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Regional innovation system dynamics and new industrial path development

Johan Miörner

LUND
UNIVERSITY

DOCTORAL DISSERTATION

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(Re-)shaping regional economies - Regional innovation system dynamics and new industrial path development

Abstract
This dissertation explores the complexities of regional economic restructuring. It casts a light on how regional environments are 'reconfigured' in relation to the transformation of existing regional industries and the development of new ones. More specifically, the aim is to advance our understanding of regional innovation system (RIS) reconfiguration in relation to new regional industrial path development.

The theoretical discussion is anchored in a broad perspective of new regional industrial path development that has emerged at the intersection of different strands of literature in economic geography. The dissertation contributes to the academic debate by 1) developing a novel conceptual framework for analysing RISs from a 'functional' perspective, focusing on how system functions facilitate the provision of assets to regional actors; 2) investigating RIS dynamics, by disentangling the modes and types of RIS reconfiguration and factors determining RIS reconfiguration capacity; 3) exploring the interplay between historically developed context conditions and the role played by reflexive agents, zooming in on the evolving characteristics of RIS reconfiguration unfolding in different regional contexts.

Empirically, the dissertation investigates processes of RIS reconfiguration and/or new industrial path development in four Swedish regions (Scania, West Sweden, and the city-regions of Linköping and Karlskrona) and one cross-border region (the Öresund region, encompassing the Swedish region of Scania and the Danish region of Zealand). Different types and stages of new path development in different industries are under scrutiny: the emergence of a digital games industry in Scania, the emergence and long-term development of IT industries in Karlskrona and Linköping, and substantial changes to the automotive industry in West Sweden based on the development of self-driving cars.

The findings illustrate the complexity of structure-agency dynamics involved in new industrial path development. They point at the ways through which actors not only change, but also re-interpret and re-purpose existing structures, in order to alter the functioning of the RIS. The empirical analysis also highlight that securing the provision of assets relevant for new industrial paths include developing RIS structures in order to form assets within the region, and ways through which actors change the functioning of the RIS by developing structures for accessing or transplanting system functions from other regions. Furthermore, the findings situate RIS reconfiguration as a core component of new industrial path development and extend existing perspectives by 1) shedding light on changes in different dimensions of the RIS and 2) highlighting the role of RIS reconfiguration in the later stages the path development process, thus not only limited to 'set the scene' for industrial change processes.

Finally, the dissertation offers valuable insights in relation to the design and implementation of innovation policy, such as smart specialisation. It suggests that the identification of regional priorities could benefit from taking a functional perspective and shows that the 'opening up' of existing RIS structures for asset provision can be a fruitful strategy across different regional contexts. By paying more attention to system functions, the reflexivity of actors and structure-agency dynamics, the dissertation provides policymakers with insights that are useful when designing transformational roadmaps and smart specialisation strategies.

Key words: economic geography, new path development, industrial change, regional innovation systems, reconfiguration, innovation policy, structural change, agency, institutions, digital games, automotive, IT, Scania, West Sweden

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MADE IN SWEDEN

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Acknowledgements

In his first book, David Hume described how he coped with the hopelessness of not finding answers to life's complicated questions: he dined, played a game of backgammon, conversed with friends and had a good time. My unqualified guess is that he probably also had a beer to wash it down. Then he would return to the difficult questions and find them so ridiculous that he could not find it in his heart to enter into them any further (Hume, 1739:192). Hume's influence on my PhD has been limited, but I have deployed very similar coping mechanisms throughout these last four years: I have dined with friends, have had quite a few beers, and played thousands and thousands (sic!) games of backgammon.

However, it lies in the concept of doing a PhD to be persistent; to return to the difficult questions over and over again, even though they may seem ridiculous at times. For me, this was possible much thanks to all my colleagues, my family, and friends, our endless discussions and the constant flow of ideas – this dissertation would never have been written without the support of everyone that have been with me along this journey! It's a daunting task to name everybody that have contributed to my development during these four years, but yet I want to mention a few people who played crucial roles along the way:

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"What will you do now?..." people tend to ask at this stage of the academic career. The answer is in the pretext – I would very much like to continue to dine, drink beer with friends, and play backgammon, so I guess I will have to find some new questions that deserve my attention there in between.

Johan Furemar Miörner
November 4, 2019
Malmö, Skåne

List of articles

This dissertation consists of the following five articles:

Article 1

Paving the way for new regional industrial paths: actors and modes of change in Scania's games industry (Miörner and Trippl, 2017) is published in European Planning Studies 25(3), 481-497.

Article 2

Creating institutional preconditions for knowledge flows in cross-border regions (Miörner, Zukauskaite, Trippl and Moodysson, 2018) is published in Environment and Planning C 36(2), 201-218.

Article 3

Developing and sustaining new regional industrial paths: investigating the role of 'outsiders' and factors shaping long-term trajectories (Fredin, Miörner and Jogmark, 2019) is published in Industry and Innovation 26(7), 795-819.

Article 4

Embracing the future: path transformation and system reconfiguration for self-driving cars in West Sweden (Miörner and Trippl, 2019) is published in European Planning Studies (online first).

Article 5

Contextualizing system agency in new path development: What factors shape regional reconfiguration capacity? (Miörner, 2019) is submitted to an international peer-reviewed journal.

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1 Introduction

The ways in which regions and industries should respond to social, environmental and economic challenges have become core topics of inquiry in academic and policy circles. Existing industries are faced with transformation pressures, such as digitalisation, disruptive technological changes and globalisation, and regions differ in terms of providing favourable conditions for industrial renewal. It is also increasingly acknowledged that the long-term success of regional economies depends on the ability to develop new industrial activities. To explore of the complexities of regional economic restructuring, understood here as the transformation of existing regional industries and the rise of new ones, is therefore crucial in order to promote regional economic sustainability and long-term competitiveness.

In economic geography, the last decade has been characterised by a revitalised scholarly discussion revolving around this topic. Fuelled by the so-called 'evolutionary turn' in the discipline (Boschma et al., 2010; Boschma and Frenken, 2006), studies have zoomed in on questions related to the 'how', 'why' and 'where' of industrial change. Scholarly work positioned in Evolutionary Economic Geography (EEG) have approached the question of industry emergence in space by arguing that industrial change is path and place dependent, referring to industrial evolution as a process in which future outcomes are dependent on the existing industrial composition (Martin and Sunley, 2006; Boschma and Wenting, 2007). Studies have directed attention to the factors that cause regional economies to become 'locked-in' to certain development trajectories (Grabher, 1993; Hassink, 2005), but increasingly also to the question of how new industrial 'paths' are developed (Martin and Sunley, 2006; Neffke et al., 2011; Tödtling and Trippl, 2013). This is also reflected in dominant policy paradigms such as smart specialisation (Foray, 2015) being centred around the idea that regional economic restructuring is crucial for fostering positive development trajectories.

The question of how and under what conditions new regional industrial paths are developed has been approached from different perspectives by economic geographers. An influential perspective in EEG takes a firm-centred perspective of industrial evolution as point of departure and, based on micro-level theoretical assumptions, explains the development of new regional industrial paths as the result of diversification processes (Boschma and Frenken, 2006; Boschma et al., 2010). In parallel, scholars have advocated broader perspectives of regional industrial path development, revolving around a set of issues that were traditionally neglected in EEG. Such issues include the role of different types of actors and agency (beyond the firm), the interplay between different spatial scales, and a broader perspective of the assets and processes involved in new path development (Martin, 2010; Simmie, 2012; Dawley, 2014; MacKinnon et al., 2019b; Hassink et al., 2019).

In other words, while studies in EEG have focused extensively on the role of firm-level dynamics in regional economic restructuring, associated change processes in other dimensions of the regional environment have been paid less attention. The point of departure in this dissertation is that regional economic restructuring is inextricably linked to such change processes and the dissertation casts a light on how the regional environment, understood from a systemic perspective, is 'reconfigured' in relation to new regional industrial path development.

Industries are embedded in regional environments which have been shaped over the course of their industrial and economic history (Martin, 2010; Boschma, 2017) and as such are endowed with different conditions for supporting knowledge generation and diffusion, skill provision, investment mobilisation and the formation of assets that might be relevant for new industrial paths. This dissertation taps into a stream of research concerned with specifying the context in which new path development takes place. Studies have moved beyond the industrial composition, and have highlighted a broader set of enabling and constraining factors and conditions (Martin, 2010). In the exploration of such conditions, one influential route has been to forge links between EEG and innovation system perspectives, most notably the Regional Innovation System (RIS) approach (Isaksen and Trippl, 2016). In this perspective, industrial development paths are being embedded in regional innovation systems, consisting of all industries and firms located in the region, networks between actors, organisational support structures and institutional conditions.

Scholars have elaborated on which RIS configurations are most conducive for new path development and on typical development challenges prevailing in different types of regions (Isaksen and Trippl, 2016). However, RIS often reflect past development trajectories and existing industrial pathways, meaning that regions are typically structured to support existing industries and continuous adaptations to existing industrial paths, rather than more substantial forms of industrial change and the development of new industrial paths (Isaksen et al., 2019). The basis for the conceptual discussion in this dissertation is that new industrial path development is inextricably linked to the reconfiguration of existing regional innovation systems. Studies have started to investigate how RIS reconfiguration takes place, but there is a need for more conceptual and empirical work, in particular with regard to the interplay between RIS reconfiguration and new regional industrial path development.

1.1 Aim and research questions

The RIS approach has been criticised for its static perspective (see Doloreux and Porto Gomez, 2017) and conceptual and empirical work on how RISs are reconfigured is sparse. There are, however, a few notable exceptions. For example, Tödtling and Trippl (2013) have investigated how new path development is linked to the creation of new institutions, network structures and actors and organisations in the RIS. Furthermore, Trippl et al. (2019a) argue that RIS reconfiguration might be necessary to overcome constraints originating from existing RIS structures and to exploit potentials emanating from favourable conditions. In another recent contribution, Isaksen et al. (2019) explore the role of 'system level agency', referring to actions able to transform regional innovation systems to support new path development.

Nevertheless, more conceptual and empirical work is needed in order to fully understand RIS reconfiguration and the interplay between industrial change processes and changes to the RIS in which they take place. In particular, previous studies have tended to conflate the assets that are required in new path development with the RIS configurations through which assets are formed or provided to actors in industrial paths. More attention should be given to the 'functioning' of the RIS and how this can change through RIS reconfiguration. Furthermore, the modes and

mechanisms underpinning regional innovation system dynamics remain to be specified in detail, as is the role played by agency.

The aim of this dissertation is to *advance our understanding of regional innovation system reconfiguration in relation to new industrial path development*. The theoretical discussion builds on broader perspective of new path development that has emerged at the intersection of different strands of literature, combining evolutionary and institutional approaches in economic geography, as well as finding inspiration from transition- and innovation studies. It reflects recent advancements in the literature, by drawing on studies investigating different types of path development (Martin and Sunley, 2006; Tödtling and Trippl, 2013; Isaksen and Trippl, 2016) and the role played by agency (Simmie, 2012; Dawley, 2014; Steen, 2016b).

Exploring how RIS reconfiguration takes place and investigating its role in new regional industrial path development is crucial in order to advance a broader perspective of new path development and to better understand regional economic restructuring. The underlying research question of this dissertation is: *How does RIS reconfiguration unfold in relation to new regional industrial path development?*

Building on the main research question, three sub-questions are formulated:

- *What are the modes, types and determinants of RIS reconfiguration?*
- *What characterises RIS reconfiguration in different types and stages of new path development?*
- *What is the role of agency in RIS reconfiguration?*

By answering these research questions, the dissertation seeks to contribute to the scholarly debate on regional innovation systems and new path development in the following ways:

1. It develops a novel conceptual framework for analysing RISs from a 'functional' perspective, focusing on how a RIS facilitates the provision of assets to regional actors rather than on the presence or absence of structural elements.
2. It investigates RIS dynamics by, on the one hand, disentangling the modes and types through which existing RIS structures are altered and the role played by agency in RIS reconfiguration, and, on the other, by investigating factors and conditions determining the reconfiguration capacity of a RIS.

3. It explores the interplay between historically developed context conditions and agentic processes in new path development, through a focus on the evolving characteristics of RIS reconfiguration in different cases of new path development unfolding in different regional contexts.

Empirically, the dissertation investigates processes of RIS reconfiguration and/or new path development in four Swedish regions (Scania, West Sweden, and the city-regions of Linköping and Karlskrona) and one cross-border region (the Öresund region, encompassing the Swedish region of Scania and the Danish region of Zealand). Different types and stages of new path development in different industries are under scrutiny: the development of a digital games industry in Scania, the long-term development of IT industries in Karlskrona and Linköping, and radical changes to the automotive industry in West Sweden based on the development of self-driving cars.

1.2 Overview of the articles

The dissertation includes five articles which are published in, or submitted to, peer-reviewed academic journals. The articles were written during the period of 2015-2019. The articles relate to the main aim in the following ways:

Article 1 *(Paving the way for new regional industrial paths: actors and modes of change in Scania's games industry)* studies how a RIS is reconfigured to become more enabling for the development of a digital games industry in the region of Scania. Particular attention is given to the modes of RIS reconfiguration and the role played by key actors of change.

Article 2 *(Creating institutional preconditions for knowledge flows in cross-border regions)* investigates reconfiguration processes targeting the conditions for knowledge flows in the region of Öresund. The article focuses on changes to the institutional dimension of a regional cross-border innovation system and the role played by policy network organisations.

Article 3 (*Developing and sustaining new regional industrial paths: investigating the role of 'outsiders' and factors shaping long-term trajectories*) compares the development of IT industries in two Swedish city-regions, highlighting the need for RIS reconfiguration for sustaining new development paths beyond the initial stage.

Particular attention is given to the role played by 'outsiders', defined as actors relocating from other regions.

Article 4 *(Embracing the future: Path transformation and system reconfiguration for self-driving cars in West Sweden)* studies disruptive changes in the automotive industry in West Sweden, driven by the development of self-driving cars. The article elaborates on what RIS reconfiguration entails from a functional perspective and analyses different types of RIS reconfiguration and their spatial patterns.

Article 5 *(Contextualizing system agency in new path development: What factors shape regional reconfiguration capacity?)* investigates factors shaping the reconfiguration capacity of RISs, from the perspective of the interplay between regional context conditions and agentic processes. It emphasises how actors' strategies for RIS reconfiguration are influenced by the context in which they take place. The article compares two cases of RIS reconfiguration and new path development in West Sweden and Scania.

1.3 Structure of the dissertation

The dissertation consists of five articles, preceded by a general introduction ('kappa', Swedish for 'coat') providing a frame of the dissertation. The general introduction consists of six chapters:

Chapter 1 is an introduction, providing the background and motivation for the research project. It presents the aim and research questions that guide the analysis, outlines the expected contributions and introduces the core arguments of the dissertation.

Chapter 2 offers a theoretical background to the topic. It provides a review of the literature on path dependence and path development in economic geography and defines the concept of 'new regional industrial path development' which lies at the core of the research project.

Chapter 3 reviews the current literature dealing with new regional industrial path development, with a particular emphasis on the broadening of path development research in terms of accounting for a wide range of contextual conditions and the

role of agency. In this chapter, the regional innovation system approach is also introduced in more detail.

Chapter 4 develops the conceptual framework and roadmap for the empirical analysis in the dissertation. It introduces a functional perspective of RISs and RIS reconfiguration, conceptually investigates the modes and types of RIS reconfiguration, and elaborates on the varying characteristics of RIS reconfiguration in different types and stages of new path development. It is concluded with a discussion about RIS reconfiguration capacity and the reflexivity of agents. The chapter is largely based on a synthesis of the conceptual arguments brought forward in the individual articles.

Chapter 5 introduces the ontological and epistemological perspectives of the research project. Particular attention is given to the structure-agency debate in the social sciences and the dissertation is positioned in the spectrum of structurally oriented and agency-centred approaches. It also discusses methodological considerations and describes the methods for data collection and analysis deployed in the articles.

Chapter 6 provides a synthesis of the empirical results and presents them through the lens of the conceptual framework of the dissertation. The presentation is structured according to the research questions. The chapter also discusses the overall contribution of the dissertation, presents the conclusions and outlines areas for future studies as well as policy implications.

2 Theoretical background

Dating back to the seminal work by Weber (1909), the locational patterns of industries is a longstanding topic of enquiry in economic geography. Weber argued that the locational decision of a production plant was the function of transportation and labour costs, as firms seek to minimise the costs of transportation. This implies that firms tend to locate close to localised resources and markets, to minimise the cost of transporting inputs and final products. According to Weber, not all resources are localised, but some are ubiquitously available across space and therefore not relevant for the locational decision. Weber also highlights agglomeration economies in his model, lowering the costs of production and allowing firms to cater to larger markets (Weber, 1909).

Partly as a result of a substantial decline in transportation costs over the last century, agglomeration economies have arguably received more attention in economic geography than the cost of transporting localised resources and final goods. Regional differences in economic performance are often attributed to place-specific externalities such as a qualified workforce, local suppliers, well-developed knowledge infrastructure, and different forms of traded and untraded interdependencies (Storper, 1997). An extensive academic debate has taken place around the issue of whether spill-overs are more frequent and beneficial if taking place within industries (localisation externalities) in 'industrial districts' (see also MAR-externalities after Marshall, 1920; Arrow, 1962; Romer, 1986) or between diverse economic agents (urbanisation externalities) (see also Jacobs' externalities after Jacobs, 1969). One more recent stream of scholarly work has been built around the idea that variety is particularly positive for regional growth if the variety is 'related', referring to the existence of different but related economic activities (Essletzbichler and Rigby, 2007; Frenken et al., 2007). Related variety is also considered a major enabling factor for regional diversification processes (see also chapter 3). A range of studies have explored the positive effects of related variety, investigating relatedness in different dimensions and their impact on different indicators of economic performance (for a review, see Content and Frenken, 2016).

When it comes to the emergence of new industrial activities, Boschma (1997) (inspired by Storper and Walker (1989)) argued that new industries benefit from 'windows of locational opportunity', as the resources and institutions they need are not yet developed in any particular location. Instead, new industries were argued to draw on generic resources that are generally available, if not ubiquitously across space then at least in several different locations. With the 'evolutionary turn' in economic geography, studies increasingly investigate how regional economic development depends on previous rounds of development, how it is 'place' and 'path' dependent (Martin and Sunley, 2006). In other words, the role of 'localised resources' has been brought back into contemporary studies of regional industrial change, albeit more broadly defined than production factors or natural resources. In particular, one stream of research, from here on referred to as the 'new path development' literature, has been concerned with the emergence of industrial novelty in regions. Rather than focusing on continuity and path dependence, recent models have suggested that regional industrial development is driven by complementary stabilising and transformative forces (Martin, 2010; Simmie, 2012). This has led to the evolution of a research agenda focusing on the question of how and under what conditions new industrial paths are developed in regions.

The 'region' has become an important unit of analysis in economic geography and it is maintained in this dissertation that the region represents a key territorial unit for understanding the economy (Storper, 1997). There is a strong regional dimension to industrial change and innovation (Martin, 2010). Regions provide the context for the activities of economic actors, and geographical proximity and supportive context conditions remain to serve as important locational advantages in a globalising economy (Boschma, 2004). Regions are defined as territorial units at the meso-level, situated on the scale between the 'local' and the 'national'. In the articles comprising this dissertation, the regional level refers to administrative regions in Sweden (articles one, four and five), to city-regions consisting of a group of municipalities surrounding a city (article three) and to cross-border regions consisting of areas located in different national contexts (article two).

2.1 From continuity to change

Engaging with evolutionary theory has undoubtedly become one of the most influential theoretical frontiers in economic geography over the last few decades.

Economic geographers have been inspired by evolutionary theory, in particular its application in economics which was presented as an alternative to mainstream neoclassical economics in the 1980s.

According to Witt (2003), an evolutionary theory of economic change has three defining features. First, cumulative dynamics between industrial restructuring and technological change are at the centre of why the economic landscape is in a state of constant unrest. Future events are influenced, but not determined, by the historical development trajectory of the economy, meaning that evolutionary economic theory emphasises the role played by history in future outcomes (David, 1985). Second, the economy is to be characterised by a degree of irreversibility and non-equilibrium (Nelson, 1995). In other words, economic evolution is an autocatalytic process centred around processes of change. Third, the generation of novelty is at the core of an evolutionary approach. Selection and competition between heterogeneous agents lead to processes of innovation (Nelson and Winter, 1982).

Several definitions of 'innovation' exist in the literature, many sharing a basic understanding of innovation as (different types of) ideas turned into practice and having (economic or social) significance (Fagerberg, 2005; Edquist, 1997). In one of the most fundamental contributions to innovation studies, Schumpeter (1934) referred to innovations as 'new combinations', focusing not only on product innovations, but also on, for example, the introduction of new production methods, the establishment of new markets, new inputs to production processes and changing the ways through which industries are organised. In addition, innovations did not have to be 'new to the world', but can be seen as economic novelty generated in a certain context (see McCraw, 2009). This dissertation adheres to a systemic perspective of innovation defined in this broad sense, stressing the matter of combining processes of knowledge generation and exploitation in order to generate economic novelty, involving systemic interactions between different actors (private and public) embedded in a particular context (Edquist, 2005; Cooke, 2004).

Broadly speaking, EEG focuses on the spatiality of economic novelty (Martin and Sunley, 2006). As a paradigm in economic geography, it has been developed around three main theoretical approaches (Kogler, 2015). First, EEG has invoked concepts from evolutionary biology. In particular, attempts have been made to understand the changing economic landscape through the lens of Generalised Darwinism, emphasising processes of variety (especially 'related variety'), selection and

retention as the core of an evolutionary perspective of the emergence and development of industries across space. Regions are perceived as the 'selection environment' in which evolution takes place, and retention mechanisms are argued to lead to the persistence of patterns of economic activity across time and space (Martin and Sunley, 2015). Second, complexity theory has been explored by evolutionary economic geographers, albeit to a lower degree than Generalised Darwinism. The potential to adopt a complex systems perspective in EEG is, however, increasingly recognised (Martin and Sunley, 2007; Martin and Sunley, 2015), in particular when it comes to understanding the emergence of economic novelty. Third, the concept of 'path dependence' has been widely adopted.

Theorisations of path dependence in evolutionary economics range back to seminal works by David (1985) and Arthur (1994) who criticised prevailing neo-classical, equilibrist models based on micro-level economic theory by showing how sub-optimal technologies can become 'locked in' despite the existence of technologically superior alternatives. The most famous example of this 'canonical' model of path dependence is that of the QWERTY keyboard layout, as presented by (David, 1985). This layout is adopted by practically every keyboard used in offices and homes all over the world and was created by a series of micro-level 'chance' events or 'accidents'. These small events had long-term effects on the technological development path taken by computer manufacturers; the layout still dominates even though more ergonomically and technically superior layouts have been developed. In other words, the early decisions made by typewriter pioneers in the late 19th century reverberate through history, closing alternative development paths and continuously reinforcing the chosen one. Related to David's work is the view of path dependence as the result of increasing returns, introduced by Arthur (1994) and situated within a complexity theory framework. Arthur puts emphasis on different kinds of increasing returns; fixed set-up costs leading to falling unit costs and increased output, dynamic learning effects, co-ordination effects and self-reinforcing expectations (see also Krugman, 1991). Arthur was concerned with the emergence of economic macrostructure from micro events and behaviours, not only with the purely technological perspective (Martin and Sunley, 2006). Together, their views clearly diverge from mainstream economic theory, where the development path is governed by an equilibrium state outcome. A path-dependent development trajectory, on the other hand, depends on the path taken towards it (David, 1985; Martin and Sunley, 2006). A feature of the canonical model of path dependence is

that such trajectories tend to persist until disrupted by an 'external shock' (Simmie, 2012).

In its early form, the concept of path dependence was embraced by geographers trying to explain why some places seem to experience declining trajectories, in particular in so called 'old industrial regions' (see e.g. Grabher, 1993; Martin, 1999; Hassink, 2005), but also industrial districts, clusters and other spatially concentrated specialisation patterns (Martin, 2010). It was argued that regions exhibit path dependence due to the "'quasi-fixity' of geographical patterns of technological change, economic structures and institutional forms across the economic landscape" (Martin and Sunley, 2006:398); that is to say, development trajectories are 'place-dependent' (Martin and Sunley, 2006). In other words, geographers pointed to the localised sources of lock-in, such as increasing returns described in the David-Arthur model of path dependence, but also at other geographically defined factors such as labour pooling effects, knowledge spill-overs, and traded and untraded inter-firm dependencies (Martin, 2010).

Path dependence has been examined at different spatial scales; the meso-level at the level of industries, clusters, industrial districts, sectors and networks, as well as macro-level institutions, growth cycles and technological shifts (see e.g. Rigby and Essletzbichler, 1997; Klepper, 1997; Henning et al., 2013; Giuliani, 2013; Neffke et al., 2011; Fisher, 2015). Economic geographers often refer to the 'regional economy' as the subject being path-dependent; that is, the persistence of regional industrial and institutional structures (Henning et al., 2013; Pike et al., 2016). This implies that the 'regional path' is an abstraction of underlying industrial, technological, institutional and organisational paths. Hence, in mono-industrial settings, such as old industrial areas, the regional path is often equated with the path of the dominating industry as regional structures tend to co-evolve with the dominating industrial path (Nelson, 1994; Grabher, 1993; Strambach, 2010). However, early on it was questioned whether an industrially diverse region can exhibit path dependence in terms of following a single development trajectory or if it is rather the case that different paths can exist in one region (Martin and Sunley, 2006).

The canonical model of path dependence lacked a sufficient explanation of how and why new pathways are developed, and relied on historical accidents and exogenous shocks to explain path creation and how trajectories were 'de-locked' (Martin,

2010). The initial location of firms in an industry was argued to be determined by 'accidents' or contingencies and paths 'created' as a result of the development of self-reinforcing processes leading to agglomeration economies based on the initial accident. In other words, very little was said about the actual origins of new paths, and 'path creation' in the canonical model refers to an intermediary phase in-between embryonic conditions created by historical accidents and a situation of path-dependent lock-in, rather than to the factors, conditions and processes leading to the emergence of novelty in the first instance. As highlighted by Martin (2010), "[t]here is thus a curious contradiction in the model, in that path dependence seems to matter only once a new industry or technology has emerged but plays no part in shaping that emergence or where it takes place." (Martin, 2010:6).

On this premise, a body of scholarly work started to target questions of how, where and under what conditions new development paths emerge. Rather than perceiving new path creation as a result of 'historical accidents', scholars started paying attention to how pre-existing regional economic structures influence processes of industrial evolution and new path development (Neffke et al., 2011; Martin, 2010). Much of this work takes the seminal contributions by Martin and Sunley (2006) and Martin (2010), outlining an open and dynamic 'path as a process' model, as points of departure. Their model emphasises the role of path dependence as an enabling factor for the emergence of new industries and the transformation of existing ones, rather than focusing only on the constraining effect of existing structures.

Economic geographers have also been largely inspired by the concept of 'path creation' (Garud and Karnøe, 2001), adopting similar terminology but drawing on sociological theory, highlighting the role of agency in explaining new path development. This strand of literature emphasises the 'mindful deviation' of entrepreneurs (Garud and Karnøe, 2001; Garud et al., 2010) as a core mechanism of new path development. Mindful deviation refers to the ability of entrepreneurs to intentionally deviate from existing structures with the goal of shaping new futures, even though they are aware that this may create short-term inefficiencies (Garud and Karnøe, 2001). It is argued that agency is distributed across various actors, and that they, through processes of 'bricolage', engage in efforts to overcome path-dependent barriers (Simmie, 2012).

The concept of bricolage was introduced by Garud and Karnøe (2003) and refers to processes involving a wide range of different types of actors who mobilise resources

in order to create new industrial paths. It is maintained that resources are often collective, meaning that not all necessary resources are available within one single firm but are distributed between different actors. In their study of the emergence of wind turbine industries in Denmark and the US, the bricolage mode of path development in Denmark was contrasted with the 'breakthrough' mode found in the US, showing how the Danish case prevailed over time. The relative success was attributed to trial-and-error processes and intense collaboration between both firm- and non-firm actors in the Danish case, highlighting the ability of key actors to align a heterogenous set of actors, assets and institutions in order to establish the new industrial path. The concept of bricolage has been widely applied in management and organisation studies and, albeit to a lesser extent, to regional development studies (see Boschma et al., 2017).

In later work, Garud et al. (2010) have criticised attempts to understand path creation from an evolutionary perspective, by arguing that combining the concept of path dependence and path creation is 'mixing ontologies'. They argued that in order to observe path dependence it is necessary to have an 'outsiders'' perspective, looking at new activities within the path as being serendipitous events not fully appreciated in any particular time-space position. In other words, the concept of path dependence is argued to be useful only for analysing the past, looking at processes of change in hindsight, as this is the only temporal position at which the significance of certain events in history can be seen. In their argument, this means that questions concerning change cannot be answered using path dependence as a conceptual foundation. The concept of path creation, it is argued, draws on a fundamentally different ontological position, leaning on a constructivist ontology in which agency is considered as an important factor, and on approaches such as actor network theory (Latour, 1996).

This type of categorical critique may be seen as counterproductive in relation to the aim of path development research, as it should lie at the core of evolutionary studies in economic geography to explain the relationship between forces of continuity and drivers of change (see also Martin, 2012). However, nor should the issue be disregarded when defining the concept of path development from an economic geography perspective. In many respects, the question boils down to the relationship between structure and agency, and the tendency of some path development research to separate the forces of continuity linked to the structural composition of 'places', from the drivers of change linked to the role played by agency. With this

background, it is important that the interplay between structure and agency is taken seriously in studies of path development, something which will be discussed further in chapters 4 and 5. The issue is also a core component of the conceptual discussions in articles three and five.

2.2 New regional industrial path development

In this dissertation, regional economic restructuring is conceptualised through the concept of new regional industrial path development. Defining and positioning what is here referred to as 'new path development' is not, however, a completely straightforward task. Studies have drawn on a wide range of theoretical approaches to explain aspects of regional economic restructuring, explicitly or implicitly tapping into the new path development debate. For example, studies have adopted evolutionary, relational and sociological approaches and innovation system perspectives to explain regional structural change and the formation of new industries in regions (see e.g. Garud and Karnøe, 2001; Simmie, 2012; Isaksen and Trippl, 2016; Martin and Simmie, 2008; Binz et al., 2016; MacKinnon, 2012; Pike et al., 2016; MacKinnon et al., 2019a).

In economic geography, studies of path development have in common that they draw on the idea that historically developed place-based factors and conditions influence processes of novelty generation. Nevertheless, one of the most persistent issues in the path development debate is often left unanswered: what is the path, i.e., what type of novelty is under scrutiny? The answer will inevitably influence the choice of theoretical approaches, and even methodological considerations. To give a few examples, studies have investigated the development of new 'regional' paths (referring to an aggregate of the most important economic activities in the region and often concerned with regions dominated by one or a few industries) (Cooke, 2012; Evenhuis, 2017), 'technological' paths (referring to a particular technology) (Simmie, 2012; Simmie et al., 2014), 'sectorial' and 'system' paths (for example 'energy', 'mobility' or 'food') (Essletzbichler, 2012; Heiskanen et al., 2011), and 'industrial' paths (referring to the development of new regional industries) (see e.g. Isaksen, 2015; Steen and Karlsen, 2014; Isaksen and Trippl, 2016). Furthermore, studies have investigated the development of new paths at different scales, ranging from local city regions (Martin and Simmie, 2008) to the global level (Binz and Truffer, 2017).

On the one hand, some of the confusion related to the application of the path development concept in economic geography originates from terminological ambiguity. Concepts such as 'path development', 'path creation', 'path emergence', 'path constitution', 'path diversification' and 'path renewal' are sometimes used interchangeably, whilst sometimes referring to different types of new paths (see chapter 3). On the other hand, studies framed in similar terminology may differ in terms of how novelty (what is the object of study) and change (what is evolving and how) are understood.

Following previous studies (Hassink et al., 2019; Steen and Hansen, 2018; Isaksen and Trippl, 2016), an industrial path is defined in this dissertation as a critical mass of functionally related firms that are "established and legitimized beyond emergence" (Steen and Hansen, 2018:4). A region may consist of different (related and unrelated) industrial paths, embedded in a regional innovation system supporting one or several industries. Thus, industrial paths are characterised by a degree of persistence, supported by organisational and institutional structures. These can be traced back to the quasi-fixity of economic patterns resulting from agglomeration economies and self-reinforcing mechanisms, specifically, path dependence (Henning et al., 2013; Isaksen and Jakobsen, 2017). Without a degree of such persistence, it would not be an industrial path but merely a set of co-located and somewhat networked economic activities; a potentially embryonic state on the verge of developing into a new path or activities that will fade away and be forgotten in the constant flux of the economy. An industrial path is 'regional' when a critical mass of activities takes place within the same region, but actors can draw on both endogenous and exogenous sources of knowledge and other input factors, and involve actors and assets at different spatial scales (Binz et al., 2016; Trippl et al., 2018). 'New' regional industrial path development thus refers to the rise of industrial paths that are new to the region, ranging from entirely new industries (new to the world) or the importation of paths from other regions, to new industrial paths originating from the substantial transformation of existing industries (for a more comprehensive discussion about different types of path development, see chapter 3).

The articles in this dissertation, even though they sometimes use different terminologies (such as 'economic paths' and 'industrial growth paths'), all investigate different aspects of the development of new regional industrial paths according to these definitions. The term 'new path development' is often used in the

papers as an abbreviation and umbrella term referring to different types of new regional industrial path development, and not to the broadly defined field of path development research that has been presented earlier in this section (see Figure 1).

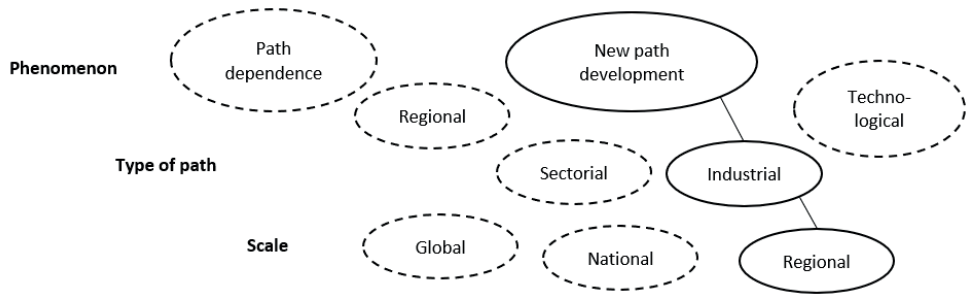

Figure 1: 'New regional industrial path development' versus the broader field of path development research (not exhaustive). Source: own elaboration.

In the 'alternative path dependence model of local industrial evolution' brought forward by Martin (2010), pre-existing local economic and technological structures inherited from previous economic evolution form the regional environment in which local agents engage in processes of experimentation and competition, in order to create new industrial paths. Before the creation of a new industrial pathway, the 'preformation' stage, pre-existing economic and social structures and technological knowledge and competences influence the possibilities for path development to occur. It should be stated that this environment can also be more or less attractive to agents from the outside to relocate to the region (Martin, 2010; Trippl et al., 2018). The 'path creation' stage is characterised by experimentation and competition among local agents, which leads to new industrial path development and eventually a critical mass of actors and industrial activities. During the 'path development' stage, externalities are created which, in turn, leads to path-dependent growth, assisting the development of the new path (Martin, 2010). In a similar manner, Simmie (2012) distinguishes between the 'path creation' process in which mindful actors deviate from established practices, the 'path establishment' process in which self-reinforcing effects are cultivated by actors, and the 'path dependence' process which is characterised by a temporary stabilisation of paths in the making. Holmen and Fosse (2017) draw on the work of Sydow and colleagues (Sydow et al., 2009; Sydow et al., 2012) and differentiate between a period of experimentation and open-ended efforts of formulating expectations of the future (the pre-formation phase),

followed by a period characterised by the emergence of a dominating pattern and a new regime (the formation phase) in which the possible outcomes are 'narrowed down'. Conceptualisations of path development stages thus have in common that they differentiate between a period of uncertainty when new activities are starting to emerge, triggered by experimentation, the arrival of actors, or mindful deviation, and a period of 'developing self-reinforcing effects', understood broadly as leading to a temporary stabilisation of the new path.

The focus on new path development reflects a shift from studying forces of continuity and path dependence in regional economies, towards focusing on dynamism and change processes. In particular, scholars positioned in the EEG paradigm have made substantial conceptual and empirical contributions to understanding the processes through which the spatial pattern of economic activity changes over time. In terms of new path development, important explanatory factors include the idea that regional diversification is enabled by existing different but related industrial activities (Boschma, 2017). However, EEG has been criticised for underappreciating both a broader set of structural factors, such as social, cultural and institutional environments (MacKinnon et al., 2009; Gertler, 2010; Hassink et al., 2014; Pike et al., 2016) and the role of agency and power relations (Dawley, 2014; MacKinnon et al., 2019a). Some recent attempts have been made by EEG scholars to approach these issues (see Boschma and Capone, 2015; Boschma et al., 2017), but the academic debate has increasingly been concerned with combining insights from different strands of literature in economic geography, as well as the social sciences, to explain path development from a broader perspective.

3 From narrow to broad perspectives of new path development

Under the umbrella of EEG, a plethora of studies have set out to investigate the sources and mechanisms of regional industrial diversification (Boschma and Frenken, 2018). It is proposed that new paths tend to branch out of the existing regional industrial structure through related diversification, driven by a recombination of resources and competences (Boschma and Frenken, 2006; Frenken and Boschma, 2007; Boschma and Frenken, 2011a; Neffke et al., 2011; Essletzbichler, 2015). Related diversification and path branching are seen in EEG as the typical pattern of economic evolution (Boschma, 2017). Unrelated diversification, i.e., new activities which require a different set of resources and competences than would be available in the existing industrial base (Neffke et al., 2018), is given increased attention in the most recent literature and is argued to be necessary to ensure long-term economic success (Boschma et al., 2017).

The theoretical foundation of the branching argument is built on micro-level assumptions and evolutionary concepts, in particular Generalised Darwinism. Firms are seen as the carriers of organisational routines or capabilities, the 'genes' of economic evolution, and evolution takes place through selection mechanisms in which the fittest routines are singled out by forces of competition. Routines are transmitted, i.e. 'inherited', and replicated through localised processes such as spin-offs and labour mobility. The branching argument revolves around the claim that new industries tend to exhibit 'relatedness', in terms of their capabilities, to existing industries in the region (Boschma and Frenken, 2011a; Boschma and Frenken, 2011b; Neffke et al., 2011). Studies situated within EEG have devoted considerable attention to considering which structural conditions are most beneficial for new industries to develop. Drawing on a Schumpeterian view of innovations as 'new combinations' (Schumpeter, 1912; Schumpeter, 1934), EEG scholars argue that existing variety in a region conditions the scope for recombinant innovations, and thus for regional branching (Boschma and Frenken, 2018). EEG taps into a

longstanding debate within economic geography concerned with investigating whether Jacobs' (increased innovativeness due to diversity, see Jacobs, 1969) or Marshallian (increased competitiveness due to specialisation, see Marshall, 1920) externalities are most beneficial for regional growth. After almost three decades of academic debate following a comparison by Glaeser et al. (1992), recent reviews have demonstrated that, despite a substantial amount of empirical work, the evidence is still inconclusive (Caragliu et al., 2016). In EEG, it is suggested that one potential reason why studies of Jacobs' externalities show only weak effects is that "many technologies and services cannot be meaningfully combined" (Boschma and Frenken, 2018:219) due to cognitive distance (Boschma, 2005). Thus, rather than the sheer levels of variety exhibited in an economy, what is more important is the existence of different but related economic activities (Frenken et al., 2007). A high degree of such 'related variety' is argued to be the single most important structural condition for new path development to occur (Frenken and Boschma, 2007), as the "local presence of industries that are related to a new industry increases the probability for a new industry to occur, given that related industries provide the main source for knowledge, capabilities, and potential entrepreneurs" (Boschma and Frenken, 2018:220).

However, while path dependence theory has indeed been proven useful for explaining retention mechanisms in the economy, Generalised Darwinism and complexity theory does not, at least not in their current application in EEG, provide a satisfactory conceptual lens for understanding the whole set of influences for the 'creation of variety' (cf. Boschma et al., 2010) and new path development. In particular, 'bottom-up' influences in terms of agency and purposive behaviour are neglected, and 'top-down and outside-in' influences in terms of multi-scalar structural conditions impinging on the regional environment under consideration are generally downplayed (Martin and Sunley, 2015).

Recent academic work has pointed out some shortcomings of how new path development is explained in EEG (see e.g. Hassink et al., 2019). Studies situated in the nexus between EEG and other approaches in economic geography have enriched the literature through a broadening of the questions, concepts and ideas argued to be important when examining new regional industrial path development. For example, scholars have developed more geographically sensitive approaches, explaining what type of industrial path development is most likely to be observed under certain structural conditions (Isaksen and Trippl, 2016), and have examined the role played

by agency (Simmie, 2012; Dawley, 2014) (see section 3.1-3.2). Increasingly, the firm-centred perspective of industrial evolution in EEG has been criticised for not taking into account the role of social, institutional and cultural influences (MacKinnon, 2012; Hassink et al., 2014; Pike et al., 2016). While being conceptually anchored in evolutionary theory, often drawing on the work by UK-based EEG scholars such as Martin and Sunley (2006), Martin (2010) and Simmie (2012) as a point of departure, the new path development debate has increasingly been taking place at the intersection of different strands of literature within economic geography, and scholars advocate a broader conceptualisation of new path development (see Dawley, 2014; MacKinnon et al., 2019a; Gong and Hassink, 2018).

At the centre of such efforts lies a broader perspective of the structural factors impacting new path development. This includes a greater focus on institutions[1] (Dawley, 2014) and regional factors impinging the regional environment defined more broadly. It also includes extending the emphasis on knowledge as the main endogenous asset provided in regional contexts. Recent studies have demonstrated how new path development depends on the formation and modification of different types of assets (Martin and Sunley, 2015; Binz et al., 2016; MacKinnon et al., 2019b; Trippl et al., 2019a) and have criticised the narrow focus on technological knowledge as the main 'input' to new path development prevailing in EEG.

Binz et al. (2016) distinguish between four key assets (knowledge, markets, legitimacy and financial investments) which need to be created in the early stages of industry formation. Other studies have defined assets broadly as tangible factors that can be used as inputs to new path development processes. This includes human assets such as knowledge and skills embedded in the workforce; infrastructural and material assets in the form of physical facilities, communications (physical and virtual), and the built environment; financial assets in the form of venture capital, bank loans and other means of capital provision; and industrial assets such as technology, firm competencies and markets, but also legitimacy and power embedded in regional firms (Binz et al., 2016; Maskell and Malmberg, 1999; MacKinnon et al., 2019a). The creation of new assets has been demonstrated to be

[1] The role of institutions has started to also be addressed within EEG (see Cortinovis et al., 2017; Boschma and Capone, 2015), demonstrating how the national institutional environment influences the propensity for new paths to emerge and that regional institutions influence whether related or unrelated industries emerge in regions.

an important driver of path development, but often takes place in combination with reusing assets embedded in existing paths (MacKinnon, 2012; Steen and Hansen, 2018). For example, the emergence of a new media industry in Scania was shown to be based on the combination of existing assets originating from the traditional media and IT industries, complemented by the creation of new symbolic knowledge (Martin and Martin, 2017). Conversely, the creation of new assets can dominate the transformation or upgrading of existing paths. For example, whilst drawing on existing knowledge assets, the upgrading of the Scanian food industry (from traditional food production to 'functional foods') relied on the creation of entirely new knowledge and markets (Zukauskaite and Moodysson, 2016). Most often however, as demonstrated in the empirical cases in this dissertation, new paths will require new assets to be created, or to access assets that have been created elsewhere. In other words, rather than focusing on the existence or absence of combinable assets, the focus should shift towards the ability of a region to provide assets needed by actors engaging in new path development. In this dissertation, a distinction is thus made between whether or not (and, maybe more importantly, to what extent) actors rely on existing structures for asset provision, rather than whether they draw on existing assets.

In addition, studies have broadened the perspective by investigating the role of linkages between industrial paths and how inter-path relationships influence the development of new industries (Frangenheim et al., 2018; Gong and Hassink, 2018). Scholars have also increasingly started to approach new path development from a multi-scalar perspective, both in terms of the environment in which path development takes place (the structural conditions) and in terms of the spatial distribution of path development activities. For example, studies have investigated the inflow of actors and assets from other regions and their role in new path development (Binz et al., 2016; Trippl et al., 2018), as well as the embeddedness of regional actors engaging in path development activities in global production networks or global innovation systems (MacKinnon, 2012; Binz and Truffer, 2017).

Furthermore, contributions have been made in order to distinguish between different types of path development (Martin and Sunley, 2006; Trippl and Tödtling, 2008; Tödtling and Trippl, 2013; Isaksen and Trippl, 2016). The most fundamental distinction shared by most typologies is that between 'path extension' and 'new path development'. Following Martin and Sunley (2006), path extension is defined by Isaksen (2015) as "incremental product and process innovations in existing industry

and along prevailing technological paths, which in situations of growth can lead to continuity or more of the same in a regional economy" (Isaksen, 2015:587). However, path extension may lead to the exhaustion of regional assets and various forms of lock-in (Isaksen, 2015), which is why it is also necessary to acknowledge the ability for regions to develop activities in new industrial fields (Boschma, 2015). Drawing on early work (Martin and Sunley, 2006; Trippl and Tödtling, 2008), studies have outlined two types of new path development, based on their radicalness. 'Path renewal' refers to intra-path changes related to, for example, the introduction of new technologies, organisational innovations or business models. 'Path creation' represents more wide-ranging changes, including the establishment of firms engaging in economic activities that were not previously represented in the region. These can be both 'new to the region' and 'new to the world' (c.f. Tödtling and Trippl, 2013).

More recently, the literature has been enriched with more fine-grained typologies. Drawing on Isaksen and Trippl (2016) and Isaksen et al. (2018), Grillitsch et al. (2018) point to five main forms of regional industrial path development and associated mechanisms: 1) 'Path upgrading' denotes a major change within an existing regional path, triggered by the enhancement of the industry's position in global value chains or production networks and based on the upgrading of skills and competences in the industry, or triggered by the infusion of new technologies or different types of knowledge, organisational innovations or business models in the existing industry; 2) 'Path importation' represents the case of establishing an industry which is new to the region and unrelated to existing industries, but not new to the world; 3) 'Path branching' is when new related industries are developed, building on assets of existing industries; 4) 'Path diversification' is a result of unrelated knowledge combinations and the diversification of existing firms into a new industry not related to those already existing in the region; and 5) 'Path creation' represents the emergence of a radically new industry, often based on scientific breakthroughs.

However, studies have criticised the dichotomy between gradual 'on the path' changes and new path development (Baumgartinger-Seiringer et al., 2019). Article four introduces the notion of 'path transformation' to capture substantial innovation-based renewal processes of established paths based on radically new technological, organisational or market innovations. The outcome is a 'new' industrial path which is substantially different from the initial one, due to the disruptive nature of the

innovations introduced. It thus refers to radical cases of path renewal and intra-path changes more broadly, rather than to a distinct type of path development.

The broadening of the path development debate has taken place in conjunction with the cross-fertilisation of EEG and other strands of literature in economic geography and the social sciences more broadly. In the following subsections, two main research directions will be explored; studies combining EEG and the Regional Innovation Systems approach in order to better understand the context for new path development, and investigations into the role of agency in new path development.

3.1 Path development in context: Regional Innovation Systems

One influential way of broadening the understanding of what regional conditions matter for new path development has been to engage with systemic perspectives of innovation and regional structural change. Innovation system approaches emphasise the importance of interactive learning processes and are built on the basis of non-linear views of innovation and evolutionary thinking (Freeman, 1989; Lundvall, 1992). They come in different variations, differentiated by how their system boundaries are defined. In addition to regional innovation systems (Cooke, 1992; Asheim and Isaksen, 1997; Cooke, 2004; Asheim and Gertler, 2005), which are in focus in this dissertation, innovation systems have been analysed at the national level (Freeman, 1989; Lundvall, 1992; Nelson, 1993; Edquist, 1997), as well as at the level of sectors (Malerba, 2002) and technologies (Carlsson and Stankiewicz, 1991; Bergek et al., 2008). The development of the RIS approach has also been closely related to other territorial innovation models that have sought to understand the geography of innovation (for a review, see Moulaert and Sekia, 2003), such as industrial districts (Marshall, 1920), clusters (Porter, 1993; Porter, 1998), innovative milieus (Aydalot, 1986; Maillat, 1995) and learning regions (Asheim, 1996; Morgan, 1997). Different innovation systems (regional, national, sectoral and technological) may overlap, as actors are part of both territorially defined innovation systems and of innovation systems around their core technologies or the sector to which they belong. In a similar manner, the RIS approach can be argued to span across and incorporate aspects from other territorial innovation models, as a RIS may potentially be encompassing several clusters, a broad set of private and public

organisations, and institutional conditions that shape innovation activities (Asheim and Isaksen, 1997; Asheim and Gertler, 2005).

Isaksen and Trippl (2016) describe the RIS approach as a "framework in which close inter-firm interaction, knowledge and policy support infrastructure, and socio-cultural and institutional environment serve to stimulate collective learning, continuous innovation and entrepreneurial activity" (Isaksen and Trippl, 2016:70). The regional innovation systems approach has received considerable attention from both scholars and policymakers. It has been used to inform place-based innovation policies, taking into account the institutional and organisational infrastructure supporting innovation activities in regions, and the interaction between different actors across public and private sectors (Cooke et al., 1997; Braczyk et al., 1998; Cooke, 2001; Asheim and Isaksen, 2002; Asheim and Gertler, 2005). In addition to becoming a widely used tool for policy design, it has also been adopted as a framework for analysing why regions experience different performance in terms of economic development (Asheim et al., 2019). It is often used to analyse regions defined by administrative boundaries (see Doloreux and Porto Gomez, 2017). However, the RIS approach is also a useful lens for understanding conditions in functionally defined regions, such as cross-border regions encompassing areas located in more than one country (Trippl, 2010; Lundquist and Trippl, 2013).

A regional innovation system can be understood as a set of actors (public and private) engaging in innovation processes or providing support to ones that do, networks between actors, and institutions influencing their behaviour (Asheim et al., 2011). In other words, a RIS is conceptualised as being made up of three core elements; that is to say, actors (elements in the organisational dimension of the RIS), institutions (elements in the institutional dimension of the RIS) and networks (linkages between elements). The generation of economic novelty is argued to depend on the interplay between these core elements of the RIS (Asheim et al., 2019). This dissertation takes a broad approach to regional innovation systems, following scholars who argue that all regions are equipped with some kind of RIS (albeit more or less well-developed) (see e.g. Doloreux and Parto, 2005).

The organisational dimension of a RIS refers to a broad variety of actors situated in the region, ranging from firms and business and innovation support organisations, to research and education facilities, financial organisations, public governance, organisations, interest organisations, and lobbying groups, among others (see

Zukauskaite et al., 2017). Many studies have focused on elements in the organisational dimension of the RIS in new path development, ranging from the role played by universities and other knowledge-generating organisations (Vallance, 2016; Benneworth et al., 2017) to governance organisations (Martin and Martin, 2017) and innovation platforms (Coenen et al., 2015). Tödtling and Trippl (2005) identified missing or inappropriate elements in the organisational set-up as a major obstacle to the functioning of a RIS. The lack of organisations active in the fields of research, education and technology transfer may be a source of innovation system deficiencies.

However, regions with highly elaborated organisational support structures may also experience innovation system deficiencies, either as a result of an overly high alignment with existing paths, or as a result of fragmentation between different parts of the RIS (Tödtling and Trippl, 2005). The mere existence of certain RIS elements is thus not enough, but it is necessary to take into account how elements are linked to each other through regional or extra-regional networks (Coenen et al., 2017a).

A core argument in the RIS literature is that differences in the institutional dimension of the RIS are important determinants of innovation activities across space (Asheim and Gertler, 2005). In the early 2000s, questions about the role of institutions in economic development were put on the agenda (see Amin, 1999; Martin, 2000). Institutions are embedded in space and shape regional economic activities (Martin, 2000; Gertler, 2010). Studying institutions is thus crucial for understanding how regional economic evolution unfolds. Institutions are defined as the rules of the game that enable or constrain activities performed by organisations and individuals (North, 1990). In other words, institutions are not organisations (Zukauskaite et al., 2017), but are part of the structural fabric in which actors, such as organisations, are embedded. Institutions can be both formal, referring to legally sanctioned and codified rules, regulations and policy initiatives, and informal, referring to norms that are enacted and enforced by social conventions or cultural-cognitive beliefs, values and attitudes (Zukauskaite, 2013; Scott, 2010). Both formal and informal institutions are often place-specific and delineated by geographical boundaries, making them interesting objects of study for economic geographers. Zukauskaite (2013) argues that institutions can be related to each other in different ways. Institutions are reinforcing when they provide the same incentive via similar functions, they are complementary when they provide the same incentive via different functions, and contradictory when they are providing opposing incentives.

New path development can be expected to be influenced by existing institutional arrangements in various ways. The impact is not universally enabling or constraining, but is to be considered as a set of more or less coherent arrangements, that enable or constrain activities to various degrees (Martin, 2010), possibly in contradictory and conflicting ways. Whilst institutional lock-in (Hassink, 2010) in terms of a strongly aligned institutional environment disincentivising all attempts of renewal, or universally enabling institutional settings pictured in early work on industry emergence (Scott and Storper, 1987; Boschma, 1997), might exist in some regions, they are likely to be exceptions (see e.g. Martin, 2010).

In other words, industrial development paths are embedded in regional innovation systems, which consist of all industries and firms located in the region, organisational and institutional support structures, and networks between the RIS elements. This makes the RIS approach a useful lens to understand the regional environment in which path development takes place, as it allows for the analysis of structural factors beyond the industrial composition.

By combining concepts from the RIS literature and EEG, scholars have aimed at developing typologies for understanding how the potentials for new path development differ between regional contexts. The focus on industrial variety has been extended with the idea that regions exhibit different degrees of 'thickness' in terms of their organisational set-up, referring to the endowment of knowledge- and innovation support organisations in the region. The concept of thickness was introduced by Amin and Thrift (1994), referring to the quantity and quality of local institutions, organisations and their interactions. Regional thickness can refer to the existence of a variety of organisations, high levels of interaction between organisations, coalition patterns and the existence of common regional agendas (Zukauskaite et al., 2017). The concept of thickness, broadly defined, has been used as a way of distinguishing between regions and their ability to foster regional industrial change.

Isaksen and Trippl (2016) distinguish between three types of RISs based on the degree of organisational thickness and industrial variety. Organisationally thin regions are considered to offer the most constraining environment when it comes to new industrial path development, with a dominance of traditional industries and poor endowment of knowledge-generating organisations. Organisationally thick regions are divided into two categories based on their industrial variety.

Organisationally thick and diversified regions are endowed with a broad industrial base and a variety of related and unrelated industrial activities, supported by a plethora of knowledge-generating and supporting organisations, and offer the most beneficial conditions for new path development. Organisationally thick and specialised regions are characterised by a narrower industrial base and a specialised innovation support system. The typical development pattern in this type of region is path extension, with associated risks of negative lock-ins, and these regions are considered to have a more constraining environment. In subsequent contributions, the authors have linked this typology to the varying need for, and capacity to attract, exogenous inputs in terms of knowledge linkages and the arrival of new actors (Trippl et al., 2018), and to different knowledge-sourcing mechanisms and types of knowledge (Isaksen and Trippl, 2017).

The RIS approach has been criticised for not taking exogenous linkages and the embeddedness of the region in other spatial scales seriously. Uyarra and Flanagan (2016) argued that it is taken for granted in the model that "all necessary resources, capacity and levers are likely to be available at the regional level" (Uyarra and Flanagan, 2016:310). In recent years, studies have targeted this gap by investigating the interplay between local and non-local knowledge circulation in RISs, arguing that the geography and types of knowledge links differ depending on RIS characteristics, and that regions differ in terms of their need and ability to access exogenous inputs (Isaksen and Trippl, 2017; Trippl et al., 2018). While studies have started to disentangle the influence of existing RIS configurations on inter-regional linkages such as knowledge flows, the literature has not yet elaborated on how RISs may have to change in order to facilitate such flows, and how the RIS may facilitate or hamper access to exogenous inputs.

Furthermore, few studies have extended the focus on the influence of certain RIS configurations on new path development beyond the idea of thickness. Existing RIS theorising tends to provide an overly stylised (and static) perspective of 'enabling' or 'constraining' regional environments, overemphasising factors belonging to organisational support structures, but underestimating other structural conditions. There is a need to broaden the analysis of factors in the regional environment from static snapshot analyses of the preconditions for new path development, towards a more dynamic perspective extending throughout the path development process.

3.2 The role of agency in new path development

Agency is broadly defined as intentional actions and interventions by actors, aimed at producing certain effects, referring to a process of social engagement which is embedded in time and space (Emirbayer and Mische, 1998). An emerging body of literature deals with the role of agency in new path development, extending the firm-centred view of EEG by investigating the role of different types of actors. For example, studies investigate the role of non-firm actors, exogenous actors relocating to the region, such as national policy actors and key firms in Global Production Networks (GPNs), and transnational entrepreneurs (Dawley, 2014; Tanner, 2014; Hassink et al., 2014; Coenen et al., 2017a; Binz et al., 2016).

Simmie (2012) argued that mindful deviation is a core mechanism of new path development, stating that "new pathways are not created by disembodied economic forces but by knowledgeable agents" (Simmie, 2012:760). Simmie et al. (2014) also studied how agency plays a role in overcoming barriers to path development. In particular, the role of key actors in the creation of 'niche conditions' (Kemp et al., 1998; Carpenter et al., 2012) is emphasised. These studies are closely connected to the early work by organisation scholars Garud and Karnøe (2001), emphasising how path development is a process of interaction between existing paths and mindful actors deviating from them (see also section 2.1). Dawley (2014) investigated how a variety of actors on different spatial scales shaped the environment in which the creation of a wind industry in North East England took place. Emphasis is put on both deliberate social agency in the development of new industrial activities and on how actors facilitate such activities by, for example, bridging "firm- and market selection mechanisms by supporting the transfer of knowledge between related sectors" (Dawley, 2014:104). In a later study, Dawley et al. (2015) further investigate the roles of state agencies and personnel, with the conclusion that public actors "sought to orchestrate key mechanisms of path creation" (Dawley et al., 2015:269) through contextual policy interventions. De Laurentis (2012) shows how firms interact with other regional organisations, i.e. the support structure, in the development of a renewable energy industry, and (Essletzbichler, 2012) convincingly makes the case of how non-firm actors played a role in mobilising and formulating a 'regional vision', a sort of roadmap for regional transformation processes, to develop new industrial paths.

Furthermore, Binz et al. (2016) include the role of non-firm actors in their analysis of how generic resources are turned into path-specific ones through anchoring and resource mobilisation in the emergence of a water recycling industry in China. In a similar manner, Tanner (2014) argues that knowledge generated by non-firm actors played an important role in processes of regional branching in the emergence of a fuel cell industry in a number of European regions. Thus, studies have started to investigate the role of public actors as being supportive of mindful deviation (Simmie et al., 2014), but also as actors actively pursuing deviation from existing paths (Boon et al., 2015). In other words, it has been argued that agency on different geographical scales plays an important role in processes of regional industrial path development. These studies consider agency as being one of the factors that may facilitate new path development, in addition to enabling or constraining structural conditions.

Studies have also made initial attempts to add a temporal perspective to agency in new path development, arguing that agency is simultaneously linked to the past and the future, and approach agency as the 'lens' through which the past is interpreted and mobilised for the future (Steen, 2016b; Grillitsch and Sotarauta, 2019). Thus, it involves all three moments of time, as actors are using knowledge about the past to generate future opportunities (Garud et al., 2010; MacKinnon et al., 2019a). For example, the role of expectations among actors, in terms of shaping visions and strategies, has been investigated (Steen, 2016b). Garud et al. (2010) argue that enabling or constraining factors are determined not only by historical economic and social evolution but also constructed by actors "who mobilize specific sets of events from the past in pursuit of their initiatives" (Garud et al., 2010:769). However, the literature is still scarce when it comes to the role of agency in transforming the context in which new path development takes place, both as a way to shape the preconditions, and as an element of the path development process.

With the broadening of the path development concept, questions about the relationship between structure and agency have been put on the agenda. In broad terms, it is possible to position path development research on the spectrum of structurally oriented accounts, to approaches emphasising the role played by agency (Isaksen and Jakobsen, 2017). In the narrow perspective of EEG, actors are seen as being embedded in social structures and the role of agency is traditionally downplayed in favour of the influence of certain structural conditions. The other side of the spectrum favours actors' strategic intentions over structural influences,

arguing that actors are able to act freely upon their individual intentions. However, in studies inspired by the early work of Garud and Karnøe (2001), it is often argued that actors are still influenced by the structures in which they are operating. The structure-agency dilemma is thus found both in the narrower and the broader approach to path development, but also within the broadening of the path development debate, where structural accounts are often separated from approaches emphasising the role of agency. This has led to a problematic 'either-or' approach to structure and agency, which must be taken into account when exploring the relationship between new path development and RIS reconfiguration in the next chapter.

4 New path development and regional innovation system dynamics

In addition to the articles in this dissertation, a few recent studies have started to acknowledge that new regional industrial path development comes with changes to the structural configuration of the RIS in which it takes place. Established RIS configurations tend to support activities in existing regional industries and not the activities of new industrial paths (Isaksen et al., 2019; Tödtling and Trippl, 2013). For example, facilities for generating knowledge and skills are targeting the needs of existing industries. The same is often true for dominant policy instruments and funding schemes, which are typically well-aligned to existing industries and geared to support existing actors. This is not to say that a RIS cannot be more or less enabling for new path development, as the review of literature in previous sections clearly shows that this is the case. However, in order for new path development to develop beyond the initial stage, regional structures need to co-evolve with industrial structures and be adapted to support new activities. Studying RIS reconfiguration offers a way of providing insights into the drivers, mechanisms and agentic processes underpinning such co-evolutionary dynamics.

The rationale for studying RIS reconfiguration is thus twofold. First, it is crucial to understand how constraining factors inherent in existing RIS configurations can be overcome and the regional structure be 'transformed' from a constraining into a more enabling environment for new path development. Second, recent studies have argued that new path development "can only be fully understood by taking heed of reconfiguration processes of innovation systems" (Trippl et al., 2019a). By highlighting RIS reconfiguration as a crucial component of new path development, a link is established between the regional environment in which new path development takes place and the industrial path development process. In other words, the ways through which RISs are reconfigured both to facilitate new

industrial activities, to dismantle barriers originating from existing RIS configurations, and to support the development of new paths in the longer run, are important issues that need to be discerned in order to fully understand new path development in regions.

Conceptual and empirical work on how RIS configurations are transformed in order to facilitate and support the rise and development of new paths is scarce. The literature offers few insights into how RISs are reconfigured in order to tackle challenges related to the development of new paths or the transformation of existing ones, and recurring critique against the static perspective prevailing in the RIS literature is continuously published in academic outlets. For example, Doloreux and Porto Gomez (2017) argued that "RIS research would benefit from adopting a more dynamic approach that would consider RIS as real, complex evolutionary systems wherein new actors can emerge and/or the roles of 'traditional' actors can mutate" (Doloreux and Porto Gomez, 2017:385).

There are, however, a few notable exceptions. In an early contribution, Tödtling and Trippl (2013) investigate the reconstruction of RISs and their evolution over time, defined as changes to the RIS in three areas: 1) new soft institutional factors such as strategies, routines and patterns of behaviour, 2) new public and private actors such as firms, funding agencies and science parks, and 3) new or reorganised networks and modes of governance. It is demonstrated how different types of new path development are associated with different degrees of RIS transformation, concluding that intra-path changes in existing industries require only minor changes while the development of entirely new industries represents the highest need for RIS changes. In a more recent contribution, Trippl et al. (2019a) argue that constraining RIS structures might necessitate RIS reconfiguration in order to facilitate (green) path development. However, to realise potentials stemming from favourable conditions might also require RIS reconfiguration.

The importance of considering RIS reconfiguration in studies of new path development has also been highlighted in Isaksen and Jakobsen (2017), bringing forward the perspective that new path development should be seen as a combination of system-based and actor-based processes. They argue that the RIS approach has suffered from being too static and not taking into account the importance of actors in RIS changes, while actor-based approaches have underestimated the influence of the regional environment and RIS configurations when explaining new path

development. In subsequent contributions, it is suggested that agency may explicitly target the reconfiguration of RIS elements. Such 'system agency' has been defined in Isaksen et al. (2019) as "actions or interventions able to transform regional innovation systems to better support growing industries and economic restructuring" (Isaksen et al., 2019:5). System agency often transcends organisational boundaries and has the ability to mobilise other actors, create visions guiding the behaviour of actors and influencing the strategies of organisations, and in other ways alter the functioning of the regional system (Isaksen et al., 2019). The focus on 'agency' rather than 'actors' reflects the fact that actor roles are often crossed and obfuscated (Gustafsson et al., 2016; Woolley, 2014) and resonates nicely with the discussion of structure and agency in chapter 5.

However, the aforementioned studies offer only a first step towards understanding the role and nature of RIS reconfiguration in new path development. In the following sub-sections, a number of gaps in our understanding of RIS reconfiguration are presented and discussed in the light of the conceptual contributions of the articles in this dissertation. Together, they form the conceptual framework of the dissertation and a roadmap for the empirical analysis.

4.1 RIS reconfiguration from a functional perspective

The RIS literature has so far been vague about what RIS reconfiguration entails from a conceptual point of view. In particular, the link between a broad perspective of assets required in new path development and how RIS reconfiguration can lead to the provision of such assets is still not properly developed, despite recent advances. Assets, defined broadly according to the discussion above, are often conflated with the RIS elements facilitating the formation or access to them. A key concern is this how changes in RIS elements can alter the 'functioning' of the RIS, moving beyond the perception of the RIS as a 'container' of assets.

In other words, the RIS approach as it currently stands falls short when it comes to fully comprehending what structural conditions matter for new regional industrial path development and 'how' they do so. To some extent, this originates from the fact that the RIS concept was developed in order to understand how regions are equipped to facilitate innovation processes, focusing extensively on the role of knowledge dynamics and skills. With the broadening of the path development

debate presented in the previous chapter, a much broader set of mechanisms must be considered. In addition, new paths need complementary assets to be provided by the regional innovation system in which they are developed, not only for the initial emergence of novelty but also for the development of self-reinforcing effects in the longer term (Steen, 2016a; Martin, 2010). In relation to the idea of varying degrees of thickness in the organisational and institutional structures of regions, this issue largely boils down to the question 'thickness for what?' (Zukauskaite et al., 2017). The RIS approach should be explicitly geared towards explaining thickness in relation to new regional industrial path development. This would require a more pronounced functional analysis of system elements (that is to say, what are structures 'providing') rather than mapping the existence or non-existence of certain elements.

Recently, scholars have turned to the Technological Innovation Systems (TIS) literature in order to formulate a more process-oriented perspective of new path development, investigating how the formation of resources takes place (Binz et al., 2016; Steen and Hansen, 2018). The TIS literature outlines a set of 'system functions' that forms the basis of an innovation system centred around a specific technology (Hekkert et al., 2007; Bergek et al., 2008). In the TIS literature, 'functions' refer to key processes that have an immediate impact on the development, diffusion and use of new technologies. Studies have specified different typologies of system functions that should be fulfilled by a TIS, drawing on a selection or variation of six functions presented by Bergek et al. (2008): knowledge development and diffusion, entrepreneurial experimentation, market formation, resource mobilisation, creation of legitimacy, and guidance of the search. In the first few contributions adopting the ideas of system functions in path development research, for example in Binz et al.'s (2016) study of the emergence of water recycling industries in China or Steen and Hansen's (2018) article on the development of an offshore wind path in Norway, different variations of these functions can be found.

Previous studies have made attempts to combine the TIS and RIS literature, for example work by Martin (2016) on the combination of regional factors and socio-technical alignment on a global scale in the development of cleantech industries. However, there is still much to learn from the process perspective found in the TIS literature when it comes to understanding the functioning of territorially defined systems, such as RISs. In article four of this dissertation, a link between RIS

elements and system functions is established, inspired by insights from the TIS literature. The basic premise is that RIS elements are contributing to system functions that are configured to provide assets to actors located in the region.

In line with the TIS concept, system functions are defined as the key processes through which assets (such as knowledge, skills, legitimacy, directionality, and financial assets, among others) relevant for a particular industrial path are formed and diffused (Bergek et al., 2008). In the framework of this dissertation, drawing on the conceptual arguments of article four, RIS elements are the localised structures through which assets are provided to regional actors. For example, research and education facilities produce and diffuse knowledge, regulations shape market conditions, and funding schemes provide financial capital to paths (see Table 1). RIS elements may contribute to one or several functions in the innovation system and particular system functions could be performed by more than one RIS element. For example, educational bodies could play a key role in the generation and diffusion of new knowledge but may also contribute to the legitimacy of an industrial path. Correspondingly, one system function, such as, for example, 'knowledge generation', is performed by different elements in the RIS (firms, private research facilities, universities and so on).

Table 1: System functions and RIS elements

System function	RIS elements
Knowledge generation	Education facilities, R&D organisations, vocational training schools, …
Experimentation	Incubators, accelerators, test facilities, …
Market formation	Demand-side policies, platforms, market regulations, action networks, …
Legitimation	Interest organisations, industry associations, consumer groups, standards, norms, …
Direction of search	Visions, strategies, expectations, …
Investment mobilisation	Banks, funding schemes, business angels, venture capitalists, …

Source: article four in this dissertation.

TIS scholars have argued that system functions are made up of elements in networked sets of independent subsystems across different geographical scales (Binz and Truffer, 2017). In other words, system functions can be understood as

'scaled processes' (MacKinnon, 2011), through which activities taking place on different scales are brought together and aligned in a particular place (region). Multi-scalarity is thus inherent in the perspective brought forward, allowing for the analysis of system functions which are taking place in different regions, or even at the global level (c.f. 'Global innovation systems' Binz and Truffer, 2017), and how there are anchored and aligned regionally through the configuration of localised RIS elements. In other words, RIS elements are conceptualised here as facilitating the provision of assets to regional industrial paths, by facilitating system functions locally and by the anchoring and aligning of system functions taking place in other regions.

However, system functions facilitated by RISs tend to be more or less strongly aligned to existing industrial paths, meaning that system functions may need to be changed, adapted, aligned or even created in order to better facilitate the provision of assets for new industrial development paths. RIS reconfiguration thus refers to the modification of structures for asset provision, and hence a changed functioning of a RIS, rather than merely the addition, adaptation or removal of RIS elements. Relevant questions thus shift from, for example, 'which research and education facilitates are present in the region?' to 'how is knowledge provided to regional industrial paths?', and from 'can new paths make use of existing knowledge assets?' to 'can new paths make use of existing system structures for knowledge provision?'.

This makes it possible to also say something on the issue of distinguishing between 'dynamic continuity' and 'change' in path development research (Martin, 2012). An ensemble of RIS elements can undergo changes without having any significant impact on the functioning of the RIS, while only minor key changes may have a large impact. Take, for example, a set of education facilities in a given region. The establishment of a major, but similar to existing, education facility, may enhance the provision of skills in the region but would not represent a case of major RIS reconfiguration in the way it is understood here, as the nature of the skills provided has not changed. However, an adjustment to an existing education programme, say by adding a focus on new technologies that are not yet adopted by regional industries, may have larger implications for the provision of skills in the region. In studies of new path development, certain events, policy initiatives, or support organisations, are often highlighted as playing a crucial role for the development of a new industrial path. The perspective brought forward here can be used to show how changes related to specific RIS elements may not give a full picture, but have

actually had much broader implications for the RIS under consideration than is revealed if using existing analytical models.

4.2 Modes and types of RIS reconfiguration

Taking the revised understanding of RISs as structures for asset provision as a point of departure, there is a need to investigate different types of RIS reconfiguration and the modes through which actors engage in system agency. In particular, greater attention should be given to interactions between existing RIS structures and actors and activities related to new paths. New path development processes are shaped by historically developed context conditions, presenting actors with unique conditions that, without being universally 'enabling', are used as stepping stones or points of departure for new path development and RIS reconfiguration. Most cases of new path development are thus likely to involve substantial re-alignment and re-application of existing RIS elements.

Article one in this dissertation introduces a typology of modes of RIS reconfiguration, referring to changes in the organisational and institutional support structure of the RIS. Inspired by institutional theory and work by Mahoney and Thelen (2010) on different types of institutional change, three modes of reconfiguration are outlined: 1) 'Layering' refers to changes involving the addition of new RIS elements, for example through the introduction of new institutions (such as regulations, standards and norms) or the creation of new support organisations (such as industry organisations, cluster organisations and educational bodies). 2) 'Adaptation' refers to the reorientation or realignment of existing RIS elements, for example by re-orienting existing institutional arrangements (such as existing initiatives and policy instruments), or the adaptation of activities within existing organisational support structures (such as adapted education programmes and tailored start-up activities). 3) 'Novel application' takes place when the impact of existing RIS elements changes due to the new utilisation or interpretation of existing elements by regional actors. This involves benefitting from existing elements, for example by exploiting institutions in new ways (such as exploiting public opinions and norms and using regulatory arbitrages), and by using existing organisations and their activities in new ways (such as identifying relevant system elements, exploiting support activities targeting other industries, or 'freeriding' on the image of other industry initiatives). In other words, this represents a type of 'changeless'

RIS reconfiguration, where the functioning of the RIS may be substantially altered through the changed impact of existing RIS elements.

In the empirical analysis of the emergence of a digital games industry in Scania and associated processes of RIS reconfiguration found in article one, it is demonstrated how actors navigated different spatial scales in order to mobilise resources for their activities. Partly inspired by these results, a multi-scalar perspective of RIS reconfiguration was developed in article four, utilising and demonstrating the value of distinguishing between RIS elements and system functions. As discussed in the previous chapter, the focus in this dissertation is on new industrial path development taking place in a regional context. A multi-scalar perspective should thus be based on a regional industry focus, and not be primarily concerned with the formation of a global innovation system around an emerging technology.

As already discussed, the RIS literature has been vague about what RIS reconfiguration entails and a key question is how a RIS can be reconfigured to facilitate system functions that are relevant for new paths. The framework in article four adopts an 'inward-outward' perspective of structural and agentic circumstances (Martin and Sunley, 2015) and introduces a typology of RIS reconfiguration taking into account the relationship between regional and global sources and mechanisms.

Apart from developing system functions locally (type 1), it is argued that RIS reconfiguration can take place in order to access system functions anchored in other regions (type 2). This is done by layering, adaptation or novel application of RIS elements, targeted not at 'producing' assets regionally but rather to support the mobilisation or transfer of assets that are formed elsewhere. For example, key knowledge assets might be developed through R&D efforts in other regions and accessed by regional actors through strategic collaborations and other types of inter-regional linkages. This may be facilitated through the creation of collaboration platforms focusing on forging links between regional and non-regional actors (Trippl et al., 2018). In other words, it refers to a way of developing RIS structures to support linkages or 'pipelines' (Bathelt et al., 2004), through which actors can access assets formed in other regions, and the processes transforming these into 'locally sticky' ones (Binz et al., 2016).

Furthermore, RIS reconfiguration can take place in order to 'transplant' system functions from other locations (type 3), by finding ways to physically relocate core elements of system functions. For example, R&D units may be relocated from other

regions, representing the transplantation of knowledge-generation activities. RIS elements might also be created in order to 'import' certain system functions more implicitly. Examples include the creation of funding schemes aimed at attracting researchers or start-ups that are experimenting with and developing solutions in other regions but facilitate their physical relocation to the region by conditioning their access to funding with being physically present in the region. The transplantation of system functions thus refers to a type of RIS reconfiguration with different spatial characteristics than linking up to extra-regional system functions, as the focus is not on accessing assets formed elsewhere but on moving the asset formation processes to the region.

To exemplify the framework brought forward in this dissertation, Table 2 illustrates how RIS reconfiguration targeting the provision of knowledge can take place through different modes and types. The table illustrates only one system function (knowledge generation) and is by no mean exhaustive, but it provides examples for each combination of mode and type of RIS reconfiguration, showing the analytical usefulness of the framework.

Table 2: Examples of modes and types of RIS reconfiguration to facilitate the provision of knowledge

	Developing system functions within the region (type 1)	**Accessing system functions elsewhere (type 2)**	**Transplanting system functions from elsewhere (type 3)**
Layering	Establishing new research facilities	Establishing new support organisations targeting extra-regional knowledge exchange	Establishing new support organisations working to attract research groups from other regions
Adaptation	Changing focus of existing research institutes by re-aligning existing research platforms	Changing focus of existing research institutes through collaboration with external researchers	Changing focus of existing research institutes by recruiting researches from other regions
Novel application	Exploiting existing regional research infrastructure to develop new knowledge	Exploiting existing platforms for external collaboration to access new knowledge	Exploiting the reputation of existing support organisations to attract actors from other regions

Source: own elaboration based on articles one and four included in this dissertation.

4.3 Exploring the link between RIS reconfiguration and new path development

At a conceptual level, it is possible to position the link between new path development and RIS reconfiguration on a spectrum resembling the typical one found in discussions about structure and agency in the social sciences (see chapter 5). On one side of the spectrum, new path development and RIS reconfiguration are kept analytically separated. This perspective is illustrated in studies primarily highlighting RIS reconfiguration as a way to overcome barriers to path development, originating from the regional context (Tödtling and Trippl, 2013; Martin and Simmie, 2008). Grillitsch and Trippl (2018) labelled these 'path breaking barriers', as they originate from the existence of lock-in effects that are the results of previous rounds of path development. On the other side of the spectrum we find perspectives based on the idea that new path development and RIS reconfiguration are inextricably linked to each other. This is reflected in the broad tenets of the 'path as a process model', emphasising the enabling rather than constraining properties of the regional environment (Martin, 2010), and it is visible in emerging work on inter-path relationships (Frangenheim et al., 2018), as well as literature highlighting the importance of system agency (Isaksen et al., 2019) and institutional entrepreneurship (Grillitsch and Sotarauta, 2019; Sotarauta and Mustikkamäki, 2015) in new path development.

Drawing on lessons learned by studying the structure-agency debate over the course of the last few decades, it is hard to draw the conceptual boundaries between a set of functionally related economic activities and the environment in which these take place. Nevertheless, the contours of a 'middle ground' position can be discerned if looking at the articles included in this dissertation, pointing to the need to take a deeper look into the characteristics of RIS reconfiguration under different regional and industrial context conditions. This includes moving away from the characterisation of regional conditions as either 'enabling' or 'constraining' and providing a more nuanced perspective of how new path development is shaped by place-specific interactions between structural conditions and agentic processes (see also section 4.4). Regions differ in terms of their existing system functions and the ways these are aligned to existing paths, implying that the need for RIS reconfiguration will depend on the combination of existing RIS configuration and the nature of the new path.

While it is true that radical forms of path creation might be strongly associated with the creation of 'niche-like conditions' (Simmie, 2012) that are somewhat disconnected from the existing regional environment, necessary in order to shield new activities from existing paths, most other forms of path development are constrained by a 'lack of assets' rather than by negative lock-in and vested interests. An important point in this framework is that different types of path development draw on existing structures for asset provision to various degrees. In other words, the focus is on the degree to which new path development can make use of existing system functions, determining to what extent (and what types and modes of) RIS reconfiguration is necessary. Some types of path development draw on system functions aligned to existing industrial paths. For example, path branching and path diversification describe the diversification into new industries for the region based on assets that are provided by existing regional system functions. The main concern for new actors is thus expected to be on modifying structures for asset provision in order to secure relevant complementary assets, providing fewer interfaces for conflicts between new and existing actors and less radical cases of RIS reconfiguration. Path renewal, on the other hand, implies more substantial changes to the RIS, as system functions for the provision of a broad set of new assets need to be developed, or existing system functions re-oriented. Finally, path importation and path creation refer to the development of industries that do not build directly upon existing structures for asset provision. In these cases, RIS reconfiguration is necessary in order to secure the provision of assets, by developing new system functions of re-orienting existing ones.

In addition, current typologies of new path development are based largely on the origins of new paths, rather than qualitative differences in the process through which they evolve over time. RIS reconfiguration is likely to play a role throughout the path development process and is, by definition, altering the regional environment in which path development takes place. In other words, while new industrial activities in a region may be characterised as a certain type of path development taking place in a regional environment characterised by some specific set of factors, both mechanisms and regional conditions are changing throughout the path development process. For studying RIS reconfiguration, it might therefore also be useful to talk about 'triggers' and 'stages' of new path development, in addition to identifying differences between 'types'.

The characteristics of RIS reconfiguration can indeed be expected to change throughout the path development process (see also Baumgartinger-Seiringer et al., 2019). At the early stage, RIS reconfiguration can be seen as a way to 'set the scene' for new activities to take place, by targeting structures for asset provision in a broad sense and enhancing system functions that are either relevant for one or several existing paths or with the explicit intention of creating a more favourable environment for new path development in general. The early stage of path development is characterised by experimentation and uncertainty, and actors may rely more on the adaptation and novel application of existing system elements, as well as the anchoring of system functions from elsewhere, rather than focusing on developing system functions within the region. However, at the later stages of path development it becomes crucial to facilitate the emergence of path-specific system functions, to foster self-reinforcing effects, and to embed the new path in the RIS.

There are many examples in the literature of how new path development has been supported, or even triggered, by the establishment of new cluster organisations, education facilities or R&D consortiums (see e.g. Isaksen, 2016; Steen, 2016b; Sydow et al., 2012). However, previous studies have primarily been associating RIS reconfiguration with changes to the organisational support structure of the RIS. Article two studies the institutional preconditions for cross-border knowledge flows, which can be seen as a core ingredient for innovation-driven integration processes and new path development (Lundquist and Trippl, 2013). Knowledge flows are shaped by institutional structures, referring to both formal and informal institutions, that create barriers and enablers for cross-border interaction. New path development may thus require RIS reconfiguration not only defined as changes to the organisational support structures, but also including changes to the institutional dimension of the RIS. Article two outlines the ways through which actors try to overcome barriers and how they exploit complementarities in order to shape a more favourable institutional environment for knowledge flows (see also the discussion on institutional agency in the next section).

RIS scholars have invoked the idea of 'institutional thickness' (see also section 3.1) as a way to understand how institutional contexts influence new path development, but most studies still look at institutions from a public policy perspective, having a fairly narrow definition of institutions as regulations or certain policy incentives. Furthermore, whilst distinguishing between regions based on their institutional and organisational thickness is indeed an important first step, thickness in relation to the

activities and mechanisms of new regional industrial path development remains to be specified (Zukauskaite et al., 2017). The institutional dimension has previously principally been analysed from the perspective of how the existing institutional arrangements impact new path development. With the broadening of the path development debate, the institutional dimension has received increased attention and institutional change has been highlighted as an important aspect. There is thus a need to better understand how the RIS enables or constrains institutional change processes that are part of new path development. In a seminal contribution by Battilana et al. (2009), outlining the concept of institutional entrepreneurship, considerable attention is given to 'enabling preconditions' such as actors' social positions and field characteristics, insights which seem to have been forgotten in the path development debate. For example, it is argued that structural conditions such as a high degree of heterogeneity in terms of institutional arrangements in a field is an enabling factor for institutional change, as it is likely to be a source of internal contradictions and tensions. The degree of institutionalisation within a specific field is also argued to matter, as lower degrees of institutionalisation are associated with higher uncertainty, which in turn enable institutional change.

To sum up, new path development requires a wide range of assets and thus changes to different system functions. Hence, the modification of structures for asset provision is likely to involve changes in different dimensions of the RIS. By studying different cases of new path development in different contexts, it is possible to provide additional insights into the complexities of RIS reconfiguration at the intersection of path-specific characteristics and regional context conditions.

4.4 Reflexive agency and RIS reconfiguration capacity

As discussed above, scholars have started to take steps in the direction of elaborating on the relationship between structural conditions and the role of agency in new path development. For example, it has been argued that new regional industrial path development should be seen as a combination of system-based and actor-based processes (Isaksen and Jakobsen, 2017; Isaksen et al., 2018). However, the relation between structure and agency in the understanding of RIS reconfiguration presented here is more complex than to argue that actors change the systems in which they are embedded. There is a need to consider both upward and downward relationships, particularly by highlighting the reflexivity of agents. This includes both spatial

reflexivity, in terms of understanding how actors are influenced by, act upon, exploit, interpret and try to change context conditions, and temporal reflexivity, pointing to the efforts of agents in terms of relating to past developments or shaping the expectations of the future (Steen, 2016b).

Agency has been argued to play a crucial role in RIS reconfiguration. Studies have highlighted the role of system agents (Isaksen et al., 2019), referring to actors who transcend organisational boundaries and mobilise other actors to alter the regional innovation system. System agents often engage in sense-making activities, in order to create visions and expectations about possible development trajectories (Sotarauta and Mustikkamäki, 2015; Steen, 2016b). Reflecting the conceptual discussion earlier in this chapter, system agency is defined in this dissertation as actions or interventions targeting the functioning of the RIS. This is not only dependent on the creation or adaptation of elements in the organisational support structure, such as educational facilities, incubators, cluster organisations and so forth, but also on guiding visions and expectations (Steen, 2016b) and other supportive institutions such as policy initiatives and regulations (Zukauskaite et al., 2017). Here, system agency reflects efforts to change organisational and institutional elements, efforts to develop guiding visions and expectations that change the interpretation and alignment of existing system elements, and agency targeting the interplay between actors and activities at different spatial scales.

The articles in this dissertation provide insights into the different types of agency in RIS reconfiguration. Aside from agency targeting changes in the organisational support structure, as discussed above, article two focuses on changes to the institutional dimension and it is argued that regional actors engage in purposeful actions to improve the institutional conditions. Different forms of institutional agency are outlined. First, there might be institutional barriers that need to be dismantled, requiring changes in both formal and informal institutions. Regional actors do not always have the power to change formal institutions, in particular if they are set at other spatial scales, but they can identify the need for change and mobilise (e.g. via lobbying) actors that have the power to change institutions, or suggest alternative interpretations of existing institutions. Actors can also aim directly at changing informal institutions, for example by promoting the value of certain activities (Stöber, 2011). Second, actors might target the provision of information about barriers and ways to overcome them, and about institutional complementarities that might contribute to an enhancement of the institutional

conditions for their activities. By providing easily accessible information it is possible to influence how actors such as firms, universities and individuals interpret, for example, regulatory barriers (van den Broek and Smulders, 2015; Terlouw, 2012). Third, actors might try to develop institutional incentives promoting their activities. This involves the attraction and distribution of funding for certain activities, as well as identifying existing institutional complementarities and promoting the exploitation of these (Klatt and Herrmann, 2011).

In other words, actors are reflexive when trying to shape institutional conditions to be more enabling for their activities and they formulate various strategies to achieve this goal, not all strategies involving institutional change per se. This has clear parallels to the 'novel application' mode of RIS reconfiguration discussed in the previous section.

The conceptual discussion in article five of this dissertation is built on the idea that the literature has lacked convincing explanations for 'why' and 'when' agency has the potential of transforming the functioning of a RIS. It can be argued that system agents mobilise actor-specific resources and traits in order to change the structures in which they are embedded. Studies have demonstrated, for example, how the degree and type of power among regional actors shape their ability to change regional structures (Sotarauta, 2009). On the other hand, the literature review in chapter 3 gives several examples of how regions provide more or less enabling or constraining conditions for new path development. The point of departure in the agency perspective brought forward in article five is that regions might differ in terms of their capacity to reconfigure RIS structures. Reconfiguration capacity thus refers to a region's ability to balance changes in the industrial dimension with changes in other parts of the regional innovation system, in order to facilitate the provision assets corresponding to the needs of new industrial paths.

In order to understand RIS reconfiguration capacity, there is a need to take a closer look at the structure-agency dynamics at play. Drawing on the strategic-relational approach to structure and agency (see chapter 5 for an in-depth review), article five develops a framework for analysing RIS reconfiguration capacity from the perspective of structure-agency dynamics. The influence of a certain set of structural conditions is considered as the result of an *interplay* between agency and structure in a particular place, at a particular point in time. Actors formulate intentions and strategies that reflect their understanding of existing structural conditions and are

thus reflexive. They draw on personal experiences, develop their own views and act strategically upon their interests. They also monitor the outcomes of their actions and select strategies recursively, based on their experiences from pursuing different strategies in previous points in time. In other words, actors in new regional industrial paths formulate strategies of RIS reconfiguration reflecting their understanding of the challenges facing new activities on the one hand, and their current knowledge of the prevailing RIS structures on the other.

Actors are embedded in a structurally selective context, referring to the idea that structures cannot ensure their own reinforcement but only favour some strategies and actions over others (Jessop, 2001). Agency is thus placed at the core of the discussion, as structures have no inherent meaning beyond the context of agents who are engaging in certain strategies of practices (Jessop, 2005). Inspired by this, 'system selectivity' is introduced in article five, referring to the tendency for the RIS to selectively reinforce some activities and curtail others. System selectivity can be traced back to previous rounds of development, reflecting political processes, regional imaginaries and conventions (Storper and Salais, 1997; Hajer and Versteeg, 2018) developed over long periods of time. They reflect both events 'happening' and failed attempts of action and change efforts. For example, system selectivity may be shaped by 'paths not taken' (Schneiberg, 2007; Henning et al., 2013), may develop as a result of conflicts over resources, and may also remain when the material conditions have changed (c.f. political lock-in).

System selectivity refers to factors such as legitimacy, power, discourses, imaginaries, expectations and visions. These are factors that are increasingly taken into account in the path development literature (see e.g. Steen, 2016b; Steen and Hansen, 2018; Isaksen, 2018). In article five, three types of system selectivity are scrutinised, encompassing factors previously highlighted in the literature: 1) 'Regional imaginaries' refer to cultural-cognitive traits (Scott, 2010) describing regional economic patterns at a general level. They are defined by the perception of the region among regional actors, effectively shaping their point of departure in terms of expectations about the future (c.f. 'spatial socialisation' introduced by Paasi, 1991). Regional imaginaries are thus mental maps of collectively shared beliefs that structure economic life (see also Boudreau, 2007; Jessop, 2012). Regional imaginaries are expected to shape the reconfiguration capacity of a RIS by empowering or supressing actors in emerging industrial paths. 2) Historically built-up 'power relations' may influence the access to important assets for actors in new

paths. It is usually not the case that one single organisation has the power to distribute assets among actors in the region, but RISs may be characterised by a more or less balanced power distribution (Zukauskaite et al., 2017). 3) 'Directionality' refers to shared visions, strategies and agendas that shape collective priorities shared by actors in the RIS (Weber and Rohracher, 2012). Directionality represents a portfolio of normative institutional elements, essentially institutionalised expectations, guiding the directions of change efforts in the RIS. They define the frame of engagement for regional actors, outline potential future scenarios and steer actors away from other trajectories (Grillitsch and Sotarauta, 2019).

System selectivity shapes how actors formulate change strategies and thus shapes the reconfiguration capacity of the RIS. Actors exploit factors enabling reconfiguration in their efforts to modify regional structures for asset provision through layering or adaptation. However, actors also 'navigate' the influence of system selectivity and formulate strategies in order to exploit potentially reinforcing effects. Rather than working against the 'tide' (Sotarauta and Suvinen, 2018) of the prevailing system selectivity, actors strategically comply and adapt their activities while at the same time maintaining their strategic intentions.

In other words, there are regional factors and conditions shaping the capability of actors to engage in efforts of trying to reconfigure the RIS. The influence is not universal for all actors but depends on the interplay between structural conditions and actor characteristics. This interplay is also scrutinised in article three, focusing on the role of 'outsiders' in new path development. The notion of outsiders refers to actors originating from other regions, who relocate to exploit regional opportunities. Studies have highlighted the role of outsiders as triggers for new industrial path development in regions (Hedfeldt and Lundmark, 2015; Stockdale; Kalantaridis and Bika) and it has been argued that outsiders may be a source of more radical change than existing regional actors (Neffke et al., 2018). A possible explanation suggested in the literature is that outsiders are often not embedded in existing regional structures, which equip them with a greater degree of freedom from constraints originating from incumbent actors and existing activities (Pike et al., 2016). However, the point of departure for the conceptual discussion in article three is that the inflow of outsiders, while being positively associated with the development of new paths, does not automatically ensure the long-term sustainability of these paths. If actors relocate to the region in order to exploit conditions such as low production

costs or other factors, new industrial actors might do little in order to embed themselves in the regional innovation system, meaning that positive spill-overs and self-reinforcing effects do not materialise. The long-term sustainability of new industrial path development triggered by outsiders is argued to be dependent on the ability of actors to 'strategically manipulate' (Karnoe and Garud, 2012) self-reinforcing mechanisms through RIS reconfiguration.

5 Research design

Academic research in social science is concerned with formulating and answering questions about society. It involves reflecting upon what can be studied, how to best approach the formulation of research questions in relation to the topic, what combination of methods that could be used to answer these, and how to interpret the results. At the core of any research design in the social sciences are epistemological, ontological and methodological considerations that guide the choice of questions and methods.

Epistemology is concerned with the philosophy of knowledge, how we can know the world and the social knowledge of objects, whilst ontology is concerned with what there is to know, namely, the nature of objects that exist in the world (Archer et al., 2013). Methods are the tools used for collecting and sorting data which provide the researcher with information about the object of study, whilst methodology is more broadly defined as the combination of methods *and* the interpretation by the researcher (Olsen and Morgan, 2005), in which epistemological and ontological positioning is crucial in order to understand the object of study and the output of new knowledge. In this chapter the epistemological and ontological position of the study will be presented, followed by a discussion of methodology and methods.

5.1 Epistemological and ontological perspectives

Critical realism as a philosophy of science perspective is associated with the work by Bhaskar (1978), and its application in human geography by Sayer (1992). According to critical realism, reality exists regardless of human consciousness and the ability to observe it (Sayer, 1981). In terms of ontology, critical realism advocates a perspective of reality consisting of three domains. The real domain refers to structures and mechanisms that are unobservable and thus exist regardless of observation, the actual domain consists of events caused by such structures and

mechanisms, and the empirical domain refers to what is observed or 'sensed' by humans (Bhaskar, 1978; Danermark et al., 1997). The aim of any scientific endeavour is to relate observations in the empirical domain to the real and actual domain, by providing theoretical knowledge about the mechanisms which caused certain events and to explain the temporal and spatial variation of the mechanisms resulting in such events (Lawson, 2006).

In critical realism, causality is argued to be the result of both structural factors and human agency. The mechanisms producing certain outcomes exist regardless of whether they have been observed or not and are influenced by other mechanisms and processes (see Figure 2). In other words, mechanisms mediate certain structural factors, but the outcomes in terms of events are context-dependent and vary due to different conditions. The relationship between structure and agency will be further elaborated in the next section.

Thus, in terms of epistemology, the critical realist position is that all observations are fallible and hence that all theory based on such observations is temporary and subject to revisions, and evolves over time (Moutinho and Hutcheson, 2011). Science should be concerned with revealing reality, but this goal will never be reached in full and with certainty; 'the truth' is fallible and conditional, produced and reproduced by human interaction and thus necessary to continuously reassess (Pratt, 1995). Our understanding of the world is produced by abstracting the empirical realm and constructing theoretical apparatuses. Such constructions can never be perfect because of the inherent fallibility of observations and perceptions, meaning that 'objectivity' is far-fetched as all researchers are biased by their previous conceptions, and all observations are theory laden. The aim must be to get as close to 'objectivity' as possible, by triangulating between multiple fallible elements (Sayer, 2000). Triangulation (Denzin, 1970) is a tool used by the individual researcher, but objectivity is rather seen as a social phenomenon than the outcome of an individually, though diligently performed, research process. It is thus crucial for the individual researcher to expose abstractions and observations to the collective of researchers, in order to receive criticism and thus triangulate between theoretical arguments (Sayer, 2000).

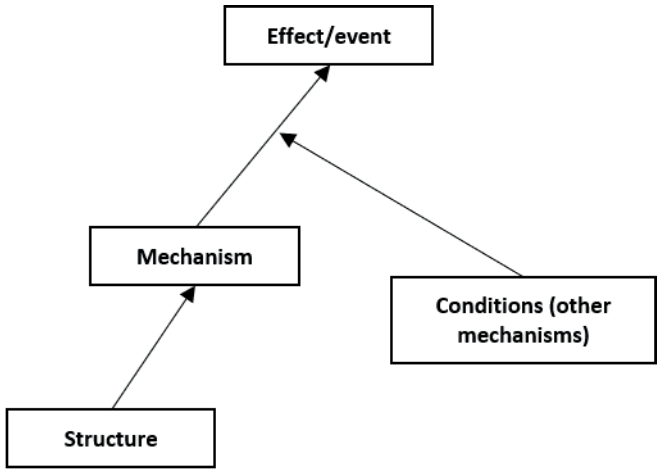

Figure 2: Causation in critical realism. Source: Sayer (2000:15)

5.2 The structure-agency dilemma

The longstanding debate over structure and agency has shaped the social sciences for well over a century. The question of whether agents are free to make individual decisions, or if the material, economic and cultural structure determines the behaviour of individuals, is one of the most fundamental in contemporary social science.

Ranging back to the structuralist approaches advocated by Durkheim, Simmel and Marx, structure can, in its most simple form, be defined as a set of patterned arrangements in various ways influencing, or determining, the behaviour of individuals. What is perceived as agency, i.e., observations of individuals making decisions, can, according to this perspective, be more or less completely explained by structural influences. At the core of structural approaches lies a holistic view of society, where it is not possible to distinguish individual traits from the greater whole. Other lines of thought have paid attention to the capacity of agents to make decisions disconnected from structural influences. Not surprisingly, this is the view found in much of the neoclassical economic literature, advocating a form of methodological individualism in which subjective individual decisions explain society at large (Blaug, 1992). In this view, individual agents are constructing their own social realities, emphasising the role of agency in explaining social phenomena,

rather than the influence of structural conditions. The contrast between methodological holism and individualism may be intellectually useful, but has been argued to be tendentious, as very few social scientists would wholeheartedly prescribe to methodological holism. Nevertheless, there are certainly explanations of society with more or less emphasis on factors that would be downplayed in methodological individualism (Heath, 2015).

Targeting the relationship, or divide, between structure and agency has become a major theme in the social sciences, in particular sociology, and various attempts at dealing with this relationship can be found in the literature.

5.2.1 Figurations, structuration and conflations

Elias (1978) demonstrated how sociology inherited a range of dualisms from philosophy, of which the structure-agency dilemma is just one among others such as mind-body, individual-society, and micro-macro. These dualisms, he continued, are inaccurate and contradictory to realistic sociology, as they encourage "the impression that society is made up of structures external to oneself, the individual, and the individual is at one and the same time surrounded by society yet cut off from it by some invisible barrier" (Elias, 1978:15 in Giddens and Sutton, 2013:88). By introducing the concept of 'figurations', referring to interdependent networks of individuals connected through relations, he tries to dissolve the dualism of structure-agency altogether. There is no need, according to Elias, to study either micro-level actions or social structures or institutions, as they are inherently made up of figurations formed by interdependent people. In that sense, 'society' is regarded as an unintentional outcome of aggregated intentional actions, possibly neglecting the particular role of strong 'key actors' such as the state or powerful corporations in shaping outcomes (Giddens and Sutton, 2013).

Economic geographers are probably more familiar with the second approach brought up here, namely Giddens' structuration theory. Structuration theory is designed to 'bridge' the gap between structure and agency, rather than 'dissolve' it, and embraces philosophy as a source of understanding of social life. It is based on the idea that individuals actively take part in the making and remaking of social structure through their activities, i.e. they take part in 'structuration' (Giddens, 1986). Giddens (1986) argued that structure and agency are not polar opposites, but are instead necessarily related to each other. Structure exists only as a result of

people behaving in regular and predictable ways, and action is only possible since individuals have socially structured knowledge. A famous example provided in numerous variations is the one of 'language' as a result of structuration (Giddens and Sutton, 2013). To exist as a social institution, language must be socially structured and hence have certain structural properties that must be observed by its users. However, these structural properties exist only if users follow their rules, i.e. taking an active part in the structuration of the language. In economic geography, structuration theory has served as a contextual approach eliminating the boundaries between social relations and spatial structures, in which "spatial structure is […] seen not merely as an arena in which social life unfolds, but rather as a medium through which social relations are produced and reproduced" (Gregory and Urry, 1988:3; Johnston and Sidaway, 2015). Whilst not being picked up by the more recent 'turns' in economic geography, structuration theory had much in common with how Hägerstrand (1968) perceived the relationship between time and space in his development of time geography (Johnston and Sidaway, 2015).

A third approach, explored by geographers from the early 1980s onwards, is based on realist propositions (Bhaskar, 1978) and largely draws on the work by Margaret Archer (1982; 1995; 2003; 2013). While Giddens suggested conceptualising structure and agency as a duality, and thus overcoming problems associated with the idea of dualism, Archer relies on a more pronounced conceptualisation of structure and argues that dualism should be used as an analytical strategy to understand change processes. If summarised, the proposed strategy can be said to separate structure and agency but focus the analysis on their interplay over time. In this way, Archer argues that conflations between structure and agency can be avoided (Mutch, 2010): 'Downwards conflation' refers to issues with structuralist explanations, where structures determine actions and actions were conflated with the structural conditions. 'Upwards conflation' refers to issues with approaches considering structure as merely the aggregate of individual activities. 'Central conflation' refers to problems related to the weak specification of structures, particularly in structuration theory.

In order to analyse changes over time, it is necessary to keep structure and agency apart and focus on the changing interplay between the two. Archer argues that while structures are indeed dependent on individual actions, they are not necessarily so on the ones "here present" (Archer, 1996). In other words, Archer introduces a

temporal dimension to the structure-agency dilemma, emphasising the changing interplay of structure and agency over time.

5.2.2 The strategic-relational approach

Since Archer's seminal work, critical realists have continued their engagement with seeking to surface the unfolding relations between economic actors and structural conditions. Proponents of the 'strategic-relational approach' (Jessop, 1990; Jessop, 1997; Hay, 2002; Jessop and Oosterlynck, 2008; Jessop, 2005), which serves as a foundation of the structure-agency perspective in this dissertation, go beyond traditional analyses of the dialectic relationship between structure and agency by "studying the recursive conditioning, mutual coupling, and complex co-evolution of structure and agency and, above all, by stressing the differential, spatio-temporal relationality of structure and agency" (Jessop, 2005:40). In other words, the enabling or constraining effect of certain structural conditions must be seen in the light of a particular interplay between agency and structure in a certain time-space position. By doing so, it targets the examination of "structure in relation to action and action in relation to structure, rather than bracketing one of them" (Jessop, 2001:1223).

To understand this relationship, the notions of 'strategic calculation' and 'strategic selectivity' are introduced by Jessop (2005). The strategic-relational approach can be used to understand how structures evolve by focusing on the interaction between a "reflexive reorganization of strategic selectivities and the recursive selection and retention (or evolutionary stabilisation) of specific strategies and tactics oriented to those selectivities" (Jessop, 2005:51). Structurally-oriented 'strategic calculation' refers to the ability of actors to formulate intentions and strategies reflecting their understanding of existing structural conditions. Actors are thus reflexive and can draw on personal experiences, develop their own views and act strategically upon their 'objective' interests. Furthermore, actors monitor the outcome of their actions, intentionally or intuitively (Hay, 2002), and select strategies and tactics recursively, based on the learning capacities of individuals or collectives and their experiences from pursuing different strategies at previous points in time. Thus, the aims of actors are seen in relation to the varying degrees of incomplete knowledge regarding the structural conditions, and in relation to the intentions, and experiences, of other actors.

Structural selectivity, on the other hand, refers to the tendency of selectively reinforcing some forms of actions and strategies and dampen others, inherent in specific structural configurations (Jessop, 2005). In other words, there are clear parallels to the concepts of path dependence, in how the strategic selectivity reinforces existing industrial paths whilst constraining the development of new ones. At the same time, the idea of a strategically selective context implies that structures cannot ensure their own reinforcement but only favour some strategies and actions over others. Agency is thus placed at the core of the debate, as structures have no meaning outside the context of agents seeking to engage in specific strategies or practices. Furthermore, there is always some degree of freedom for actors to influence existing structural conditions by pursuing their own strategies, but also by mobilising actors and resources at different spatial scales or at different points in time. Through strategic calculation actors might overcome potential constraints by transforming structural conditions and create positive feedback loops in favour of recursively selected strategies, which opens up for the analysis of not only sources of continuity but also processes of change (Jessop, 2005). The strategic-relational approach is illustrated in Figure 3.

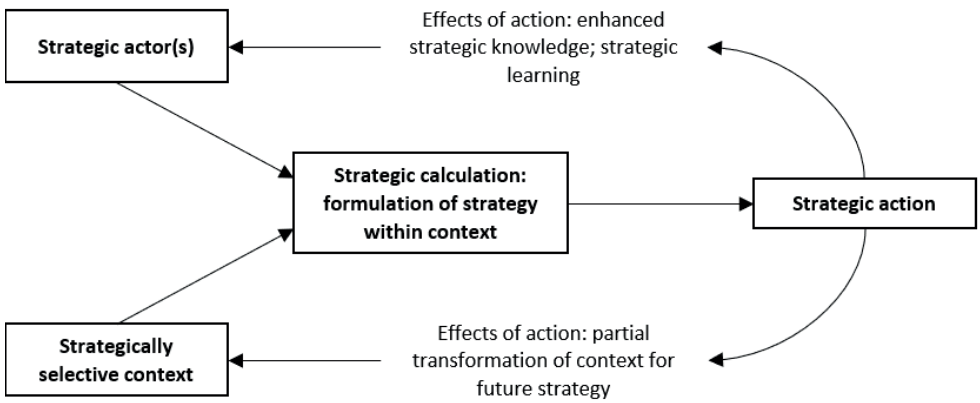

Figure 3: A strategic-relational approach to structure and agency. Source: Hay (2002)

From a strategic-relational perspective, the structured coherence that emerges from agents' activities is tendential in multiple ways (Jessop, 2001). First, as the reproduction of structure is tendential, so are the strategic conditions that they give rise to. Second, structures are not structurally, but strategically, selective. This implies that there is always room for action to overcome or circumvent constraints

resulting from structural conditions. Third, actors neither have full information about the conditions for strategic action, nor are they ever equipped to fully realise their strategies, and they always need to deal with competition from other actors with deviating strategies. This means that failure should always be considered as a possible outcome of their activities. Fourth, structures are often incoherent, exhibiting contradictions which, on the one hand, provide room for action, but, on the other, create strategic dilemmas for agents (Jessop, 2001).

In summary, through processes of recursive selection and retention of strategies, but also reflexive reorganisation of the conditions, patterns of practices, strategies and economic activity emerge. Such patterns are never completely stable, as they depend on the continued reproduction of structural conditions by agents and are constantly under the pressure from agentic actions.

5.2.3 Conflation traps in path development research

It is possible to situate studies of path development on the spectrum of structural and process-oriented accounts, to approaches emphasising agency (Isaksen and Jakobsen, 2017). In the more narrow perspective of EEG (see chapter 3), actors are largely argued to be embedded in social structures (Uzzi, 1997), downplaying the role of strategic agency. Studies situated at the other side of the spectrum treat actors as being able to act upon their intentions, more or less independent of structure. It is, however, also argued that intentional actors are still influenced by the structures in which they are located, for example by mobilising resources to create more favourable structural conditions, or by engaging in collective agentic processes involving a wide range of actors (Isaksen and Jakobsen, 2017). In the path development literature structural accounts are often separated from approaches emphasising the role of agency, leading to a problematic 'either-or' approach to structure and agency.

Arguably, there is much to learn from integrating insights from the structure-agency debate in the literature on new regional industrial path development, beyond simply stating a 'middle ground' (Granovetter, 1985) position, as seems to be the tendency in current studies. That is to say, it involves going further than stating that actors are both influenced by, and influencing, the context in which they are located, and conceptualising *how* the relationship between agency and context plays out.

First, there is a need to address the static perspective of structural conditions influencing path development. Scholars have begun to engage with a range of different bodies of literature to gain insights into, for example, the influence of institutions, multi-scalar interactions, and RIS configurations. The risk of downward conflation is well known in economic geography, where, it has, for example, been argued that "one of the most common pitfalls of an institutional approach is the constant temptation to want to 'read off' individual behaviour from [...] institutional structures" (Gertler, 2010:5). Rather than investigating yet another set of structural factors that might enable or constrain new path development, it is necessary to take a more holistic view and ask the question of 'how?' structural conditions have an influence, and how this influence changes over time.

Second, in terms of studying the role of agency in new path development, the problem is the opposite. When it can be established that something has happened 'in spite of' constraining context conditions, it is often argued that agency has played a role. In other words, agency is often seen as a "residual category" (Sydow et al., 2010:220) to structural approaches. This is not to say that studies of agency in new path development suffer from upwards conflation; on the contrary studies often acknowledge the need to take into account both structural factors and agentic process (see e.g. Grillitsch and Sotarauta, 2019). However, when examining the role of agency there is a tendency to temporarily bracket the influence of structure, reducing it to a set of combinable assets or barriers that need to be overcome. This problem of central conflation is at the core of the methodological approach suggested in this dissertation, as it is a key methodological issue when investigating the link between industry and system dynamics.

In other words, there is a need to move beyond the simple implications of the argument that actors are embedded in, and influence, structures and highlight the interplay between structure and agency in studies of new path development. Studying such 'structure-agency' dynamics should lie at the core of the research agenda, as is done in the articles of this dissertation (in particular articles three and five).

5.3 Methodology and methods

5.3.1 Methodology

Abstraction lies at the core of the methodological toolkit deployed by the critical realist researcher. To fully understand a phenomenon, abstraction is crucial in order to distinguish between what is important to our understanding, and what is not. Systematic abstraction of what the researcher is able to observe is important to form concepts which concretise objects and their relations to each other (Sayer, 2000). However, abstraction can also be seen as one of two iterations within a research process. Abstraction helps the researcher to better approach the collection of empirical data, and with the new empirical insights continue with further abstraction. Bhaskar (2014) calls this 'retroduction', and in practice this means that, when conducting research, proposed hypothetical explanations are derived from the researcher's conceptual knowledge and professional experience. These theory-led expectations are continuously compared to the results coming out of the research process, which often lead to the reformulation and reconceptualisation of theoretical assumptions (Miller and Brewer, 2003). The process of retroduction goes on until no further explanations or conceptual knowledge can be gained through additional abstraction (Yeung, 1997); that is to say, when a form of theoretical saturation has been reached.

In regards to the empirical strategy employed in the articles in this dissertation, triangulation (Denzin, 1970) has been used as a tool to validate the observations, and their interpretation. Since all observations, according to a critical realist perspective, are imperfect, triangulation is a useful tool to reduce uncertainty and reach a better understanding of reality. In practice, this is done by triangulating between different data sources, methods and theoretical perspectives. Ongoing research has also been exposed to the academic community, through the dissemination of early empirical results at conferences, seminars and workshops (Denzin, 1970). In each of the case studies in this dissertation, interview data have been combined with a review and analysis of existing literature and documents from a wide range of sources. In other words, different sources of data have been combined, and different methods have been used to collect and analyse these data.

5.3.2 Methods, data sources and analysis

Case study research and case selection

According to Yin (2013), case studies are suitable as a method when the research questions are of the 'how' and 'why' type, allowing for deeper explanations rather than the testing of narrowly defined hypothesis. This also means that case studies are suitable when the researcher is aiming for an in-depth description of a contemporary social phenomena (Yin, 2013). By using case studies, different aspects derived from theory and corresponding to one or several identified research gaps are researched in the articles of this dissertation.

It is often argued that knowledge which is independent from context is more valuable than practical, context-dependent knowledge. However, Flyvbjerg (2006) argues that concrete knowledge should not be disregarded based solely on "the vain search for predictive theories and universals" (Flyvbjerg, 2006:224). It will not be claimed in this dissertation that the aim is to provide a universal theory of how new industrial paths are developed in regions, but rather the aim is to provide important pieces of knowledge to a larger puzzle, particularly by forging a link between industry dynamics and RIS dynamics.

The above relates to a wider concern with case studies and generalisation of results as well as the generation of proposition and theories based on case studies (Flyvbjerg, 2006). In this dissertation, case studies are used to serve as illustrations or provide additional insights to conceptual arguments, to test and possibly validate conceptualisations and to fill in gaps in our theoretical understanding of a phenomenon. Flyvbjerg (2006) highlights the importance of paying attention to strategies for selecting suitable cases in order to avoid potential issues associated with case study research, related to difficulties with generalising results. All empirical studies included in this dissertation draw on an information-oriented selection of cases. This means that cases are selected based on what could be expected in terms of potential information and insights that can be provided by studying them, in order to "maximise the utility of information from small sample and single cases" (Flyvbjerg, 2006: 230). The main research question in this dissertation is conceptual in nature, concerned with defining and elaborating the role of RIS reconfiguration in new regional industrial path development. A theoretically informed case study approach is good for illustrating and further enhancing theoretical concepts and frameworks (Siggelkow, 2007), and is appropriate in

economic geography for analysing the diversity and complexity of reality (Clark, 1998). In other words, the selection of the case studies carried out in this dissertation has been informed by theoretical or analytical sampling rather than statistical sampling, through a process of identifying and defining the issues of interest (Yin, 2013). More specifically, the ambition has been to identify cases that can provide empirical material supporting, complementing or contradicting theory-led expectations and conceptual arguments.

In two of the articles (articles three and five), comparative case studies have been conducted. Comparative case studies allow for analysing how similar conditions or processes can produce different outcomes in different contexts, or vice versa (Griffin and Ragin, 1994). Nevertheless, in the synthesis of findings (see chapter 6), different aspects have also been compared across the cases under investigation in the individual articles.

Interviews and document analysis

In all five articles, open-ended semi-structured interviews have been the main means of data collection, complemented by systematic reviews of available documents and other secondary sources. Interviews are a useful tool to collect data aiming at explaining complex processes and relationships, such as actors' rationales, views, and perceptions when engaging in activities. Questions such as 'what has been done', 'how did it matter' and 'what was the impact of', are better answered through the collection and analysis of interview material, rather than through the measurement of quantitative data.

The interview guides were designed to motivate the interview partners to share their knowledge and experiences throughout the interview (Valentine, 2005). They allowed for both the collection of data covering the topics identified as important (through earlier interviews, and from preparatory document reviews), and for the exploration of unexpected discoveries during the interviews (Silverman, 2013). When selecting interview partners, centrality has been used as the main selection principle (Esaiasson et al., 2007). As with identifying the interview topics, the selection of interview partners has been informed by a preparatory review of the existing literature and documents. The final result is intended to give a balanced selection of key actors, representing different interests and perspectives. The selection is based on the expectation that, given all the information available to the researcher at a certain point in time, the selected interview partners are able to

present knowledge that contributes to the explanation of the phenomena under research, adding to the material collected through the document review. Centrality as a selection principle is operationalised through 'snowball sampling' (May, 2011). This means that interview partners have been asked to give recommendations regarding further interview partners that they consider to be important. The results of such recommendations have then been balanced with findings from the preparatory review and with recommendations from other interviewees, in order to avoid a selection of interview partners representing, or conforming to, one particular view. In line with the aim of reaching theoretical saturation through retroduction, interviews are conducted until data saturation (Glaser, 2017) has been reached, namely, until no new information relevant to the understanding of the phenomenon is revealed by the interview partners.

Table 3: Data sources and methods

Region	Industry	Primary data source(s)	Complementary data source(s)	Method(s)	Article(s)
Scania	Digital games	15 face-to-face interviews	Publicly available documents; data from Statistics Sweden	Case study; semi-structured interviews; document analysis	Article 1 Article 5
Öresund cross-border region	-	9 face-to-face interviews; 1 phone interview	Publicly available documents; newspaper articles; archived webpages of organisations	Case study; semi-structured interviews; document analysis	Article 2
Linköping city-region	Information Technology (IT)	38 face-to-face interviews[2]	Publicly available documents; newspaper articles; data from Statistics Sweden	Comparative case study; semi-structured interviews; document analysis; descriptive statistics	Article 3
Karlskrona city-region					
West Sweden	Automotive	19 face-to-face interviews 2 phone interviews	Publicly available documents; newspaper articles; industry journals and newsletters	Comparative case study; semi-structured interviews; document analysis	Article 4 Article 5

Source: own summary.

[2] The interviews for paper three were conducted by my co-authors during 2010-2015.

This dissertation draws on 84 in-depth interviews, of which 46 were carried out by the author[3]. The number of interviews per article and if they were conducted face-to-face or via phone is summarised in Table 3. In addition, the author has carried out approximately 35 interviews not included in the material on which the articles have been written, but which have contributed to the author's understanding of innovation policy (in particular smart specialisation), place leadership, new path development in relation to grand challenges, and the region of Scania. These interviews have provided material for other articles (see Grillitsch et al., 2019; Miörner, 2016; Trippl et al., 2015; Miörner, 2018) and reports (see Coenen et al., 2017b) related to the topic but beyond the scope of this dissertation.

Working with empirical material that was collected by co-authors, as was the case in article three, requires close interactions within the author constellation. On the one hand, it is, of course, important for the author to become familiarised with the empirical material, both by reading interview transcripts and through lengthy discussions with the colleague(s) who have conducted the interviews. However, it is unlikely that the author is able to grasp the full extent of the interview material, since the transcripts rarely convey the full context in which the interviews have taken place (Alvesson, 2011) and, maybe more importantly, the conceptual lens influencing the questions asked and where emphasis is put in the interview situation. On the other hand, the process of retroduction becomes somewhat 'distributed' in the author group, allowing for conceptual arguments to be closely scrutinised by the co-authors, who triangulate with their more in-depth understanding of the empirical material. Just like any other research project, the conceptual arguments are thus shaped through iterations between theory and empirics, even if these involve more effort in terms of interaction and exchange of ideas.

A majority of interviews were conducted face-to-face, but due to time-space constraints a handful of interviews took place over the phone or via Skype. These were expected to yield fewer insights, but the experience with phone interviews was largely positive. By taking measures to ensure that the interview partners have the necessary background information about the project and the researcher prior to the interview, for example by sending materials via e-mail and having short introductory phone calls during the days leading up to the interview, some

[3] This number includes a few interviews carried out together with colleagues.

'acquaintance' was developed between the researcher and the interview partner in a similar way to what takes place during the first few minutes of a personal meeting.

The interviews were recorded using a recording device (for face-to-face interviews and Skype calls) or smartphone app[4] (for phone interviews), after providing the interview partner with information about the recording and transcription procedure and an opportunity to opt out. No interview partners declined to be recorded. In the vast majority of cases, the recordings were transcribed non-verbatim and complemented by field notes taken during or immediately after the interviews. It has been argued that the value of verbatim transcriptions is overstated in most social science research settings, and that the transcription process should be seen more as a process of interpretation and generation of meanings from the data, than a mechanic clerical task (Halcomb and Davidson, 2006). Some scholars even argue that notes and summaries are superior to verbatim transcribed audio recordings, as they capture the researcher's interpretations and support the process of generating meanings from the data (Wengraf, 2001). Nevertheless, the transcribing of recordings is important for several reasons. Above all, it allows for the researcher to revisit the interview and discover new insights based on a more developed theoretical understanding of the topic. There is thus a trade-off between 'summary transcriptions' and more detailed transcription methods.

For most interviews, a reflexive and iterative process of data management suggested by Halcomb and Davidson (2006) was used, starting with concurrent audio recording and note taking, and continuing with transcribing the interviews in parallel with further developing the field notes. This provides the researcher with material consisting of both thematically and theoretically organised notes, representing a combination of field notes and transcribed interview material, and a basic transcription of the interview in full. The interviews should not be seen as merely collecting data 'from scratch', but as a way of reflecting and further elaborating on findings from the document analyses performed prior, and in parallel, to the interview process.

The collected data were analysed by applying the technique of 'rational abstractions' (Pratt, 1995), seeking for common ground among interview partners and other data sources. Rather than counting the occurrence of certain statements,

[4] 'Another call recorder' by NLL Apps.

mentions or keywords, as is the case when applying, for example, content analysis (Hsieh and Shannon, 2005), rational abstractions favour the search for casual mechanisms and in-depth understanding of a phenomena. For all articles, the collected data material was coded, either according to pre-defined theoretically informed categories, or 'in vivo' based on patterns that emerge throughout the process of collecting and analysing the data. For the two last articles (4 and 5), the coding took place with the aid of computer software[5], but the methodology as such was the same as for the earlier articles.

[5] 'NVivo' by QSR International.

6 Findings and conclusion

This chapter provides an overview of the main findings of the individual articles included in this dissertation. Table 4 provides a summary of the five articles with respect to the aim, conceptual underpinnings, empirical case, object of analysis and main findings. In section 6.1, the empirical cases under investigation are introduced. Rather than summarising the individual articles, section 6.2 aggregates the empirical results from the articles and discusses them in the light of the conceptual framework in the dissertation. This is followed by concluding remarks, a discussion of interesting areas for future research and policy implications.

6.1 Cases and contexts

6.1.1 The development of a digital games industry in Scania

The emergence and further development of a digital games industry in Scania is the focus of investigation in the first article and represents one of the cases in the fifth article. Scania is the southernmost region of Sweden and has a population of 1.3 million (Statistics Sweden, 2018). The region hosts the cities of Malmö (Sweden's third largest city), Helsingborg, Lund and Kristianstad. The RIS in Scania and can be characterised as thick and diversified, endowed with a well-developed organisational support structure and a diverse industrial structure. It has a strong endowment of universities and other knowledge-generating organisations, including Lund University, Malmö University, the Swedish University of Agricultural Sciences and Kristianstad University College. Scania also hosts a large number of intermediary organisations that support innovation and entrepreneurship activities. In other words, Scania provides a regional environment that is typically considered as favourable for new path development.

Table 4: Overview of the articles

#	Title	Aim	Conceptual underpinnings	Empirical case	Object of analysis	Main findings
1	Paving the way for new regional industrial paths: actors and modes of change in Scania's games industry	To contribute to the development of a more dynamic perspective by investigating how key actors induce changes in the regional environment, in order to 'turn' a constraining context into one that enables new industrial path development.	New path development; RIS; Agency	Digital games industry in Scania	Path development; modes of RIS reconfiguration; organisational support structures; role of key actors	Creation of a more enabling environment is an outcome of multi-scalar processes, and combination of various modes of change (layering, adaptation, novel application), employed by key individuals.
2	Creating institutional preconditions for knowledge flows in cross-border regions	To investigate how policy network organisations can target the institutional underpinnings and challenges of cross-border integration processes and knowledge flows.	Institutional theory; Agency; Cross-border RIS	Öresund cross-border region	Institutional change; role of policy network organisations	Policy network organisations have limited power to change formal institutions, but rely on mobilising actors at other spatial scales for improving formal institutional conditions. Informal institutions can be targeted by an array of different tools available to policy network organisations.
3	Developing and sustaining new regional industrial paths: investigating the role of 'outsiders' and factors shaping long-term trajectories	To explore what role is played by outsiders in the emergence and development of new industrial paths and investigate what matters for sustaining the dynamics of an industrial path after its initial emergence.	New path development; Agency	IT industry in Linköping and Karlskrona	Factors contributing to sustaining new industrial paths; role of agency (outsiders); structure-agency dynamics	Local preconditions matter for the long-term development of industrial paths, through the existence of certain preconditions but also by attracting outsiders with different characteristics. The successful embeddedness of arriving actors is a crucial determinant for sustaining new paths.

4	Embracing the future: path transformation and system reconfiguration for self-driving cars in West Sweden	To investigate how RISs are tackling challenges related to path transformation processes.	New path development; RIS; TIS	Automotive industry in West Sweden	Path transformation; types of RIS reconfiguration; system functions	Path transformation draws on a broad set of assets in addition to technological knowledge. Empirical support for three types of RIS reconfiguration. Highlights how actors tend to utilise previous networks and positions in global innovation systems rather than turning to the development of system functions regionally as the 'default option' of system reconfiguration.
5	Contextualising system agency in new path development: What factors shape regional reconfiguration capacity?	To investigate factors shaping regional reconfiguration capacity.	New path development; RIS	Automotive industry in West Sweden and digital games industry in Scania	Factors shaping RIS reconfiguration capacity; structure-agency dynamics; system agency	Strategies of system agents are shaped by factors such as regional imaginaries, directionality and power relations. Actors are reflexive and continuously enhance their knowledge about context conditions.

Source: own summary.

However, the point of departure in article one is the idea that constraining elements also exist in thick and diversified, well-developed RISs, and that it is necessary to 'turn' a constraining environment into a more enabling one through targeted efforts. First, there was a mismatch between the educations offered in the region and the needs of digital games firms. Second, there was a lack of customised initiatives for promoting networking activities and start-up support fitting the particular characteristics of the digital games industry. Third, firms in the industry suffered from a lack of venture capital and other forms of investment mobilisation support. Fourth, the diversity among industrial paths in Scania meant that there was intense competition for the attention of policymakers. The article investigates the modes through which key actors of change were able to transform the RIS to become more enabling for the development of a digital games path.

The digital games industry is concerned with the development and sales of what are traditionally referred to as 'video games' but which now covers games that can be played on a wide range of devices, including smartphones. The 'seeds' of the Scanian digital games industry were planted in the neighbouring region of Blekinge in the mid-1990s. Blekinge offered favourable preconditions for digital game start-ups, by providing various types of public support, including an incubator and both academic and vocational education programmes. Several of the leading games firms in Scania were founded in Blekinge and relocated to Scania in the beginning of the 2000s. The empirical investigation in article one highlighted the need for securing access to relevant competence as the main reason why firms could not continue to grow in Blekinge. While Scania did not offer an abundance of senior game developers, it did offer an environment which was attractive when recruiting competence from abroad, which was not the case for the more peripheral region of Blekinge. Offering attractive conditions, Malmö became the city of choice for the relocating firms. Since then, the industry has developed to reach a critical mass of 50 firms employing more than 1000 developers (Game Habitat, 2019). The largest firms are Massive Entertainment, King and Tarsier Studios, representing a majority of the industry in terms of employment. More than half of the firms covered by a mapping in 2015 were founded after 2010[6], illustrating the rapid growth of the regional industrial path (Game City, 2015).

[6] Since the first publication of article one in 2016, the size of the digital games industry in Scania has grown from 600-700 employees to more than 1000.

In other words, the case fits well into existing patch development typologies, representing a case of path importation. However, the clear-cut definition of the path development process already becomes questionable by the period immediately after the initial stage of path development, which was increasingly driven by local start-up formation and spin-off activities. In the light of these findings, it might therefore be more useful to talk about 'triggers' and 'stages' of new path development than trying to categorise the process as one distinct 'type'.

6.1.2 The creation of institutional preconditions for knowledge flows in the Öresund region

The second article investigates the creation of institutional pre-conditions for knowledge flows in cross-border regions. Thus, it does not cover a case of path development per se but instead focuses on the development of what are known to be favourable pre-conditions in a particular regional context. The notion of 'cross-border' regions captures some of the problems with categorising regions based on a stylised set of characteristics, as they are, by definition, a combination of two distinct regions with their own innovation systems, however with some degree of integration between the two parts. The case in focus in the article is the Öresund region, incorporating the capital region of Denmark (Region Hovedstaden) and Zealand (Sjælland) in Denmark, and the Swedish region of Scania. The region hosts around 3.8 million people. Öresund has often been portrayed as one of Europe's most successful cross-border regions (Nauwelaers et al., 2013), but in terms of institutional conditions substantial differences exist between the two regions comprising the cross-border area. Despite being perceived as similar in terms of culture and regulatory systems, differences in terms of legislation, educational systems, taxation, culture and social identities (Edquist and Lundvall, 1993; Garlick et al., 2006; Löfgren, 2008) are not insignificant.

The article emphasises institutional obstacles to knowledge flows existing within the cross-border region and what actors have done to dismantle barriers and to create more enabling conditions. The activities of four policy network organisations are under investigation: 1) The Öresund Committee was founded in 1993 with an explicit agenda for shaping institutional conditions in the cross-border region. It was a political organisation made up of Danish and Swedish politicians at different levels and centred around issues of cross-border integration, by lobbying at the national levels and by attracting EU Interreg projects to fund cross-border initiatives. 2) The

Öresund University consortium was established in 1998 and was responsible for fostering cross-border collaborations between 14 universities, by promoting student mobility and the creation of research networks. 3) Medicon Valley Alliance was targeting the enhancement of cross-border collaboration among actors in the life science sector. It was initiated by the universities in Lund and Copenhagen and strongly supported by major pharmaceutical companies in the region. 4) Öresund Food network had the objective of increasing collaboration actors in the food- and related industries.

In terms of structure-agency interplay, the article thus takes a bottom-up perspective, highlighting how the institutional setting is 'thickened' by different actors in efforts to harmonise institutional differences within a particular type of region.

6.1.3 The long-term development of IT industries in Linköping and Karlskrona

The path development process analysed in the third article takes on a considerably longer time perspective than in the other articles, illuminating how two path development processes may seem similar at the early stages but diverging in the longer term. This has implications for how to characterise the region and the type of path development, when seen in relation to the stages of the path development process. The article investigates the development of IT industries in the city-regions of Linköping and Karlskrona.

Linköping is Sweden's eight largest city with a population of 160,000 and is located in the region of East Sweden, which has a population of 460,000 (Statistics Sweden, 2018). It is situated approximately 200 km southwest of Stockholm. It has been an important region for Sweden's military industry, beginning in the early 20th century when the Swedish Railroad Company, located in Linköping, diversified into airplane manufacturing. In the 1930s, the division was acquired by SAAB, Sweden's largest airplane manufacturer, turning Linköping into the 'aviation capital' of Sweden. A large number of suppliers emerged, but SAAB kept much of its R&D in-house and had few interactions with other firms (Eliasson, 2010). However, with a surge in demand for airplanes after the Second World War, the industry expanded rapidly, and skilled engineers were recruited nationwide. In other words, Linköping was characterised as more or less a one-company town and an

organisational and institutional support structure had been developed around the aviation industry.

Karlskrona is the main city of the Blekinge region, which has 160,000 inhabitants (Statistics Sweden, 2018). It has a history of being a Swedish naval base and thus a strong dependence on support from the national level. In the period after the Second World War, heavy manufacturing plants owned by firms such as LM Ericsson, Vibroverken and Uddcomb were established in the region as a result of national incentives. These were pure production units which were attracted by the strong infrastructure built around navy activities. However, being more or less outdated, the regional industry was hit badly by economic crises following globalisation in the 1980s.

Both regions became key centres of the Swedish IT industry in the 1990s and article three highlights a number of similarities in the early stage of path development, beyond drawing on similar preconditions. Most notably, the establishment of universities in the regions and the role played by entrepreneurial vice chancellors were important during the initial stage of path development in both cases. Linköping University was established in 1969 and reflected SAAB's technological profile. With the introduction of computers in the aviation industry, the university played an important role in supporting SAAB's diversification into IT and electronics, for example by establishing Sweden's first IT professorship. Furthermore, the vice chancellor of Linköping University, himself an outsider to the region, went against the prevailing norms in academia which prevented collaboration with the industry, and recruited academics from other parts of Sweden which were known for being able to collaborate with the industry. The IT industry in Linköping was developed on the basis of these preconditions. First, the establishment of the university attracted outsiders from other regions, both staff and students, with a different, more entrepreneurial, mindset than existing regional actors. These newcomers were involved in new firm formation as well as spurring collaboration between existing actors. Second, the university offered applied programmes tailored to the need of the emerging IT industry.

In Karlskrona, the Blekinge Institute of Technology (BTH) was established in 1989, motivated by the establishment of a business-related software development centre (Soft Centre) two years earlier, rather than the explicit needs of local firms. BTH was influenced by Soft Centre with regard to their technological profile, and the

vice chancellor's role was similar to the case of Linköping, in terms of recruiting academic staff who brought new ideas about an entrepreneurial university with close collaboration between industry and academia. However, there was a certain mismatch between local interests in Karlskrona, shaped by the heavy manufacturing industry, and the interests of the national government and Soft Centre, reflecting a wish to develop a pronounced software profile. The initial stage of the development of the IT industry was also shaped by incentives set at the national level, most notably through a decision that the firm winning the bid for a licence to become a mobile phone operator was to be localised outside the Stockholm area. This led to the establishment of NordicTel in Karlskrona, and a number of other outsiders followed to relocate to the region, contributing to the development of the regional IT industry.

Nevertheless, while the IT industry became embedded in the existing technology-oriented economic structure in Linköping, the industrial path in Karlskrona developed few links to the dominating traditional industries. The explanation brought forward in article three centres around the question of how agency, exercised to a large extent by outsiders, played a role in fostering self-reinforcing effects and embedding the new paths in existing structures and reconfiguring the RISs. At the beginning of the period of analysis (the 1960s), both regions can be characterised as somewhat peripheral manufacturing regions. However, when taking a long-term perspective, it becomes apparent that the regional innovation system is evolving, to a large extent as a result of the path development taking place. At the end of the period of study (2012), Karlskrona would fit the description of a 'thin' regional innovation system in a rather peripheral location, whilst Linköping is certainly characterised by thickness and a reasonably high degree of industrial diversity. The article demonstrates the importance of focusing on the interplay between structural conditions and agentic processes driving path development forward, rather than 'reading off' the expected development trajectory based on a set of observed pre-conditions.

The analysis identifies factors triggering the shift from the 'pre-formation' stage to what is in the article referred to as the 'path initiation' stage, and subsequently what led to diverging outcomes in the longer run in terms of sustaining the paths beyond the initial stage. If zooming in on one of the different periods covered in the article, it is possible to specify different types of path development, but if taking a more aggregated perspective the analytical clarity is quickly fading. Instead, the cases

illustrate the idea that path development is usually a combination of different sources and mechanisms.

6.1.4 The transformation of the automotive industry in West Sweden towards self-driving cars

Articles four and five investigate the transformation of the automotive industry in West Sweden based on the development and introduction of self-driving cars and autonomous technology. West Sweden is situated on the west coast of Sweden and consists of the counties Halland and Västra Götaland. The latter is, however, the main focus of investigation in the articles, hosting Sweden's second largest city (Gothenburg) and having a population of 1.8 million (Statistics Sweden, 2018). Approximately 40% of the Swedish automotive industry in terms of employment is located in the region and it is home to large firms such as Volvo Cars, Volvo AB (trucks), HCL Technologies Sweden, CEVT, Autoliv and IAC, in addition to a large number of firms from different parts of the value chain, including smaller suppliers and consultancies. The industrial set-up is complemented by a strong organisational and institutional support structure. Important higher education organisations in the region include the Chalmers University of Technology, and there is a large number of intermediaries supporting the needs of the automotive industry. West Sweden is also home to a strong ICT industry, with firms working closely together with actors in the automotive industry. In other words, the RIS in West Sweden can be categorised as organisationally and institutionally thick, with a degree of industrial diversity, but a RIS yet heavily centred around the automotive industry.

The fourth article explicitly targets the need to distinguish the case in point from the concept of 'path upgrading', as both inputs in terms of the most important assets for the industry, and the outputs in terms of the essence of the means of value creation, are substantially transformed, and introduces the concept of 'path transformation' to capture such changes. During the last 20 years, the automotive industry in West Sweden has built a high level of competence in the field of 'active safety' technology, referring to technologies that are intended to prevent accidents, such as automatic braking systems and other warning features. In 2009, Google announced that they have established a self-driving car unit, and this was highlighted in the empirical analysis as a 'global trigger' for the development of autonomous vehicles within the automotive industry. In West Sweden, the 'DriveMe' project can be seen as the starting point, with the aim of studying different aspects of autonomous

driving. The project involves a range of private and public actors in the region and at the national level: Volvo Cars, Autoliv, the Swedish Transport Administration, the Swedish Transport Agency, Lindholmen Science Park, Chalmers University of Technology and the City of Gothenburg. It is supported by the Swedish government and sub-projects are partly funded by Sweden's innovation agency Vinnova. The core of the project was the ambition to introduce 100 fully autonomous cars to be driven by 'real customers' in and around Gothenburg. The empirical investigation is anchored in the idea that while drawing on previous technological knowledge within the active safety segment, path transformation towards self-driving cars required a reconfiguration of the RIS in order to provide actors with other types of new assets (for example, legitimacy, markets, infrastructure and other types of non-technological knowledge). It is crucial for the path transformation process that the RIS supports and facilitates the provision of such assets.

The article takes a multi-scalar perspective when it comes to tracing the origins of these processes, establishing a link between elements in the RIS and global change processes going on within the automotive industry. Similar to article one, the investigation moves beyond the argument that thickness in combination with industrial diversity is universally enabling for new path development and examines how well-developed organisational and institutional support structures are reconfigured to facilitate the substantial transformation of existing industrial paths.

In summary, the empirical cases investigated in this dissertation cover a wide spectrum of different types of path development, investigated during different stages of development and in different regional contexts. The heterogeneity of cases under investigation serves as a key to understanding how new path development unfolds under different regional conditions. Already after this short introduction to the empirical cases, however, it is possible to distinguish a basic pattern challenging some of the existing theorising in the literature. First, based on the four cases of new regional industrial path development examined in this dissertation, it is hard to empirically substantiate the existing typologies of different types of path development. In the empirical cases, the path development process is approached as a combination of different mechanisms and sources, observed in different stages of path development. Second, the influence of factors in the regional environment is examined not as a set of regional pre-conditions at a certain point in time, but rather as an unfolding interplay between context conditions and the path development process. What is enabling for the embryonic first emergence of new industrial

activities might not be equally enabling throughout the path development process, and the analysis moves beyond the perception that certain RIS configurations are universally enabling or constraining new path development.

6.2 Synthesis of results

Different reasons why RIS reconfiguration is needed are identified in the articles. On the one hand, RIS reconfiguration may be necessary to 'turn' the regional environment from being constraining for new path development to becoming more enabling. This involves activities that target the lack of assets relevant for actors in new paths, originating from both the lack of system functions providing such assets (a kind of default constraint for new path development in any given context) and from constraining effects of strong alignment between existing system functions and existing paths. When investigating the digital games industry in articles one and five, the findings indicate that the 'absence' of relevant system functions was particularly pressing. The games industry needed system functions facilitating the provision of skills, above all by being able to attract senior game developers, the provision of infrastructure such as office space and collaborative spaces, and the provision of finance in the form of start-up support and venture capital. In this case, RIS reconfiguration was driven by the need to facilitate the provision of such 'missing' assets, rather than dismantling barriers originating from what are traditionally labelled lock-in effects. The latter was somewhat more prominent when investigating changes in the automotive industry in articles four and five, where the substantial transformation of an existing industrial path required the reconfiguration of a RIS which was strongly aligned to old activities. In West Sweden, the shift towards autonomous technology and self-driving cars meant that existing RIS configurations, centred around 'active safety' and traditional vehicle manufacturing, were aligned to facilitate the provision of assets that did not match the need of actors involved in new path activities. In other words, RIS reconfiguration was needed in order to 'de-lock' existing system functions due to disruptive intra-path changes.

On the other hand, the empirical case studies approach RIS reconfiguration in a more nuanced way than merely as a means to overcome barriers faced by certain developing industrial paths. The findings indicate that RIS reconfiguration can facilitate system functions that may be relevant for several industrial paths, namely, to develop more enabling preconditions beneficial for new path development in

general, in addition to one specific path development process. In article two, the focus is on knowledge provision, zooming in on the institutional preconditions for knowledge flows between two parts of a cross-border region. The empirical analysis demonstrates the complexities of institutional change processes and how enhancing a specific system function, in this case knowledge provision, is targeted by the efforts of actors engaged in collective activities but driven by different intentions. For example, one of the policy networks under investigation lobbied public servants in different agencies (for example, the Tax Agency and Unemployment Agency) in order to solve regulatory obstacles that were beyond the reach of individual actors in the cross-border region. In addition, they worked to provide information to increase awareness about the differences in institutional conditions and how to deal with them, focusing on reducing uncertainty for actors.

In the cases under investigation in article three, new path development processes were triggered by attempts to facilitate system functions with low alignment to existing paths. In both regions under consideration, the initial stage of path development was preceded by the establishment of universities and the inflow of outsiders to the region. The inflow of such actors played an important role in facilitating the enhancement of system functions that were previously underdeveloped in the two regions. For example, universities were established, facilitating the provision of knowledge assets and skills that were not primarily catering directly to the needs of existing regional industries. In other words, the empirical findings provide reasons to consider RIS reconfiguration not only as part of ongoing path development processes, but also as an important way to shape the preconditions for, and even as a trigger of, path development activities in the pre-formation stage.

A third reason for why RIS reconfiguration takes place is discerned in the case study of the automotive industry in West Sweden, analysed in articles four and five. Here, one (but not the only) important rationale behind RIS reconfiguration was to forge links between existing industrial paths. For example, the establishment of an AI research centre and a technology incubator in the region was highlighted as being important for skill provision and finance provision shared by the developing self-driving car path and the existing IT and engineering industries in the region. In other words, the RIS was reconfigured in order to create linkages between industrial paths by shaping system functions so that they could be shared by actors active in different industries.

Having established what drives the need for RIS reconfiguration, the articles investigate the modes through which RIS reconfiguration comes about. One key finding when synthesising the results concerns the importance of modes of change that build upon existing system elements (adaptation and novel application) in relation to the creation of entirely new ones (layering). Focusing on the organisational dimension in article one, the findings point to the sequential and simultaneous combination of adaptation and novel application of existing organisational support structures including in cases where the end result includes a new element. For example, the creation of new organisational support structures such as a regional game conference and a vocational training school were preceded by activities targeting the adaptation and novel application of existing elements. One could say that actors were not only 'paving the way' for new industrial paths, but also for changes to the organisational support structure of the RIS. This pattern is even more pronounced when looking at the institutional dimension, being the focus of article two. The findings illustrate how the novel application and adaptation of existing system elements in the institutional dimension took place through information campaigns, overcoming formal institutions by relying on informal ones, and lobbying to change interpretations of existing institutions. The findings in the fourth article, studying the automotive industry in West Sweden, provide examples of how new RIS elements were created through layering. The DriveMe project represents a prominent example, where a new element was introduced and around which the development and testing of self-driving cars was coordinated. However, the findings in article four also confirm the relative importance of modes of RIS reconfiguration that strongly build on existing system elements, in addition to the creation of new elements through layering. This is reflected in how actors relied on the existing support structure aligned to the active safety segment of the industry when engaging in activities targeting the development and introduction of self-driving cars. For example, Volvo Cars decided to use the remaining funds in a large publicly funded research programme on vehicle technology for conducting research on self-driving cars. Other examples include how existing innovation support organisations as well as physical infrastructure were adapted to support the transformation of the automotive industry.

In other words, there is no convincing empirical support for a hierarchical relationship between the different modes of RIS reconfiguration outlined in the conceptual framework. Neither do the synthesis of findings provide support for the idea that layering would be more important when it comes to the provision of

radically ‘new’ assets. Instead, taken together, the findings point to the fact that even though existing system functions may not facilitate the provision of assets that are needed for new path activities, actors tend to use existing system elements as points of departure when they engage in efforts trying to secure the provision of such assets. This is observable for the different types of path development under investigation in the articles, as well as across regional contexts. The findings challenge the perception that regions are either ‘enabling’ or ‘constraining’ for new path development, by exploring constraining factors in regions considered to have a structural composition that would be generally favourable for new path development (articles one and five) and on the substantial transformation of well-established paths in more specialised regions (articles four and five), both with associated processes of RIS reconfiguration.

However, the relative importance of the different modes of RIS reconfiguration is changing over the course of the path development process. Based on the empirical findings, the largest differences when it comes to the modes of RIS reconfiguration are found in relation to the stage of the path development process, rather than the type of new path development or RIS. In the digital games industry in Scania, the initial stage was characterised by ‘newcomers’ originating from the neighbouring region, who lobbied for the layering of system elements to develop system functions that were in demand among firm actors. When it became apparent that the success of such a strategy was limited, actors turned to focus on the adaptation and novel application of existing elements instead. Examples from article one include the ways in which actors secured funding for crucial networking activities through the use of existing policy instruments in new creative ways, and how existing support for vocational training schools existing at the national level was used to access funding for the development of education programmes. Later stages, however, were increasingly characterised by the layering mode of RIS reconfiguration.

A similar pattern can be observed when taking a more long-term perspective. The empirical findings in article three support the idea that the drivers, sources and mechanisms shift over the course of path development and that the characteristics of RIS reconfiguration is no exception. In the early stage, RIS reconfiguration could be seen as a trigger of new path development. The establishment of universities was not simply a way to provide skills to established regional industries, but also served to shape the preconditions for new path development and to trigger entrepreneurial activities. However, when comparing the cases of Linköping and Karlskrona, it is

possible to argue that the relative success of RIS reconfiguration processes in the later stages play an important role when it comes to explaining the difference development trajectories, with Linköping being relatively more successful than Karlskrona. It is demonstrated how the 'fostering' of self-reinforcing mechanisms is closely associated with the facilitation of system functions, through the layering and adaptation of system elements. The new paths needed to become embedded in existing structures, and this put RIS reconfiguration at the centre stage of the explanation for why the IT industry in Linköping performed better than its counterpart in Karlskrona. The article highlights processes of institutionalisation of the region's entrepreneurship support system as a crucial success factor, as well as the integration of relocating actors in existing institutional and organisational structures. In other words, the empirical findings demonstrate the importance of RIS reconfiguration for 'maturing' an industrial path, highlighting how the interplay between an industrial path and the RIS is changing throughout the path development process. The findings also support the idea that the co-evolution between industrial paths and the RIS does not come automatically but requires agency, and that the lack of RIS reconfiguration may lead to the failure of developing paths.

The empirical analysis also provides support for the different types of RIS reconfiguration outlined in the conceptual framework, extending a multi-scalar perspective without losing the regional focus. RIS reconfiguration targeting the facilitation of access to assets that are formed in other regions is highlighted as crucial in the empirical findings. In article four, the findings support the idea that RIS reconfiguration took place in order to develop assets regionally, through the layering and adaptation of research labs, education programmes, test infrastructure, innovation support organisations and funding schemes, among others. However, reconfiguration also took place in order to facilitate access to assets formed elsewhere, for example by adapting organisational elements to take on coordinating roles in managing the external connectedness of regional actors, or through the establishment of new elements supporting investment mobilisation and the relocation of actors from elsewhere. For example, a new incubator was created, explicitly targeting the physical relocation of small firms from other regions and anchoring them in the RIS.

In other words, actors utilised existing structures in order to access and transplant system functions from elsewhere, highlighting the relative importance of these types of RIS reconfiguration over trying to facilitate all necessary system functions

regionally. In the cases of Linköping and Karlskrona analysed in article three, the layering of organisational elements (the establishment of new universities) contributed to both the facilitation of system functions to form assets within the regions and to accessing assets that had been developed elsewhere. In Linköping, the establishment of a university did of course serve as an important element in the provision of human and industrial assets but, perhaps more importantly for the subsequent path development process, also as a way to attract academics with experience of working together with industrial actors in joint projects. This example also highlights the interrelatedness between organisational and institutional changes, as the findings point to the fact that it was not the creation of a university itself which proved to have the most impact on the path development process, but how the organisation contributed to shaping institutional conditions in the region.

In other words, the empirical findings support the idea that exogenous assets are important for new path development (see Trippl et al., 2018) and highlight the role of, for example, institutions at different spatial scales (articles two and four). However, even though exogenous assets and conditions are emphasised, the conceptual arguments and empirical findings help contextualise path development processes and maintain a regional focus in the analysis, by providing insights into how the RIS facilitates the provision of assets from other regions and how it is reconfigured not only in order to support the formation of regional assets but also to provide structures supporting the access of assets from elsewhere.

The role of agency is explicitly dealt with in all but one of the articles (article four) and it is demonstrated how actors mobilise resources and engage in system agency in order to facilitate RIS reconfiguration. Particular attention is given to the role of outsiders (article three), policy network organisations (article two) and incumbent firms (articles four and five). The empirical analysis provides numerous examples of how actors try to alter the system functions in order for them to provide the assets needed for new path activities. For example, actors in the digital games industry in Scania worked hard to introduce new education programmes that would supply the industry with skilled labour and automotive firms in West Sweden introduced new types of innovation support organisations that targeted the transplantation of system functions from other regions. However, backed by the findings that RIS reconfiguration often use existing system elements as points of departure, even when the goal is to radically alter the functioning of the RIS, the empirical analysis in article five focuses on factors shaping the context for system agency and thus on

factors that determine the reconfiguration capacity of the RIS. The findings show how structure-agency dynamics, namely, a combination of regional factors and the reflexivity of regional actors, shape the strategies of system agents. In particular, system selectivity in the form of regional imaginaries, historically developed power relations and directionality embedded in the RIS shaped how system agency played out in Scania and West Sweden.

For example, actors in Scania exploited the fact that regional imaginaries were loosely anchored and that the RIS provided only weak directionality. Through system agency they tried to develop structures for asset provision and they were relatively free to formulate strategies, not being much affected by existing directionality when mobilising support for their change activities. Nevertheless, prevailing power relations turned out to play a major role in terms of shaping their system agency efforts. Rather than directly trying to change existing institutional and organisational support structures, actors formulated strategies in order to adapt or re-apply existing elements. Contrasting this, powerful incumbents in West Sweden engaged in system agency targeting RIS reconfiguration, but prevailing system selectivity shaped their activities. Both in terms of activities targeting change and navigation, they reflected the regional imaginaries, power relations and directionality. System selectivity favoured broad strategies over narrow ones, essentially leading actors to engage in system selectivity 'opening up' the RIS. Aspects such as a broad inclusion of stakeholders, including the public sector, were centre stage in the strategies formulated by incumbents. This led to a broadening of structures for asset provision rather than specialising them to a particular industrial segment.

Examples of such reflexivity among system agents are also plentiful in the other articles, as the empirical analyses demonstrate how actors reinterpret, circumvent and navigate the existing structures in order to realise their own intentions, and how actors 'make use of' existing RIS configurations. Here, the distinction between system elements and system functions is crucial. To make use of existing system elements in order to, for example, provide a new set of skills illustrates how actors are reflexive and use their knowledge about the RIS in order to change its functioning (altering system functions) without actually adding new or changing existing system elements. The change thus lies in the interplay between existing structures and actors' activities. This is accentuated in article three, where it is shown how outsiders originating from other regions may play an important role in

new path development, partly because they are not influenced in the same way by system selectivity as established regional actors. Entrepreneurial vice chancellors but also researchers, and new and established firms, played an important role and it is demonstrated how these actors were able to perceive, use and interact with the existing structural conditions in new ways.

6.3 Conclusion and outlook

The aim of this dissertation is to advance our understanding of regional innovation system reconfiguration in relation to new industrial path development. The dissertation zooms in on different aspects of RIS reconfiguration and how regional structures are reconfigured in order to enable, facilitate or trigger new regional industrial path development.

The dissertation contributes with a novel conceptual framework for analysing the regional environment from the perspective of how RISs facilitate the provision of assets to regional actors. A core argument is that RISs 'provide' actors with a broad range of assets and that structures for asset provision must be reconfigured in order to support new path development. In other words, focus is shifted from the existence of (combinable) assets and elements, to the functioning of RIS structures through which assets are provided to regional actors. A basic assumption is that there is an inherent mismatch between system functions providing assets to existing paths and the assets that are needed by actors in developing industrial paths.

Consequently, new path development implies a need to reconfigure the RIS. The dissertation contributes with a better understanding of RIS dynamics, by outlining different modes and types of RIS reconfiguration targeting the modification of structures for asset provision. The analysis shows that the layering of new system elements, for example in the form of support organisations or policy initiatives, can indeed be an important mode of RIS reconfiguration. However, the analysis also highlights the adaptation and novel application of existing elements as crucial, not only as a complement to layering but also sometimes as the first option of actors. In particular, the relative importance of novel application and forms of system agency not targeting the addition or removal of system elements is emphasised in the empirical analysis. This illustrates the complexity of structure-agency dynamics involved in new path development, as it points to the ways through which actors re-

interpret and re-purpose existing elements in order to change the functioning of the RIS. The strategies deployed by system agents are shaped by system selectivity and the empirical analysis highlighted how factors such as regional imaginaries, directionality and power relations determine the reconfiguration capacity of RISs.

The framework also allows for a better understanding of the links between local and non-local conditions and processes in new path development. It conceptualises system functions as scaled processes that are brought together and aligned through the interplay between system elements and agency in particular regions. The findings illuminate how extra-regional linkages are not only a matter of collaboration between individual actors, but also how the access to assets in other regions can be facilitated through the RIS. The empirical analysis shows that securing the provision of assets relevant for new paths not only includes developing RIS structures in order to form assets within the region, but also the ways through which actors change the functioning of the RIS by developing structures for accessing or transplanting assets and system functions elsewhere.

Finally, the dissertation contributes to our understanding of the link between RIS reconfiguration and new path development by investigating the characteristics of RIS reconfiguration in different types and stages of new path development. The empirical analysis situates RIS reconfiguration as a core component of new path development, relevant in different types of path development. It extends existing perspectives by also highlighting the role of RIS reconfiguration in the later stages of path development (the 'maturing' of an industrial path), and is thus not limited only to 'setting the scene' for industrial change processes.

6.3.1 Key areas for future studies

The results in this dissertation point to a number of interesting areas for further conceptual and empirical work.

This dissertation has brought forward the argument that configurations of RIS elements constitute system functions that provide regional actors with assets for new path development. The empirical analysis also revealed the importance of RIS reconfiguration in the later stages of path development, reflecting the need to embed new paths in the surrounding RIS. Another reason, however, might relate to challenges associated with fostering 'scale-ups' rather than 'start-ups' at the later

stages of path development. Entrepreneurship researchers have shown how the process of scaling up firms beyond their initial phase requires a different configuration of structures for asset provision, for example in the form of the organisational support structure (Brown and Mason, 2017). Some first steps have been taken in this direction by investigating different stages of path transformation (see Baumgartinger-Seiringer et al., 2019). A promising endeavour might be to explore how RISs can be reconfigured to better support 'scaling up', not only of firms but also of different types of actors active in new paths. Two interrelated questions can be asked: How can RISs be reconfigured to support firm-level scaling-up processes, and how are system functions scaled up to support a rapidly expanding regional industry?

Another interesting direction for future research could be how system functions are 'materialised' in various ways. One line of research is currently looking into processes of (de-)institutionalisation in new path development (Fuenfschilling et al., 2018) and future studies could explore the mechanisms through which system functions are institutionalised and the potential role played by agency in such processes. Furthermore, RISs and system functions often have a 'physical' dimension which has not yet been paid enough attention in the literature. While traditionally seen as different areas, it could be fruitful to explore the interface between new path development and physical planning. In the empirical cases analysed in this dissertation, there are numerous examples of how system functions have materialised through the establishment of physical infrastructure (e.g. roads and test tracks in West Sweden), the allocation of urban spaces for developing paths (e.g. 'cluster houses' and shared office spaces in Scania) and through linking large-scale urban re-generation projects to one or several industrial trajectories.

Continuing on the path towards a better understanding of the functioning of a RIS, investigations of specific functions are a promising future endeavour. Little has been said about differences between system functions, more than highlighting that new path development draws on different types of assets and thus requires a RIS that provides more than (technological) knowledge assets. The relative importance of different system functions, and the potential differences in terms of their scaled properties and spatial distribution, remains to be investigated. Furthermore, this dissertation touched upon the interdependence between different industrial paths co-existing in one region, a topic which has started to receive attention in the literature (Frangenheim et al., 2018). The functional perspective of RISs offered in this

dissertation could serve as a point of departure when investigating the relationship between different industrial paths, drawing on similar or different system functions for the provision of assets.

This dissertation has taken the first steps toward understanding the factors determining RIS reconfiguration capacity, but conceptual and empirical work remains to disentangle the factors that influence why some regions are more 'resistant' to RIS reconfiguration whilst others are more easily transformed by new path actors. In particular, studies of 'failed' attempts of new path development are worth more attention. Article three illustrates the value of not only studying successful cases of new path development and RIS reconfiguration, but similar examples are few in the existing empirical literature despite recurrent calls. One obvious reason for this might be the bias towards studying exciting 'unique' cases of new path development in well-developed regions, leading to a poor understanding of both the 'average' type path development process and the challenges prevailing in less-developed regions. Another reason, however, might be the lack of conceptual understanding of how factors and conditions may be shaped not only by successful cases of new path development but also by 'paths not taken' (Schneiberg, 2007; Henning et al., 2013). This dissertation has contributed conceptually by introducing the concept of system selectivity to understand how contextual factors shape actors' activities, and how such factors may be the result of various processes extending beyond successful cases of industrial change. Further empirical work is, however, necessary in order to specify the mechanisms through which regional system selectivity is shaped and re-shaped over time, and how different types of reflexive agency may be influenced in different ways.

Finally, the path development debate is increasingly taking into account non-local factors and influences and this dissertation has provided insights contributing to our understanding in this regard. However, few studies have explored the intersection of regional- and path-specific factors and conditions. For example, it remains to be investigated how the spatial pattern of functions relevant to a specific industry influence what strategies are adopted by system agents located in particular regional contexts. Studies combining EEG and transition studies have touched upon conceptual and empirical issues related to this interplay between the 'global' and the 'local' (see e.g. Binz and Truffer, 2017; Boschma et al., 2017) but more conceptual and empirical work is needed to disentangle how new path development

plays out differently depending on the combination of industry- and region-specific configurations.

6.3.2 Policy implications

The RIS approach has had a large impact on the design and implementation of regional innovation policies in Europe and it is probably the single most commonly used framework for designing smart specialisation policies (Asheim et al., 2019). The rationale for smart specialisation is to use regional strengths as points of departure and facilitate innovation-based transformation processes with the potential of transforming existing regional economic structures (Foray, 2015). The general objective of smart specialisation is to identify and concentrate on certain priorities consisting of one or several economic activities and a direction of change. The idea is thus not to focus on the continuation of existing trajectories but also on the transformation of existing structures, according to a strategic plan which is continuously discovered through bottom-up processes (Foray et al., 2009). Smart specialisation emphasises the inclusion of a broad range of stakeholders in policy design, the importance of balancing top-down ('planning') and bottom-up ('self-discovery') logics and the concentration of resources towards transformation processes rather than existing regional strengths. It also has an outward-looking dimension, highlighting the importance of taking into account the external connectedness of regional economies (Uyarra et al., 2018; Uyarra et al., 2014).

This dissertation offers valuable insights in relation to the design and implementation of smart specialisation strategies. First, smart specialisation involves a process of identifying thematic priority areas consisting of a subject of change (one or several industrial activities) and a direction of change (Foray, 2019). This identification process traditionally relies on an effort to understand the regional economy in terms of its structure, competitive position and innovation capacities. Trippl et al. (2019b) showed that the selection of priorities often is strongly influenced by RIS characteristics. Based on the results of this dissertation, the identification process could benefit from taking a functional perspective of the RIS as the point of departure. This would involve a mapping of system functions (what assets are provided to regional actors?), their geography (are assets formed within the region or elsewhere?) and their alignment to existing industries (are assets provided to one or several industrial paths?). Such an understanding of regional

structures for asset provision could provide important insights into the relationships between seemingly different industrial paths, as well as point to regional strengths that are not exclusively linked to one particular industry. The key to select priorities may be to identify system functions that provide actors with unique assets that could be used to develop new industrial paths or renew existing ones. It is well established that regional innovation policy should reflect regional characteristics and smart specialisation is built around the idea that place-specificities should be considered. Nevertheless, this dissertation shows that the 'opening up' of existing RIS structures for asset provision is valuable in different regional contexts: 1) in order to support the substantial renewal of existing paths in thick and specialised regions, 2) in order to support an emerging path in thick and diverse regions, and 3) in order to embed new paths in peripheral regions. This is not to call for a 'one-size-fits-all' approach to regional innovation policy, but the results in this dissertation highlight the importance of taking the potentials of RIS reconfiguration into account when designing smart specialisation strategies across different regional contexts.

Second, many regions have found it difficult to develop concrete transformational roadmaps based on the identified priority areas (Foray, 2019). While the RIS approach has indeed been useful when it comes to identifying priorities, shifting the focus towards RIS reconfiguration has the potential to offer a better translation of priorities into transformative activities. Above all, it offers a way to better understand the distributed nature of regional economic restructuring, in terms of intra- and extra-regional processes. Rather than involving the creation of a single major project, such as a specialised R&D institute destined to "become the proverbial white elephant" (Foray, 2019:2071), the transformational roadmap should target RIS reconfiguration from a broader perspective. This calls for greater attention to be paid to the adaptation and novel application modes of RIS reconfiguration, which requires policymakers to have a deep understanding of the functioning of the RIS (hence the value of a functional analysis in the identification phase). Furthermore, the transformational roadmap should take into account the geographical pattern of system functions. Previous studies have shown that actors in regions characterised by a successful implementation of smart specialisation have often been able to exploit collaboration opportunities with strategic partners without the support of public funding (Uyarra et al., 2018). To systematically identify opportunities for accessing system functions elsewhere and to transplant system functions from other regions, without relying on links between one or a few

individual actors, could be an important complement to strategies targeting the formation of assets within the region.

Third, smart specialisation should take the reflexivity of actors and structure-agency dynamics into better account. The balance between planning and self-discovery logics in smart specialisation has largely been translated into decisions made by a small group of regional policymakers (top-down) versus the inclusion of a broader set of stakeholders (bottom-up). In other words, the process has been very agency-centred, neglecting the context for decision making, direction setting and change efforts. Smart specialisation could benefit from being more explicit with regard to taking into account how regions differ in their reconfiguration capacity. It should be on the agenda of scholars to study how system selectivity shapes the design and implementation of smart specialisation, and how policies could reflect, and target the enhancement of, regional reconfiguration capacity.

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