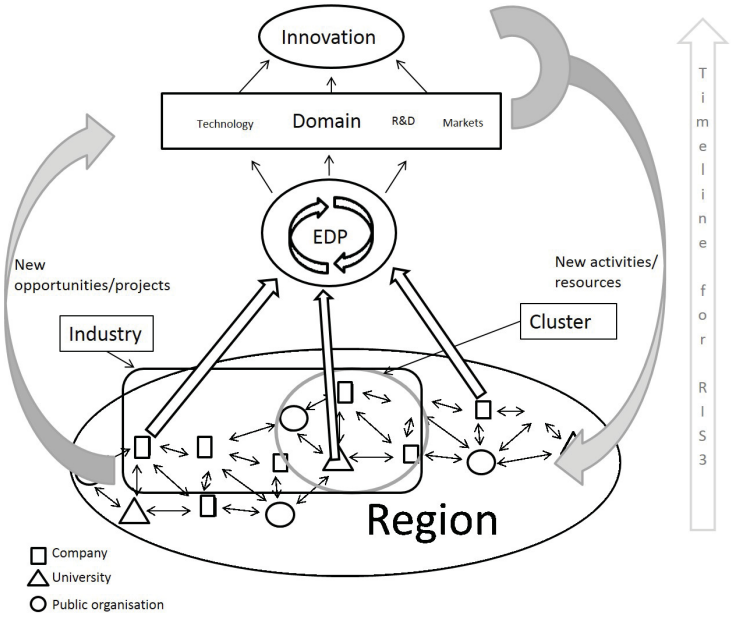

Figure 2: *Domains and the entrepreneurial discovery process (EDP).*

Domains are one way to enhance structural growth (by combining actors) and they offer an opportunity for regions to "brand" themselves on a global level. It has also been stated that domains share similarities with niche markets, as both require distinctive knowledge of the market (international) and the products (local) (Gianelle et al. 2016). One way of understanding a domain is to see it as the human knowledge that is required to create niches, as a precondition for creating something totally new (Gianelle et al. 2016).

One important issue is the focus of domains. Nauwelaers et al. (2014) distinguish between policy domains focusing on thematic prioritisation, which can be based on markets or technologies, and those focusing on functional prioritisation, such as system failure or connectivity problems. The functional focus may uncover gaps in regional networks, and thus reveal new collaboration opportunities that may turn out to be new domains if they are enhanced and prioritised (Virkkala, Mäenpää & Mariussen 2017). Thematic prioritisation is more general than functional prioritisation, but there are examples of regions that focus on improving the functioning of regional networks in addition to adopting a thematic approach (Teräs & Mäenpää, 2016; Virkkala, Mäenpää & Mariussen 2014). Therefore, we suggest that a functional focus can be seen as one theme for specialisation.

Based on the smart specialisation literature (Foray 2015; Foray et al. 2012), one could assume that regions discover domains quickly after strategy formulation, that is, after completing the smart specialisation strategy document. However, there appear to be very few studies on the actual establishment of domains or on initiation and maintenance of domains of smart specialisation. Indeed, domains are often mentioned only briefly, and there has been little elaboration on the subject in policy documents or even in the research on smart specialisation. As they represent the overall results of successful smart specialisation strategy processes, domains should be clearly structured and understood by regional actors. Currently, the definition of domains is somewhat vague in the existing smart specialisation literature and it requires a better explanation.

Often, regional actors and stakeholders are more familiar with the concept of a cluster than that of a domain. However, it should be emphasised that clusters are not the same as domains by definition. Smart specialisation strategies focus on the transformation of regional economies around new, unique and knowledge-based domains, whereas the goal of most clusters is to enhance the performance of the companies that are members of the cluster (European Commission 2013). One feature that differentiates clusters from domains is their scale, as domains may include actors from several clusters as well as other regional actors or even citizens as members. Domains may focus on the same themes as clusters, but they usually also include other elements, such as new technologies, that eventually contribute to regional transformation.

Domains are important because they are the real embodiments of specialisation. Very diverse actors (either individual organisations or clusters) may find new opportunities for co-operation with the help of entrepreneurial discovery processes, discussion and mutual domain identification. Even if local activities are already quite narrowly focused, the discovery of domains can deepen knowledge, as cross-sectoral and mutual communication may spur new ideas. Ideally, domains also stimulate an eagerness to experiment and continue a search for new opportunities.

We claim that one can consider domains as abstract regional themes that manifest in the mutual actions of the regional stakeholders.

Entrepreneurial discovery processes occur at the beginning. Regional knowledge is the basis for such processes, and it is gradually analysed with the help of stakeholder activation. Then, this leads to ideas that form the focus for regional specialisation and complete the entrepreneurial discovery process. Next, specialisation transforms into practice via implementation and related extra-regional collaboration, which are part of domain formulation. An established domain can become a global "brand" for the region, which can be supported or developed by further entrepreneurial discovery processes, forming a positive "circle" of knowledge generation (Figure 3).

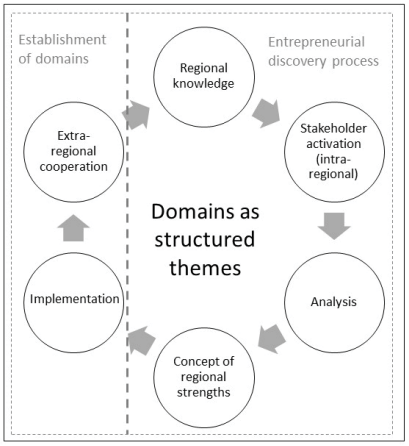

Figure 3: *Key characteristics of domains.*

Although the focus of domains is local-level co-operation, there are prospects for operating on an international level. This understanding of domains' key characteristics is important in our empirical study, as we search for the implications of the domain concept in three different Nordic regions.

Next, we study the actual implementation of the domain concept to understand how domain formulation works in practice. This is achieved by examining the three case study regions and assessing their regional smart specialisation innovation strategies, and also by interviewing regional experts behind the processes. In addition, we ascertain whether the theoretical idea of domains as "structured themes" is maintained in an empirical setting.

3. Methodology and case study regions

3.1 Methodology

The empirical component of the research was conducted as a qualitative analysis, focusing on understanding how the regions have formulated their domains. The study utilised two major sources of data. The core research material consists of the regional smart specialisation strategy documents of the case study regions. Further information was gathered via interviews with experts in charge of strategy preparation, who added to the knowledge about the case study regions and the implementation processes. This was crucial because the case study regions commenced the strategy implementation process after completing the strategy

documentation, and therefore a concrete understanding of the domain concept could not be achieved by analysing the documents alone.

We aimed to interview experts in related strategies; therefore, we focused on interviewees with knowledge of what happened during the strategy process and during the implementation stage. The interviewees were key actors from the case study areas, who were heavily involved in regional smart specialisation strategies and who were able to provide a good overview of the entire smart specialisation process in the region. Owing to their expertise, the respondents were considered to have sufficient knowledge of the cases, and, therefore only one interview was conducted per region; that is, three interviews were conducted in total. All the interviewees were able to explain current progress in the regions and proved to be very valuable sources of information. We provided the interviewees with the following description of the domain concept prior to the interviews:

> The ability to identify opportunities for the region to expand into new domains is a central tenet of the concept of smart specialisation. Domains of R&D and innovation can be understood as new specialisation fields in which a region is likely to excel given its existing capabilities and productive assets (Foray et al. 2012: 12, 63, 113). Nauwelaers et al. (2014) distinguish between policy domains focusing on thematic prioritisation, which can be based on markets or technologies, and those focusing on functional prioritisation such as system failure or connectivity problems. Domains should also focus on activities instead of sectors or individual firms (Foray 2015: 41–42). In choosing their specialisation domains, the regions are expected to take into account two aspects: intra-regional opportunities and inter-regional complementarities or similarities with surrounding regions, or even on a global scale (Iacobucci & Guzzini 2016: 1–2).

The idea was to present the views of others regarding domains, with the above description considered to include the relevant characteristics of domains, as presented in Figure 2. In addition, the interviewees received a list of related references on the smart specialisation literature prior to the interviews. Ten interview questions were provided to the interviewees before the interview. The questions focused on four different aspects of the domain, as follows:

- Understanding of the concept (how is the term “domain” used in the case study region and how it is understood; when was it introduced?)
- Implementation practices (how is the concept utilised and how were the domains formed?)
- The chosen domains (how did they benefit the region and support new activities?)
- The future of domains (how should domains be promoted and how can we determine when they are “ready” or fully-fledged?).

In case the domain concept was not used in the regions, the survey included a question about possible alternatives or similar concepts, in

order to understand how the regions have understood the overall target of entrepreneurial discovery. This was very important during the interviews, as we discovered that the domain concept had not been used in strategy formulation. The analysis provided an interesting insight into how the regions attempt to formulate domains in practice.

We chose the three Nordic regions as the case study areas (see Figure 4) for the following reasons. First, all the case study regions had already prepared and published their regional innovation strategies for smart specialisation. Second, the regions had participated in regional peer review sessions of the RIS3 platform and, thus, their regional strategies had been reviewed transnationally. Third, they all resemble each other in terms of geography (being non-metropolitan areas of Nordic/Northern Europe), population and relative abundance of natural resources. Finally, we could connect with related regional experts in charge of the respective regional smart specialisation strategies, and thus had good access to information about the regions.

Figure 4: *Case study regions: Lapland, Värmland and Nordland (Map by Julien Grunfelder, Nordregio 16.6.2017).*

The main focus of the study and the interviews was the utilisation and understanding of the domain concept. The idea was to see how the regional smart specialisation practitioners utilise the concept and how they form domains. The research also paid attention to the overall strategy process, mainly to determine how the idea of domains was formulated. Therefore, the main outcomes of the smart specialisation strategies were given more emphasis than other distinctive features of the strategy processes. For this reason, we decided not to focus on national differences when comparing the processes across the case study regions. Although there is no reason to diminish the role of the state in the smart specialisation process (Lundström & Mäenpää 2017), we did not highlight national differences, choosing to focus on understanding how the domain concept was perceived by the regions.

3.2 The case study regions

Nordland is the biggest of the case study regions geographically, covering an area of 112,948 km2 in north-west Norway. Lapland in northern Finland is the second largest (98,982 km2) and Värmland in mid-west Sweden is the smallest (19,296 km2). Nordland has a population of over 470,000, Värmland of over 272,000 and Lapland of over 183,000. Regarding the regional capitals, Karlstad in Värmland has a population of over 137,000, Rovaniemi in Lapland has a population of over 61,000 and Bodø in Nordland has a population of over 50,000. Nordland is the biggest region but also has the biggest population disparity, whereas Värmland has quite a strong centralisation of inhabitants in the regional capital (RIS3 Platform 2017b; RIS3 Platform 2017c; RIS3 Platform 2017d; Region Värmland 2015; Nordland County Council 2014; Regional Council of Lapland 2013).

Lapland is known for its tourism industry and its Arctic expertise in several areas (including Arctic vehicle testing facilities, sustainable utilisation mines, processing industries in Arctic conditions and Arctic bioeconomies). Värmland is mostly known for its steel and forest industries, and Nordland for its extensive fish farming, activities related to minerals, metals, oil and gas and green hydroelectric power. Economically, Nordland is the biggest case study region, as its regional gross domestic product (GDP) is nearly 20.1 billion euros, compared with 8.3 billion euros for Värmland and 5.1 billion euros for Lapland (see Table 1) (Nord University 2017; RIS3 Plat-form 2017a; RIS3 Platform 2017c; RIS3 Platform 2017d; University of Lapland 2017; Region Värmland 2015; Nordland County Council 2014; Regional Council of Lapland 2013).

	Lapland	Värmland	Nordland
Geographic size	98,982 km2	19,296 km2	112,948 km2
Population	183,000	272,000	470,000
Key economic areas	Tourism and Arctic expertise	Steel and forest industries	Fish farming and natural resources
Regional GDP	5.1 billion euros	8.3 billion euros	20.1 billion euros

Table 1: *Case study regions' profiles.*

Sources: *RIS3 Platform 2017b; RIS3 Platform 2017c; RIS3 Platform 2017d.*

The biggest research and educational institutions in the case study regions are Karlstad University in Värmland, which has over 16,000 students; Nord University in Nordland, which has 6,000 students; and the University of Lapland, which has nearly 5,000 students (University of Lapland 2017; Nord University 2017; Region Värmland 2015.)

4. Empirical study of domains in the three regions

4.1 Regional smart specialisation strategies and domain formulation in practice

The smart specialisation strategy processes differ between the case study regions to some extent, although the time frame for the strategy formulation was similar, taking nearly two years in all three regions. Lapland commenced its strategy process first, in 2012, and completed its strategy, Lapland's Arctic Specialisation Programme, in 2013. Nordland does not have a separate smart specialisation strategy document but included smart specialisation in its broader innovation strategy, called Innovative Nordland: Innovation Strategy for Nordland 2014–2020, which was developed during 2013 and 2014. This strategy included consideration of educational policy. Värmland's strategy was formulated during 2014 and 2015, resulting in Värmland's Research and Innovation Strategy for Smart Specialisation 2015–2020.

Lapland undertook several iteration rounds during the strategy formulation process, which involved deciding upon three broad specialisation themes and several sub-themes. The main themes were the refining of Arctic natural resources, such as mining industry resources, the utilisation of natural Arctic conditions (e.g. the tourism industry) and cross-cutting development to enable Arctic growth (e.g. supporting industries such as information and communication technologies). Lapland produced 50 specific proposals for action for the period 2014–2020 to develop these themes and sub-themes. Analyses of existing capabilities and interviews with stakeholders were implemented and company viewpoints were gathered via surveys. After the strategy formulation, in 2015, the Regional Council of Lapland undertook an analysis of all the projects implemented in Lapland in the period 2007–2013, which were co-funded by European regional development funds and European social funds. These projects were regrouped into 10 major categories and, after consultation with major actors in Lapland (the public sector, the research and education sector and the private sector), the following five smart clusters were introduced: the Arctic industry, Arctic rural networks, Arctic design, Arctic security and Arctic development infrastructure clusters.

The region of Värmland focused on potential growth markets, entrepreneurship within the area and whether it was possible to devise solutions to deal with societal challenges (e.g. diversification of jobs between men and women) within the region. A business intelligence analysis was conducted to obtain an idea of the international potential of the region. Stakeholder meetings with broad "triple helix" participation

(i.e. involving the public sector, companies and universities) were arranged under various sub-groups to devise different specialisation fields (Region Värmland 2015). Värmland developed four different categories for specialisation. The first, transverse specialisation (value-creation services), involves more general specialisation, and therefore is not necessarily important for the development of domains. However, the region developed three other categories: prioritised specialisation (including a forest-based bioeconomy, digitalisation of welfare services and advanced manufacturing and complex systems); specialisation under qualification ("upcoming" specialisation), which includes nature, culture and place-based digitalised experiences and system solutions with photovoltaics (solar energy); and finally, new smart specialisations yet to be discovered (Region Värmland 2015; Foray et al. 2012).

Interestingly, Nordland used a similar method to the Finnish region of Ostrobothnia in its smart specialisation strategy; the two regions worked together during the strategy formulations because they wished to develop comparable data and to promote transnational learning (Virkkala, Mäenpää & Mariussen 2014). Researchers from both regions devised a tool that measures the overall connectivity and depth of regional co-operation in a triple helix setting. However, the tool is aimed more at improving regional stakeholder co-operation (and entrepreneurial discovery processes) rather than specialisation and domains. Nordland specialises in three distinctive areas: the seafood industry; the processing of metals, minerals, chemicals and machines; and experience-based tourism activities. The chosen fields were based on earlier R&D and practical studies and are all export-oriented, as originally proposed by the smart specialisation guidebook (Nordland County Council 2014; Mariussen et al. 2013; Foray et al. 2012.)

None of the regions discussed "domains" during their strategy implementation processes. This was an interesting discovery and is indicative of the complex nature of the term. However, our analysis of regional strategies revealed established phases in domain formulation (such as intra- and extra-regional aspects and stakeholder activation; see Figure 2), which indicated that domain formulation was occurring on a de facto basis, even though the exact term was not used. It appears that the regions were aiming to achieve the overall objectives of smart specialisation and used the word "specialisation" rather than "domain" to describe the outcomes of the entrepreneurial discovery processes. Lapland introduced the term "smart cluster", which was regarded as a domain; using the term domain was considered to be overly complicated because there is no explicit, uniformly agreed Finnish translation of the word. It was considered that companies in Lapland would understand and adopt the "smart cluster" concept more easily, even though the regional council was aware of the fact that domains are not clusters per se. Smart clusters are seen as cross-sectoral ways to specify the existing capabilities, and therefore serve as preliminary steps for domains.

The interviews revealed that, in Värmland, the domain concept is not used in the official smart specialisation strategy document because the term was not utilised during the strategy preparation phase. The

term domain is mentioned once in the local strategy but only in relation to the former specialisation trend of the region. The region instead used the term "smart specialisation" to describe the goals of the smart specialisation strategy. Despite the word "domain" not being used, Värmland produced specialisation fields that resemble domains. These combine existing strengths into new formats, which include different clusters and industries. One major tool for new specialisation seems to be digitalisation, as this has been adopted in many of the chosen fields. These specialisation fields add to the existing industries and may provide new combinations for future products and services in the region.

Again, in Nordland, the word "domain" is not used in the official innovation strategy document (Nordland County Council 2014) or even in the case studies that were used to develop the smart specialisation strategy. Domain was not used because the term was not explained to the officials who wrote the documents. Instead, Nordland has used the words "specialisation" and "diversification". Nevertheless, Nordland has used "domain thinking" extensively; for example, oil rig technologies have been converted for use in the fish breeding industry (to provide deep water pumping for fish refineries) in the region. Overall, there have been many studies regarding cross-sectoral linkages prior to the development of the smart specialisation strategies (e.g. Mariussen 2014), and the term may have been left out because these activities (although known by different names) were already occurring. The concept is now becoming more familiar and is gradually being used more in the region.

All three regions emphasised that their domain formulation broadens innovation capabilities by providing a solid regional framework for innovation activities. Lapland and Nordland emphasised the possibility for cross-sectoral collaboration, whereas Värmland explicitly mentioned the possibility for increasing related variety. In addition, the regions emphasised the possibility of increasing the connections between regional innovation actors. This supports our view of domains as regional themes that are realised through mutual projects.

Lapland was keen to increase the efficiency of its smart cluster activities by enhancing its product and service portfolios, thus increasing the visibility and marketing of the smart clusters. Smart clusters are expected to highlight their close contacts to the business community and to avoid being seen as too academic or remote from the real world. Värmland aimed to increase co-operation with the university regarding smart specialisation projects in the future. Co-operation on digitalisation is mentioned as one way to do this. Nordland has long-term (10-year) plans and is continuing studies related to enhancing the innovative capabilities of the region. One concrete example is a new centre for education and co-operation in process engineering that was established prior to, but assists in strengthening, the smart specialisation strategy.

Region	Lapland	Värmland	Nordland
The use of the domain concept in the regional smart specialisation strategy documentation	Term not mentioned directly, but cross-sectoral thinking has been utilised to form the themes for specialisation Thematic specialisation	Term was mentioned directly but had a different meaning. However, the region has used clear combinations of existing industries, products and services in a "domain-like" fashion Thematic specialisation	Term not mentioned directly, but previous studies already include "domain thinking" Indirect functional and thematic specialisation
Domain formulation in practice (entrepreneurial discovery process)	Interviews, workshops, analyses, company surveys, statements from the stakeholders, peer review sessions with RIS3 platform	Former R&D, analysis of the region, workshops, draft consultations, gender analysis, societal challenge analysis, peer review sessions with RIS3 platform	Former R&D, analysis of the region, questionnaires, focus group interviews, peer review sessions with RIS3 platform
Domains/focus areas for smart specialisation in the regional strategies	*"Smart clusters":* Arctic industry, Arctic rural networks, Arctic design, Arctic security and Arctic development infra-structure (N.B. "smart clusters" introduced only after the completion of strategy process, as part of implementation phase)	*General specialisation:* Value-creation services *Prioritised specialisations:* Forest-based bioeconomy, advanced manufacturing and complex systems and digitalisation of welfare services *Specialisations under qualification:* Nature, culture and place-based digitalised experiences and system solutions with photovoltaics (solar energy)	Seafood industry, process industry (metals, minerals, chemicals and machines) and experience-based tourism activities (Maritime, green energy, services)
Domain focus	Market	R&D/Technology	R&D
The interpretation of domain during the implementation phase (after the strategy document was written)	Smart clusters involve "domain-like" thinking. Current work is being done to brand the chosen clusters and make them work, especially according to needs of companies	"Domain thinking" has been utilised; digitalisation in particular seems to be the key. The chosen specialisation fields are strengthened based on funding	Clear "domain thinking" has been utilised. New studies are underway to strengthen the chosen specialisation

Table 2: *Domains in case study regions*

Source: *Based on interviews; Region Värmland 2015; Nordland County Council 2014; Regional Council of Lapland 2013.*

4.2 Major findings

The three regions share many similarities in terms of their overall process and use of the domain concept (Table 2). All the regions have formalised their strategies without using the term "domain", largely because the term was not emphasised in the strategy writing process. However, the regions developed their own domain-type concepts, such as specialisation, diversification and smart clusters. Värmland was the only region to mention the term "domain" in its regional smart specialisation strategy document, but used it to describe a past regional

focus. As noted above, in Lapland, the term was not used because there is no equivalent word in Finnish and it was considered that companies would identify with and better understand the word "cluster", which used as the basis for Lapland's chosen term, "smart clusters".

The regional smart specialisation processes were also very similar in the case study regions and closely followed the entrepreneurial discovery process presented in Figure 1. The regions first gathered existing knowledge, then contacted the regional stakeholders (via surveys, forums, etc.) and discussed the possibilities for specialisation. After this regional consultation and formalisation of the vision, the regions wrote the strategy documents. At present, with the strategy preparation completed, the regions have established ongoing projects that aim to advance specialisation, and thus the formation of domains. Lapland and Värmland have focused on a more thematic specialisation compared with Nordland, but the latter has also emphasised functional specialisation by studying the triple helix connections between universities, companies and public organisations. Finally, all case study regions presented their regional smart specialisation strategies in RIS3 platform peer review meetings to gain further transnational insights.

All the domains in the regional specialisation strategies were selected by the regions on the basis of their previous knowledge of regional assets and capabilities; however, new combinations and original strategies were put forward as well. Värmland, for example, has utilised key enabling technologies (i.e. digitalisation) to form its domains and has even left some of the domains open, in order to pursue them in the future. Lapland had not given in-depth consideration to regional clusters previously, but now it is focusing on establishing innovation environments to support the smart clusters. Lapland developed the idea of smart clusters during its implementation phase (i.e. after writing its strategy document), which clearly indicates progress in its regional thinking. Nordland had a strong culture of R&D before it developed its smart specialisation strategy, but it is deepening co-operation and collaboration with other regions transnationally to learn from their experience.

In Nordland, the established domains will be further developed in the future, as the region focuses on new research and continues the entrepreneurial discovery process. Lapland wishes to strengthen its smart clusters via marketing and it is continuing to cooperate with vocational institutions and universities. Värmland is deepening its collaboration with the local university and is anticipating more EU resources to further that co-operation. The region also wishes to utilise digitalisation to formalise new services/products. It appears that all case study regions have recognised the need to continue developing their domains and, interestingly, have chosen the three different aspects (market, R&D or technology) of domains (mentioned by Foray 2015) to meet their goals. Nordland is focusing more on R&D-based development, Lapland is focusing on markets and Värmland is using new technologies via digitalisation.

It is noteworthy that the regions are taking different paths in developing their domains. For example, Lapland has developed "smart

clusters", which involve ongoing entrepreneurial discovery processes, as well as cross-sectoral co-operation. Lapland has included innovation environments, thus developing a concrete innovation infrastructure (e.g. Arctic development infrastructure) for the region during the smart specialisation implementation phase. Värmland has included the idea of utilising key enabling technologies (digitalisation) and has emphasised societal challenges in its smart specialisation strategy. Nordland has successfully combined oil pumping technology with fish farming and, thus, had clearly developed cross-sectoral products even before the smart specialisation process took place, and without having acknowledged the concept of domains.

The respondents all agreed that the related thought process and the newly-established domains help regional actors by presenting distinctive targets for future development. Domains also clarify the regions' innovation needs for local stakeholders and help in the branding of the regions. The case study regions wish to strengthen the chosen domains and hope for fruitful co-operation among the relevant actors. Although the overall results are yet to be seen, there are clear indications of development in domains, as the case study regions have included the different phases and are ending their first round of domain formulation.

Interestingly, although the case study regions did not use the term domain, they nevertheless operated according to smart specialisation strategy guidelines. The three regions understood the ideas underlying specialisation and this idea of regional specialisation perhaps even surpassed the idea of domain in its clarity. The regions utilised stakeholders and formulated ideas for regional strengths before the implementation phases. Analyses included extra-regional thinking, as the regions focused on global markets and, in future, they hope to achieve wider participation. Generally, the smart specialisation strategy processes and the related entrepreneurial discovery processes were quite similar, but the regions derived these on their own terms rather than using the existing ones. Overall, the results of this study indicate that domains or their equivalents using other names have been established, and that the overall domain formulation process is proceeding according to the smart specialisation strategy guidelines (Foray et al. 2012).

5. Conclusion

The study began with a literature review that established the basic concept of a domain, as well as its key characteristics. Some descriptions highlighted knowledge types (RIS3 Platform 2017a) and others focused on the size of the participating entities (Foray 2015) or the nature of the chosen specialisation (Foray 2015, Nauwelaers et al. 2014). We established domains as a concept for practical use and developed the idea of domains as thematic constructs that are formalised into practice via implementation and extra-regional collaboration. This description not only takes into account previous domain descriptions and discussions in the smart specialisation literature but also highlights the idea of the concrete establishment of domains and places stakeholders and local facilitators at the centre of the process.

We suggest that one way to open up the concept of domain is to understand it as a broad, cross-sectoral description of the spectrum of major themes that the region might focus on in its future activities. These themes are expected to be based on existing regional capabilities and usually focus on either technology and/or markets and/or R&D. The key idea is to use intra- and extra-regional thinking during the process. Domains should be formulated and integrated into the practices of regional innovation in order to fully utilise smart specialisation thinking in regional development. We stress that this description of domains might be useful for non-metropolitan regions (which tend to have limited resources), as it emphasises the role of local actors, which is often central to regional development in non-metropolitan regions.

Our understanding of the domain concept was empirically tested through an analysis of three case study regions, which revealed that the concept of the domain remains somewhat vague, particularly among regional practitioners. Obviously, smart specialisation is only in the first stages of implementation, but at the same time, the feedback indicates there is a need for additional clarification of the domain concept. We found that usage of the term was not very prominent in the process of strategy-making or that it did not even translate into the local language, as in the case of Lapland. Therefore, we argue that there is a need for systematic clarification of all the relevant terms used in smart specialisation strategies, especially "domain".

However, despite the perceived vagueness of the concept, the key characteristics of domains (regional specialisation, stakeholder activation, intra- and extra-regional focus, a focus on established strengths) were translated into the smart specialisation strategy practices within the case study regions. Regional co-operation has resulted in the utilisation of entrepreneurial discovery processes to create a regional focus. Domain formulation has been relatively similar in the different regions, despite the fact that the regions focused on different themes. The interviewees felt that domains could be used to focus regional development and stimulate co-operation among stakeholders. This emphasises the idea of domains as thematic constructs that are realised during implementation. This knowledge may prove to be valuable to public actors who can now view domains as planning tools for regional specialisation.

Currently, the challenge is to push regions to move forward in terms of the proper establishment of domains and their translation into practice. Based on our study, this occurs through implementation projects and extra-regional collaboration. Many regions are obviously strengthening their specialisation with projects and by applying for funding from various sources to promote development in Europe. However, there should be more studies that address the lessons learned. In addition, there is a need for new ideas on how to continue the (evidently) successful entrepreneurial discovery processes and regional specialisations. One interesting avenue of progress might be the integration of entrepreneurial discovery processes within domains that are similar to "smart clusters", as illustrated in the case of Lapland.

Overall, the idea of continuing entrepreneurial discovery processes within and alongside domains is an interesting one that requires further research.

One important issue related to the future of domains is governance. For example, who should lead or govern the development process of the domains? As Morgan (2017) points out, both the public and the private sector may lack knowledge of the subject. Companies might have very limited resources for activities outside of their main income area (and may even have additional goals that do not fit vis-à-vis the overall strategy process). Universities might provide the necessary theoretical knowledge on domains and already have the necessary research connections, but their experience and knowledge in terms of practical implementation might be limited.

If we consider the fact that, in practice, public actors (e.g. regional councils) organise smart specialisation strategies, then we might assume that they will continue their work on already established domains. However, do they have the necessary skills to see what is happening inside the domains? Do they have the resources to keep track of the local, national and global events that affect the domains? Public actors should also seek co-operation among other global domains and their relevant actors. One possible solution could be co-operation with the RIS3 Platform in Seville, which has a transnational coordinator role that may aid future collaboration among domains. We suggest that the RIS3 Platform should fully embrace this role and establish connections with different regions to ensure the flow of information between European actors.

However, the direction in which the regions should proceed with their overall smart specialisation processes remains undetermined. Should the focus be on domains established during the strategy formulation, or should the regions seek additional specialisation via entrepreneurial discovery process iterations? Interestingly, Foray (2015) suggests that four to six years might be an appropriate cycle for an entrepreneurial discovery process, after which there should be new suggestions for future domains. This may work well in some regions, but non-metropolitan regions, in particular, might have to face the fact that the chosen domains stay the same if there has been no further development to create or strengthen additional domains. Then, should the regions try to establish a nonevidence-based, radical foundation (Foray 2015) to achieve new domains or just support the existing ones? Regarding the future research agenda for smart specialisation domains, we suggest that more studies on successfully established domains and their management should be undertaken, as this will be necessary to provide a solid foundation for the future direction of domains. By further developing domains and the thinking behind them, we can enhance the future of European innovation.

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A connectivity model as a potential tool for smart specialization strategies

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ABSTRACT
The article contributes to the smart specialization literature by presenting a new approach, connectivity analysis, where Triple Helix (TH) relations (involving universities, companies and government) are at the centre of the entrepreneurial discovery process. Relations between helices may be seen, from the point of departure of proximity, as preconditions of connectivity, or interaction, measured through expectations and experiences. This offers potential solution to two limitations of proximity approach: its static nature and narrow focus on dyadic relationships. The connectivity analysis reveals the extent of mutual expectations, as well as tensions, or gaps. Based on this analysis, the article presents a policy model that is used to map structures of networks and gaps between TH actors. It may also identify strengths, weaknesses and problems. This analysis is used as input to structured dialogues between actors in leading positions in the TH and in smart specialization policy-making and implementation. This approach may lead to policy interventions supporting entrepreneurial discoveries. The model has been developed in partnership with researchers and the Regional Council of Ostrobothnia. The article also presents this case study and demonstrates the use of the connectivity model in practice.

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1. Introduction

The major regional innovation agenda of the European Union (EU) cohesion policy in the period 2014–2020 is based on the concept of smart specialization. The concept was developed in the Knowledge for Growth group as a response to the economic crisis and growth problems in the EU (Foray, 2015). It quickly diffused into mainstream EU regional policy, and was used as an 'ex ante' condition for Structural Fund programmes. The rapid translation into practice of theoretical ideas, which are still in development, may provide challenges for implementation. However, it might also provide an opportunity to develop theory in practice rather than as a linear leap from theory to practice without 'proof of concept' (Nauwelaers et al., 2014, p. 3).

Smart specialization can be characterized by the search for new growth opportunities at the regional level via analysis of unique regional strengths and specializations. New growth

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opportunities are exploited through regional strategies that prioritize certain cross-sector and cross-helix policy interventions. Public agents are expected to play a proactive role in these entrepreneurial discovery processes (EDP). The aim is to concentrate resources on activities that are likely to transform existing economic structures and reveal emerging opportunities (Foray, 2015).

An emerging body of literature addresses both the concept of smart specialization and experiences of implementing regional strategies based on the concept called the Research and Innovation Strategies for Smart Specialization (RIS3). Scholars have identified weaknesses of the smart specialization concept and its translation into practice. Those include Cooke (2016), who states the concept does not refer to specialization as such, but to diversification. Other scholars emphasize the difficulties in designing and implementing RIS3, for example, in England (Marlow & Richardson, 2016) and Portugal (Cooke, 2016). Capello and Kroll (2016) also highlight the problems and risks for less developed regions, including difficulties in precisely defining smart specialization, the capacity for identification of new related activities and difficulties in policy prioritization. More developed regions might already have many viable specializations, and they may try to avoid a too narrow specialization on one or even a few specific domains. Local conditions vary and there is a general need for several types of analysis and policy agendas.

This article provides a starting point for one challenge that many regions face: the level of connectivity between the stakeholders needed for RIS3 and particularly for entrepreneurial discovery. Even actors in large cities may have low levels of regional connectivity. Peripheral areas might also need more connectivity, both inside and outside the region. Accordingly, we argue for the relevance of connectivity measurements within, as well as beyond, the region for strategy preparation.

We aim to answer the following research question: what is the role of connectivity in smart specialization, and how could it be measured and improved in RIS3?

In order to answer this question, we present a connectivity model, which was developed in partnership with the Regional Council as an attempt to implement smart specialization strategy. The model can be used as an analytical tool for mapping networks, and identifying bottlenecks and missing links, as well as a policy model for improving the connectivity between stakeholders in the region.

The article explains how the Triple Helix (TH) model can contribute to EDP. TH actors (i.e. companies, universities and public organizations) are expected to be at the forefront of the entrepreneurial discovery process and they should work along the same lines. The RIS3 guide book (Foray et al., 2012) emphasizes both EDP and TH connectivity, without clear linkages between these two theoretical approaches. This article provides a new approach in which connectivity is at the centre of the process of EDP. In order to explicate the relevance of the TH in EDP, we extend the research on TH by using two approaches: the proximity approach and gap analysis. Various proximities are preconditions of connectivity, and connectivity as an interaction between TH actors is conceptualized and measured with the help of gap analysis. There is a considerable amount of literature on both the TH models (Leydesdorff & Etzkowitz, 1998) and proximity dimensions (Boschma, 2005), but these two strands have not yet been combined in the RIS3 context. We also demonstrate in practice how TH connectivity is relevant in EDP through a policy model that includes vision, analysis, governance, priority selection, policy mix and evaluation.

We argue that the driver of change in relations is the tension caused by expectations, which may be confirmed and strengthened, or frustrated. A gap – a difference between expectation and experience – is seen as the key to discussions of RIS3 for all kinds of regions, technology inventors and followers. More developed regions, transition regions and less developed regions all need to find more common ground and initiate discussions to identify regional strengths and new business areas. By providing a tool for measuring and improving the connections between helices we aim to broaden the scope of the discussion and provide a proper scenario for possible entrepreneurial discovery. Gaps may also help to identify emergent connections (weak relations that may be strengthened) and structural holes (lack of relations), which may reveal the issues hindering cooperation on various aspects of innovation. Gap analysis is based on the assumption that improving connectivity favours regional development. However, improvement might sometimes require extra-regional links to avoid a possible regional lock-in situation. Gap analysis provides a soft power approach to multi-level governance in TH coordination through the identification of problems and by setting the parameters of the dialogues to resolve them.

In Section 2, we describe the smart specialization concept, EDP and the RIS3. Subsequently, in Section 3, we present the conceptual framework and characteristics of the connectivity model based on TH connectivity, proximity approach and gap analysis. Section 4 examines what role the model can play in the implementation of RIS3 by referring to the steps in the RIS3 guidelines. Section 5 presents preliminary evidence on how the connectivity model has been applied in practice in the region of Ostrobothnia, Finland. Section 6 examines the findings in the light of relevant literature, and draws conclusions on the potential of the connectivity model for RIS3.

2. Smart specialization as a renewal of regional innovation policy thinking

Smart specialization is an academic concept that has evolved into a practice-oriented effort known as RIS3 (McCann & Ortega-Argilés, 2016) as third-generation regional innovation strategy. The concept of EDP as a core of the smart specialization process has attracted considerable attention, but it has also created confusion among regional developers. According to Foray (2015), EDP can occur spontaneously and in a decentralized way, and with great success. However, policy efforts are necessary in many regions, and the EU has used the concept of smart specialization as one of the foundations of its cohesion and innovation policy: the so-called RIS3. The aim of RIS3 is to ensure the continuous transformation of productive structures through research and innovation, a transformation that concerns the entire regional economy. The process of structural transformation will be conducted via the discovery and exploration of new domains (Foray, 2015).

RIS3 differs from the earlier regional innovation policy agendas of the EU in that it targets all regions in Europe, and it takes into consideration innovation concepts broader than R&D-based innovation (i.e. practice-based innovation). The bottom-up approach and priority-setting practice differs from standard, top-down industrial policy.

Many of the routines, practices and tools needed for the implementation of RIS3 have already been discussed in economic geography and related research (Kroll, 2015). The discussion includes concepts such as constructed advantage (Asheim, Boschma, & Cooke, 2011), endogenous approaches, TH connected regions (Goddard, Kempton, & Vallance, 2013), place-based development (Barca, McCann, & Rodriguez-Pose, 2011), as well as

the process of discovery and general purpose technologies (Foray, 2015). Smart specialization can therefore be seen as the synthesis of different frameworks and approaches. According to the place-based approach to development, the RIS3s should be tailored to the local context on the basis of the best data available, the most detailed knowledge and an explicit consideration of the realistic potential of the region (McCann & Ortega-Argilés, 2013).

The concept of EDP is used in the RIS3 approach in a new way. Originally, the concept was used in business theory to describe the process where entrepreneurs are continually searching for, identifying and evaluating new business opportunities (Shane, 2003). According to Foray and Rinoldi (2013), entrepreneurial discovery within RIS3 is the same on a regional level, but regional policy-makers and developers should focus on specific activities instead of sectors. Foray and Goenaga (2013) call this level of intervention 'granularity'. For example, a region should prioritize developing eco-tourism activities over developing specific companies or sectors. Regional actors should work together like entrepreneurs, evaluate their resources and try to combine them in new ways in order to appeal to global markets. In this context, TH cooperation also plays an important role in mutually determining these regional assets.

According to RIS3, innovation policy needs to allow for experiments in order to discover what works and what does not in a particular context. Failures must also be noted in order to identify success. Smart specialization relies on the theories of experimental learning based on Sabel (1992), and it develops the idea of self-discovery elaborated by Hausman and Rodrik (2003). This is the process of policy learning. The idea of discovery and experimentation points to the role of indicators and evaluations (McCann & Ortega-Argilés, 2013).

The prioritization of activities with potential to spark regional growth is essential for smart specialization. However, how it happens is open to debate, for example, it might be necessary to assess the degree of related variety between industries as a rationale for defining specialization domains. Nauwelaers et al. (2014) distinguish between policy domains focusing on thematic prioritization such as a specific technology crucial for regional development or clustering, and on functional prioritization such as system failure or connectivity problems. This article sees the prioritization process from the functional point of view, as it focuses on the gaps in the innovation system. It argues that improving connectivity in the regional network by bridging gaps or building new intra-regional or extra-regional links allows something new to emerge.

The concept of EDP emphasizes the search for entrepreneurial knowledge in regional partnership (Foray, 2015). However, elaboration of the EDP concept is still in progress (Capello & Kroll, 2016), and there is limited information as to how its aims might be achieved, which has left policy-makers and other implementers to seek solutions on how to apply the concept. This article aims to offer one possible solution through the method of gap analysis, which measures potential barriers in the EDP.

In addition, we also aim to contribute to the implementation of RIS3 by providing a new policy model, the so-called connectivity model. The model explicates the areas where interaction is needed in order to develop connectivity between stakeholders. It also helps to form the policy mix for the selected areas, for example, it can align educational, research and innovation policies in line with the local EDP, and thus adds experimental learning and gradual improvements to RIS3.

In this way, the article will deal with the research question regarding the role of connectivity in smart specialization and measuring and improving connectivity between stakeholders in the RIS3 context. We believe that responding to this question leads to inputs both to the emerging smart specialization literature and to relevant policy tools. The connectivity analysis can give some new input to the EDP issues and help implementers of RIS3.

3. Conceptual framework and characteristics of the connectivity model

3.1. TH connectivity

The TH model (Etzkowitz & Leydesdorff, 2000; Leydesdorff & Etzkowitz, 1998) is used to describe both dynamic interaction between universities, companies and public institutions and institutional continuity, as these helices consist of historical institutions with selection environments or rules. The universities, as scientific systems, communicate and function in accordance with the code of true/false, companies in accordance with the code of profit/loss and the public sector in accordance with the code of right/wrong. According to the TH model, the best environments for innovation are created at the intersection of the helices, where different types of knowledge and institutional logics intermingle (Ranga & Etzkowitz, 2013).

The TH model emphasizes interaction between institutional spheres and thus has different starting points from regional innovation system (RIS) theory, which emphasizes knowledge production and use as a basis of innovation (functional differentiation). The idea of institutional differentiation (as in the TH model) may seem a good point of departure for an empirical study. Whereas most firms mainly specialize in the exploitation of knowledge for economically useful purposes, universities are mainly involved in knowledge creation through academic – and sometimes applied – research, followed by dissemination through education. The TH concept provides ready-made empirical categories for studying connectivity between different types of actors. We gathered data on the basis of the described institutional spheres: companies, universities and public government.

The concept of TH has been applied in smart specialization forming the basis for connectivity within regions. A connected region is a norm or vision where the three helices work in harmony, thereby mutually reinforcing each other (Goddard et al., 2013). They coevolve and interact through an overlay of recursive networks and organizations which can be seen as a precondition for innovation. 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 (Goddard et al., 2013) and entrepreneurial discovery process cannot emerge. In other words, TH connectivity for successful implementation of RIS3 should offer potential for entrepreneurs to participate in its planning processes. TH actors should be connected in the search for new growth potential. Figure 1 describes TH connectivity in the EDP, and shows how better cooperation creates more opportunities for innovative interaction. What follows is an elaboration of the TH model, first with different forms of proximity indicating different preconditions for connectivity, and second with gap analysis characterizing tensions in TH relations. Proximities and gap analysis are the main elements of the connectivity analysis and policy model.

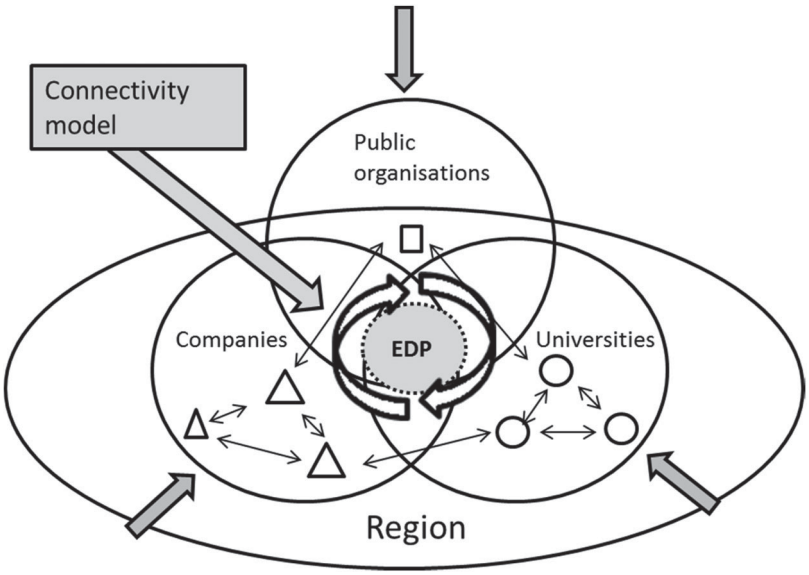

Figure 1. TH connectivity in the entrepreneurial discovery process (EDP).

3.2. Proximity as a precondition for connectivity

Proximity is required to connect actors and to enable interactive learning and innovation. This article is based on five dimensions of proximity suggested by Boschma (2005); those being geographical, social, institutional, organizational and cognitive proximity. Geographical proximity promotes unique local competences, skills and new knowledge, which can diffuse spontaneously through personal contacts via the 'local buzz' (Bathelt, Malmberg, & Maskell, 2004). Social proximity refers to personal relationships between actors, institutional proximity to joint formal and informal rules, organizational proximity to the membership of the same organizational entity and cognitive proximity to the distance between the knowledge base of actors.

However, proximity between agents in networks does not always increase their innovative performance and may even harm it. It is called proximity paradox (Boschma & Frenken, 2013). If two actors have a similar knowledge base, the cognitive distance between them is short, and their collaboration might not increase innovation performance since new ideas and some recombination are central to innovation; instead, the collaboration might give rise to lock-ins. An intermediate level of differences in knowledge bases is needed for innovative cooperation. Moreover, the strength of social ties between two actors can vary. According to Granovetter (1973), strong ties between two actors will be redundant since other actors will also be tied to them. Weak ties are important since they can connect different social groups and serve as bridges. An optimal balance of socially proximate and socially distant relations is needed. Generally, the potential of a relation depends on optimal levels of proximity, and on a balance between local and non-local links. An innovative region should be locally embedded, but at the same time oriented towards a wider market in order to gain access to global knowledge.

The proximity approach can also be used at a regional level with a focus on partnerships between actors. In this article, geographical proximity is applied to the region that should be developed with RIS3; institutional proximity indicates the rules and norms differing according to the helices, cognitive proximity refers to the similarity of knowledge bases of the selected activities or domains, organizational proximity is applied to a temporary learning organization that forms when stakeholders meet in focus groups, and social proximity refers first to the precondition for the creation of a shared vision of the regional strategy, and second to the precondition of achieving consensus within the focus group on how to bridge the selected gaps.

The proximity approach has some known limitations. Firstly, it is mostly applied to the analysis of dyadic relations to explain knowledge network (Balland, Boschma, & Frenken, 2015). The authors try to solve the problem by using proximity approach in TH relations in the context of RIS3. Secondly, proximities are seen as static, and a more dynamic approach between proximity and knowledge network is needed (Balland et al., 2015). We try to approach this limitation by measuring the expectation and experience of relationship, indicating the interaction between the partners. In doing so, we take into account the dynamic co-evolution of connectivity and proximity dimensions. This is where the role of gaps comes in. Expectations and experiences from interaction (connectivity) may be seen as dynamic results of proximities. Interaction involving dynamic combinations of expectations and experiences may also contribute to various forms of social and cognitive proximity, which may cut across organizational, institutional and spatial boundaries.

3.3. The role of gaps in cooperation and gap analysis as measurement of connectivity

We can analytically differentiate phases of relation-building based on the typology of tacit and codified knowledge. Tacit knowledge is deeply rooted in individuals' action and experience; people know more than they can explicitly say. Codified knowledge is formalized, for example, in books, manuals and programmes (Nonaka & Takeuchi, 1995, p. 59). In the first phase, actors build a relationship with their partners based on the information they possess about the importance of the relationship. The actor has expectations of this relationship. Expectations may be codified in various forms of contracts, or be tacit, based on norms that are taken for granted. In the second phase, there is interaction in the relationship, during and after which the actor has an experience, which can be characterized as tacit knowledge. In the third phase, a researcher asks about the tacit knowledge concerning 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. In this way, local knowledge of the region can be presented in abstract measurements. In the next phase, the gaps will be explained by the relevant stakeholders in a focus group meeting – sometimes causal and sometimes more theoretical explanations are needed. In this way, the tacit knowledge of expectations and experiences is codified and shared. The aim of the meeting is to reach a consensus on the reasons for the relevant gap, as well as on the possible policy interventions through structured discussions with different actors.

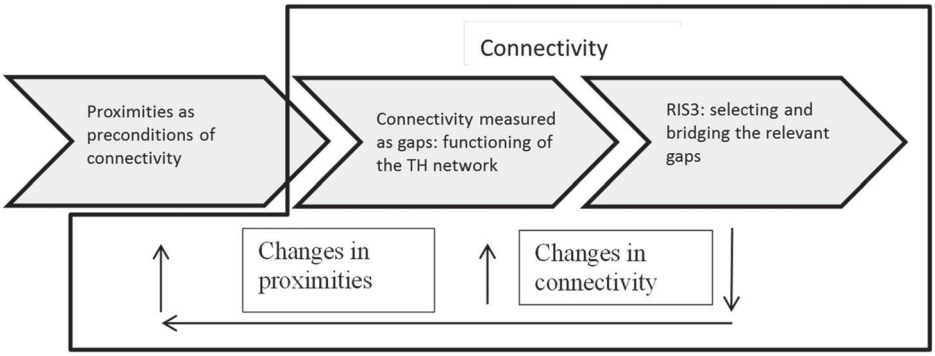

Figure 2. Proximity – connectivity interactions.

The authors have simplified and transferred gap analysis from risk level measuring in industrial management (Ranta & Takala, 2007) to the regional level in order to describe the strength of the relationship between and within helices (i.e. the connectivity). This analysis includes two key figures of expectation and experience. When both are at a high level, the relation can be seen as strong, indicating a good solution in terms of regional development policy. It can then be proposed as good practice, and other actors could learn something from the strong relationship. When both expectation and experience are low, the relation is weak. When expectation is high and experience low, there is a development challenge that should raise concerns for regional development planners.

Proximities as preconditions of connectivity and the codified connectivity conceptualized as gaps are interrelated. Various forms of proximity between TH actors may prevent or enhance learning and innovation in the relationship. The connectivity between TH actors leading to EDP is possible when there is an optimal level of proximity. The connectivity, as a relationship between the stakeholders, can be strong or weak. A strong relationship might result in a closer proximity between the stakeholders, which again might mean more interaction and a deeper relationship. The aim of the connectivity model is to influence the proximity aspects between stakeholders which then have impact to connectivity and vice versa; influencing connectivity through bridging gaps in the innovation network will also change proximity between stakeholders (Figure 2).

3.4. The analysis phase of the connectivity model

The analysis phase of the connectivity model consists of two elements: mapping the structure of TH networks in terms of proximity and interactions of the TH networks in terms of gaps. This effort requires an understanding of their geographical reach, that is, the importance of regional, national and international contacts. The first element of the model is the extent to which a specific region is a connected region in terms of geographical and institutional proximity. This is studied

- by identifying the partners of the actors in each helix as well as their locations in the TH structure and at a 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.

We gathered the empirical material on relationships between actors, but we draw conclusions on the network structure of the region reflecting the relations between and within the helices and regions (case study region vs. other regions), which describe, in particular, the institutional and geographical proximity of the stakeholders.

The second element of the analysis phase is the study of the interaction of actors between and within helices. Gap analysis enabled the authors to identify the relationships that should be developed in order to improve connectivity. There can also be holes in the networks when the actors have no relationship at all, but the presence of a relationship could be favourable for regional innovation and development. This case is a challenge for those with a boundary spanner whose task is to link different actors and create connectivity in a fragmented system.

4. RIS3 and the connectivity model

The connectivity model is a result of an action research process in which the researchers conducted a survey and gap analysis that were inputs in focus group meetings with the relevant stakeholders. Researchers also facilitated the dialogue process. The model consists of analysis and policy phases, which can be implemented according to the guidelines of the RIS3 guidebook (Foray et al., 2012). The connectivity will serve to extend knowledge of the innovative process and to make more targeted interventions in the direction of smart specialization. It will also serve to identify research agendas on relevant topics for innovation policies, key legislation needs and missing relevant innovation parameters to be communicated in a dialogue.

The different phases of the connectivity model can be described by utilizing the six steps analogy as suggested by the RIS3 guide (Foray et al., 2012, p. 27). These phases include the original steps from the RIS3 guide, as well as additions from the connectivity model.

(1) A shared vision for the future: a connected region
According to the RIS3 guide, a successful strategy should feature a shared vision of the region's future. An overall vision for the idea of a connected region can be one tenet of RIS3, and the steps of the connectivity model are derived from that vision. Since stakeholders often live in different worlds in terms of their rules and modes of operation, TH coordination is rather difficult. To formulate a vision of a connected region requires sufficient social proximity between the stakeholders.
(2) Analysis of the potential for innovation: survey and gap analysis
Gap analysis is one possible method to analyse the bottlenecks in the RIS. It is expected that it would identify core positions in the regional economy and builders in the TH, connecting science, politics and visionary entrepreneurs.
(3) Governance: building a learning organization
Improving connectivity is a learning process that needs coordination and a learning organization. The key stakeholders are members of smart clusters and regional authorities who build a learning organization. These key actors should be included in the

learning organization through focus group meetings. In learning organizations, temporary organizational proximity is created when partners are connected, and the shared vision is implemented and extended.

(4) Identification of priorities: gap indices and focus group meetings
Stakeholders should be engaged with questions about partners that will identify gaps in the innovation structure. The findings must then be verified in a structured dialogue. The bottlenecks in the innovation system are the largest gaps between expectations and experiences found in the gap analysis, and it is important to discuss the policy interventions available to bridge these gaps. In the focus group meetings, two sets of operational knowledge – the abstract and explicit (gap index) – and the tacit knowledge of the stakeholders are considered positive and sympathetic towards each other. In this way, social and cognitive proximity is enhanced between the stakeholders.

(5) Definition of policy mix: implementation
In the focus group meeting, the potential policy interventions available to fill the gaps will be discussed. Policy interventions can be either part of a larger programme, just one project or investment, or a change in regulation. The priorities would, however, most likely involve the promotion of cooperation through mutual projects. After focus group discussions, public actors – and possibly the other stakeholders – should make decisions and prepare a policy intervention.

(6) Starting a new circle: monitoring and evaluation with the help of gap indices
The connectivity model, in terms of its evaluation and monitoring stage, uses the gap index as an output indicator for RIS3. The policy measure with an objective for better connectivity in the region is a success if the gap index is reduced after the policy intervention. The idea is to repeat the connectivity measurement to identify bottlenecks and to have a continuous policy process where the success of the interventions is evaluated. The entire process can be seen in Table 1.

Besides focus group meetings arranged around gap indices, other methods of structured dialogue have also been used in regional development policy, for example, constructing regional advantage through related variety and platform policies (Asheim et al., 2011). Structured dialogue in the focus group meetings of relevant stakeholders can be seen as a regional development platform, but instead of megatrends and cross-sectoral needs (Harmaakorpi, 2006), the participants relate to the gaps and holes in the TH network.

Table 1. Steps in smart specialization strategy and the connectivity model.

Steps in the smart specialization strategy	Connectivity model of regional development policy
Elaboration of an overall vision	'Connected region'
Analysis	Measuring connectivity with survey and gap analysis: gaps between expectations and experiences
Governance	Stakeholder engagement in focus group meetings
Identification of priorities	Selection of most important gaps Structured dialogue on gaps
Definition of policy mix	Measures to bridge the observed gaps
Monitoring and evaluation	Repetition of the survey: have the selected gaps been bridged?

5. The connectivity model in practice: case study from Ostrobothnia

5.1. Case study region: connected region?

Ostrobothnia is a region in western Finland with 180,000 inhabitants. It has a vibrant industrial sector, exemplified by the energy technology cluster in and around the regional capital Vaasa, and also a boat building cluster, and fur farming businesses in the countryside. Over 60% of the value of industrial production was exported in 2012, and Ostrobothnia has been characterized as a globalized innovation system. Among the Ostrobothnian workforce 6% earned their living from agriculture, 32% from industry and 61% from the service sector in 2010 (AMCER report, 2012).

The Finnish innovation system is centralized and many important policy domains such as science, technology, innovation and university policies are coordinated at national level, with weak regional approaches. Regional Councils are responsible for regional development, including RIS3. In Ostrobothnia, a 'connected region' was selected as a vision for RIS3, and a policy model was developed according to the vision. The model was presented and commented on at a seminar on the subject of the smart specialization platform held in Vaasa, 14 May 2013. A detailed questionnaire was prepared and 53 interviews were conducted in the autumn of 2013.

5.2. Case study survey

The actual selection of respondents was made using stratified sampling. Leaders of organizations from the three helices were interviewed. The respondents were found mainly via internet searching, but some were already well known within the research group. We focused mostly on regional fields of export known as smart industrial fields, such as the energy industry, boat building and fur farming.

Information was gathered concerning the amount of cooperation between the respondent's organization and all the different helices on the three spatial levels. Each relation had unique features and required its own questionnaire, albeit the majority of the questions across the questionnaires could be linked. The method provided data on certain unique aspects of cooperation from both sides of the relationship. The network structure was outlined with the question about the number of partners within the nine relations (between universities, public organizations and companies on local, national and international levels) (Mäenpää, 2014, p. 52).

Connectivity is measured with gap analysis. Expectation means the ideal level of cooperation, and it was marked with a value from 1 to 10 to indicate what the cooperation might be, or should be in an ideal situation. Experience refers to the actual cooperation, and was measured with the same scale. The gap index was a result of subtracting the value of experience from that of expectation in various dimensions. For example, the relationship between companies and public organizations might differ in terms of employment issues, environmental regulation, spatial planning, technological development or business development. The process produces detailed data about the bottlenecks affecting various aspects of cooperation and offers a view of the key areas in need of improvement. The biggest gaps are further examined in focus group meetings. An overview of the methods and data used can be seen below (Table 2).

Table 2. Overview of the methods and data.

Topic in the connectivity model	Conceptual framework	Method	Data
Measuring precondition for TH connectivity	Institutional and geographical proximity	Mapping the number of respondents' partners by helices and by regions	Quantitative data
Measuring TH connectivity: dynamics	Strength of the relation, gaps	Gap analysis: evaluation of expectation and experience within a relation	Quantitative data, Scale from 1–10, gaps between expectation and experience
Improving preconditions of TH connectivity	Social, cognitive and organizational proximity	Focus group meetings: validation and selecting most important gaps	Qualitative data: minutes
Improving TH connectivity	Gap indexes	Focus group meetings: policy mixes implementation	Qualitative data: minutes
Evaluation and development of the model	Smart specialization policy process	Testing the model annually	Quantitative data: improvements according to the gap index

5.3. Analysis of TH networks: proximities

From the perspective of the TH framework, the connections between actors are either intra-helix or cross-helix. When helices are isolated, the networks spread inside their own helix. This is the case with the disconnected TH. The more the helices overlap and interact with one another, the more connected the region is. If we look at Table 3 and the total number of partners (657) that our 53 respondents mentioned in Ostrobothnia, it is evident that the majority (410/62%) of them are situated outside the respondents' own helices. This indicates high connectivity and actual cooperation between the helices. In particular, this high connectivity is reflected by the respondents from the public organizations and universities, but the majority (87%) of the partners of companies are other companies. Subcontractors provide an explanation for this; Ostrobothnia's energy industry in particular is known for its cluster activity. The geographical proximity of companies would also contribute to this, because over 70% of their partners are local.

The universities have an average level of geographical proximity (51%) and seem to possess a low institutional proximity (17%). However, the low institutional proximity means that universities are open to other parts of society and seem to cooperate, particularly with companies in Ostrobothnia. Public organizations indicate a high level of geographical proximity and a low level of institutional proximity, meaning that their networks are situated in the region of Ostrobothnia and their partners are mainly local companies (Table 3).

Table 3. Geographical and institutional proximity of the TH actors (Virkkala, Johnson, & Mariussen, 2014, p. 120).

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)

Notes: Low proximity – less than 25% of the number of partners in the helix or in the region; average proximity – 26–69% of the number of partners in the helix or in the region; and high proximity – more than 70% of the number of partners in the helix or in the region.

The networks of the companies seem to be regional, national and global. The energy sector companies were especially embedded in all these levels. Universities participated as much in national and international networks as in regional ones. Public organizations were mostly regionally embedded, as was expected. Considering all the actors, we could conclude, according to the notions of Bathelt et al. (2004), that there is lot of local interaction which is necessary for a strong 'local buzz' in Ostrobothnia. However, the region is also well connected internationally.

5.4. Gap analysis

The gaps between the expectations and experiences of the TH network in Ostrobothnia were generally small, indicating a cohesive network. However, the gaps vary for the different TH actors. We consider a gap to be large when the difference between expectation and experience is more than 2 (Table 4). For example, the gaps between companies and the public sector are large in two areas: regional development (−2.0) and land use planning (−2.1).

University actors seem to be happiest of all the helices, since they had no relations with large gaps. Public organizations were generally content with their partners in Ostrobothnia, but their relationships in Finland were not so good with regard to university education and environmental issues. In addition, public organizations were not content with their cooperation with other public organizations in logistical, educational and regional development on an international level.

Taking into account the expectations and experiences scoring more than seven and the gaps smaller than one, we find good practices that are concentrated mostly inside the company helix. These results indicate a well-functioning company network in Ostrobothnia, with links to both national and international actors.

One major finding was that the innovation system in Ostrobothnia is business-oriented and relatively well connected. The relations are asymmetrical: local companies have the majority of their connections with other companies, and both the public and university sectors also rely heavily on companies as their partners. This might indicate cognitive proximity in the region, as clearly the knowledge embedded in companies is sought after in all of the helices. The networks in Ostrobothnia are locally embedded and cohesive, so the gaps are relatively small. This does not mean that the innovation system is working optimally. On the contrary, emerging gaps in the system have to be identified and bridged to ensure favourable development.

Table 4. Largest gaps per helix and per region (Virkkala et al., 2014, p. 121).

	Partners helix and the biggest gaps		
Respondent's helix	Companies	Universities	Public organizations
Companies	Happy (no large gaps)	Ostrobothnia: research	Ostrobothnia: regional development and land use planning
Universities	Happy (no large gaps)	Happy (no large gaps)	Happy (no large gaps)
Public organizations	Happy (no large gaps)	Finland: education	Finland: education International: infrastructure and logistics, education, and regional development

Note: Gaps were considered to be large when rated at 2.0 or more.

5.5. Focus group meetings and policy interventions

Three focus group meetings were held with stakeholders from the energy industry, boat building and fur farming in 2014. The analysis results were presented and possible reasons for the biggest gaps were discussed. These meetings were also a good forum for increasing social proximity between the participants.

The energy industry representatives told the research team that they did not feel the local universities supported the sector enough, because there were too few students and projects. They disliked the fragmented nature of Finnish government. There were also large differences in the expectations and experiences of companies and their regional subcontractors (i.e. other companies) and high expectations for the quality of production were mentioned as an explanation.

The policy interventions were planned by the Regional Council of Ostrobothnia, which decided to use a Logic Framework Analysis. The gaps were analysed by origin and consequences, enabling the creation of intervention logic both for short- and long-term interventions. This intervention presented activities and investments that aimed to bridge the gaps. The results of this analysis were then tied to the call for proposals by the Regional Council of Ostrobothnia. The Regional Council has followed the connectivity approach as part of its regional development plan 2014–2020, and the development resources are directed yearly to the biggest gaps identified through the analysis and discussed at the focus group meetings. Since the available development resources are limited, only one or two gaps can be addressed annually. In 2014, there was a call for projects aiming to bridge the gaps between suppliers and the region's largest companies, and three projects were selected. Figure 3 summarizes the phases of the connectivity model of smart specialization, which should be a continuous process in order to evaluate whether the policy interventions bridge the gaps.

5.6. Evaluation of the connectivity model

The first round has been a learning process, which has extended understanding and permitted more targeted actions based on evidence. However, the biggest impact of applying the model is in encouraging reflection among stakeholders on innovation partnerships, which in turn prompts closer TH connectivity.

The main outcomes after implementing the model are as follows:

(1) The study regarding partners' location and helix (proximity) as well as gap analysis, which measures the relationships (connectivity) between the TH actors, provides the relevant information needed for the prioritization process in RIS3.
(2) Structured dialogue between stakeholders in the focus group meetings helps us to understand the gaps and bottlenecks in the innovation system, and to discover and select the relevant ones (i.e. the prioritization process is based on dialogue). In the case study region, only one or two gaps have been selected annually.
(3) The discussions are also useful in designing the policy mixes that are used for bridging the gaps in the agenda. In the Finnish case, the Regional Councils have limited authority compared to the national government, which restricts the opportunities for regional level development policies. The Structural Fund resources are very limited,

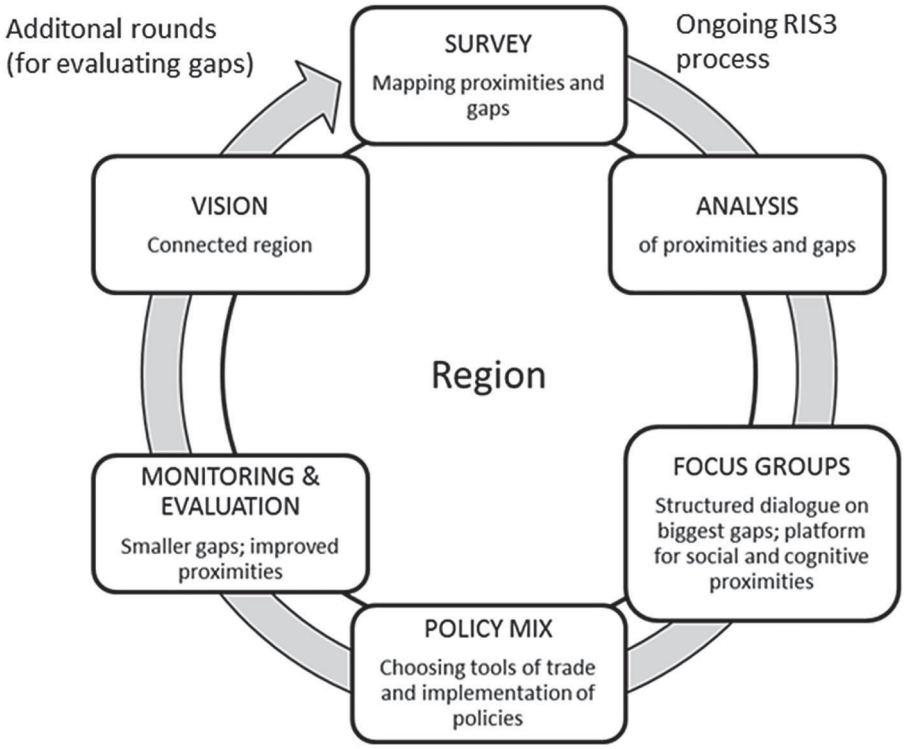

Figure 3. The smart specialization process in Ostrobothnia.

but the discussion could be broadened towards bridging the most important gaps with all possible resources, such as government funding programmes and so forth.

(4) EDP is a continuous process and the connectivity analysis, as well as focus group meetings, should be repeated in order to monitor the policy interventions applied to bridge the gaps identified. The gap index forms an evaluation indicator for the success of a specific policy intervention (see Figure 3).

These outcomes can be seen as useful phases in increasing TH connectivity, which can expand the intersection between helices and form a point of departure for additional EDPs. A connectivity model with structured dialogue between companies, universities and public administration is a method of entrepreneurial discovery because it helps to improve regional innovation cooperation by presenting the bottlenecks affecting it and by focusing support on the biggest issues.

A similar methodological approach has also been applied in the Nordland County, Norway (Mariussen, Gjertsen, Løvland, & Lindeløv, 2013). The application of the model enabled comparison and learning between the regions because Nordland also used gap analysis and focus group seminars. For instance, the first round showed that Ostrobothnian enterprises were more content with the local educational system than the corresponding companies in Nordland. This finding then raises the question of what is done differently in Ostrobothnia and whether this experience can be transferred. Through learning seminars, this knowledge can be codified, transferred and internalized between regions (Mariussen & Virkkala, 2013).

The connectivity model, however, still has obvious limitations: first, the regional institutions might not have enough capability to build a common vision, or organize a survey or focus group meetings. Second, even if the core actors managed to organize the survey and focus groups meetings, the relevant stakeholders (especially companies) might not participate in the meetings. Third, the relevant stakeholders might have vested interests. They might evaluate the connectivity from their own somewhat egocentric views and not from the point of view of the whole region. Fourth, the model does not give clear methods for evaluating the importance of the gaps, or the possibility or cost of filling the selected gaps. In the case study region, the Regional Council planned the measures to fill the gaps based on the discussions in the focus group meetings.

6. Conclusion

The article is based on the hypothesis that improving connectivity between regional stakeholders can contribute to the renewal of the regional economy. We have dealt with the research question concerning the role of connectivity in smart specialization, how to measure connectivity in the RIS3 context and how to use these measurements as guides in an entrepreneurial discovery process. This is done first by exploring linkages between the concepts of TH connectivity and EDP, and second by building an applied policy model called the connectivity model, which is based on the RIS3 experiences of one region in Finland.

The article provides a novel approach in which TH connectivity is at the centre of the EDP. This was achieved by extending the TH approach through proximity and gap analysis. Various proximities are preconditions of connectivity, and the connectivity as an interaction between the TH actors was conceptualized in the paper with the help of gap analysis. We argue that the gaps, as differences between expectations and experiences of stakeholders, may be used as drivers of change generated through the EDP. This is achieved by placing gap analysis at the centre of the policy model. Here, it directs the search for new solutions. Its practical application was tested during an action research process as part of the preparation of RIS3 in the region of Ostrobothnia, Finland. This combination of gap analysis and discovery through dialogue is a novel way to analyse, measure and improve TH connections in the RIS3 context. Overall, the connectivity model consists of surveys, gap analysis, focus group meetings, policy measures and evaluations; and its identified elements can be replicated. Key issues are gap analysis and focus group meetings in which the most important gaps are selected. The connectivity model is especially useful in regions where low connectivity seems to be a problem and the regional administration has a vision of being a connected region.

In this article, we have positioned connectivity in the context of proximity in order to overcome two limitations of proximity literature; its static nature and focus on dyadic relationships (Balland et al., 2015). Connectivity (expectations and experiences) pre-supposes a certain level of social and cognitive proximity. By measuring expectations, experiences and gaps the connectivity approach throws light on social and cognitive proximities. Through the following dialogue in focus groups, these indicators are discussed, evaluated and acted upon. The aim of the connectivity model is to influence proximity between stakeholders through bridging gaps in the innovation networks (Figure 2).[1] During the EDP process both cognitive and social proximity may be increased. In the focus group

meetings, the reasons for distance between partners are discussed, mental models are shared and strategies for knowledge bases are agreed upon. We agree on Balland et al. (2015) who see cognitive proximity as the most dynamic dimension since knowledge bases change continuously. The focus group meetings are attempts to create temporary organizational proximity. Institutional proximity was defined on macro scale as norms and operating codes of the helices, and it is very difficult to change. However, the institutional logics could be intermingled at the intersection of the helices (Etzkowitz & Leydesdorff, 2000; Ranga & Etzkowitz, 2013), and a new norm of cooperation between actors from different helices may emerge in the long run.

The article tried to solve the limitations of dyadic relationships by using proximity approach in TH relations in the context of RIS3. In regional partnership there are many varying actors and also relationships. Some of them might be closer than others on different dimensions of proximity. In the case study, we used the average institutional and geographical proximity based on dyadic relations. There are still limitations in our analysis and more research should be done to apply proximity approach in regional partnerships.

The connectivity model is a soft and gradual approach of TH coordination in multilevel governance. It makes it possible to direct specialization and priority seeking in a narrow and specific way, which helps the policy process. It can be used as one approach in the RIS3 process, possibly combined with other approaches. The connectivity model has some bottlenecks that can be addressed, especially by creating more specific methods to evaluate the importance of the gaps and their selection.

The connectivity model was planned for regions with problems of connectivity between the stakeholders and thus for the RIS3 focused on functional prioritization. According to the model, new areas and activities can be discovered where perceived gaps might be bridged. These new activities might be smaller entities than the new business areas (domains) that Foray (2015) emphasizes as a result of entrepreneurial discovery. In principle, focus group meetings could potentially lead to (cross-) technological discoveries, even unintentionally, when the actors 'collide'. However, more research is needed on how to combine functional and thematic aspects of the model, such as specific technology or activity that enables the renewal of the regional economy.

Note

1. The optimal proximity could be found by comparing regions and their connectivity measurements (gap index) with other regional performance. Then the optimal level of connectivity can also vary between regions depending on the value of these indicators and other factors.

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The Role Of Proximity In Less-Favoured Regions: Smart Experimentation Between Triple Helix Actors

Antti Mäenpää & Seija Virkkala

11.1 Introduction

Smart specialisation (Foray et al. 2012) is an academic concept that has been implemented in practice as the EU's latest research and innovation strategy for smart specialisation (RIS3). One of its central concepts is the entrepreneurial discovery process (EDP), the main idea of which is to define regional assets and utilise them for maximum effect to improve economic prosperity (Foray et al. 2012). The EDP is a challenging process, which demands a broad partnership of entrepreneurial agents, like relevant public and private stakeholders. The stakeholders should form a public–private partnership to make entrepreneurial discoveries and to prepare regional strategies based on these discoveries. However, in a less-favoured region (LFR), there might only be a few relevant stakeholders, who might be too distant from each other, which might lead to a partnership that is weak or short on interaction.

Less-favoured or peripheral regions have traditionally been defined as areas with low levels of accessibility to large-scale (national, continental, and global) interaction centres offering access to markets, production factors, private and public services, cultural facilities, sources of innovation systems, and to economic and political power (Lorentzen 2012: 16–17). They have high travel and transport costs and are remote from centres of economic activity. They also suffer from the absence of agglomeration advantages, which manifests as low rates of entrepreneurship and innovation. The category of LFR is a relative category, which should be studied in relation to the more-favoured regions. In a knowledge-based economy, accessibility to transport for physical goods has become less important, and other forms of accessibility, such as to business air travel and ICT, have become more important (Crone 2012).

The innovation systems in an LFR can often be characterised by a low level of interaction between knowledge producers and knowledge users, a lack of a critical mass of innovative firms, a weak connection with key organisations (e.g. universities, companies, and public actors), and by a low level

of clustering (Tödtling and Trippl 2005). These characteristics can make the RIS3 process challenging in LFRs. A less-developed regional innovation system (RIS) has a weak capacity to support the renewal of the regional economy over time, which is important in the RIS3 targeting initiating regional transformation via the EDP (Blažek et al. 2014: 5). Moreover, the stakeholders in the LFRs might lack knowledge of innovation and might also have a low absorption capacity in terms of acquiring key knowledge.

This chapter discusses two challenges associated with the EDP: the low connectivity between stakeholders and the lack of a role for stakeholders/entrepreneurial agents, or a weak role for them. The chapter approaches the innovation system in LFRs by analysing the innovation cooperation between the triple helix (TH) actors and companies in particular. The chapter presents an analysis adopting two approaches: the proximity approach and the knowledge typology approach developed by Lundvall and Johnson (1994), which focuses on the role of codified and tacit knowledge. The chapter aims to advance understanding regarding networking preconditions, behaviour, and knowledge acquisition regarding companies in LFRs, and also to analyse the role of different proximities in their cooperation for innovation. This is also crucial for the EDP because companies are usually the main implementers or beneficiaries of the innovation strategies and because new ideas leading to domains might emerge from these relationships and interactions. This also contributes to the proximity discussion from the perspective of the LFRs, and to that on how to overcome institutional barriers in peripheral regions.

The chapter aims to respond to the following research questions: what is the relationship between geographical and non-spatial proximity in companies in LFRs? What could be undertaken in LFRs to increase proximity between stakeholders?

These research questions are approached via the findings of a Finnish case study from the region of Ostrobothnia on various proximities and aspects of knowledge creation through innovation cooperation between TH actors. The Finnish region of Ostrobothnia and the country in general have managed to at least partly overcome the less-favoured conditions of being on the northern periphery of Europe. The innovation scoreboard of the EU ranks Finland as an innovation forerunner. This study also introduces a new way to measure social and cognitive proximity, and thus provides detailed information regarding the institutional, social, cognitive, and geographical proximities required for innovation cooperation among the various actors.

11.2 Conceptual background

11.2.1 Regional innovation system (RIS) and triple-helix models

Innovation is becoming an evermore complex, interactive, and open phenomenon, and different types of knowledge are combined in innovation processes. Strambach and Klement (2012) introduce the concept of the *combinatorial microdynamics of knowledge*, in which innovation relies on the combination of different types of knowledge. Within innovation processes, relevant knowledge is distributed, as a result of different actors in different places having elements of the necessary knowledge. Collaboration in formal and informal networks is one way for firms to acquire knowledge for innovation, and this chapter concentrates on that form. Other forms supporting knowledge acquisition include labour mobility, market links, monitoring, and knowledge spillovers.

Territorial innovation models, for example, RIS theories, emphasise the importance of regional knowledge for innovation. The RIS approach underlines the importance of interactive learning (i.e. networks): innovations are the outcome of interactive learning within and between two subsystems – knowledge generation (universities) and knowledge application (firms) – located in the region. The exchange of tacit knowledge is facilitated by geographical proximity and regional cultural contexts, that is, geographical and social proximity. However, external knowledge links are also important (Bathelt et al. 2004) and often complement regional knowledge. The combination of knowledge acquired from different spatial scales is the key to innovation. The term *local buzz* refers to free and automatic participation in often unintended knowledge circulation of actors in the same location. *Global pipelines* are seen as planned connections to distant partners and knowledge sources, which can provide new technologies and markets (Grillitsch and Trippl 2014).

LFRs usually have relatively few actors and limited local knowledge flows, only a few knowledge and support organisations, and no, or only weak, clusters. Isaksen and Trippl (2014) call them "organizationally thin regions". Regions with thin RISs are far less dynamic. They generally have fewer innovative new firms than thicker RIS regions, and the role of support organisations and extra-regional knowledge links might be more important to the EDP than in thick regions with their dense organisational network and rich local knowledge flows.

Jensen et al. (2007) introduce 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 focus mainly on incremental changes in existing products and processes. In the DUI mode, crucial knowledge of innovation processes is formed through a combination of the employees' training and working-life experience. The knowledge base is developed through in-house problem-solving by individuals and teams of workers, and this becomes evident, for example, when firms cooperate with customers who are facing new problems and when suppliers engage in innovation activity (Jensen et al. 2007; Virkkala 2013). The DUI mode is based on synthetic and symbolic knowledge (that is market/user-driven), emphasising competence-building and organisational innovations, but analytical knowledge is more important in the STI mode of innovation. The DUI mode depends more on implicit and local knowledge where know-how and know-who play an important role, but the STI mode of innovation is based on explicit and global knowledge, and emphasises know-why and know-what.

The TH model has been used as a framework of knowledge-based societies, and universities are at the core of the model. According to the model, universities, industry, and government are the key institutes whose interaction is necessary for innovations (Etzkowitz and Leydesdorff 2000). The TH approach has been criticised for conceptualising only three groups of actors (Carayannis and Campell 2012) and neglecting the absorptive capacity of companies and government to engage with universities. Responses to the criticism include attempts to incorporate a wider set of actors and institutions, as in the *quadruple helix* that includes non-governmental knowledge production, utilisation, and renewal entities as well as other civil society entities, institutions, and stakeholders (Carayannis and Campell 2012).

The concept of the TH has been applied in smart specialisation to form the basis for connectivity within regions. A connected region is a norm or vision where the three helices work in harmony, thereby mutually reinforcing each other (Goddard et al. 2013). The collaboration between TH actors in different helices is especially beneficial for many reasons, but usually the idea of different types of people, schools of thought, and varying overall objectives adds value to the innovation process (Ranga and Etzkowitz 2013). The public sector focuses on the public good, companies add market knowledge, and universities link the region to global research networks. This collaboration also provides a solid framework for the EDP, as various ideas intermingle.

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 required changes. Entrepreneurs are locked out of regional planning (Goddard et al., 2013), and the EDP cannot emerge properly. This applies

especially to an LFR lacking important actors; however, RIS3 is based on the idea that if a region lacks some actors, it may use its existing knowledge to compensate for that lack; so, for example, if there are few companies, then universities and local development agencies may prove to be sources of market knowledge. Therefore, one can state that one important precondition for regional innovation is optimal proximity between the actors, and this can vary depending on whether the region contains all the necessary actors.

11.2.2 Proximity as a precondition of a relationship

The proximity approach was introduced by Boschma (2005) and by Torre and Rallet (2005) and is used mostly to understand which type of proximity produces innovation, and to what degree. The approach primarily focuses on dyadic relationships. Proximity is required to connect actors and to enable interactive learning and innovation. Geographical proximity promotes unique local competencies, skills, and new knowledge, which can diffuse spontaneously through personal contacts via the local buzz (Bathelt et al. 2004). However, geographical proximity alone is not sufficient to foster knowledge creation, but it does facilitate non-spatial forms of proximities and the sharing of tacit knowledge. In addition to geographical proximity, Boschma (2005) suggests four non-spatial dimensions of proximity: social, institutional, organisational, and cognitive proximity. Geographical proximity refers to physical distance measured in kilometres or time. Institutional proximity indicates shared formal and informal rules. Cognitive proximity refers to the similarity of the knowledge bases of the partners, and social proximity refers to the personal or professional relationships between partners. Organisational proximity refers to the same relational framework or share of common knowledge and capacities (Torre and Gilly 1999).

When actors get closer in one dimension, they also get closer in other dimensions. This means that the dimensions have somewhat overlapping boundaries. Geographical proximity tends to create an overlap between geographical and other (non-spatial) forms of proximity (Malmberg and Maskell 2006). For instance, geographical proximity stimulates the emergence of trustful relations through the possibility of the frequency of relationship, resulting in higher social proximity. Geographical proximity may also stimulate territorial specialisation and cluster formation, which may then turn into cognitive proximity as people work closely on related fields. The overlap of geographical and cognitive proximities depends on the degree of regional specialisation (Hansen 2015). In addition to the effect of overlap, the proximity literature emphasises the possibility of substitution of non-spatial proximities for geographical proximity. According to Boschma (2005), geographical proximity is neither a necessary nor a sufficient condition for learning. The lack of one proximity can be

compensated for by the presence of another form of proximity. This is a very important statement as a precondition of innovation development in LFRs, since their actors might need to cooperate with partners in other regions to deliver innovation.

However, proximity between agents in networks does not always increase their innovative performance, and may even harm it; this is the so-called proximity paradox (Boschma and Frenken 2013). If two actors have a similar knowledge base, the cognitive distance between them is short, and their collaboration might not improve innovation performance because new ideas may require somewhat different views, and some level of recombination is usually central to innovation. Instead, the collaboration might even give rise to what are termed lock-ins (Boschma and Frenken 2013), where collaboration among actors is so strong that other partners cannot 'fit in'. Moreover, the strength of social ties between two actors can vary. Proximity may also hinder extra-regional collaboration and sometimes even local learning. This is especially true for institutional proximity, which in this chapter is operationalised as the proximity inside helices (companies, universities, or government), as high levels of institutional proximity mean less cross-sectoral knowledge transfer. In addition, geographical proximity can become a hindrance if collaboration occurs only on the local level. High social proximity might mean that new actors are not easily accepted. Optimal proximity varies region by region, and therefore should be studied in association with its regional background.

Innovation cooperation can also be dynamic: interaction between actors can contribute to various forms of proximity that can cut across organisational, institutional, and spatial boundaries. During interactions in the innovation process, the partners learn from each other, their knowledge bases will change, and their shared mental models will be adjusted, which leads to a reduction in their cognitive distance, which enhances the learning effects (Menzel 2016). The interaction can also create a common social context in which personal relations develop despite organisational, geographical, or institutional backgrounds or knowledge bases (Balland et al. 2015). In a similar way, it is possible to see the EDP as a process in which the different proximities are changing and new relationships will be created. In order to better understand social and cognitive proximity, in this chapter the proximity approach is linked to the knowledge typology.

11.3 Research design

11.3.1 Knowledge taxonomy as proximity

The literature review provided a framework on TH and proximity as theoretical concepts, but they can be operationalised in different ways. The authors think that the idea of institutional differentiation (as in the TH model) can offer a good point of departure for an empirical study. Whereas most firms specialise mainly in the exploitation of knowledge for economically useful purposes, universities are involved mainly in knowledge creation through research, followed by its dissemination through education. The TH concept provides ready-made empirical categories for studying relationships between different actors. Accordingly, data were collected on the basis of the described institutional spheres: companies, universities, and public government.

Geographical proximity normally refers to physical distance measured in kilometres or time, but in this chapter the concept refers to intra-regional vs. extra-regional proximity. Institutional proximity indicates the joint formal and informal rules, and, in this chapter, refers to the helices: universities, as scientific systems, communicate and function in accordance with the code of true/false, companies in accordance with the code of profit/loss, and the public sector in accordance with the code of right/wrong. Cognitive proximity refers to the similarity of the knowledge bases of the partners, and social proximity refers to the personal or professional relationships between partners (Virkkala et al. 2017). Our empirical analysis is based on the data on geographical, institutional, social, and cognitive proximities. There were insufficient data available on organisational proximity to be able to include it.

The authors illuminate the relationships between actors with the help of a knowledge taxonomy that takes account of the division between codified and tacit knowledge. 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. The knowledge typology of Lundvall and Johnson (1994; Jensen et al. 2007) mixes codified and tacit elements and specifies functional types of knowledge with the help of four categories: *know-what* is knowledge about facts on regions, inhabitants, and industrial structure, and describes what is going on; *know-why* is knowledge that explains why things are done in a certain way (or theories on the reasons for development), the principles and laws of nature, in the human mind, and of society; *know-how* defines how things happen in practice (or how to perform skills), and is often tacit by nature; and *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).

Knowledge taxonomy has been used in a survey to define the depth of the relationship with regard to a respondent's knowledge of his/her partner. The deeper the relationship, the more dimensions are covered by the respondent's knowledge about his/her partner's activities connected to innovation. Table 11.1. combines the knowledge taxonomy with the proximity dimensions. *Know-what* and *know-why* refer to cognitive proximity, *know-who* and *know-how* to social proximity.

Table 11.1. Knowledge taxonomy and proximity dimensions explaining the network relations between triple helix actors (Source: authors' own analysis*)*.

Knowledge taxonomy	Content	Proximity dimension
Know-what	knowledge about facts (often codified knowledge)	Cognitive
Know-why	Knowledge that explains why things are done in certain ways	Cognitive
Know-how	Practical knowledge how to perform skills (often tacit knowledge)	Social
Know-who	Knowledge regarding who knows what: the actors and partners	Social

11.3.2 The region of Ostrobothnia: data and methods

Ostrobothnia is a region in western Finland with a population of 181 000 people. The national capital, Helsinki, is situated over 400 kilometres away, and the largest regional city, Vaasa, has 67 000 inhabitants. The region is known for its industrial sector, which consists of the energy technology cluster in and around the regional capital Vaasa, a boat building cluster, and fur farming businesses in the surrounding countryside. Over 80% of the value of energy technology production was exported in 2017, and Ostrobothnia has been characterised as a globalised innovation system. Among the Ostrobothnian workforce in 2014, 6% earned their living from agriculture, 29% from industry, and 64% from the service sector (EnergyVaasa 2018; Regional Council of Ostrobothnia 2018).

The case study region has some characteristics of an LFR, in that it is relatively small and the agglomerative advantages are limited. In addition, its location is unfavourable relative to the main national and European centres of population and economic activity, which results in increased travel and transport costs. However, the case study region and Finland in general have managed to at least partly overcome the less-favoured conditions of Europe's northern periphery. In the innovation scoreboard of the EU, Finland has been classified as an innovation forerunner.

The Finnish innovation system is centralised and many important policy domains such as science, technology, innovation, and university policies are coordinated at the national level, with weak regional approaches. Regional Councils are responsible for regional development, including RIS3. This background has obviously affected the authors' view on regional innovation and needs to be addressed here. In Ostrobothnia, a 'connected region' was selected as a vision for RIS3, and a policy model was developed according to that vision.

The data used in this chapter were gathered during 2013 as part of an earlier study on overall regional connectivity (Mäenpää 2014). In total, there were 53 respondents representing various expert and leading positions in companies (21), the public sector (17), and universities (15); the group represents the three most important export sectors of the region: the energy technology cluster, boat building, and the fur industry. The actual data gathering was undertaken via surveys, but, due to the wide range of questions, was complemented by an interviewer helping the respondents to complete the survey sheets. The cooperation between the TH actors was studied via nine relations. First, there were the three types of organisations: universities, public organisations, and companies. Second, there were also three geographical levels: regional, national, and international. This created the nine connections that were focused upon. The respondents reported the number of partners and their importance by utilising simple tables into which they entered the (exact) number of partners and, in another table, their importance on a scale from 1 to 10 (from lowest to highest, and using 0 to denote no connection).

Different knowledge types were analysed by asking about experiences of cooperation according to the different aspects of knowledge typology (also on a scale from 1 to 10, and 0 if there was no connection) (Table 11.1). The questions were designed to elicit the extent to which the respondents knew the staff of their partners, or the ways in which their partners work (social aspects), or what their partners were working on, or why they were doing so (cognitive aspects). Questions were asked about the innovation partner, and there was a general description (actual dialogue, not just purchasing activities) for it, as the aim was to let the respondents themselves decide what they considered important aspects of collaboration. The method offered a route to identifying possible development challenges.

The same question sets were answered 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 exceptions were public organisations, as their connections to companies outside the region were not studied 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.

This chapter presents a new analysis investigating how different non-spatial (institutional, social, and cognitive) proximities substitute for and/or facilitate geographical proximity. The idea is to analyse data regarding the importance and number of different partners for the respondents and regarding a respondent's knowledge of their partners' innovation activities. The authors then evaluate how proximity affects the emergence and functioning of the innovation network among the TH actors.

11.4 Analysis and results

11.4.1 Geographical and institutional proximity

Taking account of the total number of partners (657) mentioned in the 53 interviews, only 38% of the relations are directed towards the respondents' own helices and 62% are directed towards the other helices. These figures can be interpreted as signifying quite low institutional proximity. However, low institutional proximity also implies high connectivity between the helices. Comparing the geographical proximity (67%) figure to this indication, it is clear that, overall, the region of Ostrobothnia has a good number of connections between helices, but they are mostly regionally embedded (Table 11.2).

Table 11.2. Geographical and institutional proximity in Ostrobothnia (Virkkala et al. 2014a: 120).

Helix of respondents	Geographical proximity: Ostrobothnia vs. other regions	Institutional proximity: own helix vs. other helices
Companies	High (70 %; 119/171)	High (87 %; 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 30 % of the number of partners in the helix or in the region. Average proximity: 30–70 % 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.		

With regard to the companies, most of their partners (70%) are based in Ostrobothnia, which indicates high geographical proximity. The institutional proximity of the companies is, however, even higher (87%), suggesting that they largely cooperate with other companies instead of the other two helices. The university sector has an average rate of geographical proximity (51%) and a low /average rate of institutional proximity (17%). However, in this case the low institutional proximity might mean that universities are not living in a closed academic world, but instead are open to other parts

of society, and that they cooperate particularly with firms in Ostrobothnia. Public organisations display a high rate of geographical proximity (75%) and a low rate of institutional proximity (22%), meaning that their networks are mostly in the region of Ostrobothnia (as the legislation establishes) and also consist mainly of companies.

The data on the importance of partners (Table 11.3) reflect similar results, as regional companies are valued above all others in importance. This is especially relevant as the question was related to the innovation and actual collaboration of all respondents. Thus, simply buying products was not sufficient to justify the connection, which had to include innovation-related dialogue.

Table 11.3. Importance of partners across spatial scales and helices for all respondents (Source: authors' own analysis).

How important are these partners? (avg)	Companies (n=21)	Public organisations (n=17)	Universities (n= 15)
Regional level	8.5	7.7	7.2
National level	7.4	7.0	6.9
International level	6.1	5.0	5.8

The data regarding the number and importance of partners highlight the fact that the Ostrobothnian region is business-oriented. The majority of respondents thought that their most important partners are regional companies, but the list of most important partners also includes national and international companies. It seems fair to say that the innovation system in Ostrobothnia is business-driven. The analysis of the structure of Ostrobothnia's innovation network helps to examine the social and cognitive aspects of companies' relationships to determine the degree to which they are embedded in the region. This analysis is also important owing to the significant role of companies in the EDP as custodians of market knowledge.

11.4.2 Social and cognitive proximity

The role of geographical proximity is especially relevant regarding LFRs. Might there be a scenario involving overlapping proximities so that when geographical proximity is high (i.e. the innovation partners of Ostrobothnian companies are located in the region of Ostrobothnia), social and/or cognitive proximities are also high? The scenario of overlapping proximities means that geographical proximity might facilitate either social or cognitive proximity or both. The second possibility is that the companies compensate for the absence or weak supply of innovation partners in the region

(especially in an LFR) by cooperating with extra-regional (national and international) partners. In that case, firms might have developed high social and cognitive proximities with the extra-regional partners. It is also interesting to see if there are differences across the helices in the social and cognitive proximities of the innovation partners of Ostrobothnian companies.

An inspection of the relationships between companies and public organisations (Table 11.4) reveals that both social (know-how/who) and cognitive (know-what/why) proximities are lower from the companies' view of cooperation at the regional level. Companies have weaker experiences of cooperation with public organisations overall on all spatial levels. The experiences are lowest for both companies and public organisations regarding their knowledge of their partners' reasons for their activity, and on the theories underpinning their activity (the know-why typology), as it requires a wealth of knowledge of the actual processes within the companies/public actors. Our analysis offers results only on the intra-regional connection from the public actors' side, as their legal status requires that they operate on a regional level only.

Table 11.4. Social and cognitive proximities in relations between companies and public organisations (Source: authors' own analysis).

Regional level					
Proximity type	Companies, Experiences (avg)	n	⟷	n	Public organisations, Experiences (avg)
Cognitive	7.1	15	Knows our work (know what)	11	8.9
Cognitive	5.5	15	Helps us with our difficult problems (know-why)	10	7
Social	7.1	14	Contacts us (know-how)	12	8.4
Social	5.6	15	Knows our staff (know-who)	10	8.2
National level *					
Proximity type	Companies, Experiences (avg)	n	⟷	n	Public organisations, Experiences (avg)
Cognitive	6.3	12	Knows our work (know what)	x	X
Cognitive	5.8	12	Helps us with our difficult problems (know-why)	x	X
Social	6.7	11	Contacts us (know-how)	x	X
Social	5.4	11	Knows our staff (know-who)	x	X
International level *					
Proximity type	Companies, Experiences (avg)	n	⟷	n	Public organisations, Experiences (avg)
Cognitive	5.8	4	Knows our work (know what)	x	X
Cognitive	5.8	4	Helps us with our difficult problems (know-why)	x	X
Social	7.0	4	Contacts us (know-how)	x	X
Social	6.3	4	Knows our staff (know-who)	x	X
* Interviewed public actors only have jurisdiction on local level					

An examination of the relationships between companies and universities (Table 11.5) reveals that both social (know-how/who) proximity and cognitive (know-what/why) proximity are lower from the companies' than from the universities' perspective. Companies have weaker experiences regarding cooperation with universities on all scales. Universities seem to have quite strong experiences of cooperation with companies regarding social and cognitive proximities. This is interesting because companies' institutional proximity is high (Table 11.2.), so the knowledge residing within universities does not seem to be of interest to local companies. Indeed, institutional and geographical proximity seem to correlate, and it is probable that the explanation lies with the regional innovation structure.

Companies' experiences of cooperation with regional universities with regard to analytical knowledge that improves the innovation process (know-why) are lower than those with national and international university partners. This indicates that companies might substitute the knowledge production of regional universities with extra-regional cooperation. It also reflects the fact that innovations are complex and the knowledge necessary for production is often dispersed in different locations and on different scales (Strambach and Klement 2012). To acquire knowledge, companies must cooperate in innovation networks even with geographically distant university partners. According to our case study, this seems to be the situation for companies in the LFRs too. However, to acquire the distributed knowledge might be more challenging than to cooperate with the regional universities, and could also demand a higher absorptive capacity of the companies.

196

Table 11.5. Social and cognitive proximities in relations between companies and universities (Source: authors' own analysis).

Regional level					
Proximity type	Companies, Experiences (avg)	n	⟷	n	Universities, Experiences (avg)
Cognitive	6.0	14	We know our most important partner's work (know what)	12	8.4
Cognitive	5.5	14	Improves our innovation process (know-why)	12	8.2
Social	6.1	14	We know our most important partner's research and development methods (know-how)	12	7.5
Social	6.1	13	We know our most important partner's staff working in our field (know-who)	12	7,9
National level					
Proximity type	Companies, Experiences (avg)	n	⟷	n	Universities, Experiences (avg)
Cognitive	6.1	8	We know our most important partner's work (know what)	9	7.7
Cognitive	6.9	7	Improves our innovation process (know-why)	9	7.3
Social	6.8	8	We know our most important partner's research and development methods (know-how)	9	6.8
Social	4.7	7	We know our most important partner's staff working in our field (know-who)	9	7.0
International level					
Proximity type	Companies, Experiences (avg)	n	⟷	n	Universities, Experiences (avg)
Cognitive	6.2	6	We know our most important partner's work (know what)	5	7.6
Cognitive	6.2	6	Improves our innovation process (know-why)	4	7.8
Social	6.5	6	We know our most important partner's research and development methods (know-how)	4	7.0
Social	5.0	5	We know our most important partner's staff working in our field (know-who)	4	7.0

The Ostrobothnian companies knew the staff (know-who) of their regional partner universities better than the staff of their national and international partners. Even if the overall social proximity regarding innovation cooperation is higher on the regional level, the knowledge of partners' research and development methods (know-how) is higher at the national and international levels. On national and global levels, one can already see indications that companies do not know research staff (know-

who), as these are the lowest figures. One explanation is also institutional proximity, as some previous results indicate that, for Ostrobothnian companies, other companies on any spatial scale are more preferable partners than universities (Table 11.2).

Social proximity (know-how and know-who) between the Ostrobothnian companies and their university partners seems to be little higher at the regional level than on the other spatial scales, which suggests that geographical proximity is facilitating social proximity. Spatial collocation increases the likelihood of accidental encounters, and trustful relations can emerge when the exchanges are regular and the people know each other (Storper and Venables 2004).

Companies' connections with other companies are intra-helix relationships according to the TH model, and that is the reason we have measurements from only one side regarding both social (know-how/who) and cognitive proximities (know-what/why) in Table 11.6. Both social and cognitive proximities are higher in the context of cooperation between regional companies than that between Ostrobothnian companies and extra-regional companies. However, the results still show that, on a regional level, social proximity between companies is higher than cognitive proximity, and a comparison of cognitive proximity between companies at the regional and extra-regional (i.e. national and international) levels shows that cognitive proximity is higher among regional companies. High levels of institutional proximity, as indicated by the finding that companies prefer to cooperate with other companies rather than with universities and public organisations, also affect social proximity between companies at the regional level. This is in line with the structural analysis and the fact that the RIS in Ostrobothnia is business-driven.

Table 11.6. Social and cognitive proximities between companies (Source: authors' own analysis).

Regional level			
Proximity type		n	Companies, Experiences (avg)
Cognitive	Knows the standards/concepts (know what)	13	7.8
Cognitive	Helps us with our difficult problems (know-why)	14	8.0
Social	Knows our products/services (know-how)	14	8.2
Social	Knows our key staff (know-who)	15	9.3
National level			
Proximity type		n	Companies, Experiences (avg)
Cognitive	Knows the standards/concepts (know what)	12	7.1
Cognitive	Helps us with our difficult problems (know-why)	13	7.2
Social	Knows our products/services (know-how)	13	6.8
Social	Knows our key staff (know-who)	14	6.2
International level			
Proximity type		n	Companies, Experiences (avg)
Cognitive	Knows the standards/concepts (know what)	9	7.3
Cognitive	Helps us with our difficult problems (know-why)	9	6.9
Social	Knows our products/services (know-how)	9	7.6
Social	Knows our key staff (know-who)	9	6.3

11.4.3 Summary of findings

An interesting question is whether geographical proximity explains the high rates of other proximities. If one looks at the companies' relations to universities (Table 11.5), one can see that they are generally more distant (i.e. the level of proximities is lower) than the relationships between companies, which may indicate that geographical proximity cannot totally explain the findings. Institutional proximity might be one indication, and companies are known for their focus on business-related matters (which directs cooperation with other companies), but one indicator in the company results might offer a more profound explanation. Social proximity, and especially the knowledge of partners' staff (know-who), seem to be quite high at the regional level. This result stands out in the analysis as a whole, as it is the only one near the maximum figure (9.3).

The findings of the analysis show that both social and cognitive proximities are highest at the regional level. However, the differences between cognitive proximity across spatial levels (regional, national, and international) are smaller than those of social proximity across spatial levels.

With regard to the proximities across helices, the findings indicate a clear pattern, according to which social and cognitive proximities are highest in relationships between companies at all spatial scales, but these proximities are especially high at the regional level. One can say that the findings indicate that companies' institutional, geographical, social, and cognitive proximities are overlapping, and it can also be inferred that regional proximity really does facilitate other forms of proximities (Table 11.7) However, this is verified only for innovation cooperation with other companies and public organisations because cooperation between companies and universities indicates generally higher social and cognitive proximities at the national and international levels than at the regional level.

This result is especially interesting in relation to LFRs, as they may lack intra-regional connections, and, in the case of Ostrobothnia, it would seem that regional cooperation has affected the overall TH collaboration, as the regional results for cooperation between companies and universities are low. Local companies, in particular, network among themselves, which might explain why there is high institutional proximity. Universities may not have been able to step into the business-driven networks, as the results indicate that companies' cognitive proximity with universities is lower than the other way around. This might indicate that universities are studying what companies do, but that companies have not invited universities to participate in their entrepreneurial initiatives. Or perhaps regional companies prefer extra-regional universities for collaboration more than regional ones.

Table 11.7. Geographical proximity facilitating other proximities; other proximities substituting for geographical proximity (Source: authors' own analysis).

Geographical proximity vs other proximities	Facilitating/overlapping with geographical proximity	Substituting for geographical proximity
Social proximity (know-how)	Yes (average proximities higher in the region than other scales)	Yes, (Company–university relation higher proximity at national and international levels)
Social proximity (know-who)	Yes (higher in the region than in other scales)	No
Cognitive proximity (know-what)	Yes, (company–company relationship)	Yes, slightly (company–university relation)
Cognitive proximity (know-why)	Yes (company–company relationship)	Yes, (company–university relation and company–public organisation relations)
Facilitating = The proximity between partners is higher in the region of Ostrobothnia than at other geographical scales (national, international). Substituting = The proximity between the partners is higher at other geographical scales (national, international) than in the region of Ostrobothnia.		

11.5 Conclusions

This chapter has discussed the proximity dimension of innovation cooperation from the perspective of LFRs. Based on the literature on proximities, the innovation system, and the TH, the chapter used a Finnish case study to focus particularly on the role of geographical and non-spatial proximities as they affect innovation partners in LFRs. The chapter focused on companies because they are especially important to the EDP. It is important for actors in an LFR to understand the degree to which the possible weaknesses or lack of actors and knowledge suppliers can be improved via cooperation with extra-regional innovation partners. This means the substitution of geographical proximity with non-spatial proximities. The proximities are seen as preconditions for relationships and innovation cooperation between different TH actors across different spatial scales and helices. It seems valid to ask what actions could be undertaken in LFRs to enhance proximity between stakeholders.

The analysis of the Finnish case study leads to four major conclusions. First, different proximities overlap at the regional level, and geographical proximity slightly facilitates social proximity. This might not be surprising since collocation increases the likelihood of accidental encounters, and trustful relations can emerge when people familiar with each other have regular exchanges (Storper and Venables 2004).

Second, companies operating in LFRs might substitute the insufficient knowledge production of regional universities for extra-regional cooperation. We might even suppose that the companies of the case region have managed to overcome the limitations of the LFR, such as there being few actors and tiny knowledge resources, by undertaking extra-regional networking to acquire and utilise geographically dispersed knowledge in their production processes. Regarding LFRs in general, there seem to be opportunities for high levels of cognitive proximity (i.e. knowledge exchange) even in the absence of some regional connections or key enablers. If one considers this in the EDP setting, it might indicate that the idea of utilising universities or development organisations as substitutes for a lack of market knowledge may work, as has been suggested in the RIS3 guidebook (Foray et al. 2012).

Third, in the Finnish case, the level of social proximity was relatively high between regional companies and their international company partners, which might indicate that collaboration over distance is more likely between individuals and organisations with established social relationships. This would seem to indicate that dynamic changes are in play, but the issue should be studied further.

Fourth, and as a response to the research question of how to enhance proximity between stakeholders, the authors suggest that public government should promote and establish a successful EDP partnership between relevant stakeholders. By providing a tool for measuring and improving the connections between stakeholders, the connectivity model with its proximity analysis (developed by Virkkala et al. 2017; 2014b) could broaden the scope of the discussion and provide a proper scenario for possible entrepreneurial discovery. The EDP can be seen as a search process for new business areas, but it is also a process advancing an optimal proximity between actors. This example indicates there is an opportunity for regional developers to search for optimal proximities, which is a precondition for smart experimentation.

In the Finnish case study, one notion was the fact that companies and universities do not cooperate enough, because universities "lack projects and students" (Mäenpää 2014: 62). However, this dialogue continued and, finally, during 2017, the Regional Council, in cooperation with regional technology companies and the University of Vaasa, and with the help of European Regional Development Fund funding, managed to establish a fuel and engine laboratory, VEBIC (Vaasa Energy and Business Innovation Centre), in the region, which is specifically designed to help bridge the gap between company and university knowledge. This is one example of regional collaboration not offering a direct route to new domains and innovation, but one that will nurture a stronger region. This sort of smart experimentation may very well turn into a new specialisation.

The empirical case study has limitations. The data only reflect one region, are based on structured interviews, and come from a limited number of respondents. One research avenue would be to examine the dynamic aspects of the proximities and relationships. Proximities are constantly changing during interactions between partners in the innovation process. When the partners learn from each other, their knowledge bases will change, and their shared mental models will be adjusted, which will lead to the reduction of their cognitive distance, which in turn will enhance the learning effects (Menzel 2016). The interaction can also create a common social context in which personal relations develop despite differences in organisational, geographical, or institutional backgrounds or knowledge bases (Balland et al. 2015). One way to dynamise the proximity analysis would be to employ longitudinal data (Hansen 2015), but more qualitative data with in-depth analysis would also be required. The authors have tried to capture the dynamic aspects of innovation cooperation by measuring the gaps between the expectations and experiences of relationships (Virkkala et al. 2017).

To evaluate the proximities of partners with the help of knowledge typology is only one option. There could also be other measurements, including more statistical analysis (cf. Hansen 2015), but

that would require more quantitative data. Furthermore, more case studies would illustrate how regions differ in their collaboration, and which types of proximities and balances between proximate and distant relationships are prominent in different types of LFRs, and how the proximities might be enhanced to mitigate the limitations of the peripheral regions. This knowledge could be used to develop more tools to encourage specific types of collaboration between various actors. In this way, the EDP could be enhanced and unique ideas for regional specialisation could be promoted. Regional comparison and transnational learning among LFRs would then become possible.

The actors in the LFRs may find new ideas within the region, and need not automatically be left behind in the innovation race owing to their potential lack of connections. Proximity analysis does not address all of the issues, but it does provide one viewpoint for regional analysis and serves as a discussion opener. The authors argue that sometimes it may be smart to focus on the relationships; the rest can then follow.

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Wicked game of smart specialization: a player's handbook

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ABSTRACT
The objective of this article is to explore the theoretical foundations of a wicked game. The theoretical part is based on the notion of wicked problems, which is developed further. It is also illustrated that the latest innovation strategy of the European Union, called smart specialization, resembles a wicked game. Comparison between the two revealed several similarities gives new insights into the theory of wicked problems and into the process of smart specialization.

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Introduction

Ever since Rittel and Webber (1973) published their seminal article, wicked problems have attracted growing interest in the realm of planning and policy-related research. Although the original article was published over 40 years ago, countless articles on wicked problems can be found especially in the twenty-first century (e.g. Balint, Stewart, Desai, & Walters, 2011; Camillus, 2008; Candel, Breeman, & Termeer, 2016; Levin, Cashore, Bernstein, & Auld, 2012; Mason & Mitroff, 1981). It seems that the theme is more interesting than ever (McCall & Burge, 2016). However, as Xiang (2013) has noted, most of the research on wicked problems is repetitive in nature and lacks well-grounded theoretical explorations. The usual case is to prove that the problem observed is a wicked one, and to add descriptions of the stakeholders and their views. At the same time, Raisio and Vartiainen (2015) share the concern over repetition, and they call for more empirical research.

This article addresses Xiang's (2013) point by presenting the theoretical foundations of a wicked game and explores how the players resolve the wickedness from their own subjective perspective. This is done in the context of smart specialization strategy (RIS3), the latest approach to innovation policy by the European Union (EU). The wicked game perspective envisages a more active role for stakeholders in creating and resolving the wickedness. The second objective is to view RIS3 as a wicked game and utilize the concept in order to gather new knowledge regarding the challenges in the RIS3 process. RIS3 has increasingly attracted the interest of policy practitioners recently and its wickedness has even been identified to some extent in the smart food industry and the university sector (Cavicchi, Rinaldi, & Corsi, 2013; Kempton, 2015). The authors argue that elaborating on and demonstrating the wicked gaming element of the strategy will raise awareness of its profound challenges and spur new solutions. The awareness of the wicked situation

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is also emphasized by Xiang (2013) as one tool for working with wickedness. The concept of a wicked game has been touched upon before from the citizens' perspective (Lundström, 2015; Lundström & Raisio, 2013; Lundström, Raisio, Vartiainen, & Lindell, 2013, 2016), but the concept will benefit from an examination of strategy to illustrate how it functions on a multi-scalar level.

The main idea of RIS3 is to enhance regional specialization by finding new ways to utilize its existing strengths. This requires collaboration among universities, companies and public actors (Foray et al., 2012). Each of these different actors and their 'multilevel interplay' (Magro & Wilson, 2013) with various agendas provide an interesting framework for 'regional innovation games' (RIGs), but surprisingly, there have not been any major publications regarding RIS3 itself as a wicked problem. The results of this article benefit both the wicked problems-orientated research, by demonstrating a multilevel case from the wicked games perspective, and the understanding of RIS3 as a process, by adding the gaming element and the highlighted role of the players to the discussion regarding its implementation challenges.

This article continues by presenting the idea of regional innovation and research strategies for smart specialization (RIS3) as approaches in regional development policy, and then makes theoretical observations on a wicked game. Next, the wicked game perspective is contemplated conceptually under the RIS3 approach. This stems from the notion that regional development policy and public policy in general are very sensitive to wicked problems (Head & Alford, 2015; Rittel & Webber, 1973). RIS3 is a practical approach to regional development policy and similarly involves many different stakeholders, or players, from different spatial levels, so it is inevitably complex (Lundström, 2015). This is also the case with RIS3, although the number of players is more restricted as the direct participation of ordinary citizens can be more limited (due to the lack of innovation knowledge/interest) than in regional development policies in general. Therefore, RIS3 gives practical opportunities to conduct research as the key players are known. After establishing the theoretical background, the similarities between the wicked game and RIS3 are explored. This is done by combining the main elements (players, playing fields, objectives and rules) of the wicked game into the RIS3 process.

The notion of game has been used quite often in planning and policy-related research (e.g. Head & Alford, 2013; Leino, 2012; Sotarauta, Kosonen, & Viljamaa, 2007). Even Healey (2006, p. 92) speaks about 'local games being played' among a mix of key players and their viewpoints. Van Bueren, Klijn, and Koppenjan (2003) have come closest to the concept of a wicked game. They used also the gaming aspect in describing 'policy games', but from a network perspective. According to them, 'wicked problems are dealt with in policy games' (p. 194). This interpretation is shared here but developed to fit the context of wicked problems in a more suitable way. The novelty here is the use of the wicked gaming perspective on wicked problems and policy issues, which adds a new aspect to both literatures: the role of the players not only in resolving, but also in creating the wickedness. The notion implies that we are all part of the game and can discover some new and interesting ways to understand the wickedness. Wicked problems are usually seen as 'something out there'.

The authors want to emphasize that to play the wicked game does not mean that the players or the game are suspicious, murky, unprincipled or anything similar. On the contrary, if the wicked game is played as if it was a tame game, the results are worse and the

players do not address the reality of the 'RIG'. The wicked game is necessary if we are to acquire a better understanding about the wickedness and to reformulate or resolve a wicked problem.

Smart specialization in the context of regional development policies

Regional development policies can generally be seen as aims to improve conditions in a certain region. They can be seen as a process and usually refer to economic growth intentions, but are here viewed as a wider ensemble. In addition to the economic aspects, they also refer to the aims of welfare broadly, directly and indirectly. In this, the economic side is only one part but includes the operations of universities, firms, various officials (e.g. local, national and EU levels), various public or semi-public development agencies, the third sector and citizens, to name but a few. The paradigm of regional policies has shifted from central government to different levels of stakeholders (OECD, 2010; Sotarauta, 2010). Overall, according to Bentley and Pugalis (2014), regional development policies are 'a constellation of social, cultural, political, economic and institutional attributes' (p. 292). In the EU, the main regional development activities are conducted under the cohesion policy, which focuses on reducing the differences between regions and tries to ensure growth across Europe by providing structural funds for regional development (European Commission, 2017).

The RIS3 is the latest approach to the innovation policy of the EU and was originally developed by the Knowledge for Growth group to offer solutions for the European economic crisis and growth issues (Foray, 2015; McCann & Ortega-Argilés, 2013). The practical formulation of the RIS3 takes place through developing RIS3 (Foray et al., 2012). These local strategies try to achieve the objectives of the overall RIS3 and their role has been highlighted by tying them with the structural funds programme, that is, with the cohesion policy. RIS3 is an ex ante condition and thus regional actors have to form their own strategy in order to receive structural funding.

The main focus of RIS3 is on regional specialization, which should be evidence based and thus focus on the genuine strengths of the local community. The use of the term 'specialization', however, does not only imply cherry-picking from existing activities, but should also involve serious thinking about how to combine existing regional assets in new ways and either finding new markets or even creating them for future economic growth. The inclusion of the word 'smart' in the term indicates research-driven and evidence-based specialization where local research actors utilize global research networks, and thus assume a central role in getting the innovation activities flowing and growing (Foray et al., 2012; McCann & Ortega-Argilés, 2013).

The overall idea of RIS3 is that regions act almost like regional entrepreneurs as they try to locate and utilize their local assets (personnel, education, products, services, etc.) to attract maximum interest on global markets. This process of identification has been named the Entrepreneurial Discovery Process (EDP) and regional cooperation is central when these strengths are sought after (Foray et al., 2012). Emphasis is put on the process, as the idea is to monitor and evaluate the work and its outcomes in order to ensure development is constant. The role of companies has been highlighted in particular, as they have the knowledge of the global markets and the ability to spot new market potentials (Foray, 2015).

Interestingly, RIS3 presents the triple helix (3H) theory by Etzkowitz and Leydesdorff (2000) as one framework useful for identifying these important local actors (universities, companies and public actors), but places more emphasis on the proactive role of the public sector in generating EDP via its control of strategy work and other local actors (Foray et al., 2012). Originally the 3H theory focused on the role of universities as regional connectors and innovation agents, but now RIS3 introduces a new major player group to the game (Rodríguez-Pose, di Cataldo, & Rainoldi, 2014).

Several studies have established that implementing this subnational strategy is challenging, and there has even been discussion on the vagueness of some key concepts (Cooke, 2016; Iacobucci, 2012). The whole RIS3 concept has recently been challenged by Capello and Kroll (2016, pp. 3–4) who ask how it 'could provide a common political rationale for a socio-economically and territorially diverse set of regions and nations facing different place-based challenges and different innovation modes, hence, quite legitimately, different policy agendas'. One reason for these difficulties might be the lack of understanding regarding wicked problems and especially the fact that RIS3 might be seen as one form of a wicked game.

According to Sotarauta (2010), policy-making and implementation are now understood as multi-agent, multi-objective, multi-vision and pluralistic processes. Forsberg and Lindgren (2015) describe the regional policy of the EU as strongly influenced by the governance model, and therefore by the network orientation (see also Adshead, 2014). This means that the policies are constantly changing and that the players come and go. Therefore, the notion of a tame game and tame problems must be irrelevant to actual policy-making. The notion of a wicked game helps to understand the above multi-processes and networks in a more systematic way, as it explains how they are founded. In addition, it is of course always good to know what kind of game is being played.

Wicked development issues call for a wicked game

Rittel and Webber's 'Dilemmas' has been widely used to describe wicked policy issues (Australian Public Service Commission, 2007; Durant & Legge Jr., 2006; Freeman, 2007; Head, 2008; Head & Alford, 2015; Rittel & Webber, 1973). Rittel and Webber (1973, p. 155) also recognize this aspect: 'Policy problems cannot be definitely described.' The notion of wickedness is becoming ever more useful as we enter 'the era of complexity' (Lundström, 2015; Raisio & Lundström, 2014, 2015). This notion refers to present-day societies becoming more complex, a situation that results from publicity and openness, from the options the current forms of communication offer and from the fact that information is more open than it used to be; but the social side of problem-solving has its effect, which cannot be ignored. In addition, the citizens want better justified decisions. It also calls for a new kind of leadership that embraces the complexity and the wickedness instead of suffocating it (Raisio & Lundström, 2014, 2015). Regional developers (Sotarauta, 2010) are not in a different situation.

Mason and Mitroff (1981) described tame problems through three dimensions. They can be separated, reduced and the right solution can be defined. Conklin (2006) added that the solution is objective. He also noted that tame problems belong to a class of similar problems and all of them can be solved in the same/similar way. It is also noteworthy that tame problems have a stopping point. This means that the problems stop

when the solution is found. The term tame should not be read as signifying that the problem is easy to solve, but the question is about the repeatability and lucidness of the process (Lundström & Raisio, 2013).

Wicked problems contrast with tame ones. They are problems that cannot be solved, and are impossible to define in a clear and acceptable manner. Finding a durable solution is difficult owing to the contending stakeholders and their views, concerns, value systems and beliefs (Lundström et al., 2016; McCall & Burge, 2016; Rittel & Webber, 1973). It all comes down to the interactions present as everyone owns a part of the truth (Roberts, 2000). A number of different lists have been presented claiming to summarize the properties of wicked problems (Conklin, 2006; Norton, 2005, 2012; Rittel & Webber, 1973). Norton (2005, 2012) reduced the original aspects presented by Rittel and Webber into four subgroups: (1) 'Problems of problem formulation' due to value-ladenness; (2) 'non-computability of solutions', that is, the decisions become operational only after the decisions have been made; (3) 'non-repeatability', because the desire for one-size-fits-all solutions should be buried; (4) 'temporal open-endedness', which means that the new resolutions lead us to only a temporary state of equilibrium. This means that the lucidness and repeatability of tame problems are absent in wicked problems.

According to Rittel and Webber (1973), every wicked problem is a symptom of another wicked problem. McCall and Burge (2016) identify this as the central theme of wicked problems. This matches with the complexity point of view and the concept of emergence (Richardson, 2008).

Rittel and Webber (1973) compared tame problems to a chess game. As we all know, a normal game of chess has a set of rules which all players know and accept. Usually the rules concern the number of players, the playing field, who wins and how, if there is an opportunity to tie, what kind of moves are allowed or how the players move on the playing field, the playing time, etc. Sports games and suchlike are tame games; they might be difficult to play, but everyone knows the objective of the game and the rules are familiar to the players. Such games also have no impact on another game; they concern only the players.

It is clear that these kinds of problems call for engineered solutions (Lundström et al., 2016). They also enable the visualization of an all-knowing planner (Morçöl, 2005). This kind of a worldview is considered quite common in the public sector (Raisio & Lundström, 2015). To the all-knowing planner, it is of course always possible to describe the wicked game as a tame one in retrospect. In other words, people tend to simplify the wickedness, especially when time has passed and the situation is not as wicked as before: everything is clear in hindsight.

Wicked games reveal the processes behind the wickedness

The terms researchers use reveal something of their view on wicked problems, especially of how researchers are sensitive to the language used to describe them. A brief overview of the different ways to grasp the wickedness would note how Raisio (2010) 'embraces', Norton (2012) 'lives with', Houghton and many others 'tame', the Australian Public Service Commission (2007) 'tackles', Conklin (2006) and Jentoft and Chuenpagdee (2009) 'address', Camillus (2008) 'resolves', Roberts (2001) 'copes' and many others 'try to deal with' (e.g. Termeer, Dewulf, Breeman & Stiller, 2013; Van Bueren et al., 2003)

wicked problems. The gaming perspective differs from these in that it is more focused on the dynamic part of resolving and formulating these kinds of problems. They are not just out there. Van Bueren et al. (2003) have aptly stated in the context of wicked problems that the differences in the perceptions of the problem cannot be solved by more research.

Rittel and Webber (1973, p. 161) stated that 'it becomes morally objectionable for the planner to treat a wicked problem as though it were a tame one, or to tame a wicked problem prematurely, or to refuse to recognize the inherent wickedness of social problems'. It is good to note that Rittel's understanding of a designer was quite broad: 'Everybody designs sometimes; nobody designs always' (1987, p. 1), or as 'the making of plans to bring about desired situations in the world' (Protzen & Harris, 2010, p. 14). Therefore, planning or design is not restricted only to planners or designers and the morally objectionable concerns everyone who is part of the wicked problem. If a tame game is morally objectionable in the context of wicked problems, Rittel and Webber call for something else.

It would be tempting to illustrate tame and wicked games through the 10-point list provided by Rittel and Webber (1973). However, as has been noted, the items of the original list overlap somewhat (Conklin, 2006; McCall & Burge, 2016; Norton, 2005, 2012). This is why the gaming perspective follows it only partially. The gaming characteristics are presented in Table 1.

One cannot say that there are any rules in a wicked game apart from the law of good manners. This assertion is based on two facts: first, because of their own perceptions of the problems and the potential solutions, the players have different ambitions for what should be done and how based on their own subjective strategies (Van Bueren et al., 2003). The second reason stems from the fact that the players change constantly. Although some of the players can be considered to have a permanent role in the game, some evidently do not. According to Rittel and Webber (1973, p. 163), the players have an equal role because no one has the power to set formal decision rules to determine correctness. From the perspective of the wicked game, the players are not truly equal. Some of them have a greater power to dictate to others; for example, the state has the role of a legislator and oversees budgetary decisions. Such roles make it possible to influence the aims of the game. Therefore, one player might have more power and can even produce somewhat forced solutions, but it does not mean that those solutions are more or less correct than other options. It must, however, be recognized that they do change the game.

Table 1. Tame and wicked games (modified from Lundström et al., 2016).

	Tame game	Wicked game
Rules	Strictly defined set of rules for all situations that can occur, rules are known by every player Rules are mechanical	No coherent set of rules, everybody can play the game by their own rules Rules are organic
Players	Limited number of participants recognized by everyone	Players change all the time, everyone who is involved in the game is a potential player
Playing field	Can be defined precisely	Networked and complex, the spatial scale is relative and can vary
Practice	Repetition can help one to develop skills The more you play, the better you get There is often the possibility of a return tie	No one can master a wicked game because the game, the rules and the players change constantly There is no possibility of a return tie
Ending point	The game has a clear end point Answers are right or wrong	The game does not end Answers are better, worse, satisfying or good enough

All players are part of the game even though they might have stronger or weaker connections to it, which vary as the game changes. The complexity arises not only from the number of the players, but also from the quality of their connections to other players (Dooley, 1996). Van Bueren et al. (2003) have acknowledged the strategic side of the game in addition to the volume of the players. They described the cognitive and strategic uncertainties that result not only from the players' strategic and institutional factors, but also from the volume of players. The rules are organic; they change as the players come and go.

The players are part of the game whether they want to be or not. Sometimes they can be strong and at other times they can almost vanish. Sometimes the players are unaware of their potential stake and remain silent (Healey, 2006). They can intensify if the game evolves in a direction which demands actions from a certain player with weak links to the game. Each player possesses the capability to influence the game (Camillus, 2008) and according to Rittel (1972), the information needed is distributed across many people.

Players are of course dependent on each other. This stems from counteractions taken by some players as they react to the moves of others, and some also form alliances. The moves do not always have an immediate impact; the impacts might become apparent only after a longer period, but they cannot be traced to specific moves. Of course, the actual impacts are joint effects between the actual moves and the countermoves from other players (Rittel & Webber, 1973). These can also emerge as undesirable effects.

Playing a wicked game can lead to different kinds of gaming behaviour; enemies might be thrown together and friends find themselves in conflict, and this situation changes constantly. The situation can cause people to think they are competing against parties who do not necessarily consider themselves to be competitors in that particular situation. Therefore, the notion of the enemy becomes vague. The situation can be the total opposite too. In that case, a player expected to be a member of one team defects to play for the opposite side. There is always a third way, where the players consider themselves to be on the same side. This can lead to alliances or a team game (Lundström et al., 2016).

The wicked game is played at different spatial levels ranging from the local to the international as the decisions are made in different places and by different players. Local decisions, for example, are made by local citizens, but international regional development policies are made at the level of the EU; and of course, there are many levels of players in between (Benz & Eberlein, 1999). This implies that in addition to players' interconnectedness, the regional level is scaling as well. The wicked game is being played at many regional levels (or regional arenas as in Van Bueren et al., 2003) at the same time. The game is scaling horizontally and vertically, in just the way Rittel and Webber (1973) described the poverty problem. Some players are local and interested only in local issues, some other players in the regional issues and still others in multinational issues, while others operate on many different levels at the same time. The levels interact; the local influences the regional, and vice versa, directly and indirectly through the region and directly through players from different levels. This is represented in Figure 1.

In Figure 1, the players operating on the same playing field or regional level interact with each other directly or indirectly. The system also contains feedback loops that influence the players, and very often the national level interferes with the local level.

To master a wicked game is a quite impossible task. There is just too much going on at the same time; too many players entering and leaving, too much self-organization, too

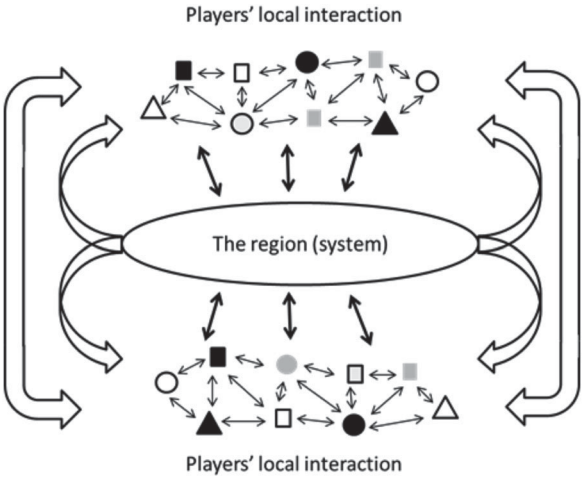

Figure 1. Interaction of players and two playing fields in a wicked game (inspired by Lewin, 1993).

many feedback loops and also the emergence of new players. This explains why there is confusion among the players involved in regional development. The players cannot make moves so as to test their impact. Instead, once a move is made, it resonates through the system, sometimes with bigger impacts and sometimes with lesser ones; the system is not the same once a move is made (Rittel & Webber, 1973).

The search for the end point of the wicked game will be in vain. The region will not stop, it will not be ready. This notion stems from the characteristics of development. For some, the results are good and for others they are awful, which form will be based on the players' subjective mindsets. This kind of juxtaposition is the engine that perpetuates the wickedness. There are no right or wrong answers in wicked problems (Rittel & Webber, 1973), so the answers are something in between to all the players.

RIS3 through the wicked game concept

Playing fields and the players

RIS3 formulation is interconnected on three geographical levels: local or regional, national and international (Mäenpää, 2014; Rodríguez-Pose et al., 2014). However, this should not be seen to denote a strict segmentation of the playing field, for some players such as small firms or individuals may play the game on the local level, whereas universities often involve all of the levels (Etzkowitz & Leydesdorff, 2000; Kempton, 2015). These playing fields are also contradictory, as the national level is not based on the regional level alone, the international level is not based only on the national, etc. According to Magro and Wilson (2013), it is 'the mix of rationales, domains and instruments from different administrative levels' that creates a challenge for proper innovation policy formulation (p. 1655). The state, for example, is a player with a strong influence on all levels. To illustrate the challenges of this innovation game, all three levels and their connections are examined below. The main focus is directed to the regional level.

The RIG

The local level in RIS3 is probably the most chaotic in nature and interestingly forms the most vital field for the players. The RIG here means the part of a wicked game of RIS3 which is played at the local or regional level, even though players from various fields participate in it. Obviously different actors have different roles in the RIG and it is beneficial to define these player groups in order to understand the complexity of formulating RIS3. The 3H classification is used here because it is a typical classification of the various stakeholders in RIS3 (Ketels et al., 2013). It should be noted that these roles may clash and even become contradictory or overlapping.

One important aspect is also the overall inclusiveness of different actors and the wider acknowledgement of the local micro-level connections. Benner (2014) elaborates the idea of smaller networks and even single actors as innovators instead of region-wide constructs. As he states, 'examples for innovations developed in formalised coordination arrangements are much more difficult to find' (Benner, 2014, p. 40). Overall, Benner (2014) encourages wide participation within the local level, including employees as well as directors, and students as well as professors. The authors agree on the local complexity and the role of the individual actors, but still progress to highlight the 3H differentiation between the key players of the RIG in order to build a framework for it.

Although the public sector's role at the regional level is crucial, it does not step into the RIG from the start. Companies and universities already have a built-in need to create something new in order to reach their objectives. Naturally, they have done this for a long time, and, for example, many specialization fields have taken decades or even centuries to form. However, it is the public sector in RIS3 that is interested in boosting regional specialization and especially EDP (Rodríguez-Pose et al., 2014). The public sector, in other words, has the motivation, if not the skill. Obviously, this interest is limited to the relevant public actors who have a legal mandate to address development issues, such as regional councils. From the RIS3 point of view, the role of these public actors is quite similar in every region. Their overall objective is to act as a mediator or as a negotiator and to formulate the discussions, analysis and negotiations needed to provide the vision and goals for the regional strategy (Rodríguez-Pose et al., 2014). Public actors also act as enablers, as they produce the main strategy document (RIS3) and present it at the EU level (Figure 2).

Universities are an indispensable part of regional innovation systems and are local innovation actors that connect other local actors 'via' research, and provide global links to the region through universal research connections (Etzkowitz & Leydesdorff, 2000; Pugh, 2016). They are thus crucial for formulating a successful RIS3 in regions with few connections or low levels of entrepreneurial knowledge (Kempton, 2015; Pugh, 2016). Local universities usually have a genuine interest in regional development, especially if funding or a project is included. However, there are obvious differences between the universities and different faculties (Etzkowitz & Leydesdorff, 2000, p. 117). This is what makes the role of universities individual; the focus areas of universities are different.

Understandably, most companies are primarily interested in making profit and do not have explicit interest in regional development per se. Their interest should be seen as implicit; they are usually interested in regional well-being (e.g. infrastructure), but only

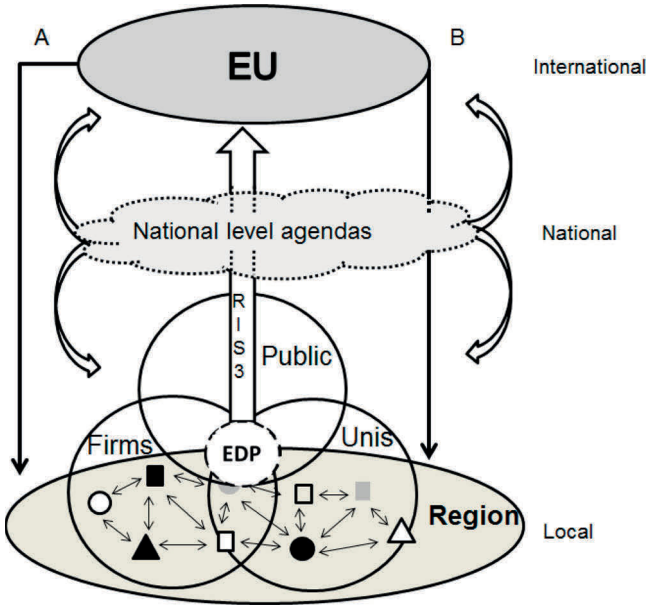

Figure 2. Smart specialization as a wicked game. One region as an example.

participate when they must. Alternatively, they may even completely lack a culture of engagement (Georghiou, Uyarra, Saliba Scerri, Castillo, & Cassingena Harper, 2014, p. 428). Indeed, the involvement of the companies in the RIS3 process has been distinguished as one of the major challenges. Several studies indicate that public and university actors have participated more strongly in strategy formulation than companies (Georghiou et al., 2014; Mäenpää, 2014; Sörvik, Midtkandal, Marzocchi, & Uyarra, 2016, p. 23; Virkkala, Mäenpää, & Mariussen, 2017). This is a challenge for the public actors who somehow have to involve companies, because their entrepreneurial knowledge is one of the central issues in the creation of a solid EDP, which translates into a strong RIS3 (Foray, 2015; Foray et al., 2012; McCann & Ortega-Argilés, 2013). According to Benner (2014), there is also a high risk of favouring established companies, who often have connections within the local development network. These 'insiders' may favour the current development, while it is often new 'outsiders' who contribute the new ideas. There are also differences between small firms and large companies, as the smaller, 'sunrise' industries are hard to find and usually have fewer opportunities to participate. This is especially true in RIS3 as it promotes evidence-based specialization, which can be seen as a deterministic view on established industries, even though they may represent a 'sunset' trend (Benner, 2014; Johnson, 2014; Rodríguez-Pose et al., 2014) or do not even bother to apply for development funding because of the associated bureaucracy involved (Pugh, 2016).

The decision to take part in RIS3 planning can also be affected by the lack of knowledge, individual timetables or even chemistry between people. As previously mentioned, finding the right people may prove to be challenging and this problem has been highlighted recently by studies indicating that individuals may indeed play quite a large role in regional growth (Benner, 2014; Georghiou et al., 2014; Wixe & Andersson, 2016). If these

individuals are not identified, or do not wish to participate, the chosen specialization may lose its relevance.

RIG is, however, not only internal and vertical, but is also played horizontally between regions. In RIS3, this competition is encouraged on a global level. The idea is that similar regions might learn from each other (e.g. in peer-review sessions on the RIS3 platform) to become better in their chosen specialization (Foray et al., 2012; Midtkandal & Hegyi, 2014; Rodríguez-Pose et al., 2014). However, the regions are also competitors, and local companies in particular might not be interested in sparring with their international counterparts, especially if doing so includes sharing some business insights. This creates an interesting mix of local/international and public/company incentives and agendas and creates even greater complexity around the RIG.

Finally, there is no way to determine the 'winner' of this game. Regions do their best to prosper and even though the EU benefits from potential successes, these competitions can also hinder cooperation between regions and create local issues. Companies might want to stay away from public actors they deem too bureaucratic and focus on the international markets themselves (Mäenpää, 2014). The fact that bigger companies already know their global competitors and do not need RIS3 to determine where the future lies adds to this issue, especially if the structural funding is not sufficient to provide an incentive.

National level blessing

In RIS3, the state is the most powerful player in the national playing field, and interestingly, its role is not clearly defined in the RIS3 concept. Even though some nationally based company headquarters may also influence the local specialization, the state can take a strong role in the game as a controller or adapt to a subtler role of enabler (cf. Lundström, 2015; Raisio & Lundström, 2014, 2015). The role of a controller is generally mandatory for the state as it accompanies the role of legislator. However, when it comes to RIS3, the state is not compelled to undertake that role. The main intention of RIS3 is to promote the role of the regions (Barca, McCann, & Rodriguez-Pose, 2011) and thus bypass any possible national agendas that may not take the local conditions into account. However, this direct local–EU interaction (see line A in Figure 2) may never really happen as the state gets involved either wholly or partially (line B in Figure 2), for example, through budgetary decisions (Johnson, 2014). One could even argue that the state is the judge in RIG as it is always able to remove important players from the game (even the EU, as would seem to be the case in the U.K.). In a way, the state thus affects the game by its mere presence as the overall goals of local RIS3 must be thought out in the national context. This forms 'clouds' over the local playing field (Figure 2) and the regional councils need to monitor 'the weather'. Regions with low levels of structural funding are especially vulnerable to the whims of the state as they rely more on national support (Johnson, 2014).

International level influence

It is understandable that the EU acts as the most important player in the international playing field in RIS3. It is the ultimate enabler of local RIS3 as it provides the mandate, guidelines and support for RIS3 formulation (see Foray et al., 2012). In exchange, RIS3

provides local results for the EU, which tries to spot and finance the innovation sweet spots and thus support overall European innovation efforts (line A in Figure 2). However, the EU also controls the process and through the guidelines and funding, it states what is acceptable specialization. Even though the EU promotes the idea of evidence-based strategies, it is still de facto joining the local innovation field and forcing its objectives. When one adds national goals into this same mix and considers what the local actors are trying to accomplish, the overall wickedness of the game starts to become more evident (see Table 2). It is indeed so evident that the need to elucidate the first two levels is justified.

Conclusions

This article presents the wicked game as a course of action that creates the structure of regional development policies. This viewpoint stresses vertical and horizontal interaction from a regional perspective. This has not been emphasized enough in the literature on wicked problems. The people as players are not only a necessary part of the search for the resolutions to wicked problems, but they also create the wickedness.

The current article indicates that there are three main lessons regarding the wicked game perspective in RIS3: first, the identification of the consensus-based strategy that does not recognize the role of individual players; second, the role of the state in the RIG which is not yet fully recognized and last, as one solution to the issues above, the importance of dialogue and the possibility of wider audience participation in the RIS3 process.

Table 2. Players and their roles in the wicked game of RIS3.

Main players	Main objectives outside RIS3	Main objectives in the context of RIS3	Desire to take part in RIS3	Role in wicked game of RIS3	Interested RIS3 participants within the player group
Public sector	Uphold law and prosperity of the region	Boosting regional development and specialization	High	Mediator, negotiator, enabler/ controller	Regional councils, development agencies, stakeholders acting as respondents
Universities	Research, education and societal impact	Creating networks and issuing project funding, fulfilling third mission	Medium	Partner, connector	Depends on the faculty/unit and on the focus areas of the university
Companies	Making profit	Creating profitable networks and issuing project funding	Low	Partner, market knowledge	Export-oriented companies
The state	Uphold law and prosperity of the nation	To enable or to control	Depends on the chosen specialization (if adds to national specialization, then high; otherwise low)	Enabler, controller	Ministries, national innovation programmes
EU	European development, integration, cooperation	Regional and economical development, influence	High	Enabler, controller, creates the wicked game of RIS3	Internal networks, especially actors in structural funding

One could argue that the RIS3 concept stems from a view and assumption that there really are unified specialization goals that benefit the whole region. Of course, some sort of consensus is needed and therefore EDP is vital, but one must still ask how much of the contribution is used to evaluate other possibilities. The majority of the regional strategies list the participants/stakeholders at least by categorizing them through a 3H dialogue (Georghiou et al., 2014; Mäenpää, 2014; Sörvik et al., 2016, p. 23; Virkkala et al., 2017), but are there any lists of potential stakeholders who could not participate in RIS3? Perhaps this might be one future research avenue that could help to strengthen the implemented RIS3: to put its assumptions to the test and see how well it works. This could also benefit from a wicked game analogy by introducing a citizen perspective to bolster the mutual regional strategy.

One big challenge to the consensus-based strategy is the idea of individual players, which must be acknowledged. The notion of a wicked game in RIS3 helps the players to understand the wider framework and that their subjective point of view is only one part of the wicked game. That understanding in turn encapsulates the idea that other players might even have diametrically opposed objectives, despite having the same ultimate goals. Therefore, it helps the players to understand their role in the game. Moreover, it stresses that the players involved are contributing to the wickedness. When they define their own subjective limitations in the process, they reshape the problem to make it a different kind of a problem. This is the reason wicked problems are so hard, or even impossible, to get to grips with, and why their recognition is so important. The key players involved with RIS3 must, therefore, recognize the wicked side of their own actions. When they participate in the game and thus bring their own restrictions to it, they contribute to the wickedness. Therefore, they do not only try to resolve the problems. One possible route to mitigating this challenge is to raise the awareness of the wicked game and problems among the key players of RIS3. This seems to be a good way to get better results when the wholeness of the wicked game of RIS3 is observed. It is possible that the idea of the wicked game is already in the minds of the players, but is only intuitive or implicit. The notion of a wicked game tells the story in a more concrete way.

The wicked game perspective also illustrates the interplay of regional levels and the challenges the different levels bring to regional development policies. The current article classifies the main types of players on the local level. Besides these local players, the state is a formidable player operating between the local and the international (EU) level. However, the role of the state is quite often dismissed in the RIS3 literature, which seems problematic according to the wicked gaming viewpoint. By using the existing literature, we were able to identify the state's role as controller or enabler. This is one major issue regarding the future of RIS3, as national entities can clearly affect the outcome of the process and are not directly involved in many local RIS3 formulation processes. This means that one major player is sitting on a bench and it may even be the decisive player. The authors suggest that this issue might be a good subject for future studies and would like to see more RIS3 implementation examples where the national level has been included in the process.

Overall, our findings emphasize the role of public actors, who are seen as important mediators between the local will, national aims and international influences. The findings, therefore, help verify the RIS3 policy framework regarding public interference. We thus return to the meaning of communication and dialogue in formulating a successful RIS3.

Indeed, our findings emphasize the significance of communication and dialogue. When the players understand the wickedness of the game and their role in it, the only remedy is communication. If every player plays just their own game without any awareness of the wickedness and without communication, the outcomes are worse. In the RIS3 setting, the wicked game adds an emphasis on stakeholder activation and proper consultation. It also adds the notion of games into the RIS3 policy mix and promotes the idea of large-scale cooperation in order to avoid the traps of its complexity. According to previous literature, collaboration is seen as the best way to address the wickedness. The notion of a wicked game confirms this view, and gives weight to the role of public sector, which is the key player in the context of RIS3.

The citizen aspect of RIS3 also merits more reflection. Interestingly, it was the fourth helix in the original RIS3 guidebook (Foray et al., 2012), but its practical use has been minimal. The authors do not say that citizens should be considered the 'fourth wheel', but their importance cannot be bypassed. Citizens can bring some interesting elements to the strategy formulation, for example, ensuring that 'sunrise' industries or companies are included in the strategy, because they may have more knowledge of these smaller, local actors. They can also challenge the interpretation of strategies by giving their own insights into the chosen specializations. At a bare minimum, the strategy formulators need to justify the chosen direction and this can be a real eye-opener for the strategy process. It is all about who is invited to the venue; who gets to pick the insiders from the outsiders (Benner, 2014). The inclusion of civil actors is of course challenging. According to previous studies, the citizens are not always too keen to play the wicked game even if it is about their own neighbourhoods (Lundström et al., 2016), let alone when the game is about abstract EU-driven policies.

Overall, the authors argue that the notion of a wicked game is a realistic portrayal of the policy-making process. The idea of the wicked game also recognizes the focus on the process of RIS3, as it suggests that the development is in constant motion. This highlights the importance of tools for monitoring and evaluation in the RIS3 policy process. Sometimes good intentions can lead to undesirable outcomes if the players do not comprehend that they are playing a wicked game. In addition, the notion depicts the contradictory viewpoints within a certain region.

While all geographical levels are vital, the most challenging part of the game is played at the regional level. This stage was named the RIG as it forms the most vital – and the most vulnerable – part of RIS3, since it is the point where the future direction is set. This emphasizes the need for complexity-based research in the RIS3 setting – especially in the RIG context. For example, what kind of leadership permits the system to develop without the need for too rigid, and therefore too restrictive, guidance? After all, future possibilities may lie just beneath the surface. This type of leadership would also recognize the importance of the different viewpoints of all players.

The lesson regarding the importance of all players raises the important issue of local connections and highlights the role of public actors as experts in this matter. Indeed, some of the latest results seem to verify the important role of individuals as promoters of regional growth (Wixe & Andersson, 2016), and this leaves the challenge of finding the right people to the public actors. Interestingly, the EU seems to recognize the local challenges, as it promotes the idea of local cooperation and evidence-based solutions. However, it also seems to be rather vague on the specific tools available and to focus on

the goals rather than the rules, which leaves room for different playing styles and thus adds complexity, especially between various regions.

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Entrepreneurial Discovery Processes through a Wicked Game Approach: Civil Society Engagement as a Possibility for Exploration

Antti Mäenpää & Niklas Lundström

4.1 Introduction

The entrepreneurial discovery process (EDP) is one of the central concepts in S3 because it is the main instrument facilitating evidence-based regional specialisation. The combination of local expertise and market knowledge is a mix that is hard for any region to resist. EDP is primarily designed to create something new out of existing capabilities or resources (Mariussen and Virkkala, 2018, the introduction to this volume). Current cases of EDP, however, seem to indicate something more evidence based and perhaps fewer new ideas (Kroll, 2016; Perianez Forte et al., 2016; Teräs and Mäenpää, 2016) – a situation that could eventually lead to regional path dependency. One indication of such path dependency may be the fact that the concept of domain has not been expressly mentioned by many regions (Mäenpää and Teräs, 2018), even though the domain concept is meant to highlight the novel thinking in the region and is officially stated to be an outcome of successful EDP.

As Mäenpää and Teräs (2018) observe on the subject of domains, the exploration is often based on analysis of the existing capabilities and previous knowledge. After choosing the domains, the process seems to stop. Results from Kroll (2016:4) show that EDP continues 'strongly and comprehensively' in only a little over 20 per cent of the 179 cases analysed. Why is this happening and what should be done to encourage actors to maintain the cooperation that forms the core of whole EDP? One example of good practice is presented by Rodrik (2004), who suggests that there are ten issues that must be addressed in policy design (see also Chapter 1 in this volume, Virkkala and Mariussen, 2018). Of those ten principles, only one (incentives) addresses the collaboration between actors directly. This chapter argues that the failure to make EDP an ongoing process may be because the EDP does not explore all the options offered by a complex world. A failure in exploration may thus lead to lock-in on existing strong sectors, which may lead to long-term challenges.

One explanation may stem from previous research about the role of wickedness in regional development policies. Wicked problems are problems that defy a clear solution and are subject to

constant change (Rittel and Webber, 1973). Their changing status means it is impossible to find an objective solution to these kinds of problems in which subjectivity always plays a crucial role. The previous research has concluded that regional development practices, such as S3 or EDP, are themselves wicked *games* – a viewpoint that emphasises the active role of the stakeholders in the problem formulation and any attempts to find resolutions (Lundström, 2015, 2016; Lundström and Mäenpää, 2017; Lundström et al., 2016). This viewpoint of a wicked game also highlights the actors' roles in EDP. The concept of the wicked game makes it possible to study EDP in practice and offers insights into how EDP works in a wicked environment, where there are no easy processes to advance regional development. Only by accepting the complexity of regional innovation can one focus on finding the optimal procedures and solutions.

Previous literature argues that one possible way to discover new solutions is to elicit citizens' views. The utilisation of the fourth helix (i.e., civil society) has been debated at great length; some studies (e.g. Marinelli and Perianez Forte, 2017) indicate that the use of citizens in strategy formulation has been useful, but others come to the opposite conclusion (Kroll, 2016; Vallance, 2017). The question is why in some cases civil society involvement enhances EDP while sometimes it does not.

Usually the fourth helix or civil society refers to more organised, or categorised citizen involvement (Carayannis and Campbell, 2012), but the authors have included individual citizens in the same concept. This is based on suggestions that individual citizens could be a good addition to EDP as they may provide new insights on regional innovation and help to challenge the thinking behind its implementation (Aranguren et al., 2017; Benner, 2014; Lundström and Mäenpää, 2017).

The key research questions of this chapter address the complexity surrounding EDP and especially how to utilise civil society in a meaningful manner, and they also examine where new ideas appear. To answer these questions, we focus on the following:

- How does the wicked game approach describe EDP exploration?
- How might such exploration be enhanced through civil society engagement?

This chapter continues by demonstrating how EDP can be seen as a wicked problem. This also provides a starting point for the discussion of the wicked game concept and how it affects EDP. We also discuss the somewhat paradoxical idea that the inclusion of more actors could enhance emergence, or generation of ideas, while bearing in mind that involving more actors has not worked in all S3 cases – something that demands an explanation. After this discussion, the chapter focuses

on turning the complexity aspect into a positive driver for new ideas and suggests that different actors could support that. Finally, in the conclusion section, we answer the research questions presented above.

The chapter is based on literature analysis and aims to explore the relevance of the concepts of the wicked problem and wicked game in the interpretation of the EDP. This means that EDP is conceptualised using the notions of wicked problems and the wicked game to build a new kind of understanding of EDP. This kind of investigation is needed because the current practices do not seem to comprehend the EDP itself as a complex process, which may result in good ideas being omitted.

4.2 Wicked problems and the wicked game

Rittel and Webber (1973) originally introduced wicked problems and the term has been used to describe wicked policy issues, although it was also a critique aimed at the planning theory of that time. The original study emphasised that the crisis facing planning was not about the planners' lack of knowledge or intelligence, but about the very nature of the problems they tried to address. The main idea of Rittel and Webber was to divide problems into two different categories: tame and wicked.

First of all, tame problems have an objective solution and once that solution is found, the problem ceases and does not reappear; an example offered by Rittel and Webber (1973) was that of a chess player trying to achieve a checkmate in five moves. In this example, the objective is clear and there is no question of whether the problem has been solved. That is because the game is governed by rules known by each player. In addition, according to Mason and Mitroff (1981), tame problems can be separated and reduced. This means that the problem can be removed from its context and broken down into pieces, which can in turn be solved individually. In addition, Lundström and Raisio (2013) underline that in societal problems the tame aspect is found in the repeatability and lucidity of the process. Once a solution is found, similar problems can be solved in the same way. Of course, this is not the case with most societal problems. Rittel and Webber (1973) described tame problems as relatively easy, but wicked problems as far more stubborn. Tame problems might be complicated, but are not complex per se. From the complexity point of view, being complex and being complicated are not synonymous. When we use the terms complex and complexity they refer to the worldview of complexity, especially complexity thinking (Richardson and Cilliers, 2001) unless otherwise stated; see also Chapter 7 in this volume (Aasen, 2018) for clarifying variations in complexity thinking.

Wicked problems cannot be solved for good, and even the definition of the problem is ambiguous. Some examples are healthcare or environmental issues, as they are never solved (Levin et al., 2012; Vartiainen, 2005). It is impossible to deliver a definitive solution because the stakeholders have contending views and beliefs. Of course, the backgrounds of stakeholders and their value systems play a crucial role as well. For some the proposed solution is the only option, while others cannot even live with that proposal. The environment or the outside also change the problem and impose new limitations on the process. Rittel and Webber (1973) originally stated that every wicked problem is a symptom of another wicked problem – something identified as at the core of wicked problems (McCall and Burge, 2016). When one problem is temporarily resolved, it then transforms into a different problem. This property has been portrayed as resembling the Hydra of Greek mythology; when one head was chopped off, the monster would regrow a couple more (Mason and Mitroff, 1981). It also resonates with the complexity point of view and especially the concept of emergence as random change and something that emerges from nothing when looking from the perspective of the whole (Goldstein, 1999; Lundström and Mäenpää, 2017; see also Aasen, 2018).

In addition to the original list of the properties of wicked problems (see Box 4.1), researchers have compiled a number of lists of their characteristics (cf. Conklin, 2005; Danken et al., 2016; Norton, 2005, 2012). Danken et al. (2016) conducted a literature review on the core properties of wicked problems. According to their analysis, the present understanding of wicked problems can be summarised in three interrelated properties. First, wicked problems do not have a clear solution. Property one forms the basis of the second property, which leads us on to the role and properties of the stakeholders, who have diverging values and interests. Third, wicked problems are not fully understood, and therefore the definition of the implications and the nature of the problem differ, too.

Box 4.1. The Properties of Wicked Problems Summarised

1. No definite solution
2. No stopping rule
3. Solutions are not true/false, but good/bad
4. No immediate or ultimate test of a solution
5. Every solution has consequences; every solution is a one-shot operation
6. Do not have an exhaustive set of potential solutions
7. Are essentially unique
8. Are a symptom of another wicked problem
9. The causes can be explained in numerous ways
10. The planner has no right to be wrong

Source: Based on Rittel & Webber (1973)

The worldview of complexity, especially complexity thinking (Richardson and Cilliers, 2001), and wicked problems share similar presumptions (e.g. Zellner and Campbell, 2015). Wicked problems are seen to influence and are influenced by complex systems. The boundary between wicked and complex is somewhat vague. To begin with, wicked problems and complex adaptive systems (CAS) have similar characteristics (Waddock et al., 2015). They must both be treated holistically, both involve emergence and co-evolutive patterns and both are unpredictable. They both acknowledge that relationships are non-linear, emphasise the significance of initial conditions and interpret the systems as open (Peters, 2017). However, wicked problems are not just complex problems. Wicked problems are regarded as '…intractable masses of complexity, so conflict-prone and/or knotty that they defy definition and solution' (Alford and Head, 2017:399), while merely complex problems are problems where the definition is agreed upon but the consensus on how to solve it is missing (Roberts, 2000). Interestingly, Interestingly, Peters (2017:385) sees the recognition of wicked problems as a precursor to the complexity sciences in the social sciences (see also Zellner and Campbell, 2015). The notion of wicked problems can be seen as a way to practicalise complexity (Raisio, 2010).

If wicked problems are truly problems that cannot be solved, what approaches can be applied to them? No one owns the wicked problem, and every stakeholder owns only a part of the truth, while no one is in total control (Lundström and Mäenpää, 2017; Roberts, 2000). The importance of collaboration is emphasised in the literature about wicked problems. Danken et al. (2016:25) identified that scholars underline the importance of cross-boundary collaboration and public leadership and management when seeking to live with wicked problems. In the segment of cross-boundary collaboration, stakeholder deliberation and dialogue are seen as a fruitful way to address wickedness. In Roberts' (2000:13) words, we need to get 'the whole system in the room' and the citizens' perspective should be included (Lundström et al., 2016). Stakeholder participation also enables the emergence of shared knowledge (Conklin, 2005). In addition, when it comes to management, policy-makers need to know how to separate tame problems from wicked problems (Danken et al., 2016). If a wicked problem is treated as a tame one, the outcomes will not be desirable (Lundström, 2016; Lundström and Mäenpää, 2017). It is about tackling the right problem with the broad participation of stakeholders. One could argue that communication and interaction are at the heart of the process (Zellner and Campbell, 2015). The worldview of complexity shares this same presupposition. Therefore, they both see the process as one of continuous exploration and discovery because the problem formulation and problem resolution are unknown.

It is suggested that this kind of interaction, where no one is in charge, where the stakeholders might share the concern over addressing the same problem (not always), but where their remedies may be

totally different, should be interpreted as a wicked game (Lundström, 2015; Lundström and Mäenpää, 2017; Lundström et al., 2016). The concept of a wicked game is a quest to emphasise the role of the actors or players instead of only theorising about the quality of the problems. The wicked game perspective incorporates both tame and wicked aspects similar to Rittel and Webber's original dichotomy of wicked problems.

A tame game can be seen as the opposite of a wicked game. In a tame game, the problems are not seen as wicked, and even if they are, they are treated as if they were tame. This kind of gaming has certain outcomes. First, if the problems are treated as tame, the answers are engineered solutions and therefore mechanistic. This approach can also lead to categorising problems into similar types, which means that the problems are treated in a similar way in many regions. The tame game also has a stopping point; the problem disappears when the problem is solved, and the next issue can be addressed. The tame game is the framework in which the taming of wicked problems takes place (Conklin, 2005; Daviter, 2017; Roberts, 2000). The results will be sub-optimal if the players do not address the reality sufficiently, that is, if they get involved in playing a tame game instead of a wicked game (Lundström and Mäenpää, 2017). Daviter (2017:578–579) describes that treating wicked problem as tame '…allows public authorities to limit participation and debate, assign administrative responsibility, reduce the need for cross-sector coordination, take swift action, draw on the available expertise, and apply pre-existing policy instruments and evaluative criteria'. All of this is understandable if the resources limit the process, but it does not sound very innovative. It is argued later in this chapter that the presence of a tame game can be seen in past experiences of EDP.

The development of a region can be a wicked problem (Lundström, 2015; Lundström and Mäenpää, 2017) because the definition of development per se is ambiguous, let alone when the context is as wide as a region, which includes so many different players, organisational levels, ambitions, goals, etc. The wicked game (Lundström, 2015; Lundström and Mäenpää, 2017; Lundström et al., 2016) is a framework in which the region is developed in the presence of wicked problems. The wicked game includes players from different horizontal and vertical regions or arenas as outlined by van Bueren et al. (2003). Although the aim of the game is to develop the region, the aims and interests of the various players sometimes clash. Actors may also have different ambitions or perceptions of the goals, so some try to be a negotiator and some pursue only their vested interest. It is clear that not all of the players are interested in acting for the benefit of the region. However, it is also possible that different actors have mutual goals, and that the cooperation may be very efficient as the collaborators all focus on developing the aspects that they know well or can influence. In such cases, the wicked game may also include coalitions of different kinds of players. The key point is that the players' involvement

changes constantly and that the importance or role of a certain player might change during the game, and some players may be totally dismissed; in addition, some players influence the game more than others do. These characteristics have also been noted in the context of S3 (Lundström and Mäenpää, 2017; Mieszkowski and Kardas, 2015).

Generally, wickedness has a negative connotation, but that is not the case with a wicked game. On the contrary, the very idea of a wicked game must be interpreted as the positive side of wickedness and as something to be embraced and perhaps to benefit from (Raisio, 2010) and not merely something that must be tolerated (Norton, 2012). The wickedness cannot be eliminated or resolved for good; therefore those affected by it must change their perception of it. One way to do so is to study how innovation could prosper in a complex environment and perhaps even benefit from it.

4.3 EDP exploration in the wicked environment

Regional development as a whole has been recognised as a wicked problem (Lundström, 2015; Lundström and Mäenpää, 2017) and this suggests that EDP itself falls into the same category. As Aranguren et al. (2017:170) state: 'A region is a complex system and in a complex system the knowledge necessary to overcome challenges and take advantage of opportunities is distributed, and not only among other territorial actors, but at a global level.' The idea of a wicked game is thus encapsulated in the thought that EDP is a continuing process (Marinelli and Perianez Forte, 2017; Perianez Forte et al., 2016), as final solutions cannot be found for regional innovation or development. This adds to the idea that EDP might be seen as a wicked game. It is also the reason why EDP cannot stop when the domains are found; exploration must continue if new ideas and solutions are to be found.

The typical players involved in smart specialisation are actors from the research and development sector and representatives of civil society, but also include research leaders, education institutions, inventors, non-governmental organisations (NGOs), societal associations, researchers, suppliers, manufacturers, service providers, entrepreneurs and consumers (Mieszkowski and Kardas, 2015). But this is of course only the official side of the game. According to Lundström and Mäenpää (2017), the players involved with S3 can be divided into three different major player groups: the public sector, companies, and universities. Each group has a different role and diverse aims in the wicked game. To summarise, the university's role in the wicked game of smart specialisation is to be a research partner, and the public sector tries to be a mediator, negotiator, or enabler of RIS3. Companies bring market

knowledge to the game and seek partnerships and opportunities for future profit. The role of different actors has been discussed recently (Kroll, 2016; Marinelli and Perianez Forte, 2017) and some studies (Kroll, 2016:7–8; Lundström and Mäenpää, 2017) indicate that regional governments are perhaps the major actors aiming for the original goals of S3, whereas the other actors are acting more or less according to their own interests.

One could argue that overall EDP exploration consists of three distinct phases (see Figure 4.1.). Existing knowledge of the region (usually gathered by regional governments and sometimes involving research commissioned from universities) forms the basis. After that there is some sort of stakeholder participation. Stakeholders from the public sector, firms and universities (known as triple helix, or 3H) with the addition of civil society (known as quadruple helix, or 4H) are involved and the established knowledge is either verified or adjusted to meet the views of the regional actors); and, lastly, formulation of the ideas or concepts to promote regional strength (Mäenpää and Teräs, 2018).

This presentation of the phases of an EDP may seem simplistic, as the RIS3 process can involve numerous iterations and rounds of dialogue between various actors. There are, however, indications that several regions have utilised a quite similar style when deciding upon their regional specialisation (Aranguren et al., 2017:172; Mäenpää and Teräs, 2018), and this process-like approach (where regional innovation is analysed and then 'solved') may be an indication of tame practices to develop regional innovation. Ideally, EDP should be an ongoing process (Perianez Forte et al., 2016) but evidence suggests that EDP has slowed down after the RIS3 implementation (Kroll, 2016:4), which supports the view of a tame process appearing in problem-solving.

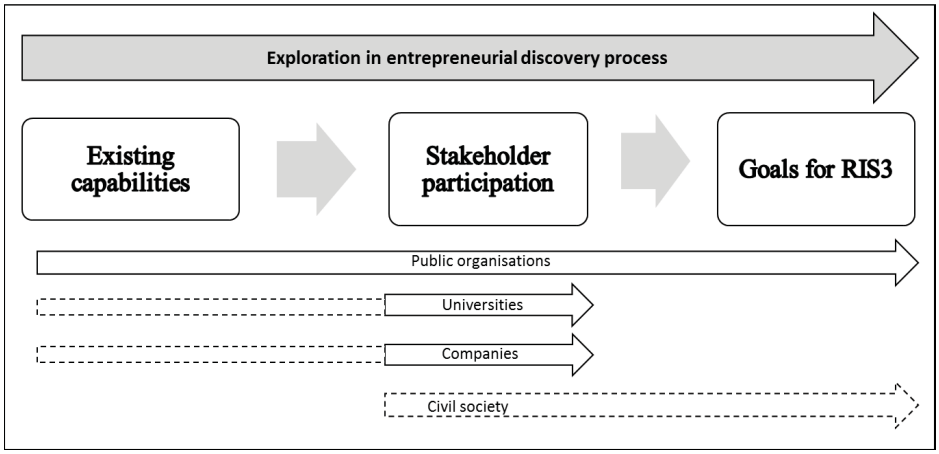

Figure 4.1. The distinctive phases of exploration in the EDP and usual stakeholder participation in a linear model.

A particularly interesting phase of EDP exploration is that in the middle, as the different stakeholders can then have their say on issues around innovation. Discussions in the triple/quadruple helix (3H/4H) setting are often mentioned in the official RIS3 documents as they explain the decisions being made and what should be done in the future to enhance the chosen specialisation aspects or goals. Several cases seem to verify this pattern where 4H is utilised, but not necessarily throughout the whole process (Teräs and Mäenpää, 2016; Vallance, 2017).

The overall outcome of EDP can be affected by the configuration and participation of different types of stakeholders (Benner, 2014; Lundström and Mäenpää, 2017) and even by the actual individuals involved (Aranguren et al., 2017). The role of stakeholders and individuals is particularly highlighted in the preparation process as local public actors might adjust the outcomes of EDP when they compose the RIS3 document and set its goals. This phase is interesting because it shows that within EDP exploration there is still room for regional politics. EDP is usually understood as 3H or 4H cooperation, but it is important to see that it includes phases with varying degrees of cooperation. Some research indicates that the RIS3 process may even involve a 'mix and rotation of leadership' during specific phases of its formulation and implementation (Aranguren et al., 2017:172). Indeed, different stakeholders hold different positions and may therefore have greater or lesser influence during the strategy process (e.g., universities might lead a regional analysis, while companies might lead EDP). However, only regional governments can influence and react to the whole process. This is understandable of course, as public actors are usually the only regional stakeholders who know which resources are available, which obviously can affect their decisions on the chosen domains and on their implementation, which then transforms into regional innovation. This reality suggests, however, that rotation of leadership is perhaps a little artificial as regional government has control of the process.

In addition to the internal game played within a region, a wicked game is also played between regions (Lundström and Mäenpää, 2017). This is also integral to the idea of S3, because the regions compete with each other if they are working on similar types of products or services, regardless of whether the regions are in Europe or even in the USA. Consequently, the different regional levels interact, which brings the wickedness to the fore. The interconnectedness is also due to players from various fields participating in the wicked game and the environment causing mixed messages to be brought into the game. After all, the environment plays a crucial role in the game.

The environment here means exogenous properties, in other words, what takes place outside a certain region that affects that region and its actors. Such properties would embrace the trends and

flows in the global economy, the political climate, and actual climate issues, innovations, and public will. These issues often have an unexpected influence on regional innovation and may exert different effects on individual actors. They also can change unpredictably, are often emergent, and the results may be chaotic (see Raisio and Lundström, 2017; Zellner and Campbell, 2015). Very often these environmental effects are not included in RIS3 owing simply to resource issues or because they are difficult to predict.

A wicked game does not stop even if some temporary resolution is found. Zellner and Campbell (2015:464) describe the problem-solving process as 'one of on-going exploration and discovery, where the system is understood by trying to define and explain it through explicit representation, simulation, and evaluation and reflection from a variety of perspectives and with a variety of tools'. Therefore, the EDP should not stop at any point. According to the literature, many of the experiences of EDP indicate that the game played is often tame, as the processes have slowed down after the initial implementation rounds (Kroll, 2016; Mäenpää and Teräs, 2018). The regional consensus does not seem to generate very new ideas and, therefore, there is a need to deepen and perhaps to reinvigorate the EDP in order to fully utilise regional capabilities and to evaluate whether they are having a sufficient impact on innovation.

In addition to the above findings, Benner (2014) emphasises the importance of even single actors, such as employees, directors, students, and professors, as innovators. The objective of the game is the same for all players in theory – to identify the domains of specialisation – but when considering the wide spectrum of possible participants, clearly interests and agendas can collide. This might be one of the reasons for tame answers and the tame game: the need to keep the participants satisfied, and the belief that the problems can be solved. Nevertheless, a coping strategy involving a broad collaboration is not unproblematic (Roberts, 2000), especially if the participants are not satisfied with the results. The question of collaboration is a wicked one; when only experts and recognised players play the game, the results are somewhat tame or predictable, but when more players are introduced, the risk of conflict and regional disparity rises. The problem of the role of single actor is already built into EDP. The people who are summoned to the table are the ones who get to have their say (Lundström and Mäenpää, 2017). The public sector representatives have an important role in considering who they call to attend and, ultimately, they also formulate the RIS3 and thus decide what specialisation benefits the region. A single political actor may have huge impact on the overall process.

Interestingly, Foray (2015:29) has mentioned the possibility for 'radical foundation', which can be understood as specialisation without necessarily having a direct existing knowledge base. This sort of inclusion might benefit regional innovation and especially EDP. Radical foundation also paves the way for the introduction of new stakeholders, as it is not based purely on existing knowledge and therefore does not require prior expertise on regional matters. The authors find this to be innovative as it allows for true citizen participation and therefore opens the innovation discussion to the whole of the region not merely 3H actors and experts. This inclusion of radical elements may truly influence or enhance regional innovation discussion.

4.4 Enhanced EDP exploration through civil society inclusion

As mentioned above, current EDP exploration practices may be based on a more tame view of regional development, even though EDP operates in a wicked environment and is in itself a complex entity. One way to bypass the mechanistic process and to elicit new ideas is to accept that there are no certain truths and ready-made tools for the task. In practical terms that means that every idea counts, so to have the best chance to obtain optimal results, one has to understand and utilise the whole system (Roberts, 2000:13). This adds to the challenges of EDP, as a process based on such an understanding of the whole system must include citizens and end users of innovations alongside the usual 3H stakeholders.

This inclusion of citizens has been mentioned in the original strategy guidebook, where the fourth helix is mentioned (Foray et al., 2012) and thus it has been endorsed right from the beginning of the S3 process. Despite this, however, the fourth helix has been undermined in RIS3 implementation, as a recent study by Marinelli and Perianez Forte (2017:8) states: '…EDP emerges as largely a 3-ple helix business, with some interesting signals emerging from the 4th helix.' There are also several other studies emphasising that despite good intentions, 4H collaboration has not been very comprehensive, even when the focus has been on living labs (Vallance, 2017), or even involved EDP steering group participation (Aranguren et al., 2017). Indeed, even when civil society has been involved in the process, there are indications that it is engaged more often in a monitoring role, whereas companies and universities are approached to formulate and assess proposals (Marinelli and Perianez Forte, 2017:10). Essentially this means that the fourth helix is engaged after the decisions have been made. This sort of engagement is rather limiting, and we would suggest there should be citizen participation at the beginning of the EDP to improve insight and ideas.

It is understandable that citizen activation can be a challenge in EDP, as citizens are not perhaps that keen on discussing innovation (Lundström and Mäenpää, 2017). This may be due to a lack of expertise or interest in regional development. People are usually keener to address issues that concern them on a practical level, and matters of regional innovation activities are perhaps not among those. Another issue lies in the disparity of the fourth helix. It is far easier to target companies or universities as their leaders/experts are known. The fourth helix consists of various types of citizens and some know more than others. And all are difficult to contact.

Civil society inclusion has been studied in an S3 setting by Aranguren et al. (2017), who investigated 4H utilisation in Navarre and the Basque Country. Although the base premises for both Spanish regions were quite similar, the results indicated that 4H inclusion was perhaps more profound in Navarre, but the results were perhaps more concrete in the Basque Country, as dialogue was established between the actors. The authors of the study indicate several reasons for their results, including notions on the regional institutions. For example, the Basque Country had a more collaboration-heavy culture and lots of locally-owned companies, which made collaboration easier, even without full 4H participation. Navarre, on the other hand, utilised 4H in its EDP process and even included civil society representatives (e.g. politicians and labour representatives) in the steering group. However, because of larger companies and a more political EDP process, there was relatively little evidence of consensus on the directions the region should take.

Another study of a pair of 4H cases examines health-based domains in Tampere (Finland) and Northern Ireland (United Kingdom) (Vallance, 2017). Both regions had based their domains on an existing knowledge base, although they had different specifications (health technology in Northern Ireland and ICT in Tampere). Although he considered both cases to be good examples of domain construction, Vallance (2017:140) states that: '…emerging innovation systems have yet to take the form of a quadruple (rather than triple) helix arrangement in which societal users are centrally integrated. This is despite both regions exhibiting aspirations to move in this direction.' Vallance explains that civil society participation in actual innovation-related matters is quite minimal as they are mostly used to gather data in a living lab fashion.

The participation of civil society is important despite the issues involved because the citizens' view complements the ideas and thoughts of the regional experts. Citizens are able to view the innovation environment that surrounds the region, as they do not necessarily know about all of the megatrends or latest research. This environment includes some relatively fixed characteristics (location, history, etc.) but is also subject to change, as new trends (products, ideas, companies, etc.) come and go.

Citizens' views are therefore valuable, as they may represent the 'local buzz' of the region (Bathelt et al., 2004:13) and thus offer insights into what sort of activities are supported by the local citizens. Knowledge of the environment adds more elements that are spontaneous because it is impossible to know when new ideas arise and how they affect the region or its citizens. By adding the fourth helix into the mix, the region can receive information from the ground level and this may even include hints about future sunrise industries (Lundström and Mäenpää, 2017). Citizens can also pitch new ideas and challenge existing ones, which further enhances the thinking process and may lead to new ideas concerning RIS3 implementation (Cavalli et al., 2016:130).

When should citizens be involved? The authors suggest that because of the nature of S3, the regional governments who are officially responsible for the formulation of RIS3 should lead the overall process. However, this does not mean that a living lab model (Vallance, 2017) should always be utilised, where citizens simply provide data for analysis. Citizens should be engaged in all the different phases of EDP exploration, and especially during the collation of existing capabilities, as wider participation generates more ideas, which ensures that the chosen specialisation is truly relevant to the local residents. This is especially important in regionally based solutions, as local citizens may have deeper insight into the region itself than some experts (who might live in a different region altogether). According to Hajer (2005:461), planning should not be based on 'facts-as-information but on facts-as-experience'. It has already been suggested that civil society actors may spot future sunrise industries (Lundström and Mäenpää, 2017) and that in itself should be a reason for the more extensive inclusion of members of civil society (see Figure 4.2).

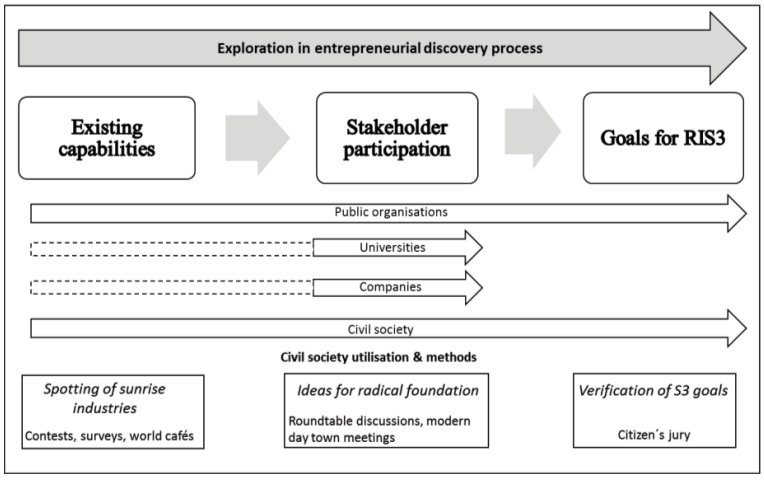

Figure 4.2. Suggested civil society inclusion methods with possible benefits for the EDP exploration process.

One could also argue that spontaneous ideas (or the radical foundation suggested by Foray, 2015) might come more naturally from regular citizens, who see the possibilities because they do not know of all the limitations. Experts can then consider these ideas and evaluate if they are feasible to implement. This process would help with the verification of the EDP as well because the experts would have to explain why suggestions do or do not work for the region. The importance of citizens' external knowledge can also be viewed through the literature of innovation. For example, Strambach and Klement (2012:1844), who apply the notion of combinatorial knowledge to describe the combination of different bases and scales of knowledge, also seem to acknowledge the benefits of micro-level inclusion and point towards the options individual actors can provide by operating 'between networks of firms and organizations'. The study does not specifically mention civil society, but the principle is applicable.

Methods of deliberative democracy, such as citizens' juries (Crosby and Nethercut, 2005) are one possible specific tool to harvest citizens' views (Lundström et al., 2016). In short, operating citizens' juries means that the citizens' perspective is acknowledged alongside that of the usual experts or the recognised players. Possibilities for innovation stem from the pure unpredictability of wicked problems; if the problem (such as regional innovation) is undergoing constant change, the resolutions must be dynamic as well. Of course, there are many more possible methods besides the citizens' jury, for example, world cafés, modern-day town meetings, planning cells, consensus conferences, twenty-first-century town meetings, to name but a few (cf. Lukensmeyer and Brigham, 2002; Fung, 2003; Wilson, 2009). The number of possible methods helping to foster public deliberation has continued to grow in the twenty-first century, as new technologies, methods and applications have been developed.

It is important to understand that different kinds of methods may be used to elicit different sorts of ideas and forms of verification from civil society. For example, world cafés are useful mechanisms to gather good ideas and hear, for example, about sunrise industry suggestions or even radical ideas. This happens naturally as the respondents are not necessarily aware of the regional economy or only understand some parts of it well. Their suggestions are then based on their subjective views and experience and are therefore unique. Radical foundations for innovation can also be sought by utilising semi-formal modern-day town meetings where there is some sort of event for discussion (cf. Fung, 2003; Lukensmeyer and Brigham, 2002). Citizens' juries, in contrast, are more structured, and regional experts give the respondents additional background information before they have discussions and try to reach conclusions (Lundström, 2016). This sort of method would be ideal for the later stages, where the strategy is verified. This sort of verification would also help in the introduction of

the strategy, as civil society members are well equipped to spread the word and the strategy could thus slowly alter the whole image of a region.

The citizens' view is also a tool for making the EDP a more bottom–up approach. This idea of cross-boundary collaboration is the most recommended approach in the literature on wicked problems (Danken et al., 2016) and has also been advocated in the context of S3 (Lundström and Mäenpää, 2017).

4.5 Conclusion

The main aim of this chapter was to look at EDP and 4H collaboration especially via the wicked game approach. In addition, the chapter focused on how EDP might be enhanced through engagement with civil society. The chapter's main findings can be presented as three suggestions regarding civil society engagement:

1. Focus on civil society members in addition to the experts
2. Civil society engagement requires proper methods
3. Development projects are one way to bring people together

The idea of including more members of civil society than are currently involved stems from a wicked game viewpoint, which illustrates how the EDP could function in a more actor-based framework. Accordingly, it is clear that some of the chosen methods, such as 4H application, might be a very useful addition to the EDP, as the inclusion of a spread of civil society has been seen as one way to enhance the search for solutions to wicked problems. The authors nevertheless agree that contributions in S3 should come from all possible sources and not just from civil society actors (Cavalli et al., 2016:135). However, members of civil society may offer new ideas and solutions, without the constraints arising from relying on a too narrow expertise of the regional experts. At the very least, the ideas originating from civil society could be given due consideration and help develop the thinking in the region, as the experts will need to explain their decisions on feasibility. By utilising the right methods during the right phases, civil society can be a good additional asset in the strategy formulation process.

Examination of former 4H collaboration in the S3 setting revealed that there have been cases when EDP has benefitted from 4H collaboration, and some when it has not. The potential reasons for that are intriguing. Closer EDP analysis distinguished three major phases in the EDP during the exploration phase and this allowed for closer examination of the possible civil society enactment

methods. It was discovered that multiple methods could be used but different tools work better during different phases, and there is no single tool or method that has proven optimal throughout the EDP exploration. This may explain why some studies of 4H involvement have had mixed results. However, this success may be insufficient for the overall EDP, especially if civil society actors are engaged only after the decisions have been made. If the tools are insufficient, the results are often very impractical or lack emphasis, which makes them unlikely to be approved by local people.

One way to engage civil society members might be the utilisation of bottom–up framework programmes (Kuznetsov and Sabel, 2011:5). That research suggests that micro-level interaction can change the macro level, if there are sufficient projects that can be scaled up to make a difference. Indeed, the EDP itself can be seen as one development project aiming to affect macro-level economic interaction within the region. Interestingly, Kuznetsov and Sabel (2011:2) also highlight the issue that 'no agent has a panoramic view of the economy' and also add that 'all views are partial', which could be seen as an invitation for more civil society collaboration to maximise the harvesting of new ideas.

One of the major challenges for regional decision-makers might be the need to accept that civil society should be a part of the process, not an afterthought or artificial addition in the S3 project report. This also means that there should be resources directed towards civil society inclusion that allow for the widescale participation of actors throughout the EDP process. Even during the exploration phase there are three distinct phases that may require different tools to maximise the benefits of civil society inclusion. The authors also wish to emphasise that civil society inclusion enhances the domains, as the idea of the domain transforms into public speech and thus becomes the norm for the region. These discussions may even help in building up the regional image, which slowly works as one sort of specialisation in itself. With some resources and time for proper engagement, there might be much to gain.

This chapter illuminates some new topics that merit further exploration. As research literature has shown, there have not been many successful 4H processes where the voices of civil society have been taken into consideration throughout the EDP. Therefore, some empirical studies regarding the various citizen activation methods, used in innovation activities, would help the RIS3 organisers. There could also be more studies regarding the wicked gaming in S3, as a better understanding of the player groups would help the regional actors attract more participants into the EDP. This would generate more ideas and make the process more collaborative than it is currently.

Finally, this chapter is based on a literature analysis of the EDP exploration and 4H collaboration. The authors would like to emphasise the importance of empirically testing its findings by using participatory methods in one pilot region, for example, to obtain a broader view of the discovery process. The methodology used should not be based only on the existing options but involve the whole region. The EDP is unique in including all of the different regional levels and players, and thus providing a solid framework for regional innovation, and it therefore warrants a profound analysis of suitable methods in the future.

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