Fostering smart specialisation: the emergence of guided self-organisation at the regional level

Henna Riikka Kangas and Sanna Pauliina Ryynänen
Faculty of Social Sciences, University of Lapland, Rovaniemi, Finland

ABSTRACT
Smart specialisation is an ambitious innovation policy of the European Union that encourages European regions to develop areas of specialisation and increase sustainability, innovation and growth. Regions are responsible for implementing complex guided policy priorities, but processes, methods of implementation and areas of emphasis vary. The study investigates how regional project actors self-organise into complex adaptive systems (CAS), the factors of which enable and restricts guided self-organisation and what is the outcome of emergence. Data for this study were gathered from interviews with actors in a smart specialisation implementation project in the Lapland region of Finland and were analysed through content analysis using CAS concept principles. This study demonstrates that actors have self-organised in CAS based on multiple roles and narrowed participation of companies. However, public institutions also have restrictive guidance of self-organisation because of the ability with autonomy for change and the current situation of simultaneous changes in organisations. Political guidance diversified international and regional development. EU-level development as well as regional development was successful and multidimensional, despite the gap between the guidance of international and regional development. As an outcome of emergence, multi-level network activities have increased, but challenges in realisation of actions and diverse goals have also appeared.

1. Introduction

Increasing innovation, sustainability and growth requires a complex process of collaboration. Smart specialisation (S3) policy guides regions to implement the policy through various practices. The task of S3 was to strengthen regional collaborative governance and renew regional innovation policies through EDP (entrepreneurial discovery process). EDP emphasises public–private partnerships and a bottom-up approach to local contexts. Discussion has lately evolved the concept of S3 into S4+ (Sustainable Smart Specialisation Strategies for Inclusive Growth), highlighting sustainability and inclusiveness in smart specialisation strategies and the EDP process (Capello & Kroll, 2016; McCann & Soete, 2020). As McCann and Soete (2020) have been said: ‘The purpose is no longer the change in itself but ensuring a more sustainable development path within a global
perspective, contributing e.g. to the UN Sustainable Development Goals’ (McCann & Soete, 2020, 10). Therefore, the future focus is increasingly on effective governance of the EDP process. This study focuses on the era of S3 but has implications to S4+ when pinpointing critical guidance factors in the self-organisation process of smart specialisation regional implementation.

In this study, project, actors and actions that implement smart specialisation development are interpreted as complex adaptive systems (CAS), a holistic entity that is simultaneously unpredictable and co-evolutive and has elements of non-linearity (Lundström & Mäenpää, 2017). CAS actors are self-organising and follow guidance from the European Commission as well as regional institutions and organisations (Foray et al., 2012).

Previous research demonstrates that the implementation of smart specialisation (S3) at the regional level faces many challenges in governance (e.g. Kroll, 2015; Sörvik et al., 2019; Trippel et al., 2020). Resources and institutional structures vary between regions (e.g. Lundström & Mäenpää, 2017; Mäenpää & Lundström, 2018; Sörvik et al., 2019). There is no previous knowledge about regional conditions from the point of view of participants as CAS in smart specialisation processes, nor information about how they communicate and the challenges they face during the process of self-organisation (e.g. Ghinoi et al., 2020; Sörvik et al., 2019). According to Uyarra (2021), the focus of smart specialisation research should be increasingly on complexity and its variations. Esparza Masana (2021) raised a critical question about the process of transition from S3 to S4 by asking how such transition can be possible when there is little empirical evidence concerning smart specialisation in diverse regions. This study provides novel ways of understanding regional dimensions during S3 through guidance of self-organisation into complex adaptive systems.

Smart specialisation strategies guide regions to collaborate horizontally with various stakeholders, including the government, research organisations, the private sector and civil society, to create an inclusive process of smart specialisation (Perianez-Forte et al., 2020). However, vertical guidance in terms of strategies, recommendations of the European Commission and horizontal guidance for governance structures and practices all affect the implementation of smart specialisation in European regions (Ghinoi et al., 2020; Guzzo & Gianelle, 2021; Mäenpää & Lundström, 2018). Horizontal guidance emphasises cooperative capacity among regional actors, along with the capacity of institutions and their endowments, to implement the process of smart specialisation (Karo & Kattel, 2015; Wang et al., 2017). By considering smart specialisation implementation, it is possible to reach beyond the relationships of institutions and cooperation between regional actors by using the concept of guidance.

There are previous data on what challenges regions face, particularly in terms of their development status (e.g. Capello & Kroll, 2016). It has also been mentioned that coordination of activities is important in S3 and S4+ governance (Guzzo & Gianelle, 2021; Sörvik et al., 2019) According to Uhl-Bien and Arena (2017), the process of self-organisation and adaptation is a key factor for understanding regional innovativeness and learning. Therefore, factors that constrain or enable the emergence of self-organisation should be studied to determine solutions to problems on a regional level. When there is an understanding of the outcome of emergence and self-organisation, the
processes of guidance can support specific regional needs and enhance change at a systemic level, as well as the transfer of good practices, particularly in sustainability-oriented smart specialisation (S4+).

This article focuses on the guidance of self-organisation into smart specialisation in Finland’s Lapland region and complements the current research of the need for understanding self-organisation of implementation practices and aims to answer the following research questions: ‘How do actors in regional project self-organise within CAS to achieve the goals of smart specialisation?’ ‘What factors enables and restricts guided self-organisation in CAS?’ and ‘What is the outcome of the emergence of guided activities in a regional smart specialisation project?’ With this knowledge, proper guidance can foster a more effective implementation of smart specialisation.

2. Implementing smart specialisation

Strategies for Smart Specialisation (S3) has guided regions to develop diverse regional strength and economic development through research and innovation processes almost a decade. The concept of S3 has emphasised relationships between various public organisations, research institutions and stakeholders. There have been dynamics changes in the 2021–2027 programming period, which emphasises sustainability from both environmental and social perspectives (S4+). To rearrange practices and priorities, transition is dependent on regional settings and developed based on diverse situations (McCann & Soete, 2020).

The organisation and results on smart specialisation differ. Although smart specialisation has been criticised for having a restrictive and narrow impact on regional policy (Kroll, 2015; McCann & Ortega-Argilés, 2015; McCann & Soete, 2020), regions have arranged successful governance systems according to its guidance (e.g. Trippl et al., 2020). Smart specialisation is encouraged to be implemented through specialised and innovation-based clusters in collaboration with various stakeholders (Foray et al., 2012; Foray & Goenaga, 2013). Despite encouragement, cluster-building in many regions is accomplished successfully through public interventions (Perianez-Forte et al., 2020, 2016). However, because actions are mainly based on public interventions, there are public institutions guiding implementation of smart specialisation in collaborative, complex and adaptive processes. Institutional change and greater relational infrastructure are as key elements in increasing regional innovation potential (Ghinoi et al., 2020; Marques & Morgan, 2018; Sörvik et al., 2019), but institutional change is also dependent on stakeholders and a regional vision of the future in smart specialisation-related development.

Regions have reorganised activities based on specific regional structure, but there are many obstacles between policy and practice and a lack of information concerning barriers and complexity of guidance (Gianelle et al., 2020). Challenges in implementation have appeared in governance processes – in many regions there is lack of critical mass and creativity as well as poor absorptive capacity (Capello & Kroll, 2016). These insufficient resources affect to the organisation of regional complex systems. According to Capello and Kroll (2016), ‘in regions where a smart specialisation approach could in theory be perfectly viable and productive, barriers and complexity at the level of the local policy and governance system may keep the agenda from being consequently transferred
into effective policy programmes’. Ideally, innovation-based clusters and EDP process work without public interventions, but regions are balancing activities between public and private organisations by self-organisation (Capello & Kroll, 2016; Perianez-Forte et al., 2016). For example, lack of multi-professional actors has caused difficulties in balancing activities (Kroll, 2015). Additionally, understanding of the concept of smart specialisation in a regional context has been a challenge (Kroll, 2015). This contributes directly to the need to understand reasons for this and reflects the adaptivity and complexity of the system.

International comparison (Tripl et al., 2020) has found out that smart specialisation-related guidance has changed regional practises such as routines and top-down emphasis of development. Regions have identified new competencies such as new domains and capacity of actors. Additionally, coordination in internalisation have been identified (Ghinoi et al., 2020; Henderson & Roche, 2020). However, issues related to the bottom-up approach, especially in sparsely populated areas, have had less attention (McCann & Soete, 2020; Sørvik et al., 2019). Ongoing transition from S3 to S4+ challenges regions through its ability to be sustained. According to Tripl et al. (2020), European regions, despite the status of development, have various problems regarding stakeholder involvement. There is a need for a larger variety of stakeholders and allocation of resources or goals and understanding of which guided factors cause stakeholder involvement as an emergence.

There have also been obstacles in organising activities on regional levels (Kroll, 2015). For example, the EDP process has been seen as an unsupportive of traditional entrepreneurs (Balland et al., 2019; Mieszkowski et al., 2016) and therefore ignores several stakeholders and narrows the development of implementation activities along with the creation of system-level innovation in each region (Asheim et al., 2016). For better implementation results, Iacobucci (2014) suggests a consultation process to increase efficacy and inclusiveness and decrease conflicts between bottom-up practices and regional strategies (Kroll, 2015). From the perspective of guidance, the consultation process focuses more on direct guidelines and, therefore, control the system of self-organisation. Furthermore, bottom-up consultation process and RIS3 guidelines have been nonetheless performed, especially in less developed regions, but coordination is unclear (Guzzo & Gianelle, 2021; Kroll, 2015).

Guzzo and Gianelle (2021) identifies the importance of coordination to have more synergy in the complex policy context of Smart Specialisation where different multi-level actors and arenas are involved. Coordination is needed horizontally from the perspective of strategy implementation, inter-government actions and requires clear mandate as well as resources. Vertical coordination contributes to the interests of all relevant stakeholders, ensure effective implementation and coherence across different territorial levels and avoid duplications, restricts and the deployment of contradictory measures, while promoting synergies (Guzzo & Gianelle, 2021).

However, although there is previous research concerning organisation in smart specialisation activities, there is less research on how organisation can be interpreted as CAS and the role of guidance. There are also lack of research on guidance as a concept of self-organisation especially in various practical contexts (Gershenson & Raul Espejo, 2015). More knowledge is necessary on how and under which conditions smart specialisation is implemented in complex adaptive systems and what outcomes of guided factors may have (Gianelle et al., 2020), particularly in sparsely populated areas where
there has traditionally been a lack of multi-sector collaboration in governance. When implementing sustainability factors during S4+, the role of guidance in implementation of activities can lead more effective outcomes of emergence.

3. Complex adaptive systems (CAS)

3.1. Defining CAS

CAS theory has its deep roots in complexity science, starting with systems theories (Von Bertalanffy, 1967, 1972, 1975) and the cybernetics theory of Norbert Wiener (1948, 1950), which has led to various theories of complexity. Numerous researchers have contributed to the broad interdisciplinary field of complexity science (Maguire et al., 2006). Historically, complexity science can be divided into two increasingly overlapping approaches: the European School of Complexity (e.g. Prigogine, Haken, Allen, Nicolis, Cramer and Mainzer) and the North American School (e.g. Mandelbrot, Lorenz, Anderson, Kauffman, Kaye, Holland, Arthur, Wolfram, Casti and Bak and Rittel and Webber; Maguire et al., 2006). According to Lichtenstein (2016), Anderson (1999) contributed to introducing complexity science into organisational science. Complexity theories, and in the focus of this study, CAS theory, have been investigated in several research fields, such as organisation and management, public policy, health, communications and engineering (Maguire et al., 2006; Poutanen et al., 2016). Research into complexity theory has increasingly moved from the models of natural sciences to social organisations to investigate human behaviour as different forms of CAS (e.g. Poutanen et al., 2016). Social organisations that can be studied in this way include teams, firms, communities and various other groups of people (Carlisle & McMillan, 2006) at different societal levels.

Holland (1995) defined CAS as ‘systems composed of interacting agents described in terms of rules. These agents adapt by changing their rules as experience accumulates. In CAS, a major part of the environment of any given adaptive agent consists of other adaptive agents, so that a portion of any agent’s efforts at adaptation is spent adapting to other adaptive agents’ (p. 10). The agents’ interaction with their own rules is the key issue in CAS (e.g. Stacey & Mowles, 2016), but at the same time it can be guided, such as in the EU’s guidance for smart specialisation. Thus, both spontaneous and guided self-organisation are focused on in this study.

During recent decades, CAS theory has transitioned to more precise definitions of the main concepts – emergence and self-organisation – through mathematical models and computational searches of causal relations. In the literature, it has been stated that it is a challenge to define and apply CAS unambiguously. This mostly stems from the lack of proper definitions of CAS, emergence and self-organisation, despite efforts to identify these. There are numerous theoretical lists of how to describe CAS, such as the general model of features of feedback, emergent properties and self-organisation, as well as non-linear dynamic behaviour (Carmichael & Hadžikadić, 2019).

According to CAS theory, organisations are understood to be adaptable, dynamic and open systems within individual, group, organisational or wider economic, social and political environments (Carlisle & McMillan, 2006). Organisations differ in their structures, scales and agents; but regardless, they can be described with features of CAS. The
boundaries of organisations and their environments are spontaneously formed and flexible. This enables the creation of various cooperative relationships with a wide range of actors.

Smart specialisation itself, as well as the regions that implement it, has features of CAS theory (Lundström & Mäenpää, 2017). Physically, regional locations are quite stable, but the way they interact and cooperate is partly formed through their unpredictable relationships and actions. The EU guides them through targets and goals, but more practically, self-organised guidance for cooperation is needed for local actors in smart specialisation. Combined EU and self-organised guidance provide space for novel types of cooperation that permit innovative actions in economic, social and regional development. CAS theory and smart specialisation build a compatible research framework for investigating self-organisation and the outcomes of emergence.

3.2. Emergence as a result of guided self-organisation

Self-organisation as an emergent reaction refers to bottom-up interactions based on local rules for local actors. This kind of non-linear and spontaneous action leads to emergence, but it is also engaged in a process of constant renewal (Stacey, 2003, pp. 238–241). The system is not stable; rather, it is continuously reforming through self-organisation (Stacey, 2003). Uhl-Bien et al. (2008) described emergence in CAS as a qualitative reformulation of elements based on self-organisation. Emergence does not always refer to new innovations or products but also to new ideas or habits in social systems (Uhl-Bien et al., 2008). Emergence can be seen as a result of hybrid networks not only among humans, but also technologies, and is constructed as a result of bottom-up actions and adaptations to environmental changes (Poutanen et al., 2016).

Fundamentally, the focus of self-organisation is to find internal order for a system without external guidance as a command or constraint, but it does not mean that regional actors are devoid of constraints and enablers of the specific conditions of local interactions between them (Stacey & Mowles, 2016). According to (Goldstein, 2008, p. 80) organisations are open systems and have the capacity for self-organisation, albeit with certain preconditions such as the flow of resources, energy and information. These resources should go through the system and boundaries to enhance the construction of self-organisation. However, some internal and external factors, such as environmental factors or administrative controls might limit self-organisation (Marion, 2008). Self-organisation can be understood as a reflection of the needs of the environment (Poutanen et al., 2016). This interpretation refers to guidance, particularly in smart specialisation implementation, whereby the need for political direction is crucial.

However, guidance has become a part of the academic discussion of self-organisation. Gershenson and Raul Espejo (2015) referred to guidance as steering self-organisation relative to its desired goals or specifying or limiting the dynamics of the system (Prokopenko, 2009). Ay et al. (2012) illustrated guidance through the actions of ants, which normally self-organise and act without external guidance. Nonetheless, they do so to reach a goal, and that goal and its variations are seen to guide actions in particular ways. Goal-specific self-organisation focuses on the design and control of the system. Guidance thus reduces or increases the constraints of self-organisation, and in this way, it is also possible to reduce organisational tensions. Guidance influences the diversity and
interconnectedness of actors (network construction, operation and development), allowing self-organisation to freely develop (Gershenson, 2012). It can also develop interaction towards two-way dialogue and narrow the complexity gap by increasing activity between two or more organisations (Schneider et al., 2017). Guidance, therefore, means not affecting an actor’s way of acting, but rather only affecting the operating environments wherein actors work by increasing or decreasing restrictions on self-organisation (Ay et al., 2012).

Guidance in this research is primarily defined in terms of smart specialisation strategical guidance (Regulation EU No 1301/2013). The EU set smart specialisation strategies as a precondition for European Regional Development Fund awards in the 2014–2020 programming period, guiding regions to develop strategies based on their own strengths. In the Finnish case, regional councils have had a major role in coordinating smart specialisation from the beginning (Kangas & Aarrevaara, 2020; Perianez-Forte et al., 2020), but implementation practices are mainly based on the strategic guidance of smart specialisation and coordination of thematic focus areas (e.g. Perianez-Forte et al., 2020). Smart specialisation in selected area is implemented at the regional level, and regions have a responsibility to answer to political demands. Secondly, guided self-organisation is defined as the response of regional actors to political guidance about the EU’s smart specialisation programme (Foray et al., 2012; McCann & Soete, 2020). Guided self-organisation, therefore, is connected to restrictions and enablers of regional actions in implementation. Regional actors have been self-organised based on the ASE project from different organisations. Every organisation has different starting points, as well as strategical development, which guides implementation. Therefore, guidance is understood as guidance of smart specialisation strategy and cooperation of partner organisations on smart specialisation implementation projects. In this study, emergence is understood as a result of spontaneous and guided self-organisation in selected project.

4. Methodology

4.1. Smart specialisation in Lapland

Lapland, the northernmost region of Finland, is sparsely populated with fewer than 180,000 residents (density 1.8/km²). The region has long been home to different industries including mining, metals, forestry and the bioeconomy. Lapland is a unique target because of its institutional thinness and absence of big cities and companies and regional stakeholders’ capacity for cooperation (Ghinoi et al., 2020). Focusing on smart specialisation implementation as a CAS in a peripheral Northern European region, this paper provides insight into the development process of S3 and S4+ implementation by analysing guidance in a regional context.

Lapland has been the target of a few previous studies (e.g. Ghinoi et al., 2020; Kangas & Aarrevaara, 2020; Sörvik et al., 2019) that give insight into issues related to the process of self-organisation in governance practices and provide mechanisms for smart specialisation implementation processes. There is little research from a regional perspective, for example, about how self-organisation mechanisms, especially in co-creative systems, connect to institutional structures and how governance arrangements and alignments
could achieve companies’ needs more effectively (Ghinoi et al., 2020.) By researching guided self-organisation at a regional level, more information can be used for implementation practices, especially in sparsely populated areas.

Smart specialisation development began in Lapland in 2013, following which its regional strengths have been analysed by the regional council, leading to the establishment of five clusters in 2015. Clusters are key thematic focus areas of regional smart specialisation and key factors for the development of the smart specialisation strategy. Arctic Smartness Excellence (ASE), which was the third official smart specialisation implementation project for Lapland during 2016 and 2018, was investigated for this research. Its key focus was to connect all the relevant, mostly public actors to find synergies for cluster development, as well as innovative ideas for project proposals and the potential for internationalisation (Heikka et al., 2013).

### 4.2. Data

Data for this study were gathered through interviews between 2016 and 2020, while cluster strategies from 2015 complement the interview data. The interviews were conducted in two parts and the roles of the interviewees, who worked on smart specialisation-related projects and clusters, their organisations and the roles of the smart specialisation-related projects, are presented in Table 1.

The first portion of the interview process was conducted during the ASE project. Participants in this process were higher education institutions, regional councils, research organisations and development centres in Lapland. Regional councils included the Regional Council of Lapland, which is responsible for smart specialisation strategy development in Lapland (works also as an actor in selected project) and the Centre for Economic Development, Transport and the Environment, which is primarily responsible for collaboration between entrepreneurs. Development centres refer to organisations that work in close collaboration with entrepreneurs from various industries (in industry and the circular economy). Originally, the data were gathered for the developmental evaluation of the ASE project, when 20 interviews were conducted (2016–2018). During the spring of 2020, these interviews were supplemented by three further interviews with similar questions. The interviewees of this set of interviews were from the University of Lapland (same as in

| N    | Organisation                                         | Role                                                                 |
|------|------------------------------------------------------|----------------------------------------------------------------------|
| 4    | Regional councils of Lapland                         | Connections to S3 platforms, internationalisation activities, role as a funding authority in ERDF funding instrument |
| 4    | University of Lapland                                | Project management, coordination of Arctic Design cluster             |
| 5    | Lapland University of Applied Sciences               | Coordination of Arctic Safety and Arctic Development Environments clusters |
| 3    | Centre for Economic Development, Transport and the Environment | Funding authority, regional development organisation                  |
| 2    | Rural Advisory Services                              | Coordination of Arctic Rural Network cluster, collaboration with entrepreneurs |
| 2    | Development centres                                  | Coordination of Arctic Industry and Circular Economy, collaboration with entrepreneurs |
| 3    | Representatives of enterprises                       | Organisation of entrepreneurs and companies collaborating in cluster activities |
| 5    | Cluster strategies                                   | Starting points of cluster development and their role in regional and international innovation system development |
2016–2018) and two from Lapland University of Applied Sciences (one new and one the same as those conducted during 2016–2018). Interviewees in 2020 were selected to gain insight into the current state of smart specialisation implementation in Lapland. These persons have worked with development of smart specialisation tightly after the ASE project and had expertise on current projects and the status of cluster development as well as future plans for collaboration. A total of 23 interviews were conducted in Finnish and translated by the authors. The results can be applied on a case-by-case basis in other areas, for example, in sparsely populated areas with similarities in governance structure.

There are now six clusters in Lapland, namely the Arctic Industry and Circular Economy, Arctic Smart Rural Communities, Arctic Development Environments, Arctic Design, Arctic Safety and Smart and Sustainable Arctic Tourism clusters. The Sustainable Arctic Tourism cluster is not represented in the data of this study because it began as an official cluster after the ASE project.

4.3. Methods

The method utilised in this research is based on a qualitative research methodology, with constructivism as a background theory. In constructivism, knowledge is created by researchers, who interpret the views of the objects of the research (Flick, 2004, pp. 90–93). This research pursued an understanding of the attribution of meanings in social reality (Flick et al., 2004, pp. 6–7).

Data for this study were analysed using theory-driven content analysis. This means that, in the context of this study, the main concepts of CAS theory – self-organisation, guided self-organisation and emergence – guided the classification of the data into the main categories. Audio data from the recorded interviews were analysed with NVivo 12 software using analytical codes.

At the beginning of the analysis, the audio files were carefully listened to without coding to provide a general understanding of the contents of the data. Code analysis began during the second listening round. Original expressions were written down using interpretation to shorten the original expressions, and sentences were coded in the audio file. Reduced impressions were classified into abstracted subcategories to interpret similarities in the data. Furthermore, the upper categories were formulated by combining subcategories (Schreier, 2014, pp. 180–190). In the main category phase, the upper categories were combined with the main theoretical concepts. All expressions of analytical codes were listened to multiple times to ensure the consistency of the categories. The benefit of the audio files compared to transcript data is that it was possible to return to original expressions and revise them (Kowal & O’Connell, 2014, p. 66). Returning between the original expressions, categories and theoretical concepts abductively confirmed the results of analysis.

5. Research findings

5.1. Enablers and constraints of self-organisation in the regional CAS

Enablers and constraints of self-organisation refers to the models of actions and roles. The main function of the implementation of smart specialisation has been to connect public authorities and organisations, as well as companies, and create a common governance
structure for the region. The self-organisation has the specific conditions of local interactions between the actors. As an enabler, common development has focused on the construction of communications, strengths and knowledge. In the self-organisation process, organisations have prepared for wider regional development by strengthening networks and concentrating on the capabilities and benefits of collaboration. These collaborations have led to, for example, the development of joint public projects and each respective operator getting to know each other. Table 2 depicts the results of this study by providing an overview of the context, construction of the smart specialisation and the emergence of actions.

Implementation included principals from each partner organisation and the funding agency of the project. In the beginning, each partner conceived of smart specialisation in different ways, and it took a considerable amount of time before the formulation of a common understanding of the goals of the project was achieved. Initially, each organisation was strategically organised according to their main tasks. After continued collaboration, as an enabler of self-organisation, a more cooperative culture emerged. Smart specialisation implementation through projects as a joint public effort has also been seen as a mandatory element because the ability to develop and implement smart specialisation on a regional level without homogenous goals would have been difficult. The quotes below reflect this:

Regional partners have come really close to each other and the logic by which the area is taken to the right forums is focused. Lapland has gained such a good international image that would not have been possible without a joint public effort.

– Representative from regional council, male

Arctic smart specialisation has led to a very conversational and interactive process based on every organisation’s key expertise. Let’s say, it has been a journey whereby all the actors have altogether learned a new approach and culture. Because of that, a joint public effort has been a necessary element.

– Representative from development organisation, male

Analysis of this study revealed that there are enables related to actors’ roles. Because of the lack of absorptive capacity there have been overlapping roles in project activities and these roles could be seen as a natural part of project work. They could increase the knowledge flow of projects and organisations if smart specialisation implementation practises were done strategically in CAS. This has emerged, for example, in project groups wherein actors have roles across several groups and a basic task in the operating organisation. These situations refer to enablers of self-organisation with the requisite flow of resources.

According to the results of the analysis, there are also restrictions related to actors’ roles and lack of guidance. Smart specialisation-related project work faces several challenges in the flow of resources. Resources from regional CAS refer to rules, knowledge and the lack of clarity of actors’ roles (Goldstein, 2008; Stacey & Mowles, 2016). Having fewer people in the region has led to overlapping or even redundant roles. Multiple overlapping roles have increased complexity, which arose particularly in managerial situations, work organisation and when results were reported. Additionally, multiple overlapping roles within a project, which made it seem like the core roles had not been identified, caused a lack of organisation among the actors. The following quotes reflect the overlaps:
Table 2. Main goals of the data analysis.

| Reduced impressions (examples)                                                                 | Subcategories                                                                 | Upper categories                                                                                                                                  | Theory-based main class                                                                                                               |
|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Development is mainly constructed of networks of public organisations and public funding entity | Multiple actors and roles                                                      | Models of actions and roles and in smart specialisation related implementation project                                                            | Constraints and enablers of self-organisation in the regional CAS                                                                       |
| Internationalisation and regional network model                                                 | Network model between public organisations                                     |                                                                                                                                                    | Restrictive guidance of public institutions                                                                                           |
| Diversity of roles of the actors                                                              | More collaborative culture                                                    |                                                                                                                                                    |                                                                                                                                        |
| Simultaneous changes in organisations                                                         | Lack of common goals                                                          |                                                                                                                                                    |                                                                                                                                        |
| Project work without clear focus on joint goals                                               | Individuals and institutions change potential                                  |                                                                                                                                                    |                                                                                                                                        |
| Actions are dependent on institutional autonomy                                               | Strategy to develop actions                                                    |                                                                                                                                                    |                                                                                                                                        |
| Capacity to change is not realistic if actors are just fulfilling their own interests          | Institutional autonomy                                                        |                                                                                                                                                    |                                                                                                                                        |
| Lack of companies                                                                              | Local level existing structures and strategies                                 | Utilisation of EU-level and regional policy priorities                                                                                             | Achieving guided political goals at local and international development                                                             |
| Previous regional contracts and strategies as a basis for development                          | EU-level priorities and development potential                                   |                                                                                                                                                    |                                                                                                                                        |
| Foresight information of region                                                               |                                                                                 |                                                                                                                                                    |                                                                                                                                        |
| Utilisation of EU-level priorities                                                            |                                                                                 |                                                                                                                                                    |                                                                                                                                        |
| Finding EU-level synergies                                                                    |                                                                                 |                                                                                                                                                    |                                                                                                                                        |
| Construction of image                                                                         |                                                                                 |                                                                                                                                                    |                                                                                                                                        |
| Direct connections to S3 platforms                                                            | Emerging possibilities on EU level                                           | Multi-level network activity                                                                                                                     | Multi-level actions and challenges as an outcome of emergence                                                                       |
| Preparation and experiment of international funding proposals                                 | International capacity building in networks                                     |                                                                                                                                                    |                                                                                                                                        |
| Networking and recognition of value chains                                                    | Diversification of goals                                                      |                                                                                                                                                    |                                                                                                                                        |
| Enhanced collaboration between public actors                                                  |                                                                                 |                                                                                                                                                    |                                                                                                                                        |
| Entity of funding proposals is not clear                                                      |                                                                                 |                                                                                                                                                    |                                                                                                                                        |
Actions in different groups or roles are not so systematic all the time. Different groups, however, have their responsibilities and issues they contribute to. There is no problem with mixing roles if people act based on their organisational mandate.

– Representative from educational organisation, female

When the project is unclearly planned, it is also unclearly managed, and actors themselves do not know what their role is and what requirements they should meet. Systematization and organisation are lacking when the role is not identified.

– Representative from entrepreneurs, male

The roles of companies as operators in smart specialisation-related project have caused restrictions in CAS. Although the number of companies were strategically defined, their roles were still limited. Furthermore, the ability of companies to profit from their actions was limited because the knowledge base of the programme, implementation and actions would vary. Additionally, the situation varied among actors with long traditions of collaboration that would naturally operate within the corporate sector. Although smart specialisation policy emphasises the role of regional companies in implementation, companies within organisations’ networks would not usually participate in decision-making or implementation process of a project or the development of regional smart specialisation implementation practices. Furthermore, the role, aim and future direction of companies’ collaboration were unclear and partly overlapped with other regional industry clusters that were different from smart specialisation-based clusters.

5.2. Role of guidance in self-organisation

5.2.1. Restrictive guidance of public institutions

Regional changes are dependent on two main factors: institutional ability with autonomy for change and the current situation of simultaneous changes in organisations. They can be considered as guidance factors constraining self-organisation. The actors did not have the autonomy to take individual actions because such decisions were made from the perspective of institutions or general abilities, as well as the regional funding agency for the project. Institutions also gave mandates to actors to move towards fulfilling the goals of the smart specialisation project. However, the goals of the project did not necessarily have measurable indicators, and they did not create a common basis for joint development:

It should be clear what the focus of the actions is and why you are participating in it. Did you get what you were pursuing? Did you, for example, end up as an international project consortium? There is a need for clear monitoring indicators, especially when a lot of money moves through these actions.

– Representative of regional authority, female

Project objectives should be clearly measurable and monitored. It is not enough to aim to introduce networking at certain events, but to be more concrete in order to develop cooperation at the regional level.

– Representative of regional authority 2, female
There were multiple simultaneous organisational reforms taking place at the same time as the project. Many organisations were facing difficulties, which correlated directly with the implementation of smart specialisation, and this emerged through uncertainty of commitment to the regional development activities. By contrast, difficult times can provide an opportunity to demonstrate the importance of an organisation to regional development in general, and this was a factor that interviewees raised as a possibility. It is significant for the strategy of smart specialisation to also support the strategy of organisations in the societal context. Generally, the ability to change is dependent on the entirety and results of actions across a wider perspective.

Institutional autonomy to act was present in many decisions. The stage of implementation was dependent on the level of autonomy that organisations handed to individuals. The results of the institutional guidance revealed that this was also problematic because by acting in the confines of a smart specialisation project, individuals needed to disentangle from their roles at their home organisations and required the ability and mandate to create a regional-level collaboration model. Dissenting opinions from operational management might restrict the achievements of policy goals:

What kind of opportunity do the managers of organisations give, especially in organisations where the head office decides on the commitment of the regional actors even though it is located outside of the region?

- Representative of development organisation, male

The challenge is that everyone always goes to the activity on the agenda of their own organisation; when an action becomes common is still uncertain. For the activity to be sustainable in the future, the management of each organisation should commit to giving individuals the freedom to do the necessary things without having to play many roles within their own organisations.

- Representative of development organisation 2, male

Change in region is not possible if actors adhere strictly to the interests of their own organisations. However, regional actions cannot be separated from national actions, and sometimes actions differ at various geographic levels. Project-led implementation of smart specialisation is dependent on the guidance of financial instruments and diversely funded projects. The results of the guidance of institutional factors indicates that even though participants had achieved new regional and international funding and numerous goals had been achieved, the strategies of partnerships were unclear. This issue is connected to the effectiveness of the implementation of the regional smart specialisation strategy.

5.2.2. Achieving guided political goals for local and international development

Actions related to a regional smart specialisation project are constructed through two main pathways: first, using existing structures, and second, through the guidance of the EU’s policy priorities. The results indicated that previous regional contracts and foresight towards the future challenges of the region had been constructed as the basis of knowledge for smart specialisation. Actions were also constructed by using EU’s priorities, which had been gathered through peer review processes, monitoring and evaluation from different regions.
Regional-level development and international activities had been developed together, but there were multiple issues concerning the direction of those activities. Guidance on implementation came not only from the EU level, but also from the national and regional levels, and results were divided into two main focuses: local and international development. Local development is based on a consensus of the expertise of local actors and results of the reflective creation of common competence. Local-level development refers to the construction of a network model inside a region. That means connections, trust and developing competences inside the region to fulfil the guided international demands of funding instruments and platforms. Collaboration is regarded as being central for international development and a thematic smart specialisation entity.

International activities are constructed in two ways. First, smart specialisation continuously reflects the EU’s guided policy development and finding synergies for regional development. Additionally, developing organisations in regions have a long tradition of belonging to international networks. Second, international activities are based on the creation of an image of smart specialisation in the region, and that image is a key factor in the construction of smart specialisation. To achieve internationalisation goals, it is important to understand the operational environment and regulation of the EU in terms of smart specialisation, collaborations and funding, as the following quotes indicate:

There are alliances done like this in smart specialisation and key themes and status of the themes, be they sparse populations or being in the Arctic, etc., and the importance of these has [been] raised in the EU. It is absolutely the best thing to be done in the construction of smart specialisation in Lapland.

– Representative of development organisation, female

In general, these Lapland organisations, which used to compete for EU funding, now meet their needs together. Competing together for large EU funding is downright ingenious and promotes an understanding of how to act at EU level.

– Representative of entrepreneurs, female

The results demonstrate the guidance of political factors, in that actions in terms of regional and international levels do not seem to fully intersect. International activities need a strong model for collaboration at the regional level, and international marketing should be based on the strengths of the region. Although the construction of a smart specialisation is guided from the regional and international levels, national guidance has been minimal in the Finnish case. Political guidance was based on strategic alignments and the broader vision of the goals. Criticism concerned the lack of clarity about the entity. Furthermore, concepts of understanding smart specialisation goals varied between actors. These issues were strongly connected to the coordination system of regional smart specialisation, as the following quotes indicate:

There has been a lot of networking between project actors—there were about a hundred project initiatives, but when you consider that there are a hundred project initiatives in a project of this size [ASE] and in an area of this size, you might want to ask if the entity is under anyone’s control.

– Representative of entrepreneurs, male
A major challenge for smart specialisation activities is that the region of Lapland lacks mandates for the coordination of businesses and innovation activities, in which case the systematic nature of activities suffers.

– Representative of higher education institution, male

The research findings point to overlapping project goals; however, a main goal and clear time frame were missing from the activities. Furthermore, concepts of understanding smart specialisation goals varied. This caused problems for the management of activities and made monitoring capacity-building difficult. In addition, the monitoring of smart specialisation was decentralised to the regions in Finland. The absence of a national control or monitoring system has led to the responsibility for implementation of smart specialisation and its contents and methods being moved to the regional level. This means that regions can decide on the distribution of targeted funds, and they are independent of the defining goals of smart specialisation. From a national perspective, this is also challenging because guidance might increase competition between other regions in smart specialisation-led activities, although the fundamental idea was to increase regional and, simultaneously, national competitiveness.

5.2.3. Multi-level actions and challenges as an outcome of emergence

The outcomes of emergence are divided into two main categories that refer to positive connections in multi-level actions and networks as well as challenges in realisation of activities. The success of the emergence of international activities refers to networks in the EU, programme preparations, funding opportunities and knowledge transfer. EU-level operations have increased the number of actors as well as the effectiveness of regions and the benefits to them. Effectiveness as a regional factor has increased, for example, connectivity to thematic platforms. The major impacts of actions have created international activities, EU-level actions and an increase in international competence, which refers to the ability to act within an international network and secure international funding such as Horizon 2020.

As a result, we expect international RDI readiness to be increased in our region. European Union funding moves more and more to projects funded directly by the EU, and we think this project has increased competences to achieve this competed funding.

– Representative of funding authority, male

Lapland has found people who are familiar with these EU policies and been able to take advantage of them, which is valid in different financial patterns. These issues related to knowledge transfer and synergies have been achieved by regional actors implementing smart specialisation.

– Representative of development organisation, female

International network abilities have increased the identification of value chains and competences of regional actors as well as knowledge transfer. Additionally, regional-level visibility has emphasised Lapland’s role as a permanent and credible participant in programme-planning in the EU. Collaboration has transcended interfaces and surprising
new opportunities have been found outside the core functions of the organisation. It seems that a regional consensus on smart specialisation has been formed around innovation activities.

Project activities have also revealed the needs of companies and strengthened the emergence of new interfaces in multi-sectoral collaboration. Although smart specialisation activities are mostly led by public organisations, collaboration between them has resulted in the emergence of new contacts and interfaces in project work as a necessary part of product development that had previously been unknown. This has made visible the innovative interfaces outside organisations’ core actions.

However, challenges have emerged that have caused the diversification of smart specialisation-related goals on the European and regional levels. This means that actions made at the regional level should be more in line with European-level good practices. For example, in cluster development, this narrows the gap between activities and policies. However, it is unclear how submitted projects and project actions will be realised. Problems of emergence are connected to lack of coordination of smart specialisation entities and various understandings of the desired results. For example, as a result of smart specialisation, few new businesses have emerged in Lapland.

The need would be to increase more skills to act in different roles within a broad consortium. Networking has taken this direction in this project, but it should be more in line with international activities. If we focus only on mutual cooperation, then it can seem very small. More good practices etc. should be utilised in a more strategic line of regional and international activities.

- Representative of development organisation, male

When it comes to hundreds of [smart specialisation] actors around the world, how are the benefits targeted here in our region? Is it the case that there are small groups that benefit from it? How will the benefits be brought to the region for the benefit of local actors? It is difficult to implement this without coordination.

- Representative of entrepreneurs, male

The actions mentioned above have been under development for almost a decade, and the strategy and goals have been modified to meet the needs of regional and political guidance. Future steps include inter-regional and international planning and development for cluster-building, rather than there being only a regional focus. However, while actions are project-based, most of the decisions and actions are made without external coordination and understanding of the project entity.

6. Discussion

CAS is constructed regionally through different project groups, actors, roles and institutions. It is also highly adaptive and transformative. The actors self-organise in such a way that the operating environment is influenced by multiple means of guidance. Methods of self-organisation can also vary, and the same thing can be done in different ways (e.g. internationalisation and international image of a region). Actions in CAS have mainly been done by public interventions. However, results of this study show that guidance of public institutions restrict the implementation of smart specialisation by at the same time
guidance restricts self-organisation by limiting actors’ ability to implement tasks and their ability to change is limited. Role of public institutions in smart specialisation processes is emphasised (e.g. Trippl et al., 2020), but their multidirectional role of guidance seems to have restrictive impact on smart specialisation implementation and organisation in CAS.

Political guidance seemingly enables social connectivity and therefore restricts regional diversity (Ay et al., 2012; Trippl et al., 2020). Funding applications and regional networks guide actors not only by affecting the operational environment but also enhancing actors’ ability to network and skip boundaries between institutions. Sörvik et al. (2019) and Kroll (2015) emphasised the coordination of programmes and strategies for smart specialisation actions especially in sparsely populated areas. According to the results of this study, there is also a need for guidance in the use of results of implementation projects. More guidance of self-organisation could instead target the realisation of actions – how to have an optimal operating environment for the effective use of the results. The EU loosely guides the outcomes of self-organisation because specified goals limit the dynamics of the system (Gershenson & Raul Espejo, 2015; Prokopenko, 2009).

In the results of this study, it seems that multiple funding proposals have been produced for collaborative process. Instead of findings that smart specialisation have narrowed use of cohesion funds (Kroll, 2015; McCann & Ortega-Argilés, 2015), during the ASE project, cohesion funds and other funding instruments have been successfully used during the project. Therefore, guidance of self-organisation could be targeted more of the focus of smart specialisation at the regional and national levels. This could increase the effectiveness of smart specialisation-related projects. Unclarities of the focus of policy are identified also in previous studies (e.g. Trippl et al., 2020) and despite previous results, guided factors have increased unclarities in finding focus in innovation practices nor in favour of certain domain.

According to Marques and Morgan (2018) and Sörvik et al. (2019), higher innovation potential in sparsely and less-developed regions needs to be fostered through institutional change, and it increases in relational infrastructure. This research indicates that there is a lack of legitimacy of actors to achieve such goals because of institutional guidance and institutional roles. Institutions must be aware of the results beforehand, but project-based development of smart specialisation is unpredictable. Therefore, multi-level governance should also be coordinated (Kangas & Aarrevaara, 2020), and tighter guidance should come from examples to ensure institutional capacity and legitimacy in smart specialisation. This result reveals complexity of the concept of smart specialisation and emphasise the importance of the knowledge of innovation system (Kroll, 2015). Additionally, there appears to be a lack of knowledge concerning the basic, unpredictable nature of CAS itself in smart specialisation implementation.

In the institutional guidance of self-organisation, attention should be paid to the level of guidance and different aspects of involvement. Gianelle et al. (2020) have emphasised collaboration and co-creation between actors in smart specialisation. One result of this study is that guidance from public organisations limits companies’ ability to join the governance model or profit from its results. According to Gershenson and Raul Espejo (2015), guidance affects the dynamics of complex systems. The interpretations of Gershenson and Raul Espejo (2015) support the proposal of Balland et al. (2019) and
Trippl et al. (2020) that smart specialisation policy is also not seen as supporting entrepreneurs in traditional fields. The emergence of guided self-organisation is connected in Lapland more to social innovations of public organisations, at least at this point of development. To have more effective regional outcomes in wider social networks, guidance regarding self-organisation could be targeted to enable a culture of enabling companies to play more of a role in the development of smart specialisations, especially in the era of sustainability goals in smart specialisation S4+ (McCann & Soete, 2020).

However, there are several limitations to this study. First, the data include only intra-regional perspectives on guidance of self-organisation. Second, project-based development is a continuously changing process, and ongoing transition has not been able to be researched. Therefore, future actions of guidance particularly refer to the implicit guidance of self-organisation, and especially inter-regional collaboration, and more to the sustainability dimension of smart specialisation. This implies, for example, more coordination of actions regionally and nationally, along with multi-level governance and a network model of smart specialisation. Future research is also necessary on collaboration between public organisations and private enterprises and their models of collaboration as well as incentives in smart specialisation implementation projects. There is also a lack of research concerning how the legitimacy of giving recommendations for regional and national self-organisation is formed.

**Note**

1. *Structural Funds in Finland 2014–2020*, available at: https://www.rakennerahastot.fi/web/en/programme_for_sustainable_growth_and_jobs (Accessed 26 April 2021).

**Acknowledgments**

This work was supported by ProSoc research group from the University of Lapland under Grant number 22001640. Special thanks for proofreading and comments to postdoctoral researcher Antti Mäenpää, University of Vaasa, Finland.

**Disclosure statement**

No potential conflict of interest was reported by the author(s).

**Funding**

This work was supported by ProSoc research group from the Faculty of Social Sciences of the University of Lapland.

**ORCID**

Henna Riikka Kangas [http://orcid.org/0000-0002-9682-9758](http://orcid.org/0000-0002-9682-9758)
References

Anderson, P. (1999). Complexity theory and organization science. *Organization Science, 10*(3), 216–232. https://doi.org/10.1287/orsc.10.3.216.

Asheim, B., Grillititsch, M., & Tripl, M. (2016). “Smart specialization as an innovation-driven strategy for economic diversification: Examples from Scandinavian regions,” Papers in Innovation Studies 2016/23, Lund University, CIRCLE—Center for Innovation, Research and Competences in the Learning Economy.

Ay, N., Der, R., & Prokopenko, M. (2012). Guided self-organization: Perception-action loops of embodied systems. *Theory in Biosciences, 131*(3), 125–127. doi:10.1007/s12064-011-0140-1.

Balland, P.-A., Boschma, R., Crespo, J., & Rigby, D. L. (2019). Smart specialization policy in the European Union: Relatedness, knowledge complexity and regional diversification. *Regional Studies, 53*(9), 1252–1268. https://doi.org/10.1080/00343404.2018.1437900.

Capello, R., & Kroll, H. (2016). From theory to practice in smart specialization strategy: Emerging limits and possible future trajectories. *European Planning Studies, 24*(8), 1393–1406. https://doi.org/10.1080/09654313.2016.1156058.

Carlisle, Y., & McMillan, E. (2006). Innovation from organizations in a complex adaptive systems perspective. *Emergence: Complexity & Organization, 8*(1), 2–9. doi:10.17357/ emerg10.17357.120dec460fb3975905c83ef42abd3252.

Carmichael, G., & Hadžikadić, M. (2019). The fundamentals of complex adaptive systems. In T. Carmichael, A. J. Collins, & M. Hadžikadić (Eds.), *Complex adaptive systems: Views from physical, natural, and social sciences* (pp. 1–16). Springer. https://doi.org/10.1007/978-3-030-20309-2.

Esparza Masana, R. (2021). Towards smart specialisation 2.0. Main challenges when updating strategies. *Journal of the Knowledge Economy 13*, 635–655. https://doi.org/10.1007/s13132-021-00766-1.

Flick, U. (2004). Constructivism. In U. Flick, E. Von Kardorff, & I. A. Steinke (Eds.), *Companion to qualitative research* (pp. 88–94). SAGE publications Inc.

Flick, U., Von Kardorff, E., & Steinke, I. A. (2004). *What is qualitative research? An introduction to the field*. SAGE publications Inc.

Foray, D., Goddard, J., Goenaga, X., Landabaso, B. M., McCann, P., Morgan, K., Nauwelaers, C., & Ortega-Argilés, R. (2012). “Guide to research and innovation strategies for smart specialisation (RIS3)”. The European Commission.

Foray, D., & Goenaga, X. (2013). *The goals of smart specialisation*. S3 Policy Brief Series No. 01/2013, EUR 26005 EN, Publications Office of the European Union. JRC82213. https://doi.org/10.2791/20158.

Gershenson, C. (2012). Guiding the self-organization of random Boolean networks. *Theory and Bioscience, 131*(3), 181–191. doi:10.1007/s12064-011-0144-x.

Gershenson, C., & Raul Espejo, D. (2015). Requisite variety, autopoiesis, and self-organisation. *Kybernetes, 44*(6), 866–873. doi:10.1108/K-01-2015-0001.

Ghinoi, S., Steiner, B., Makkonen, T., & Hassink, R. (2020). Smart specialisation strategies on the periphery: A data-triangulation approach to governance issues and practices. *Regional Studies, 55*(3), 402–413. http://hdl.handle.net/10138/331884.

Gianelle, C., Guzzo, F., & Mieszkowski, K. (2020). Smart specialisation: What gets lost in translation from concept to practice? *Regional Studies, 54*(10), 1377–1388. https://doi.org/10.1080/00343404.2019.1607970.

Carlo Gianelle, Fabrizio Guzzo & Krzysztof Mieszkowski (2020) Smart Specialisation: what gets lost in translation from concept to practice?, Regional Studies, 54:10, 1377–1388. DOI: 10.1080/00343404.2019.1607970.

Goldstein, J. (2008). Conceptual foundations of complexity science: Development and main constructs. In M. Uhl-Bien & R. Marion (Eds.), *Complexity leadership, Part 1: Conceptual foundations*. Information Age Publishing. pp.17-48.
Guzzo, F., & Gianelle, C. (2021). Assessing smart specialisation: Governance. In EUR 30700. EN, Publications Office of the European Union. ISBN: 978-92-76-37673-6. https://doi.org/10.2760/48092, JRC123984.

Heikka, K., Jokelainen, K., & Teräs, J. (2013). Lapland Arctic specialisation program. In Regional Council of Lapland Publication series A37/2013. 978-951-924-71-6. [Authors’ translation].

Henderson, D., & Roche, N. (2020). Examining the policy mix for broadband deployment in Wales: The role of informal coordination in the last mile. Local Economy: Journal of the Local Economy Policy Unit, 35(1), 48–67. https://doi.org/10.1177/026904219883396

Holland, J. H. (1995). Hidden order: How adaptation builds complexity. Free Press.

Iacobucci, D. (2014). Designing and implementing a smart specialisation strategy at regional level: Some open questions. SCIENZE REGIONALI, FrancoAngeli Editore, 1(1), 107–126. doi:10.3280/SCRE2014-001006.

Kangas, R., & Aarrevaara, T. (2020). Higher education institutions as knowledge brokers in smart specialisation. Sustainability, 12(7), 3044. https://doi.org/10.3390/su12073044.

Karo, E., & Kattel, R. (2015). Economic development and evolving state capacities in central and Eastern Europe: Can ‘smart specialisation’ make a difference? Journal of Economic Policy Reform, 18(2), 172–187. 1009068. https://doi.org/10.1080/17487870

Kowal, S., & O’Connell, D. C. (2014). Transcription as a crucial step of data analysis. In U. Flick (Ed.). The SAGE handbook of qualitative data analysis (pp. 64–78). SAGE Publications. https://www.doi.org/10.4135/9781446282243

Kroll, H. (2015). Efforts to implement smart specialization in practice—leading unlike horses to the water. European Planning Studies, 23(10), 2079–2098. https://doi.org/10.1080/09654313.2014.1003036.

Lichtenstein, B. (2016). Emergence and emergents in entrepreneurship: Complexity science insights into new venture creation. Entrepreneurship Research Journal, 6(1), 43–52. https://doi.org/10.1515/erj-2015-0052.

Lundström, N., & Mäenpää, A. (2017). Wicked game of smart specialization: A player’s handbook. European Planning Studies, 25(8), 1357–1374. https://doi.org/10.1080/09654313.2017.1307328

Mäenpää, A., & Lundström, N. (2018). Entrepreneurial discovery processes through a wicked game approach: Civil society engagement as a possibility for exploration. In A. Mariussen, S. Virkkala, H. Finne, & T. M. Aasen (Eds.), The entrepreneurial discovery process and regional development: New knowledge emergence, conversion and exploitation (pp. 74–91). Routledge. https://doi.org/10.4324/9781351273763

Maguire, S., McKelvey, B., Mirabeau, L., & Oztas, N. (2006). Complexity science and organization studies. In S. Clegg, C. Hardy, W. Nord, & T. Lawrence (Eds.), Handbook of organization studies (2nd ed., pp. 165–214). SAGE Publications.

Marion, R. (2008). Complexity theory for organizations and organizational leadership. In M. Uhl-Bien & R. Marion (Eds.), Complexity leadership, Part 1: conceptual foundations. Information Age Publishing, pp.1-16.

Marques, P., & Morgan, K. (2018). The heroic assumptions of smart specialisation: A sympathetic critique of regional innovation policy. In A. Isaksen, R. Martin, & M. Trippl (Eds.), New avenues for regional innovation systems—theoretical advances, empirical cases and policy lessons (pp. 275–294). Springer. https://doi.org/10.1007/978-3-319-71661-9_14

McCann, P., & Ortega-Argilés, R. (2015). Smart specialization, regional growth and applications to European Union cohesion policy. Regional Studies, 49(8), 1291–1302. https://doi.org/10.1080/00343404.2013.799769.

McCann, P., & Soete, L. (2020). Place-based innovation for sustainability. Publications Office of the European Union. ISBN: 978-92-76-20392-6. https://doi.org/10.2760/250023, JRC121271.

Mieszkowski, K., Gómez Prieto, J., & Nauwelaers, C. (2016). From priorities to projects: Selection criteria and selection process. In C. Gianelle, D. Kyriakou, C. Cohen, & M. Przeor (Eds.), Implementing smart specialisation strategies: A handbook (pp. 60–77). Publications Office of the European Union.
Perianez-Forte, I., Guzzo, F., Hegyi, F. B., & Gianelle, C. (Eds.). (2020). Case studies on smart specialisation. In EUR. Vol. 30753. EN, Publications Office of the European Union. ISBN: 9789276393542. https://doi.org/10.2760/815309.

Perianez-Forte, I., Marinelli, E., Foray, D., Edwards, J. H., Pertoldi, M., Morgan, K., Mieszkowski, K., Gomez-Pierto, J., Nauwelaers, C., Rakhmatullin, R., Stanionyte, L., Mariussen, A., Gianelle, C., Kleibrink, A., & Doussineau, M. (2016). Implementing smart specialisation strategies: A handbook. Publications Office of the European Union.

Poutanen, P., Soliman, W., & Stähle, P. (2016). The complexity of innovation: An assessment and review of the complexity perspective. European Journal of Innovation Management, 19(2), 189–213. doi:10.1108/EJIM-03-2014-0036.

Prokopenko, M. (2009). Guided self-organisation. HFSP Journal, 3(5), 287–289. doi:10.1080/19552068.2009.9635816.

Schneider, A., Wickert, C. M. J., & Marti, E. (2017). Reducing complexity by creating complexity: A systems theory perspective on how organisations respond to their environments. Journal of Management Studies, 54(2), 182–208. https://doi.org/10.1111/joms.12206.

Schreier, M. (2014). Qualitative content analysis. In U. Flick (Ed.). The SAGE handbook of qualitative data analysis (pp. 170–183). SAGE Publications. https://www.doi.org/10.4135/9781446282243.n12

Sörvik, J., Teräsvirta, J., Dubois, A., & Pertoldi, M. (2019). Smart specialisation in sparsely populated areas: Challenges, opportunities and new openings. Regional Studies, 53(7), 1070–1080. https://doi.org/10.1080/00343404.2018.1530752.

Stacey, R. (2003). Strategic management and organisational dynamics: The challenge of complexity. Pearson Education.

Stacey, R., & Mowlles, C. (2016). Strategic management and organizational dynamics: The challenge of complexity to ways of thinking about organisations (7th ed.). Pearson Education.

Trippl, M., Zukauskaite, E., & Healy, A. (2020). Shaping smart specialization: The role of place-specific factors in advanced, intermediate and less-developed European regions. Regional Studies, 54(10), 1328–1340. https://www.doi.org/10.1080/00343404.2019.1582763

Uhl-Bien, M., & Arena, M. (2017). Complexity leadership: Enabling people and organizations for adaptability. Organizational Dynamics, 46(1), 9–20. https://doi.org/10.1016/j.orgdyn.2016.12.001.

Uhl-Bien, M., Marion, R., & McKelvey, B. (2008). Complexity leadership theory: Shifting leadership from the Industrial Age to the knowledge era. In M. Uhl-Bien & R. Marion (Eds.), Complexity leadership, Part 1: Conceptual foundations. Information Age Publishing, pp.298–318.

Uyarr, E. (2021). "Regional missions and values in innovation policy," Keynote in Norsa conference, Thursday, Parnu, Estonia October 14, 2021.

Von Bertalanffy, L. (1967). General systems theory. In N. J. Demerath & R. A. Peterson (Eds.), System, change, and conflict (pp. 115–129). The Free Press.

Von Bertalanffy, L. (1972). The history and status of general systems theory. In G. J. Klir (Ed.), Trends in general systems theory (pp. 21–41). Wiley-Interscience.

Von Bertalanffy, L. (1975). Perspectives on general systems theory: Scientific-philosophical studies. (George Braziller).

Wang, C., Madsen, J. B., & Steiner, B. (2017). Industry diversity, competition and firm relatedness: The impact on employment before and after the 2008 global financial crisis. Regional Studies, 51(12), 1801–1814. 1254766. https://doi.org/10.1080/00343404

What is smart specialisation? European commission smart specialisation platform. Retrieved April 20, 2021, from https://smartplatform.jrc.ec.europa.eu/what-we-do

Wiener, N. (1948). Cybernetics: Or control and communication in the animal and the machine. MIT Press.

Wiener, N. (1950). The human use of human beings. Houghton Mifflin.