DOCTORAL THESIS

Entrepreneurial Discovery Process Design for Sustainable Development within Smart Specialisation Strategies

Christopher Paul Meyer

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Hereby I declare that this doctoral thesis, my original investigation and achievement, submitted for the doctoral degree at Tallinn University of Technology, has not been previously submitted for doctoral or equivalent academic degree.

Christopher Paul Meyer _____
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CHRISTOPHER PAUL MEYER

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KIRJASTUS

“The measure of greatness in a scientific idea is the extent to which it stimulates thought and opens up new lines of research.”
– Paul Dirac –

“If we knew what we were doing,
it would not be called research,
would it?”
– Albert Einstein –

Contents

List of Thesis Publications

The list of author's publications, on the basis of which the thesis has been prepared:

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II Meyer, C. (2021). Integration of Baltic Small and Medium-Sized Ports in Regional Innovation Strategies on Smart Specialisation (RIS3). *Journal of Open Innovation: Technology, Market, and Complexity, 7*(3), 184. https://doi.org/10.3390/joitmc7030184

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IV Meyer, C., Gerlitz, L. & Klein, M. (2022). Creativity as a Key Constituent for Smart Specialization Strategies (S3), What is in It for Peripheral Regions? Co-creating Sustainable and Resilient Tourism with Cultural and Creative Industries. *Sustainability*, *14*(6), 3469. https://doi.org/10.3390/su14063469

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Author's Contribution to the Publications

Contribution to the papers in this thesis are:

I Sole authorship.

II Sole authorship.

III Conceptualisation of the research methodology applied; Audit questionnaire prepared; Audits implemented; Result comparison and synthesis; Literature Review including research gap and problem analysis; Cross-Border Concept Drafting; Integration of comments and research outcomes generated by the co-authors; Harmonisation of outcomes into one model; Responsibility for S3-related policy results and implications; Lead writing of the article; Formulation of conclusions and contributions to theory and practice; Final editing and review process finalisation.

IV Conceptualisation by incorporation of design and business policy perspectives of involved actors; Outline of the research; Proposal of theoretical and analytical phases; Coordination, suggestion and monitoring of research design, methods and data; Responsibility for S3-related policy results' analysis and evaluation; Harmonisation with existing topical literature; Formulation of Conclusions and implications for research and practice.

V Sole authorship.

Author's Publication List

Gerlitz, L., Meyer, C., & Prause, G. (2020). Methodology approach on benchmarking Regional Innovation on Smart Specialisation (RIS3): a joint macro-regional tool to regional performance evaluation and monitoring in Central Europe. *Entrepreneurship and Sustainability Issues, 8*(2), 1359–1385. https://doi.org/10.9770/jesi.2020.8.2(80)

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Meyer, C.; Philipp, R.; Olaniyi, E. O.; Prause, G. (2020). A HOLISTIC ASSESSMENT APPROACH FOR CLEAN SHIPPING INVESTMENTS. 14th *International Conference on Operations Researc*h. Universidad de La Habana, Investigacion Operacional.

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Abbreviation List

ANT	Actor-Network Theory
BSR	Baltic Sea Region
CCI	Cultural and Creative Industry
CRQ	Central Research Question
EC	European Commission
EDP	Entrepreneurial Discovery Process
EGD	European Green Deal
EU	European Union
KET	Key Enabling Technology
NUTS	Nomenclature of territorial units for statistics
RIS3	Research and Innovation Strategies on Smart Specialisation
S3	Smart Specialisation Strategies
SMSP	Small and Medium-Sized Port
SDGs	Sustainable Development Goals
TBL	Triple Bottom Line
UN	United Nations

1 Introduction

Smart Specialisation Strategies (S3) have received increasing research interest by policy, innovation, technology-based and social sciences' scholars in recent years. Nevertheless, S3 design and application remains still diffuse for policy-makers, academics as well as businesses. In order to demystify S3 policy, an Entrepreneurial Discovery Process (EDP) is being largely deployed as an instrument embedded into S3 on a micro-level (firm-level), which helps to push innovation on regional level alongside the selected industrial and business areas, the so-called S3 priorities. Whereas S3 aims at providing sufficient and comprehensive framework for innovation policy design, the EDP shall act as a driver for practical innovation application on a firm-level, both supporting regional development. In this sense, S3 policy is linked to business management and leadership through the EDP. Furthermore, the EDP is the concept connecting all articles and thus serving as basis for this thesis. Here, each of them addresses improvements, theoretical and / or practical contributions related to EDP understanding and conceptualisation in the context of S3 design and implementation. Thus, this present thesis builds upon the EDP exploits EDP potential for more effective and sustainable regional development through S3 phenomenon, which is understood as an innovation policy on regional level. The present chapter marshals therefore the conceptual intertwining, reflects on theoretical and practical research gaps, draws research trajectory and articulates research questions.

1.1 Setting the Scene for Smart Specialisation and Sustainable Development

The current funding period 2021–2027 of the European Union (EU) has just begun. In this context, S3 policy shape regional innovation and development governance paths of European regions for this particular and upcoming development cycles. Ambitious targets have been set here, in particular, by means of the European Green Deal EGD) to accelerate Europe's sustainable transition and contribute to the United Nations (UN) Global Sustainable Development Goals (SDGs) (European Commission, 2010b). All three instruments require continuous adjustment of regional governance in order to enable strategic development linked to sustainability and incorporating interests of all affected actors from four helices – entrepreneurial, academic, political, and social spheres, the so-called Quadruple helix stakeholders (Aranguren et al., 2019; Larosse et al., 2020). However, the majority of Europeans entrepreneurs is either not aware of the EGD at all or not ready for the transition processes required (Geerts et al., 2022). As a result, such lack of knowledge jeopardises ability of entrepreneurs in future business modelling and competitiveness strengthening. To fill in this knowledge gap, the concept of Smart Specialisation might be worth in bringing into the discourse of regional development.

The idea of Smart Specialisation was initially introduced as a reaction to a growing productivity gap between Europe and the USA back in the mid 90's, when European policy-makers had to ensure not to fall back in terms of innovation and competitiveness. Later, the concept was transformed into Smart Specialisation Strategies (S3), also labelled as Research and Innovation Strategies on Smart Specialisation (RIS3). It was introduced by the European Commission (EC) as a regional governance policy to support regional economic development and growth as important pillars within the Europe 2020 Strategy (European Commission 2010abc) as well as to ensure sufficient and targeted EU funds' distribution (Santos et al., 2022). Respectively, individually (by each EU region)

identified thematic industry and business areas based on the regional strengths were introduced as a means to streamline EU funding distribution. Those key priority areas, the so-called S3 priorities, stipulate the backbone of S3 policy development for European regions (McCann and Ortega-Argilés, 2015), alongside the regional fund acquisition (Marrocu et al., 2022). The S3 implementation for 2014–2020 is in its final stage (funds to be used until 2023 – "n+3 rule") and is already subject to regional evaluation. Subsequently, European regions are currently updating their S3 individually to determine the regional innovation and development for the next funding period from 2021 to 2027 (Gianelle et al. 2020), based on experiences made and insights gained from the previous funding period (Boschma 2015). This, in turn, highlights relevance and topicality of the thesis in hand. European funds remain an important income on national, regional, local but also entrepreneurial level when it comes to support transition processes and sustainable development (Becker et al., 2022; Bogoslov et al., 2022; Laranja, 2021).

At the beginning, S3 received higher attention in policy sciences due to its logic and conceptualisation within the EU Cohesion Policy, as it was perceived as regional growth policy framework (Pugh, 2014) and innovation policy discourse (Foray & Goenaga, 2013). However, criticism has been raised within this context, as the impact of S3 policy-making was not traceable on entrepreneurial level performance. This meant that S3 priority setting was based on local politicians' desk investigation of what appeared to be innovative (Eklinder-Frick et al., 2020). Consequently, this caused a paradox in theoretical S3 development and its practical application (Capello & Kroll, 2016; Foray, 2016; Valdmaa et al., 2020). For this reason, the actual S3 policy transfer from academic to business sector has been put into the centre of S3 research to support technological progress (Kempton et al., 2013) and later – knowledge and capacity building (Kangas & Aarrevaara, 2020). The trend towards more entrepreneurial and actor-driven approaches for S3 continued to mushroom, bringing up concepts of entrepreneurial ecosystems (Szerb et al., 2020), social capital (Bellavista et al., 2022) and business innovation (del Carmen Sánchez-Carreira et al., 2021; Marinelli et al., 2021) as those shaping future S3 implementation. In the meantime, S3 research is covering and incorporating different economic and political fields, depending on the applied (theoretical) perspectives by researchers. Though, the present thesis is stepping in at this focal point of S3 research development, whereas it should be classified as a new field within entrepreneurial innovation governance.

As aforementioned, one of the core elements on regional and local level of S3 policy is the concept of Entrepreneurial Discovery Process (EDP), which aims at improving deployment of limited resources in certain domains of regional specialisation (key priority areas of European regions) (Mieszkowski & Kardas 2015). EDPs can be defined as a group of processes and activities implemented by stakeholders in an ecosystem including formal and informal bodies and networks (Asheim, 2019), with the aim to develop new activities – products and services – as well as accelerate structural changes (Foray, 2014). Hence, an EDP strongly relies on regionally involved actors into innovation processes and attempts at establishing multi-level combinations of stakeholders to turn the regional innovation strategy into reality (Grillitsch, 2016). As a result, its development and implementation generate highly individual challenges on regional and local levels (Deegan et al., 2021). In addition, while individually selected S3 priority areas might support the application of EDPs in a particular region, EDPs can support identification of completely new specialisation domains, which develop into new S3 priority areas (Deegan et al. 2021). However, putting the concepts of S3 and EDP into the actual policy

discourse is still problematic (Laranja, 2021). Moreover, the role of policy-makers within the EDP on a micro-level remains unknown, as current literature lacks applicable knowledge on integration of policy perspectives (Estensoro & Larrea, 2022).

While there exist topical needs to update previous S3 in European regions, S3 monitoring and its measurement set the path for potential lessons learnt and best practices to be integrated into future S3 policy design (Masana & Fernandez, 2019; Woronowicz et.al., 2016). Given a range of individual regionally bounded monitoring systems, current monitoring approaches and their evaluation lack any comparability. This bears a clear problematic nature. Moreover, some EU Member States have introduced national strategies reinforcing regional ones or substituting them. However, established structures fail to effectively coordinate S3 monitoring and generate overlapping insights by national and regional bodies (Metaxas, 2017).

Paradoxically, regional innovation policy governance has very limited impact on S3 future programming on European level (Marques & Morgan, 2018). The reason behind that can be associated with an identified risk-averse behaviour of involved regional actors, which limits experimentation, flexibility and social initiatives. This, in turn, jeopardises open innovation of regional actors involved into EDPs (Lazzarotti et al., 2015) as well as hampers transparent bottom-up initiatives under S3 programming (Landabaso, 2014). Despite this, however, regional bodies play an important role for informal factors in institutions, such as trust, responsibility, partnerships, social innovation and regional leadership (McCann & Ortega-Argilés, 2014). Here, it is necessary to dive into the mismatch of regional policy promoting by means of (open) innovation processes, while at the same time reinforcing approaches that facilitate innovative thinking and self-discovery.

Consequently, lack of open-minded innovation policy governance, which is indeed proven most efficiently on NUTS-2 regional level (Ruhrmann et al., 2020) hampers the implementation of S3 and their monitoring. Moreover, the European Smart Specialisation approach does not provide any framework for S3 policy governance supporting and engaging regional actors (Capello & Kroll, 2016). Similarly, the impact on the S3 on a micro-level (firm level) is unclear and driven by still existing gap between theory and practice (Masana, 2022). This bears the main research problem of this thesis accompanied by clear negative managerial consequences – insufficient fund distribution on entrepreneurial level and scant potentials for sustainable development. Hence, there is a clear need to support regional S3 design and implementation through EDPs to facilitate effective regional development and innovation, including tools, models, concepts and theoretical approaches – a toolbox that pinpoints and demystifies cause and consequence relations (Morgan, 2017), which, in turn, provide the room for deeper elaboration in this thesis.

To tap into this potential, the current S3 implementation for the period 2014–2020 is the most optimal point of departure. This S3 policy programme is currently under evaluation and confronts regional policy and decision-makers with several obstacles that hinder them to draw conclusions for future regional innovation and development pathways (Masana, 2022) as well as to determine economic, environmental, social and political challenges. Therefore, the “new” S3 policy for the funding period 2021–2027 is crucial in terms of sustainable development in European regions and regional competitiveness (especially in the context of the EGD) (rf. Appendix – Article II; Gianelle et al., 2020), advancing an outdated perception of regional innovation and sustainability governance (Landabaso, 2014) as well as introducing better structured and justified

distribution of European funds (Foray, 2014). Finally, Smart Specialisation potentially offers great synergies with other innovation and growth initiatives (local, regional or national) towards sustainable development (Corpakis, 2019). Considering this, the current research in the field of S3 is only slowly shifting its focus towards sustainability mindset (rf. Appendix – Article V), even though, the impact of S3 on sustainable development is evident (Kogut-Jaworska & Ociepa-Kicińska, 2020; Veldhuizen, 2020). Yet, the recent literature yields an upgrade of the approach towards Smart Specialisation Strategies for Sustainability (S4) (Laranja, 2021).

To analyse the contributions and results of this thesis towards sustainable development, the Triple Bottom Line (TBL) concept is applied, referring to economic, environmental and social value of processes (Elkington, 2013). The concept is widely used in business literature exploiting sustainable development trends (Khan et al., 2021), but also found application within regional context (Aguiñaga et al., 2018; Coffman & Umemoto, 2010), thus making it suitable for this thesis as well. In this manner, the thesis expands the pattern of sustainable development by including institutional perspective, since established organisations, such as universities, technology parks or other innovation hubs, get involved as actors in S3 and EDP implementation (Tiits et al., 2015). Even though, institutional perceptions are important in the S3 discourse (Benner, 2022). In this context, only few research contributions are available, which link up to institutional theories and aspects related to sustainability (Lehmann et al., 2022), the fact that also underpins the relevance of this thesis.

1.2 Identification of Research Questions

At the beginning of the first S3 implementation period (2014–2020), researchers have already criticised the poor evidence-based design of regional strategies (Morgan, 2015). However, a gap between theory and practical implementation (Komninos et al., 2021) as well as missing theoretical conceptualisation (Boschma, 2014; Fellhofer, 2017; Gerlitz et al., 2020) still call for new research approaches for strategy design to emerge (Tödtling et al., 2021).

in this light, the EDP serves as a crucial concept for S3 implementation, based on the idea of self-discovery of involved actors within a given ecosystem embedded in a particular region. Hence, active regional actors, their networks as well as used innovation capabilities are crucial precincts for successful EDPs to emerge in an innovation ecosystem.

However, current research mainly promotes EDPs in such ecosystem born by industry (Kakderi et al., 2020) or induced by profit-oriented needs (Stam & van de Ven, 2021) supporting new regional knowledge creation and its application for innovation (Carayannis et al., 2018). In this particular context, however, little is known about social and sustainable EDP pathways (Audretsch et al., 2021; Boden, 2017; Hassink & Gong, 2019, Komninos et al., 2020), their delimitation within innovation activities and processes, their potential in meeting social demands (Mulgan, 2006) as well as their theory-based incorporation into innovation ecosystems (Wurth et al., 2021). For this reason, those knowledge gaps result into a doctoral research gap that focuses on missing knowledge on EDP potentials and contributions within the sustainability transition discourse. Consequently, this thesis formulates the following Central Research Question (CRQ):

⇒ *How can EDP set-up be improved to grasp their sustainable development potential within S3 implementation?*

The EDP set-up is defined within the S3 of European regions. To identify EDP success and impact, a regional monitoring system is one of the core instruments to be in place for S3 design. Whereas the amount of published research items dealing with S3 and / or RIS3 increased in recent years, research activities in the field rather focussed on S3 design and implementation paradigms instead on the S3 monitoring (Mora et al., 2019). The existing literature subsumes monitoring as small part of the overall S3 implementation (Gianelle & Kleibrink, 2015). The latest published research items highlight the lack of sufficient monitoring systems (Masana, 2022) and the need to introduce better mechanisms to compare the processes and outcomes of S3 policy implementation across regional borders (Fuster Marti et al., 2020). Moreover, EPDs shall be at the core of each S3 monitoring approach (Masana & Fernandez, 2019).

This marginalised focus on monitoring approaches alongside S3 implementation calls for an increase in practice-oriented research, providing necessary knowledge, data and tools wo operate with in this specific research field. This also means that a sufficient set of indicators for benchmarking and comparative measurements is indispensable. However, such a set is not yet applied for the monitoring of European regions' S3 performance (Gerlitz et al., 2020; Guzzo & Perianez-Forte, 2019). Whereas some European regions partly integrate S3 monitoring results into their succeeding S3 policy design, those monitoring tools remain, however, individually developed (individually chosen indicators) and applied. Therefore, a comprehensive and comparable monitoring concept based on a theoretical framework for S3 implementation across Europe is still missing (Andersons & Bushati, 2019; Fuster Marti et al., 2020). Considering this scattered knowledge landscape in S3 monitoring, the first research question (RQ1) can be emphasised:

⇒ *How can EDP impact on S3 implementation be better monitored across European regions?*

Considering monitoring as a tool to design and re-shape regional S3 governance as well as the involvement of relevant actors in a dynamic system (Aranguren et al., 2019), it is necessary not only to elaborate on the S3 monitoring system itself but also to scrutinise and evaluate actual actors being involved. Whereas an EDP is seen as an innovation process of bringing different entrepreneurial actors together in a policy governed participatory process (Komninos et al., 2020), the existing literature is still highlighting the gap between S3 theory and practical implementation (Komninos et al., 2021). In particular, the articulated gaps pinpoint the lack of comprehensive frameworks dedicated for S3 implementation (Andersons & Bushati, 2019) with strong stakeholder engagement. Moreover, in EDPs, policy integration remains problematic (Papamichail et al., 2022), while, similarly, the integration of the entrepreneurial level into S3 strategy design must be questioned, once EDPs potential for European regions is being deliberated. As regional actors and their reciprocal relations determine understanding of an innovation policy and, even more important, the development and implementation of EDPs (Aranguren et al., 2019) on micro (local) and regional level, those aspects must experience an uptake by S3 policy in order to catch up with regional innovation and sustainable development. Thus, a second research question (RQ2) is formulated:

⇒ *How are EDPs actors incorporated and reflected within S3 priority set-up?*

Considering previous explanations, EDPs are collaborative and participatory approaches for innovation development in a regional set-up born by entrepreneurial actors. Moreover, they are seen as an active driver for open innovation (Markkula &

Kune, 2015). Indeed, the concept of Open Innovation is strongly linked to EDPs, as it fosters the creation of new ventures on entrepreneurial level (Eftekhari & Bogers, 2015). Open innovation is linked to experimentation, flexibility and social perspectives (Lazzarotti et al., 2015) as well as presupposes a high level of collaboration (Osorno-Hinojosa et al., 2022) among Quadruple helix actors (Parveen et al., 2015). However, a collaborative mindset is so far limited to regional borders within S3 research, because S3 design and implementation demands sufficient cross-border cooperation and conceptualisation across regional actors and especially for rural areas (Tiits et al., 2015). Surprisingly, even though it is well known that cross-border cooperation can be a success factor for building up regional competitiveness and strong innovation (Lorenz & Oleaga, 2020), the reasons behind low cross-border cooperation in terms of S3 policy are ascribed to low understanding, limited interest and capacities on policy level (Radosevic & Stancova, 2018). In addition, missing willingness for political commitment and prevailing obstacles in developing common S3 policy tools hamper initiatives to overcome this gap (Uyarra et al., 2018). This, in turn, manifests still existing lack of cross-border cooperation in the development of future S3 towards the period as of 2021–2027 (Masana, 2022). Since S3 policy promotes utilisation of diverse regional resources, but at the same time recommends regions to specialise on certain fields in science, technology, and innovation (Muller et al., 2017), missing expertise and knowledge might be acquired in other regions. In this sense, an additional focus in needed on how to promote knowledge spill-overs and learning linkages between actors of different regions (Mikko et al., 2021). Therefore, this aspect is covered by the third research question (RQ3):

⇒ *How can EDP actor collaboration be improved towards open innovation application?*

Following the three research questions, the CRQ is tackled within this thesis from different aspects and thematic fields as well as from both theoretical and practical perspectives. In addition, after re-elaboration of the conducted research and its results' display, additional theoretical insights can be gathered in the given S3 policy paradigm by means of introduced theoretical concept – Actor-Network Theory (ANT).

This thesis is a cumulative work based on the listed articles published by the author. The above addressed research questions have been developed during the actual research journey, which is a common procedure in qualitative and longitudinal studies (Agee, 2009). However, the questions mainly serve here to address and find feasible answers to the formulated CRQ, which is the main driver behind the conducted research project. In a nutshell, Figure 1 below is illustrating the conceptual pattern of this thesis, displaying the introduced research questions addressing three thematic areas, which have been explored during the research. Moreover, the research questions are corresponding to the two S3 levels referred to in this thesis: entrepreneurial and regional (policy) level.

By answering the research questions and the CRQ, the main research objective of this thesis is to improve understanding of EDP set-up and its role for sustainable development within S3 policy. Moreover, the entrepreneurial / micro level considerations related to S3 policy implementation shall be better linked to policy level, thus overcoming the EDP paradox of policy-makers being locked in traditional planning culture (Capello & Kroll, 2016) and supported by the recent calls to strengthen the bottom-up / top-down collaboration (Valdmaa et al., 2020). In addition, insufficient design of EDPs and S3 implementation shall be minimised to improve targeted utilisation of funds being

distributed from regional policy level towards entrepreneurial level. Therefore, as illustrated in Figure 1, the CRQ is positioned as the interplay of those two levels, thus allowing main findings and conclusions being discussed from both views.

Following a synopsis of S3 and EDPs conceptualisation as well as positioning them within the current research landscape, the second chapter of this thesis provides the accumulated theoretical background used for the implemented research journey. Besides the key theoretical S3 place-based manifestation, EDP understanding, S3 monitoring and evaluation, the succeeding sub-chapter introduces the ANT, which has not yet been part of Smart Specialisation research discourse, but yields a logical consequence of the implemented study. The ANT serves as an analytical tool behind actor involvement and delineation of their relations towards sustainable development.

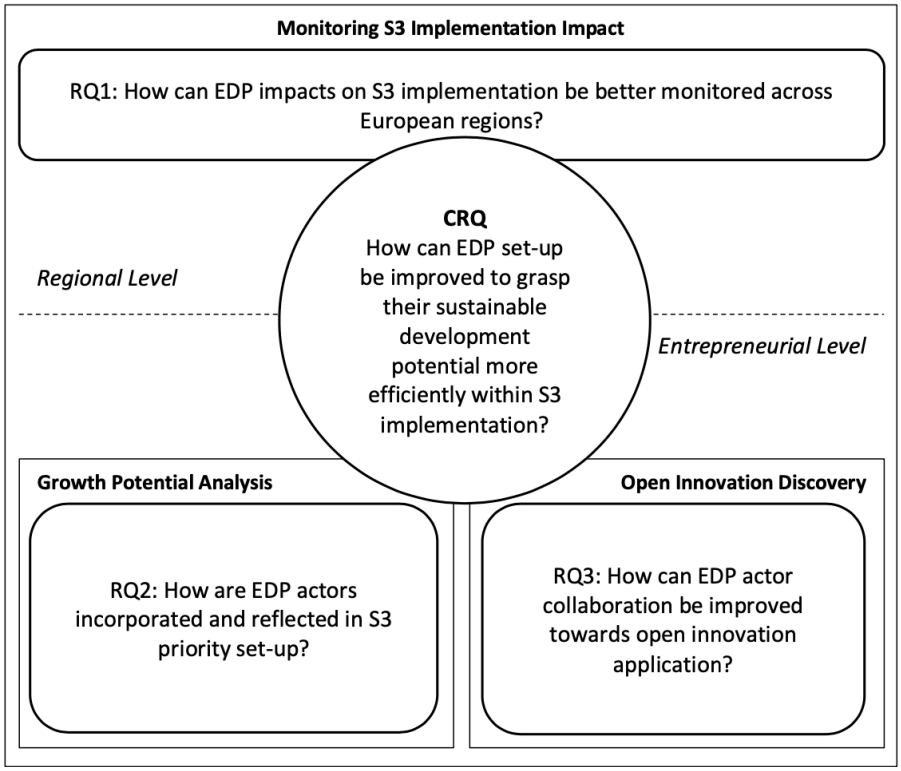

Figure 1. Conceptual Pattern of the Doctoral Thesis' Research Questions
Source: Compiled by author

Subsequently, the third chapter illustrates the research methodology applied for this thesis, by highlighting main research methods and approaches. Chapter four depicts main findings and presents results based on the implemented empirical research activities, which were circled around the formulated research questions. In the fifth chapter, main findings are elaborated and placed within the current research landscape, followed by substantial theoretical and practical footprint the present thesis made – theoretical and managerial contributions. In the very last chapter, concluding remarks are formulated, summarising the thesis in hand as well as addressing its limitations, which, in turn, provides room for succeeding outlook and new future research trajectories in this particular field.

2 Theoretical Background

The concepts and theories of Smart Specialisation as an innovation policy have been analysed and exploited well in the existing research (Hassink & Gong, 2019; Landabaso, 2014; Lopes et al., 2021), including its thorough literature reviews (Fellhofer, 2017; Janik et al., 2020; Komninos et al., 2014; Lopes et al., 2019). However, following the identified research gaps and questions, in the following sub-chapters, key aspects on place-based approaches and monitoring concepts towards S3 policy governance are exploited. Place-based approaches have been identified as one of the main theoretical concepts when it comes to S3 elaboration in the literature in general, and specifically pertaining to sustainable development (rf. Appendix – Article V) and involvement of regional actors into EDPs (Aranguren et al., 2019). Since regional institutionalisation set-up strongly determines potentials of EDPs (Papamichail et al., 2022) and the evaluation of S3 impact via the monitoring, the present theoretical background provides an overview of applied theoretical justifications covering S3 monitoring concepts, which, in turn, serve as a solid basis to address the research questions. However, existing place-based theories and monitoring concepts are not sufficiently enough to explain and justify EDPs' design and implementation towards more sustainable development paths, as has been introduced. Therefore, the research deploys the ANT, by demonstrating its potentials and added value for S3 implementation and benefits for the upgrade of S3 design. In this sense, the thesis claims to be both theory testing (place-based approach) and theory building. Above that, based on the conceptual pattern illustrated in Figure 1, the following sub-chapter elaborates on place-based approaches, which constitute the core of entrepreneurial actions (entrepreneurial level) and connects to key theoretical justifications regarding S3 monitoring (regional level). Subsequently, interlinkages between S3 and ANT are established, thus enabling to expand the current theoretical understanding of EDPs within S3 policy and to position this new research perspective as potential future research avenue.

2.1 Place-Based Approaches for Entrepreneurial Discovery and Sustainability

Place-based approaches in multi-stakeholder ecosystems are seen as an effective concept towards sustainable development on local, regional, national and transnational levels (Ayala-Orozco et al., 2018). Though, involvement of multi-stakeholders on horizontal and vertical levels is very much highlighted by the literature on S3 and EDPs (Aranguren et al. 2019, Roman et al. 2018; Uyarra et al. 2014). However, in the research discourse, EDPs are either connected to regional industry, market-oriented products and services (Coffano & Forey, 2014; Del Castillo et al., 2015; Pinto et al., 2019). Nevertheless, EDPs shall be seen as potential specialisation mechanisms, where available knowledge of academics, businesses, policies (entrepreneurs) and society (Quadruple helix approach) (Gerlitz et al., 2020) will pull together for a technical invention and innovation to emerge (Foray & Goenaga, 2013) rather than just exploring new fields of innovation and sustainable usage for given regional assets (Foray, 2012).

In this specific perspective applied here, place-based S3 approaches support economic and social development at local and regional level (Neto, 2020). Consequently, they also bear great potentials for and should be better embedded in peripheral regions (Barzotto et al., 2020; Hassink and Gong, 2019; Morgan, 2019). Notwithstanding that, rural areas face higher challenges in capitalising on S3 policies (Papamichail et al., 2022).

To overcome such challenges, S3 should focus more on socio-ecological model for innovation to improve quality of life, underpin learning mechanisms, support businesses and society capacity building, encourage social innovation as well as to reinforce cooperation among regional actors (Morgan, 2019). In this regard, peripheral regions react more sensitive in terms of place-based social innovation, since they are characterised b a smaller number of local actors with shared social, political, integrative, cognitive and institutional proximity (Balland et al., 2015; Georgis & Barrai, 2021).

Despite increasing attention to socio-ecological peculiarities addressed in S3 policy, topical concepts and approaches continue to mushroom in regional science and to focus on technology-driven mindset for innovation. Some new trends emerge that highlight potentials of the Quadruple helix approach for S3 policy, alongside regional social capital and sustainable development aspects (Benner, 2020). Following this path, social entrepreneurship and social innovation are becoming more important, as they enable discovery of new combinations of products, services, organisations or processes (Defourney & Nyssens, 2010). Indeed, discovery is at the heart of an EDP and integrates into place-based innovation approaches (Noruzi et al., 2010). However, social-ecological and social innovation concepts and their impact on S3 / RIS3 have been only implicitly mentioned in this context (Hassink & Gong, 2019), although they are closely linked to social entrepreneurs (Philipps et al., 2015). This fact indicates innovation potentials and synergies towards EDPs, since social innovation bears potentials to create or increase competitive advantages (Castro-Arce & Vanclay, 2020) and, thus, contributes to sufficient S3 implementation (Taliento et al., 2019).

From the placed-based perspective, S3 implementation has been addressed by cluster-theories (Aranguren et al., 2019). On the one hand, cluster-theories are used to explain certain economic processes. On the other hand, they presuppose a clear intertwining with the concept of innovation policy governance (Sotarauta, 2018). As mentioned, sufficient S3 implementation requires involvement of different actors from different sectors, like academics, policies, businesses (entrepreneurs) and society in large, from the so-called Quadruple helix (Carayannis & Campbell, 2019). Within such multi-layer interactions, governance is understood as a kind of coordination to accept collectively binding decisions in a defined system. More precisely, governance promotes the shift from classical management policy towards a more expert-driven and actor-led participation in decision-making (Beunen et al., 2016). Similarly, in the cluster related literature, innovation policy governance also deploys multi-level stakeholder approach with bundle of diverse actors involved (Aranguren et al., 2019). Among that, policy learning mechanisms are key pillars of S3-driven governance (Gianelle et al., 2019). They are referred to as policy-level capabilities to transform theoretical concepts into sufficient innovation policies, thus implying policy change, which fosters regional (innovative and sustainable) development. Hence, an efficient innovation policy governance is bound to path dependency. Consequently, networking, (policy) learning, open innovation and new knowledge are key drivers for smart development (Dagiliene et al., 2019) and in such, they constitute key components for S3 design and implementation.

On top of that, accumulation of place-based specialisation in knowledge, technology and innovation capabilities are seen as key criteria to initiate sustainable development (Ferreira & Seixas, 2019). Thus, adding an institutional perspective to S3 is crucial (Tiits et al., 2015), since established regional (research) institutions are key actors in supporting learning, knowledge creation and spill-overs. Altogether, this leads to place-based

specialisation, which again supports the application of Quadruple helix approach. More precisely, regional stakeholders and institutions on vertical and horizontal network perspectives need to be involved into S3 design and implementation (Grillitsch, 2016). Considering the call for increasing cross-border cooperation, new and unknown challenges may arise when targeting cooperation of multi-level networks in different regions, as regional actors do not possess enough knowledge and sufficient application of S3 policy instruments (Korhonen et al., 2021; Tiits et al., 2015). Under the institutional perspective, such challenges might accumulate, since smooth S3 implementation then relies also on intra-institutional coordination and cooperation on regional, national, supra- and subnational levels (Perianez Forte et al., 2016).

2.2 Conceptual Background for S3 Monitoring

Regional development is the core objective of innovation policies, meaning that regions should transform into learning ones by continuous advancing as well as supporting knowledge flows, ideas and learning (Florida, 1995). In such a way, monitoring activities are crucial for S3 policy making and sustainable development (Kuznetsow & Sabel, 2017). Nevertheless, available research underpins a challenging way among responsible policymakers to utilise on sufficient monitoring towards S3 intervention logic and its effectiveness (Farole, 2011; Kleinbrink et al., 2016). Among them, the availability of data and selection of the "right" innovation indicators to measure innovation performance resulting from S3 implementation are rather complex benchmarks, handicapped by different understanding of S3 policy among involved actors and stakeholders (Kleibrink & Magro, 2018). However, innovation indicators are useful and important for sustainable development and S3 policy planning mechanisms (Brugmann, 1997). On top of that, current literature is demanding a mixture of quantitative and qualitative indicators to fully cover and reveal S3 policy impact on regional innovation performance level (Gianelle & Kleinbrink, 2015; Kangas & Ryynänen, 2022). This, in turn, highlights the need to develop new approaches and paths in terms of S3 monitoring.

However, the importance of S3 monitoring and evaluation is contradicting its current scientific status quo (Mora et al., 2019). S3 monitoring has been analysed in several research streams and, indeed, one research trend can be recognised in the ex-ante of S3 monitoring period, i. e. during the transition phase between the funding periods (Arnold, 2004; EC, 2014; Gianelle & Kleibrink, 2015; Magro & Wilson, 2013; Masana & Fernández, 2019; Panori et al., 2020; Prause, 2014). However, at the end of first S3 implementation phase, current research is continuing to search for sufficient S3 monitoring approaches (Masana, 2022). This is because S3 monitoring is crucial to foster policy learning, support adaptation capability within the new strategic orientation, provide a solid basis for sustainable policy implementation (Aranguren et al. 2019; Gianelle & Kleibrink, 201; Kroll, 2015; Magro & Wilson, 2013) as well as to improve stakeholder involvement (Virkkala et al., 2017).

Overall, the majority of research steams regarding S3 focuses on strategy design (Paliokaite et al., 2015; Piirainen et al., 2017), highlights place-based approaches (Kroll, 2015; Magro & Wilson, 2019), involvement of different level of governance (Arangunen et al., 2019) and underpins regional institutional frameworks (Grillitsch, 2016; Mazzucato, 2014; Krammer, 2017; Rodriguez-Pose et al., 2014). In synopsis with those research streams and, in particular, considering their add-value for setting the theoretical foundation for S3 monitoring, a bunch of different conceptual approaches and theories can be identified. The exploration thereof in this thesis identifies particular keywords that

can be associated with particular research aims in the topical literature. The following Table 1 illustrates principal S3 keywords and their nexus with their key contribution (Meaning / Value) and applied theories (Conceptual Province) as well as the covered actors in the existing scholarly literature (Application Field).

Table 1. Conceptual Keywords and their Provinces Driving S3 Evaluation and Monitoring Discourses

Keyword	Application Field	Application Meaning / Value	Conceptual Province	Research Record
(Re-) Definition of S3 outputs	Academics Policymakers Businesses	+ S3 governance improvement for future	+ Balanced scorecard + Business model innovation	+ Panori et al. (2020)
Decision-making (evidence-driven)	Policymakers	+ Strategic S3 management + S3 revision + Reducing information asymmetry, uncertainty and risk	+ Decision theory + Principal-agent theory + Game theory	+ Kleibrink et al. (2016) + Panori et al. (2020)
Participatory policy making and cooperation	Academics Policymakers Businesses	+ Informing about policy responses + Ensuring accountability & transferability of results + Participatory and inclusive approaches towards stakeholders	+ Network-based innovation theory + Open innovation	+ Kleibrink et al. (2016)
Entrepreneurial Discovery Process (EDP)	Businesses	+ Strengthening user-driven innovation + Engagement new actors in the EDP + Open platforms for cooperation + Attraction of talents	+ Open innovation + User-driven innovation + Design thinking + Service design	+ Cvijanovic et al. (2020)
Evaluation methods and criteria for RIS3	Policymakers	+ Means of learning & improvement for the future + Regional observation + Harmonised tools and data availability	+ Organisational learning + Absorptive capacity	+ Pires et al. (2019)
S3 Priority identification & investment horizons	Policymakers Businesses	+ Long-term prioritisation and planning + Anticipating long-term industrial and technological trends for transformation & emerging industries	+ Strategic foresight + Decision theory + Transaction Cost Theory	+ Ranga (2018) + Vezzani et al. (2018)

Keyword	Application Field	Application Meaning / Value	Conceptual Province	Research Record
Policy learning and stakeholder communication	Policymakers	+ Learning from failure + Learning about transformation + Sustainable self-improvement cycles + Building & reinforcing trust and cooperation	+ Collective learning + Absorptive capacity + Path dependency	+ Bellini et al. 2020 + Kleibrink et al. (2016)
Stakeholder involvement and coordination in RIS3	Academics Policymakers Businesses	+ Developing programme for S3 monitoring improvement + Consultation, engagement, and bottom-up participation + Support economically weaker regions with limited capacity for S3 monitoring through open engagement	+ Network-based innovation theory + Open innovation	+ Magro et al. (2014) + McCann (2015) + McCann & Ortega-Argiles (2016)

Source: Gerlitz, L., Meyer, C. & Prause, G. (2020)

The positioning of the keywords does not provide any weighting among each other but is displayed in an alphabetic order (definition, decision-making, cooperation, EDP, evaluation, priority identification, policy learning and stakeholder involvement).

Reviewing Table 1 as the result of an extensive literature review, it offers different aspects to be taken up for this thesis in terms of the EDP elaboration. Cross-cutting scrutiny reveals that EDPs are strongly linked to key theoretical approaches, such as Open Innovation, User-Driven Innovation, Design Thinking and Service Design (Cvijanovic et al., 2020). Overall, those approaches show huge potential for further integration and elaboration in this thesis. Moreover, research records covering all three analysed actor categories (Businesses, Policymakers and Academics) are applying network-based theories, which, indeed, supports the necessity claimed by this thesis to enlarge the place-based perception on S3 and EDP.

2.3 An Actor-Network Theory Perspective

Despite a variety of applied theories in Smart Specialisation research, as shown in Table 1 for the specific area of S3 monitoring, the Actor-Network Theory (ANT) has not been approached as a theoretical foundation for S3 literature yet. However, since ANT is critically reflecting past development, while at the same time delivering knowledge and insights towards future prospects (Durepos & Millis, 2012) as well as enabling to elaborate on multi-level actor involvement and relations between human actors and institutions, the ANT can be successfully utilised to explain S3 processes and regional innovation ecosystems. Although the ANT has not been followed during the overall research methodology of the thesis, the present research results also clearly indicate a

need to explore theories that go beyond place-based approaches and to address network related concepts. This is confirmed by the overview provided in Table 1 as well as the results achieved when analysing cross-border collaborations in the S3 context. In addition, the ANT was applied within the present research methodology of the fourth article building up the thesis (rf. Appendix – Article IV). Hence, in a retrospective analysis of the achieved results and contributions during the doctoral studies, the ANT seems to be a promising approach to overcome known problematic nature and challenges pertaining to S3 and EDP research discourses. Moreover, it represents a potential future research avenue of the author. Finally, the deployment of the ANT is also adding a theory building aspect to this thesis by pinpointing its applicability to S3 research in this sub-chapter.

The ANT was born in social sciences to analyse how growth and knowledge creation can be explained through interactions of actors and networks (Muniesa, 2015). This, in turn, corresponds with the aim of innovation policies, such as S3, to create informal networks and to support knowledge exchange and cooperation among actors (Szakálné et al., 2022). Nevertheless, besides social sciences, the theory also receives growing attention as an analytical tool in other research areas, such as social innovation (Degelsegger & Kesselring, 2012), politics (Alcadipani & Hassard, 2010), sustainability (Irish & Romkey, 2021) and urban studies (Farias & Bender, 2010), making it also worth to examine in terms of its theoretical potential for S3. Indeed, the ANT is seen as potential research stream in the policy area to close the gap between theory and practice (Passoth & Rowland, 2010), which is, as aforementioned, one of the existing research problems in the S3 design and implementation field. In this context, the ANT can be also used as a connecting theoretical construct. Whereas network theories focus on relations and boundaries of involved entities and actors, place-based approaches examine locally or regional available assets. The ANT expands the understanding of involved actors, who can only be described in relation to the network, which is vice-versa not existent without its actors (Wihlborg, 2018).

In this theory, actors can be human or non-human entities, or in other words, any entity that is going into some kind of relation within the network (Latour, 1996; Whittle & Spicer, 2008). Important note to make here is that the ANT is calling for one crucial and binding assumption of so-called symmetry, which declares that all involved actors – human and / or non-human – in the network are equally powered (Jackson, 2015; Whittle & Spicer, 2008). Though, in this scope, the ANT can solve two challenges in the context of S3 implementation. First, the principal idea of S3 is grounded on a practice-oriented bottom-up approach, reflected through EDPs, but usually implemented as a top-down concept set by regional policy-makers (Foray, 2016; Valdmaa et al., 2020). This paradox can be addressed by deploying the ANT feature of symmetry and equal empowerment of all involved actors. Second, S3 design and implementation calls for rather interdisciplinary cooperation among the involved actors, based on the Quadruple helix view (Carayannis & Rakhmatullin, 2014; Fellhofer, 2018). In this context, the ANT might lend practical implementation potential to overcome the S3 related challenges, by simply allocating the same power to all involved actors. In addition, according to the theory, all actors are historically driven (Durepos & Mills, 2011). In this manner, the concept of path dependency addressed in the ANT also finds its application in S3 and regional policy making (Bellini et al., 2021).

From the ANT point of view, actors are addressed based on the so-called translations, which reflect relations and interactions among involved actors and thus set up the actual network (Durepos & Mills, 2011; Miettinen, 1999). In addition, translations describe how involved actors create effects through negotiation or how they manipulate and direct other actor's interests towards one's own, with the objective to mobilise any kind of support (Jackson, 2015). In general, however, translations are originally aligned to four main steps in the ANT: problematisation, interessement, enrolment and mobilisation (Callon, 1984). Putting these four stages of the theory into the policy innovation context, the ANT is framing an innovation ecosystem, by means of defining a problem, developing possible solutions, iterating possible solutions as well as institutionalising and refining preferred solutions. By undertaking those actions, the ANT, in fact, yields a key advantage compared to other theories in the given innovation policy discourse (Young et al., 2011) as well as closely dovetails with the S3 governance and implementation aspects within one specific funding period.

As translations between actors can be very heterogeneous, uncertain and ambiguous, the ANT introduces so-called "translation zones". Such zones subsume all actors and their translations towards a common aim or a field of interest (Barry, 2013), by means of knowledge exchange and innovation application (Rantisi & Leslie, 2015). This tenet of the ANT, in turn, establishes a clear link to the EDP, which is known as key driving concept behind the S3 implementation (Dubois et al., 2017). Indeed, the EDP facilitates understanding of translations zones as entrepreneurial discovery spaces (Morgan, 2016) and supports in this manner multi-actor and cross-sectoral exchanges (Asheim, 2011). In addition to that, translation zones can also be perceived as priority areas fixed in the regional S3 policy, allowing the existence of different translation zones with different actors involved in S3 design and implementation in the given regional boundaries. In sum, to showcase benefits of the ANT and, in particular, importance of actors' relations and interactions (translations), it is also important not only to concentrate on actors' involvement and interactions, but also to reflect on mediators and their performance (Latour, 2007). Mediators are important "nodes" connecting actors alongside translations and their performance, by predicting their outputs by means of inputs made.

Summing up, the principal insights made here is that there has not yet been any scholarly link established connecting S3 and the ANT in the scientific discourses. The reasoning made aboe, however, yields clear conceptual linkages, which can be expanded and showcased by further in-depth analysis of key ANT tenets and their intertwining with S3 policy, as Table 2 below illustrates.

Table 2. Overview of Further Key Actor-Network Theory Aspects and their Implication for S3

Further Key Concepts in Actor-Network Theory (Jackson, 2015, p. 30)	**Meaning and Application Potential for S3**
Inscription – Embodied translations into a medium or material	Translations as incentives used for early actor mobilisation, which lead to a certain development of a common objective, by means of deployed EDPs, innovation process and Key Enabling Technologies, with a clear focus on actors operating on entrepreneurial level.
Enrolment – Mobilising support by means of creating a body of allies through translation	Joint aim of actors in EDPs building up consortia and creating networks for a specific thematic objective and generation of innovation, which enables sustainable transition.
Black box and punctualisation – A temporary simplification in a given network that acts as a single unit so that the network transforms into one actor	S3 rationale is associated with efficient fund allocation through different territorial programmes. In this, building up consortia of different actors from different regions alongside a common thematic goal bears successful procedure to acquire these funds.
Quasi-object – A non-human that is necessary for the collective to exist, or an object that passes through a social group, which in doing so forms relations between members of the group	Thematic priority area that is bringing affected actors together – into one socially bound group, including potential sub-categories and objectives linked with that thematic area.
Hybridity – The idea that neither a human or non-human is pure, that is, neither human or non-human in an absolute sense, but rather entities produced in associations between the former and the latter. Thus, humans are considered as quasi-subjects and non-humans as quasi-objects	Boundaries of human and non-human actors are vanishing, social innovators and creative brokers are co-creating innovation and sustainable transformation with academic, policy, business, and social non-human entities (institutions).

Source: Compiled by author.

Considering the provided overview of key concepts that supplement applicability of the ANT for S3 related research, as summarised in the table above, the ANT bears clear and strong potential to increase the understanding of European regions in designing and implementing S3, thus paving the way for sustainable regional transformation. However, this is a first research attempt made in applying the ANT for the purpose of drafting sufficient future-oriented constitution of a European region in this particular field. Thus, this thesis provides new perspective on S3 theoretical reasoning and expands its conceptual terrain by integrating the ANT into S3 research discourse, which, in turn, minimises the gap of theoretical foundation for this innovation policy.

3 Methodology

The doctoral research work made use of different research methods in order to address the raised research questions. This is particularly true bearing in mind the interdisciplinary nature of S3 research, driven by spill-overs of S3 and intertwining with different disciplines, such as policy-making, technology, innovation, social sciences as well as regional and sustainable development. Coming to the point, the following chapter illustrates research pathways undertaken by the author throughout the doctoral research journey, leading to results and contributions for the scientific discourse and policy-making.

Referring to introduced research problems and gaps, the thesis is based on qualitative approaches in order to explain and analyse a concept or phenomena of interest (Creswell, 2014). Utilisation of quantitative methods and inputs remain limited to what necessary and reasonable in the given context. The choice over a qualitative research trajectory is also reflected in the formulation of proposed research questions, emphasising "how" relations between the objects of interest shape EDPs within S3 related exploration. Moreover, qualitative approach enables to delineate the overall design of the research path, allowing the researcher to be reactive on findings, as they are not possible to be planned beforehand (Korstjens & Moser, 2017).

In the research field of Smart Specialisation, several researchers are calling for the implementation of more qualitative approaches to analyse political interventions on innovation governance (Björn & Johansson, 2017; Georghiou et al., 2014; Komninos et al., 2014; Kroll et al., 2016). Notwithstanding that, an increasing number of scholarly treatises are demanding to introduce both qualitative and quantitative approaches to sufficiently analyse and explain S3 processes (Gianelle & Kleibrink, 2015; Kleibrink et al., 2016; Masana, 2022; McCann & Ortega-Argilés, 2013; Roman, 2018). Nevertheless, qualitative approaches shall be preferred when important variables to be examined are unknown (Creswell, 2014) and / or new paths in different regional contexts undefined (Dawley et al., 2015; Hassink et al., 2019; Trippl et al., 2020;). Subsequently, the thesis builds upon analytical and exploratory qualitative approaches (Silverman, 2020), as it supports and advances the elaboration of discovering new insights and cross-overs in a particular research field (Bartlett, 2017; Borrego, 2007). Furthermore, the implemented research approach has a hybrid nature (Fereday & Muir-Cochrane, 2006), combining inductive and deductive perspectives. On the one hand, deductive analyses have been based on existing theories and concepts located in the S3 nexus. On the other hand, the inductive reasoning stems from deployment of particular cases scrutinised during the doctoral research with the objective to deliver both general conclusions and practical applications, e.g. for S3 design and priority area setting.

Consequently, the hybrid research and thesis' methodology design are based on constructivism and interpretivism (Creswell, 2013; Mertens, 2010). Constructivism is postulating utilisation and practical functioning of theoretical constructs (Crotty, 1998) within concerned multiple realities under investigation, whereas the researcher himself is involved into the objects of interest (Lincoln et al., 2011). In doing this, knowledge and insights are constructed by the researcher rather than taken for granted. Here, reflection on experiences is important and serves as a key driver for knowledge creation, as the author is reflecting on those experiences and incorporates new information to pre-existing knowledge, thus enabling new knowledge construction. In this sense, the research is in line with the tenets of the S3 path-dependency paradigm. Despite this fact,

constructivism remains the core of research methodology design of this thesis, as pre-existing knowledge of the researcher, building upon literature reviews and connecting to empirical reasoning, i.e. active participation of the researcher in S3 innovation activities (involvement in transnational INTERREG project on S3), is enlarged by new concepts and approaches resulting into newly constructed knowledge, which, in turn, reduces the research problem and addresses the research questions concerned.

As the interactions and relations of involved interdisciplinary actors and stakeholders are also key to explain S3 paradigms, interpretivism of the researcher allows to give certain meaning and foundation to actions, relations and processes (King & Horrocks, 2011). However, as the present philosophical research discourse leaves the boundaries of strict philosophical stances, the thesis can also be placed within the emerging research streams, namely interactive approaches (Svensson et al., 2008). Yet, it shall be mentioned here that the introduced Actor-Network Theory is categorised as a constructivist approach (Muniesa, 2015), pinpointing its relevance as a theoretical foundation as well.

The thesis is based on multi-method approach encompassing different qualitative research methods during the conducted research. Such an approach yields a clear contribution in answering the CRQ, delivering comprehensive result portfolio, developing contributions to the scholarly literature as well as minimising the identified research gaps. Building upon individual research articles, research results are triangulated within this thesis for the purpose of developing a comprehensive overview, which merges insights gained from separated research articles (Morse, 2003). Based on the extensive scholarly literature and published S3 documentation including non-scientific contributions (mainly policy papers), the research problems were revealed and research gaps identified. Consequently, the status quo of the scholarly and practical situation pertaining to S3 guided the author to formulate comprehensive research questions that were addressed throughout individual studies. To answer the questions, independent research tasks were designed and implemented. As a result, in the following, research pathways and data collection concerning each research question is manifested and subsequently consolidated into the overall research methodology of the thesis.

Research Question 1 (RQ1) was addressed in Article I (rf. Appendix). The research has deployed primary and secondary data. Firstly, a performance audit of 21 actors in the field of EDP and S3 implementation was conducted covering monitoring mechanisms and monitoring related problems. Moreover, case studies of participating regions in the "SMART_watch" project (INTERREG Central Europe) were used to develop a raw model for comprehensive and comparable monitoring system in the Central Europe region. The results were supplemented by secondary data gathered through desk research, document analysis and comparative analysis of published strategy documents of the involved European Regions on their S3 monitoring.

RQ2 was dealt with in Article II (rf. Appendix). As S3 and EDP related thematic scope is vast, the research focus was limited to Blue Economy or, even more precisely, port sector in the Baltic Sea Region (BSR). The rationale of linking S3 and Blue Economy lies in the nature of this sector, whereby both S3 and Blue Economy are referred to as innovation drivers addressed in the policy initiatives set by the EU as well as promising economic development and unlocking growth policy thinking (European Commission, 2017; McCann & Ortega-Argilés, 2014). Here, Small and Medium-Sized Ports (SMSPs) were identified as Blue Economy drivers, the so-called "blue actors", filling a role of entrepreneurs, who under the EU growth policy are called as crucial innovators. Beside the conceptual interlinkage of S3 and Blue Economy, the researcher was involved into

several other initiatives related to SMSPs and Blue Economy encompassing both scientific work and practical innovation application (INTERREG project coordination). Thus, knowledge gained from the research literature was underpinned by hands-on experiences resulting from close collaboration with the SMSPs on project level. Subsequently, practical insights were traced back to the scientific work. Hence, it is claimed here that the choice over the EU sector, such as Blue Economy and, in particular, port industry, can be successfully used to develop both practical insights and theoretical contributions. However, for the purpose of the research, only secondary data was used. First, the S3 documents of all 37 coastal regions of the BSR were analysed and compared with a focus on priority setting supporting future development of port sector. Second, those regions filtered with ports as a priority area in the identified regional S3 documents and having a SMSP in the region were selected for further analysis, which was undertaking by using port performance data. Here, the Eurostat database was consulted to compare performance of passenger and cargo flows in ports between 2014 and 2019. This timeframe was selected for the purpose to compare innovation performance at the beginning and the end of the funding period covered by S3 policy. Data codes include the following: TGS00076, TTR00009, TGS00075 and MAR_MP_AA_CPH. Finally, following this, an exploratory and analytical comparison was performed to inductively develop insights and recommendations on how the actor incorporation within the EDP into a given priority set-up of S3 can be facilitated and what effects can be expected from this integration into the EDP for entrepreneurial and thus overall innovation performance.

RQ3 was addressed through a combination of different approaches – Article III, Article IV and Article V (rf. Appendix) described in the following. The research conducted in Article III was circled around a specific field of interest – multi-functional agriculture. This field was chosen due to given social proximity, as the researcher himself is based in the rural region the development thereof being driven by agriculture. As a result, a stronger thematic interest provided principal impetus to collect, compare and evaluate nutrition-based priorities in the area of S3 design. In this context, multi-functional agriculture is described as a tool in agriculture policy as well as a concept for rural development and agricultural transition leading to more sustainable development (Knickel et. al., 2018). Moreover, a farmer-driven innovation process is at the heart of the multi-functional agriculture (Holmes, 2012; Wilson, 2007). In this sense, an actor / entrepreneur (here – farmer) driven innovation establishes conceptual link to the EDPs in the sense of S3 policy applied in agriculture. However, in the context of multifunctional agriculture policy development, farmer-driven innovation processes have been so far ignored (Knickel et al., 2018). This, again, postulates a research to practice problem, especially as the application of multi-functional agriculture concepts are set as a clear regional policy task aiming to facilitate sustainable development in rural areas for over a decade already (Grbic, 2010). Hence, considering the aforementioned, the present research claims to be well justified and topical, when it comes to transfer practical insights into the EDP and S3 discourse. In order to implement this research, primary data was used resulting from 21 implemented audits in the context of the EDPs, involvement of actors into S3 policy design and implementation as well as their cross-regional cooperation. Following this, a comparative analysis of multi-functional agriculture as S3 priority was undertaken in the given territorial and cohesion related setting, i.e. RUBIN area (German Programme for Regional Entrepreneurial Collaboration for Innovation). In this particular research task, an actor approach was used as a methodological tool in creating practical content. This approach was chosen, given the research objective to

develop a cross-border network model, which strongly relies on actors' relations within that network (Fricke, 2015). In this particular sense, new knowledge can be constructed from multiple perceptions shared by a larger number of people (Arbnor & Bjerke, 2008). As a result, the actor approach appears to serve as an appropriate tool here, simultaneously facilitating understanding of experienced, observed and analysed reality as an interdisciplinary and social construct embedded within management, innovation policy, policy-making as well as multi-functional agriculture and co-creation concepts. In such a way, the research claims to have established a solid methodology for the cross-border model to emerge as a practical contribution of the undertaken doctoral research.

Turning to the Article IV (rf. Appendix), the topical research deployed primary data based on 32 expert interviews that thematically addressed innovation process and its relevance for sustainable development and resilience of a product or service being prototyped throughout the innovation process. Innovation process was undertaken by entrepreneurs including participation of representatives from Cultural and Creative Industries (CCIs). In this sense, the delineation of innovation process served to reveal individual building blocks of an EDP. Based on the insights gained from the EDP evaluation by means of the interviews, the cross-case comparison and content analysis were implemented by deploying case study analysis. This method facilitated positioning of the results within the S3 and sustainability context. Indeed, this is a common research method used in the S3 related discourse (Kogut-Jaworska & Ociepa-Kicinska, 2020; Mieszkowski & Kardas, 2015; Kristensen & Pugh, 2022). As the thesis is grounded on qualitative nature, a case study method serves as an umbrella method combining both thematic and content analysis (Braun & Clarke, 2006; Yin, 2009, 2011) as well as postulating building blocks of a specific phenomenon to be explored (Thomas, 2011). In such a way, deployment of a case study is explorative and aims at contributing to the underdeveloped research field (Shields & Rangarajan, 2013). In this vein, the research perceives case studies as an investigation by using "how" questions in a particular research field based on introduced problem and gap, taking a case as a phenomenon in real life context with unknown relationship and little or no control by the researcher (Yazan, 2015; Yin, 2018). Following this, the research implemented is able to draw conclusions and recommendations on improving the EDP.

Looping actor involvement in the EDP to the comprehensive innovation perspective addressed in the RQ3 and, in particular, from the social innovation and sustainable development point of view in the S3 context in Article V (rf. Appendix), the interplay of social innovation, S3 and sustainable development has not yet been covered in the topical research. Thus, a systematic literature review was conducted to cross-link insights and knowledge from different applicable disciplines. This research work followed transparent, reproducible and iterative processes, allowing to overcome and / or minimise potential bias (Phillips et al., 2015). Though, a key benefit of systematic literature reviews refers to identification of evidence-based key scientific contributions in a certain field of interest or revealed research gaps (Tranfield et al., 2003). Following seven-principles rule – Transparency, Clarity, Integration, Focus, Equality, Accessibility and Coverage (Pittaway, 2008), the researcher was able not only to address the research gaps, but also to open up future research pathways.

Even though each integrated research work followed a comprehensive and profound research methodology, individual methodological steps are embedded into overall research methodology of this thesis. In this sense, main research strategy was set starting

with an extensive literature analysis. Here, research gaps and problems were identified in the existing literature and the research objectives formulated, although finding minor adjustments during the actual qualitative research. The research strategy was built upon a mixed methodological framework applicable for qualitative studies to examine and analyse various and complex aspects of S3 approaches.

The research methodology is based on longitudinal and cross-sectional perceptions. First, S3 and EDP concepts focus on significant social, economic, environmental and political changes within one particular EU funding period in European regions. Here, monitoring and performance data are used in a longitudinal manner. In addition, the thesis partly deploys cross-sectional study perspective, especially when it comes to literature reviews and use case analysis which were implemented with involved actors.

The thesis is in its nature and design a theory testing terrain rather than a theory building endeavour, even though the results yield the need to further elaborate on novel and future-oriented theoretical concepts. Overall, the research followed a structured path during the whole doctoral studies by using the well-known research onion (Saunders et al., 2003). Figure 2 illustrates the research onion for this thesis and, in doing this, also summarises the methodological paradigm introduced.

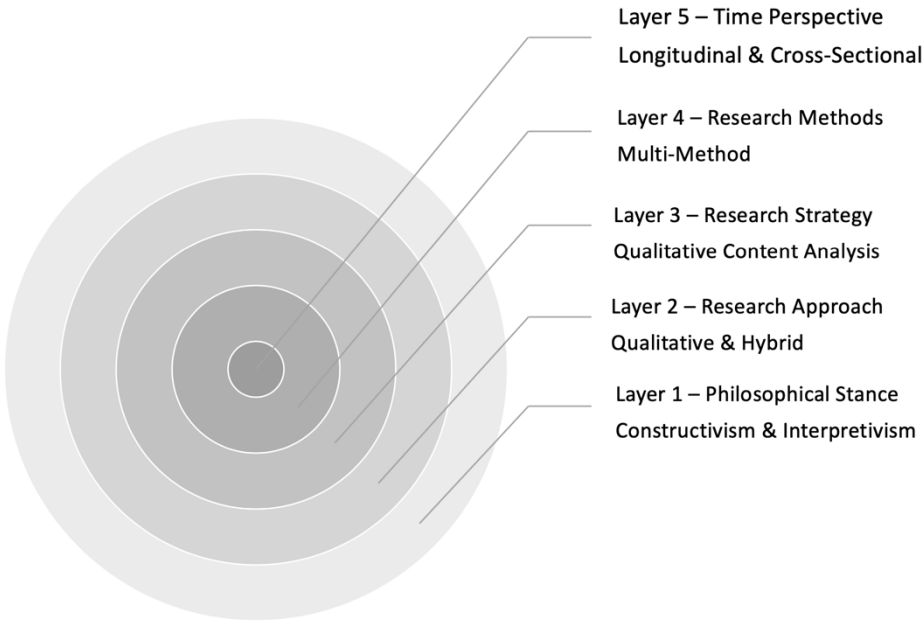

Figure 2. Research Onion of Doctoral Thesis
Source: Compiled by author)

The illustration of the research onion is not only offering a progressive view on the conducted research (Bryman, 2016), but also provides a retrospective view on the implemented methods as well. In sum, the conducted research of this thesis followed a comprehensive journey to address the introduced EDP, S3 and sustainable development related research problems and corresponding research questions. By means of implementing multi-method approach, as discussed above, the author was able to compare, to sound out and finally to leverage the most suitable approaches and methods to his best of knowledge.

4 Results

Individual research work presented in the selected articles provides a sound understanding on potentials and future prospects regarding EDP design in the S3 policy nexus. In the following, key results and contributions of the articles are displayed and reflected upon in the sub-chapters, which each of them yields researcher's contribution to science and S3 policy practice and responds to the addressed research problems and concerned research questions.

4.1 Measuring S3 and EDP Implementation Impact through Monitoring Systems

Key obstacles for S3 and EDP monitoring within the S3 policy nexus are addressed in the development of the so-called Transnational RIS3 Observatory Model. This model is based on a cross-regional comparison in S3 monitoring as well as on thorough selection of measurable and sufficient S3 performance indicators. The model delivers a structural concept for a monitoring system dedicated for deployment by different regions as well as for national and European level. The model development, described in detail in Article I (rf. Appendix), is based on a place-based approach and supplemented by case studies from ten participating European regions. It offers a hands-on framework to synthesise monitoring concepts across regions and on European level. Thus, the model addresses both the bottom-up approach through stakeholder engagement and involvement as well as the top-down approach integrating perspectives of key European institutions responsible for S3 implementation.

The main advantage and the unique characteristic of the model are associated through manifestation of transfer of monitoring processes from governmental bodies towards the transnational observatory acting as an institution responsible for evaluation of European regional performance and its monitoring, which are based on a particular thematic priority selected in the respective S3 policy domain. In such a way, European regions are able to perform not only a general S3 monitoring, but also to compare and assess monitoring results pertaining to the regional performance in the respective thematic priority / priorities, which is resulting from EDP implementation. In this context, the Transnational RIS Observatory body is referred to an institution encompassing three main parts: (i) Managing Committee being responsible for monitoring process design and implementation; (ii) Communication Body being active in disseminating and communicating monitoring results towards the European Commission and the Joint Research Centre, which acts as the main European research institution responsible for S3 policy development; and (iii) Thematic Experts / Stakeholders engaging for consultancy purposes and facilitating EDP along the S3 implementation nexus.

In line with the model developed, a crucial policy recommendation was formulated by the author regarding the unification of S3 priority areas. As the observatory rationale itself is based on bringing regions together for the purpose of thematic areas' collaboration, it is necessary to re-think the concept of priority selection. therefore, in terms of the policy insight made, unification of S3 priority areas does not only enable comprehensive and comparable S3 monitoring, but also opens up opportunities for cross-border cooperation under a certain priority area on both policy and entrepreneurial level.

Another key recommendation reflected in the model concerns potentials to re-shape the procedure in S3 performance indicator selection, which in term, should lead to a

more consolidated approach across European regions and their work in monitoring S3 performance. Currently, indicators for S3 monitoring and evaluation are individually chosen by regions, including individual choice over respective target values, which leads rather to a biased performance comparison among regions. To avoid this, the model calls for pre-defined indicators co-created on the European level in close contact with the Transnational RIS3 Observatories, the so-called Set of S3 Indicators. As the best practices have shown, at least context, output and result indicators must be bundled together for the purpose of S3 performance monitoring (European Commission, 2020). However, such "general" indicators need to be extended by thematic indicators defined by the respective Transnational RIS3 Observatories, which are referred to as S3 "Priority Specific Indicators". Considering both types of indicators, a sophisticated S3 performance monitoring and evaluation on regional and entrepreneurial level can be ensured, also reflecting the potential of the model to support the incorporation of diverse regional capabilities and assets under given heterogeneity of European regions.

In sum, the research delivers a macro-regional and transferable model concept for S3 governance by means of comprehensive S3 performance monitoring and evaluation. Furthermore, the author's work provides a portfolio of opportunities to foster collaboration across European regions on S3 monitoring and smoother S3 implementation in the next future. Policy involvement and participation in S3 performance monitoring is ensured through the transnational network integrating all Transnational RIS3 Observatories, which, in turn, exchange with each other in this specific task as well as connect with representatives of the European Commission, the Joint Research Centre and the existing S3 Platform established as the main contact points for Smart Specialisation policy in Europe.

The model and its functions can be transferred from theory into practice in the current S3 implementation period, by means of existing and developed online tools. Required bodies and institutions are already established across European regions. Therefore, as a next step in the upcoming research work, a feasibility study of the model concept covering several European regions is necessary to be undertaken in order to validate and iterate model structures and functions as well as to elaborate its potentials in fostering and improving S3 monitoring and evaluation in the next future. In doing this, the developed monitoring model strongly contributes towards sustaining and enhancing already established institutional pillar for S3 performance monitoring. As mentioned, the proposed model activates and integrates already established entities in European regions, which, however, currently show low collaboration in terms of their responsibilities and actions for EDP facilitation and S3 monitoring.

4.2 Unlocking Entrepreneurial and Regional Growth Potentials through Priority Set-up – A Maritime Use Case

As the thematic coverage of S3 priority selection and EDP identification under S3 can be manifold, a concrete case from the Blue Economy was subject to the present research work, which aimed at unlocking growth potentials through sufficient actor incorporation into EDP and S3. Blue Economy and Blue Growth bear great potentials for regional and sustainable development (Philipp et al., 2020). Whereas the existing literature has shown integration of the Blue Growth related priority areas (thematic focus) into S3 design and implementation (de Vet et al., 2016; Kogut-Jaworska, 2019; Pace & Drago, 2020. However, little is known about the involvement of blue actors into innovation policies.

Thus, using a place-based approach, Small and Medium-Sized Ports (SMSPs) were considered as a very specific regional asset to be subject for the scrutiny of regional S3 design and implementation. Since SMSPs can be drivers for the Blue Growth, they also appear in the S3 policy nexus. The impact of S3 on SMSPs performance, if those represent a part of the S3 priority set-up in the given region, can be identified and assessed. In this context, SMSPs are seen as entrepreneurial entities – Small and Medium-Sized Enterprises (SMEs) from the port industry. However, since there is no clear definition what a SMSP is (PAC2, 2014), from an operational perspective, SMSPs can be defined through their functional role they are filling. Thus, SMSPs can act as facilitators of the Blue Economy as well as perceived as active actors in regionalisation processes, providing sound capacity for multi-port gateway regions (Feng & Notteboom, 2013; Notteboom, 2010; Notteboom, 2014). When it comes to logistics performance, small ports can be classified as those handling goods up to 10 million tons per year, whereas middle-sized ports handle up to 10 to 50 million tons of goods per year, and big ports – more than 50 million tons of goods per year (Verhoeven, 2010). To make it crystal clear, however, SMSPs definition in this thesis will be borrowed from the Trans-European Network for Transport (TEN-T), which defines SMSPs as those integrated into the Comprehensive TEN-T Network or not integrated at all (European Commission, 2014).

Following this delineation, in total 37 European NUTS-2 coastal regions in the BSR were subject to the research study with a special focus on the selection of SMSPs as a S3 priority in the officially published S3 documentation. Using the European classification of ports from the TEN-T Network (European Commission, 2014), the World Port Source Database and the Eurostat data on a NUTS-2 level were deployed for the purpose to assess BSR SMSPs as introduced "port priorities" in the S3 policy nexus. Having identified coastal regions in the BSR, which list port priorities in the S3 design, applicable remaining regions were filtered against categories of core, comprehensive and small ports for the purpose to generate a final set of sufficient cases (regions) to be analysed. However, the first analytical attempt has already clearly shown a very low contribution or consideration of SMSPs within the S3 policy realm among the applicable BSR coastal regions. In addition, the majority of analysed regions does not include port priorities and Blue Economy sub-sectors at all into their S3 policy, thus supporting the challenge of insufficient S3 utilisation and low governance of regional assets for the funding period 2014–2020. In cases, in which SMSPs were integrated into S3 priorities, those regions were able to increase their cargo and passenger performance between 2014 and 2019 (based on the latest data availability). In addition, each of the regions prioritising specialisation in the SMSPs sector also outperformed the national level on cargo and / or passenger movements. Some regions and their SMSPs were able to successfully specialise within the S3 priorities, either on cargo or passengers, resulting in a remarkable increase in performance in the specified area (rf. Appendix, Article II, Table 3).

Following the analysis, the research delivers two policy recommendations that can be deployed by policy-makers for future S3 design:

1. Utilising regional resources and capabilities for S3: Low consideration of the Blue Economy and limited integration of blue actors into S3 policy design and implementation reduces potentials for regional development and building up competitive advantages.
2. Understanding S3 as a tool to support regional assets: S3 deployment on regional level increases regional performance and enables to sustainably specialise in available regional assets, thus reducing competitive disadvantages.

By providing those recommendations, the conducted research does not only support sustainable development of S3 policy (Fotakis et al., 2014), but also confirms the existing gap of insufficient utilisation of regional assets for S3 design. Furthermore, the work also reveals easy gains for particular regions in the future, once deploying S3 as a tool for policy-making (Gerlitz et al., 2021; Uyarra et al., 2014) and / or integrating it as a business strategy (McCann & Ortega-Argilés, 2014). Finally, as the conducted research perceives SMSPs as actors in the frame of innovation growth policies, it is coherent with current scholarly contributions treating SMSPs as innovative ecosystems (Di Vaio et al., 2018). Serving as transnational gateways and constituting economic centres at the same time (Audretsch et al., 2019), SMSPs become actors with social, environmental, political and economic positive footprint (Cantner et al., 2020; Notteboom & Haralambides, 2020; Tolstykh et al., 2021). Following this insight, SMSPs can be treated as ecosystems enabling new interactions (translations) in existing innovation policies, such as S3, as well as opening new pathways for sustainable development. More precisely, social, environmental, institutional and economic potentials and / or improvements can be associated with the results and recommendations made.

4.3 Discovering Open Innovation for Sustainable Development on Entrepreneurial Level

The concept of Open Innovation is generally linked to S3 paradigm. When it comes to a regional perspective, S3 policy strongly favours the concept of Open Innovation (Oliviera et al., 2021; Surya et al., 2021). In this context, Open Innovation addresses entrepreneurial level (Lopes et al., 2021). As illustrated in the Theoretical Background of this thesis, Open Innovation connects to the concept of EDP as well, by highlighting different aspects that might turn the EDP into a more sustainable one, with economic, environmental, social and institutional contributions made. Based on the implemented research, three areas fostering Open Innovation were examined, namely social innovation, cross-border cooperation and creativity.

4.3.1 Rationale of Social Innovation for EDPs and S3 Implementation

The conducted research focused on examining the interrelation between S3 and social innovation, thus contributing to sustainable development. By undertaking a systematic literature review, which was supported by content analysis, the author recognised and revealed potential research gaps to be further addressed in the future research. In addition, the work done positioned the current literature on incorporation of social innovation within the S3 policy ream as well as displayed potentials for applicability of social innovation supporting sustainable development. There exist a number of research records linking up S3 (Fellnhofer 2017; Janik et al. 2020; Komninos et al. 2014; Lopes et al. 2019) with social innovation (Dionisio and Vargas 2020, Eichler and Schwarz 2019, Phillips et al. 2015; Pomaquero-Yuquilema et al. 2019) and sustainable development (Bolis et al. 2017; Mensah 2019; Murphy 2012). The conducted research clearly reveals, however, a very narrow attention paid to the intertwining of those concepts. Following this, content analysis was applied to scientific contributions yielding conceptual interlinkages, by means of inclusion and exclusion criteria as well as Boolean operators. Consequently, three key themes were identified within the social innovation paradigm for the purpose of showing its conceptual meaning for EDP and S3 policy design:

clustering as method and theory for policy-making, social capital and regional assets as well as social innovation governance.

To start with, cluster concepts are frequently used in the research to understand regional development (Ablaev, 2018) and sustainability (Pozdnyakova et al., 2017; Prause, 2014), which yield great potentials for innovation to emerge (Bittencourt et al., 2019). When it comes to S3 policy discourse, cluster approaches can serve as an effective tool for strategy design (Citkowski, 2020), but rather show limitations in their application for S3 implementation (Hassink & Gong, 2019). Indeed, this can be partly justified with policy-driven path-dependency of decision-makers (Morgan, 2017; Pugh, 2018). As a result, this initiates a growing debate concerning re-thinking the deployment of cluster approaches for S3. In this sense, Social Innovation might serve as a concept breaking down such path-dependencies on policy level and supporting development of more sustainable approaches (Olsson et al., 2017).

When it comes to the integration of social aspects, network theories are used to explain actor relations within clustering approaches (Neumeyer & Santos, 2018; Reid et al., 2008). Considering potential of cluster policies to drive regional development (Cooke, 2012), cluster approaches can be deployed suitable concepts connecting social innovation and S3 towards sustainable development. Yet, cluster approaches appear to be feasible for the analysis of social innovation, EDPs and S3 towards sustainable development only. Moreover, cluster approaches are also linked to the Actor-Network Theory, by which clusters are labelled as translations zones. In this perspective, theoretical considerations are not contradictory to each other but rather supplementary.

Bearing this in mind it can be stated that social innovators in European regions are crucial actors for S3 design and S3 implementation leading to sustainability. Yet, as noticed during the systematic literature review, social capital as an available regional asset remains rather unutilised (rf. Appendix – Article I & Article II; Aranguren et al., 2019). Given this insight, the thesis calls for new concepts and ideas that go beyond known approaches and integrate place-based and network theories to efficiently elaborate potential integration of social innovation into S3 design and thus to unlock sustainability potentials. To initiate this change, the literature recommends deployment of concepts, such as transformative governance (Visseren-Hamakers et al., 2021), social mindfulness (Komatsu et al., 2022), co-creation (Ansell & Torfing, 2021) and corporate social responsibility (Tibiletti et al., 2021; Triantafyllidis, 2022). Nevertheless, existing scholarly records on social innovation governance are mainly used to explain potentials for the environment and therefore connect to sustainability mainly through the environmental dimension (Suitner et al., 2022). The relevance of social innovation governance and its impact for S3 has not been exploited yet, although the conducted research has clearly shown interlinkages of the concepts to support regional sustainable development by means of social innovation. Thus, the present work is stepping into and opening up a new path for the future research by revealing this particular research gap in the existing S3 literature.

Summing up, the involvement of social innovators into S3 as one of the main actors from the multi-level governance perspective acts as a key enabler towards sustainable development, driver for knowledge creation, facilitator for learning, enhancer of spill-overs as well as amplifier for cross-border collaboration. This is obviously linked to the social sphere of sustainable development but, as mentioned, also slightly touches upon the environmental one.

4.3.2 Cross-Border Cooperation as A Breakthrough for Entrepreneurial Discovery Processes

To elaborate potentials of cross-border cooperation within the S3 paradigm, the conducted research analysed EDPs with actors involved into the identical priority area of the region. A case of multi-functional agriculture for legume production was identified as a specific area of interest. Multi-functional agriculture receives an increasing attention. This is particularly true for rural areas, in which it can be used as a tool for upgrading agriculture innovation policies as well as supporting regional development (Holmes, 2012; Wilson, 2007). Due to this functional manifestation, this sector is closely linked to S3 by means of S3 objectives as well as through Key Enabling Technologies (KETs) and EDPs, which, in turn, are utilised for S3 implementation (Cvijanovic, 2020; Czermański, 2013; Prause & Boevsky, 2015). Thus, in this perspective, the present research provides insights to improve economic development and innovativeness of rural areas (Bacsi & Kovacs, 2006) by means of an appropriate S3 design (Papamichail et al., 2022).

For the research to achieve this objective, 21 implemented audits with Triple helix actors (academia, business and policy representatives) from different regions involved into S3 application pinpointed an explicit lack of initiatives established on a cross-border level as well as their reluctance to engage into S3 implementation. In addition to that, S3 priorities set by the selected rural and less-developed regions and deployed as case studies within this research were subject to the analysis of potential synergies prevailing or emerging in the respective research field of interest. Based on that, a sufficient cross-border cooperation concept was developed for the particular field of multi-functional agriculture within the S3 context and for the selected case regions.

Beyond the call for cross-border cooperation, the developed concept advocates improvement of locally produced raw materials, i.e. endorsement of a place-based approach. By increasing level of efficiency of such raw materials, diverse spill-overs emerge and generate positive effects on different economic and social dimensions of a region, such as imports, transport, labour market and circular economy. This, in turn, reduces environmental burden and paves the way for more sustainable concepts (Manhart et al., 2019). With this in mind, the cross-border cooperation concept (rf. Appendix – Article III) is seen as an enabler and a developer for EDPs and KETs, which result from the utilisation of knowledge hubs. Created and shared best practices, values, ideas, knowledge and lessons learned bear potentials to achieve necessary innovation level under S3 policy towards regional sustainable transition. Resulting from the concept development and its positioning in the S3 discourse, three key recommendations can be drawn from the implemented research:

1. As European regions are revising their S3 for the upcoming funding period, it is crucial to learn and utilise experiences gained from the current funding period as well as to adapt best practices and lessons learned from other counterparts. The “right” selection of regional S3 priorities is hereby crucial to set the path for potential identification of ways to engage into cross-border cooperation in the S3 realm. This, indeed, repeats the call for unification of S3 priorities (rf. Appendix – Article I).
2. Sufficient cross-border cooperation can locate potentials for regional diversification and discovery (Santoalha, 2019), which, in turn, generates innovation in different (new) fields. Therefore, in this very specific research

field covered, cross-border cooperation is not only an enabler for a more multi-functional agriculture to develop, but also to grasp opportunities to deploy legume raw materials in completely new fields (such as health and medicine).

3. Cross-border cooperation should incorporate knowledge hubs for interdisciplinary approach, which identifies new innovation potentials and finds new ways for KETs to be deployed. Indeed, knowledge transfer in hubs by business actors is a key for EDPs to thrive (Franco & Haase, 2015; Schartinger et al., 2006). In the S3 context, those knowledge hubs can be driven by actor, such as Creative Brokers and CCIs (rf. Appendix – Article IV).

In sum, sufficient S3 priority selection and cross-border cooperation approaches bear great potentials for successful EDPs and KETs, and, much more, might result into new paths for utilisation of locally available resources, thus providing environmental, economic, social and institutional benefits for sustainable development, as it has been shown in the particular field of multi-functional agriculture.

4.3.3 Creativity as A Driver for Co-Creative Innovation and Sustainable Mindset

CCIs are well-known as innovation brokers (Gerlitz & Prause, 2021). They are also positioned in the EU Smart Growth paradigm connected to place-based specialisation discourses (Cooke & De Propris, 2011). Nevertheless, from the perspective of regional innovation and cohesion policies in the context of CCIs, the doctoral researcher missed the nexus of CCIs with S3 and synergy potentials thereof (European Union, 2012; Rivas & Cappellano, 2020, Stanojev & Gustafsson, 2021). Bearing this in mind, the role of creativity and CCIs in the S3 design and implementation was explored, including potentials to contribute to sustainable development. The existing literature in this field has not yet revealed innovation potentials stemming from CCIs to strengthen EDP and S3 design and implementation. Reviewing available research records on CCIs' exploitation for regional development, the focus so far has been laid either on single industries or cross-industry innovation. Here, CCIs benefits are associated with multi-lateral approaches and positive effects on innovation by means networks, relations and alliances (Colombo et al., 2015; Gassmann et al., 2011; Santoro et al., 2020). In terms of S3 policy design, CCIs potential is still scant. Only ten percent of European countries have selected S3 priorities related to CCIs in the funding period as of 2014–2020 (Stanojev & Gustafsson, 2021).

The conducted research followed an interdisciplinary approach by linking different competences from diverse economic sectors to showcase potential of CCIs for S3 and sustainability. Building upon 32 multi-case studies of European SMEs and by deploying an action research approach, the present research work made a first attempt in integrating creative potential of CCIs into the S3 policy nexus. This was done just beyond simply linking both through S3 priority selection. In this vein, the research results yield CCIs' potential for streamlining and improving local and regional innovation capacities through S3. Innovation co-creation with CCIs as selected from the European tourism service sector and thus represents a sound EDP implementation case. In this case, CCIs fill a role of knowledge brokerage and mediation, which turned to be successful on the entrepreneurial level (micro-level) as well as within the innovation ecosystem (meso-level) and regional system (macro-level). Thus, CCIs' integration into EDP design and implementation is a crucial success factor, thus increasing innovation potential

of that EDP. Taking into consideration strong conceptual relatedness of CCIs and S3 – especially for the EDP – the research in hand calls for a pro-active integration of CCIs into S3 policy design and implementation in processual and institutional dimensions.

The research, first, enlarges the theoretical and empirical foundation of S3 policy and its impact on micro-level. This is achieved by means of exploring CCIs' innovation potentials, sustainable development and co-creation initiatives on entrepreneurial level in the participating regions and in the tourism sector in the S3 nexus. The research was able to identify EDP and S3 policy bottlenecks on the micro-level by examining perceptions of affected stakeholders in the given cooperation setting, i.e. Quadruple helix. Second, the research opens up new avenues for sustainability in S3 design. This is possible through conceptual linkages CCIs and S3 policy share in terms of sustainability, capability and proximity. In doing this, the role of CCIs as brokers for all involved Quadruple helix actors is revealed, considering actor engagement strategies in the discovery (co-creation) process. Indeed, co-creation, which is largely exploited by CCIs enables to increase necessary capacities for sustainable environmental, economic, social and institutional transition. In this sense, CCIs become not only effective transition brokers, but also mediators driven by human-centred motives, ecological responsibility, resource efficiency, social inclusion and institutional stability. Third, the developed and proposed Creative Audit Tool can support entrepreneurs in innovation development, accompanied by creative brokers' intervention. In this manner, future-oriented challenges and transition processes can be efficiently tackled and necessary capacities generated. Indeed, this contribution is coherent with challenge-oriented innovation policies, thus playing crucial role for S3 and sustainable development.

Finally, the research work improves understanding and importance of actors for sustainable EDP and S3 to emerge, who are organised in Quadruple helix networks. In this specific aspect, the research lends a special role to CCIs in Quadruple helix networks, in which CCIs fill a role of mediators and brokers with the purpose to boost innovation potentials. Similarly, CCIs can be perceived as social actors, as their integration affects not only any particular single helix but rather the entire environment and innovation ecosystem (Rodríguez-Gulías, 2020). When it comes to sustainable innovation, the ANT calls for translators, who actively define and establish relations between engaged actors (Aka, 2019). This role of translators can be filled by CCIs, as they support entrepreneurship and open innovation among Quadruple helix actors and pave the way for sustainable environmental, economic, social and institutional thinking and acting (rf. Appendix – Article IV; d'Orville, 2019).

To conclude on CCIs role for innovation and sustainability in the S3 context, the present research offers both theoretical and practical contributions. Theoretically, the work increases S3 understanding with creative mindset, which is needed to accelerate innovation and sustainable transformation. CCIs' intervention and brokerage support transformation of S3 towards sustainability. Practically, the research enhances innovation competence portfolios on entrepreneurial level. Local and regional SMEs dealing with innovation are offered an opportunity to benefit from and utilise co-creation tools as well as to exploit CCIs potentials. The developed tools are based on a holistic view and, thus, enable S3 implementation on micro-level and also connects to the regional and macro level in terms of S3. Overall, the conducted research calls for a more intensive cross-sectoral collaboration through CCIs brokerage and mediation on micro, regional and macro level. The potential of CCIs to boost regional development

is widely recognised, offering improvements on economic, social and environmental level as well. Moreover, CCIs better equip entrepreneurial actors with tools and methods towards innovation application and sustainable transition integrating both environmental and social aspects under one roof in the upcoming funding period as of 2021–2027.

5 Discussion

Smart Specialisation qualifies as the main innovation policy on regional level in Europe and bears therefor great potentials for innovation development and sustainable transition of the entire (entrepreneurial) ecosystems circled around individually set S3 thematic priorities. In this vein, synergies, spill-overs and intertwining with other future-driven initiatives become evident. As a consequence, research on S3 is sophisticated one. However, bearing in mind the end of the first S3 implementation period 2014–2020 and linking up with the future design of those innovation strategies, the present research emphasises several mushrooming lacunas connected with S3 application from both theoretical and practical point of view (Masana, 2022).

To begin with, as the doctoral research has shown, in the process of re-shaping S3 on the regional level, perspective of sustainable development does not appear within EDPs, which, in turn, might jeopardise future S3 design and implementation. Only few research articles addressed sustainable dimension, by linking up S3 with the EGD and its strategic implications on S3 (Larosse et al., 2020). This paves the way for emergence of the upgraded idea of Smart Specialisation, namely Smart Specialisation 2.0 (Kakderi, 2020; Masana, 2022, Panori et al., 2020) and Sustainable Smart Specialisation Strategy (S4), respectively. in this manner, S4 focuses on EDP improvements, but rather misses its positioning and interlink to the policy level (Kangas & Ryynänen, 2022; Laranja, 2021). At this point the present thesis touches upon this topic in the last research contribution and elaborates in-depth on how S3 and sustainable transition can be accelerated in S3 design and its perception. In line with this endeavour, the present research highlights the importance of EDPs, the concept which stands as a key S3 enabler and constitutes a central piece within the S3 policy puzzle (Laranja, 2021; Müür, 2022). However, EDPs find themselves caught in a dilemma. One the one hand, they enable discovery, e.g. through learning, open innovation and co-creation processes and thus appear to be very promising S3 accelerators. On the other hand, by implying huge potential for co-creation and change, they rather remain under the radar among policy-makers, who due to prevailing traditional thinking and planning of regional policies remain rather reluctant in EDPs' deployment (Capello & Kroll, 2016). This is also exaggerated by the bottom-up / top-down discourses (Valdmaa et al., 2020). These concerns are reflected upon in the following, by addressing the CRQ and three research questions.

5.1 On the Way towards Sustainable Entrepreneurial Discovery Process

In order to improve monitoring potential of EPDs contributing to S3 implementation in Europe (rf. RQ1), the Transnational RIS3 Observatory Model was developed (rf. Appendix – Article I). Here, the model itself represents a solution to overcome well-known monitoring challenges in the S3 discourse, such as missing comparability of cross-regional performance. To do this, it is necessary to transfer monitoring responsibilities from regional bodies towards transnational observatories by establishing them as institutions. In order to activate and accelerate collaboration cross regions, the model proposes consolidation of processes when selecting S3 thematic priority areas. By now, each region is choosing and defining its priority areas individually, resulting into fuzzy and overlapping S3 thematic landscapes low or absent collaboration potentials on any implementation level in the S3 policy domain. Proposing a shift to rather S3 thematic monitoring instead on focusing on overall regional performance monitoring, the Model offers a novel approach for a more efficient impact monitoring of

S3 implementation in European regions. This model also delivers a harmonised perspective on S3 indicator selection and deployment. However, the proposed Model is drawn from a regional and European perspective on EDP and S3 design and implementation. Thus, it is not possible to monitor one particular EDP, but rather to subsume EDPs' impact from a certain period of S3 implementation into the analysis. This bears improvement potential towards currently used monitoring approaches in theory and practice.

When it comes to the improvement of sustainable development through EDP design, the Model addresses the institutional perspective. Therefore, emergence of sustainable EDPs follows interactions and shared responsibilities among mainly established institutions, which enable to increase efficiency in S3 performance monitoring. Turning the focus on actor involvement (rf. RQ2), a special case of SMSPs as blue actors within the Blue Economy, which manifests maritime innovation and growth initiative, reveals rather limited attention paid to ports and their inclusion into S3 priority setting in coastal regions. This bears a clear paradox, despite the fact the Baltic Sea is one of the busiest seas worldwide regarding traffic (Czermański, 2017), and on the macro-regional level SMSPs constitute important economic, environmental and social actors. As a result, potentials for regional and sustainable development remain unused as well as competitive advantages lost. Interestingly, SMSPs are known for their institutional role and active participation in EDPs on local and regional level to drive innovation with economic, environmental, social and institutional innovation. As the research has shown, in regions with SMSPs included into S3 thematic priority list, logistics performance tends to increase and outreach that on a national as well as European level. With this research insight, S3 can be seen as a tool supporting regional actors in their EDPs from regional and entrepreneurial perspective. Since S3 policy aims at experimentation and calls for flexibility, including development of social capital, strong partnerships, trust and even an open mindset, EDPs shall follow conceptual propositions residing in Open Innovation and participatory approaches. However, in this matter, available participatory approaches are mainly targeting S3 policy governance, when it comes to EDP analysis (Komninos et al., 2020). Therefore, for the purpose to improve (and enhance) collaboration among actors involved into EPDs in regions (rf. RQ3), the thesis provides three main findings supporting stronger manifestation of EDPs in the S3 policy precinct.

Above all, social innovation and social innovators within the S3 and sustainable development nexus yields an untapped field in the exiting literature. Few research contributions are available, which generalise the involvement of social capital into S3 design and implementation as well as social EDPs. In this context, social innovation is seen as a potential breakthrough concept addressing risk-averse behaviour and path-dependency aspects on policy level. Despite those advantages, the present research track detected low level of social capital utilised within S3 conceptualisation, the insight also supported by other researchers as well (Martinidis et al., 2022). On the one hand, this constitutes a clear drawback, which was addressed by RQ2. On the other hand, it clearly pinpoints unused potentials for S3 in terms of sustainable development and missing perceptions on social account. For the entrepreneurial level, concepts, such as social mindfulness, co-creation and corporate social responsibility are emphasised to transform EDPs into more sustainable ones. Moreover, the involvement of and collaboration with social innovators paves the way for knowledge creation, facilitates learning as well as enhances cross-border cooperation.

Picking up on the latter point, cross-border cooperation qualifies as a potential driver for more sustainable EDP implementation, as addressed in the RQ3. As a concept, Open Innovation builds upon cross-border cooperation in the entrepreneurial context (Anshari & Almunawar, 2022). In this sense, the present research corresponds with similar studies highlighting the need to enhance understanding of cross-border cooperation for multi-actor involvement in S3 (Mikko et al., 2021), despite the fact that existing cross-border cooperation is born in the era before S3 implementation (Muller et al., 2017). The proposed model by the researcher provides a concept for cross-border cooperation, which works for EDP design and implementation. For the model design, again, a harmonised S3 priority area selection process constitutes a necessity to create a common thematic scope for all actors involved. More specifically, at the core of the model, the so-called knowledge hubs need to be institutionalised. This kind of institutionalisation takes place in a form of actor brokerage and is crucial to identify and generate potential synergies for EDPs to emergence across regional borders. However, from a practical view, i.e. on entrepreneurial level, performance of actors involved in EDPs is not limited to regional boundaries, hence, cross-border cooperation is already widely applied for innovation processes. However, for the scope of the thesis, only EDPs under S3 policy are relevant and, in this sense, cross-border cooperation has been neither considered nor integrated yet. Therefore, the proposed model addresses this scholarly gap and contributes to the research by integrating EDPs within both cross-border cooperation and S3 policy towards sustainable development.

Finally, the thesis reveals potentials resulting from integration and collaboration with CCIs for EDPs in the context of S3 design and implementation. Deployment of creativity and its potentials for an EDP is a promising approach to achieve the earlier mentioned open innovation and sustainable development. This is achieved through creative processes, such as experimentation, open mindset, collaboration, social responsibility, self-discovery and learning. As shown, CCIs' integration into EDP design and implementation enhances sustainability of the processes on entrepreneurial level. Moreover, CCIs represent the necessary link, by which they broker and connect social innovation and cross-border cooperation. Current studies are also calling for the need to integrate such change agents without identifying them (Kristensen et al., 2023). Hence, the thesis is contributing, again, theoretically and practically to the topical research discourse focusing on CCIs' intervention and brokerage positioning in EDPs and S3 set-up.

By showing practical collaboration pathways for actors involved into EDPs and S3, the thesis also makes a theoretical contribution by means of integrating the ANT into S3 conceptualisation. It is worth mentioning here that putting the ANT into S3 nexus is opens up new future research horizons. Research results and findings clearly emphasise the necessity to shift theoretical conceptualisation in the EDPs, S3 and sustainability discourse towards network-oriented theories. By now, however, S3 design and implementation has been strongly based on the interplay of affected institutions as regional actors. The concepts introduced in the thesis make it clear that in order to initiate the shift towards sustainable development in EDPs and thus S3 by means of social innovation integration, cross-border cooperation and CCIs' intervention, it will not be enough to recall place-based approaches only, given the fact that network theories bear sound potential to explain such cooperation through social relations and structures (Pachucki & Breiger, 2018). Hence, the ANT serves here not only as a feasible theory to explain and justify the findings made in this thesis, but also facilitates intertwining with concepts supporting EDPs and S3 design.

Summing up the sustainability discourse in the light of EPDs and S3, the thesis approached raised research questions from different perspectives and different thematic areas to develop comprehensive terrain for sustainable development. Table 3 shows a synopsis of the research by placing author's contributions within sustainable dimension.

Table 3. Outline of RQs, Research Contributions and their Impact on Sustainability

Research Question	Article	Sustainability Dimension(s)	Contributions
RQ1: How can EDP impacts on S3 implementation be better monitored across European regions?	Article I	Institutional	+ Transnational RIS3 Observatory Model overcomes non-comparability of S3 monitoring in European regions. + Harmonisation of priority area selection procedure is necessary to enable collaborative monitoring.
RQ2: How are EDP actors incorporated and reflected in S3 priority set-up?	Article II	Economic Social Environmental Institutional	+ Available regional assets shall be utilised for S3 priority selection. + Deployed as a tool S3 improves performance on regional and entrepreneurial level
RQ3: How can EDP actor collaboration be improved towards open innovation application?	Article III	Social	+ Social innovation needs more attention in S3 conceptualisation. + Involvement of social concepts and innovators transforms EPDs into more sustainable ones.
	Article IV	Economic Social Environmental Institutional	+ Cross-Border Cooperation is a driver for Open Innovation of participating actors. + Cross-Border Model for EDPs cooperation showcases importance of connecting knowledge hubs in a brokerage construct.
	Article V	Economic Social Environmental	+ CCIs' intervention within EDPs improves sustainability of the innovation and general collaboration process itself. + Acting as brokers CCIs are able to link different concepts targeted to EDPs related improvement.

Source: Compiled by author.

Picking up on the findings, the CRQ needs to be addressed from two perspectives. One the one hand, from a regional point of view, particular S3 design of a region serves as a framework either enabling or disrupting EDPs and their contribution to sustainable development. To enable efficient and effective S3 design to occur, thematic priority areas to be chosen by the region is crucial process that requires harmonisation on a policy level in Europe. This improvement would not only kick-start a more comprehensive monitoring system on a regional (and European) level, but also would strengthen thematic collaboration opportunities on entrepreneurial level. In particular, this would result into a positive top-down impact for S3 implementation. In addition, a more targeted and comparable monitoring system might not directly affect the EDP design itself, but a collaborative and consolidated monitoring across involved regions allows a more detailed track of drawbacks resulting from EDP application and dovetailing of best practices.

On the other hand, from an entrepreneurial point of view, the thesis emphasises the conceptual shift of EDPs towards stronger attention to Open Innovation concept, which can be conceptually linked with EDPs and S3 through integration of social innovators, cross-border collaboration and CCIs. Specifically, an EDP does not imply emergence of innovation by one entrepreneur, but rather embraces an interplay of different actors from different areas coming together. Thus, EDP set-up in the S3 context needs to cover social and collaboration aspects from the very beginning. Furthermore, future EDPs should be based on actor collaboration to facilitate and enable experimentation, learning, self-discovery, flexibility and social integration under one roof of interaction, which postulates explicit pathways for sustainable potential to be grasp and deployed.

Overall, in doing this it becomes clear that S3 priority area serves as a principal link between regional and entrepreneurial level. S3 can be a tool for a change to stimulate among entrepreneurs. Vice-versa, entrepreneurs should be integrated into S3 priority selection from the very beginning, the process, which is usually in the sole responsibility of policy-makers. This interplay is crucial and, in its sense, contends that sufficient S3 implementation is based on participatory approaches but the participation itself should take place on all affected governance level. Hence, S3 priority area set-up is the most crucial building block for S3 design and determines therefore all tenets of EDPs and their potentials towards a more sustainable development for the whole region, in particular, however, as exploited by this thesis, for S3 monitoring, actor involvement and cross-border cooperation.

5.2 Research Contributions to the Topical Discourse

Picking up on the present research terrain, the thesis enhances the current status of scholarly achievements on EDPs and S3. First, it facilitates better and sufficient S3 design and its governance. Monitoring process is a key behind S3 design, governance and iteration. Despite this fact, strategy design has received so far low attention in the scholarly community. In order to reduce this gap, the present work developed the so-called Transnational RIS3 Observatory Model. The model is going beyond the existing monitoring concepts and serves as a first research endeavour to set up a comprehensive, comparable and cross-level monitoring system for S3. With this model proposed, the research contributes to the theory on the one hand. On the other hand, by addressing the research-to-practice-gap, the work offers practical conceptualisation of S3 evaluation and monitoring being linked with governance tools (Gerlitz et al., 2020).

Second, the thesis enhances S3 design and implementation by advocating the bottom-up approach, as it is promoted in line with EDPs in the S3 nexus. By echoing topical literature (Gianelle et al., 2019; McAdam et al., 2018), S3 policy design and implementation have so far missed exploration of its potentials for and effects on the micro-level (actors and partnerships, firm-based). The research makes here a clear footprint by proving positive effects on a micro-scale, provided that sufficient S3 priority areas are chosen, which integrate particular actors on a micro-level into S3 design, as it was showcased with SMSPs in the BSR. Moreover, theoretical contributions have been made in applying S3 for the Blue Economy. As the researcher demonstrates, SMSPs are referred to as important regional assets and blue actors and, thus, shall be involved into EDPs and into S3 design as well. The conducted analysis has revealed a lack of such exemplary utilisation of available maritime capacities, which contradicts the conceptual reasoning in place-based theories. Nevertheless, as aforementioned, the study results show positive effects of S3 governance on performance SMSPs, underpinning a growing

demand for sufficient integration of regional assets into S3 priority selection and S3 implementation. With this result, the thesis demonstrates practical contribution as well.

Third, the thesis supports and better utilises innovation capacities for S3 design and implementation. The theoretical contribution is mainly driven by place-based theories applicable for S3, as the implemented systematic literature review of S3 and its relation to sustainability reveals. Hence, place-based actors and thus EDPs constitute central pillars for S3 design and implementation and enable sustainable development. Knowledge, technology and innovation capabilities of a region are key factors fostering sustainable development (Ferreira & Seixas, 2019), which, in turn, demands active involvement of regional society represented by social innovators or social capital brokers. Indeed, those actors are principle agents for knowledge creation, learning facilitation and spill-overs to emerge. In this manner, the thesis contributes to theory with the analysis done on social innovation paradigm in the S3 context, with no research contributions available on the intertwining of the social realm and S3, capable to lead to sustainability so far. In addition, the thesis revives deployment of a Quadruple helix approach for S3 transformation towards sustainability, thus paving the way for S4.

Fourth, the thesis showcases theoretical footprint by showing how cooperation among European regions in the task of S3 design and implementation can be facilitated. As own exploration reveals, cross-border cooperation under S3 policy is scattered. However, in order to accelerate sustainable development, efficient cross-sectoral partnerships and collaboration among multiple actors leaving their "boundaries" is required (Köhler et al., 2019). By introducing a cross-border cooperation concept in a particular S3 priority – multi-functional agriculture – the thesis responds to this research gap and develops a model, which serves as a conceptual framework for stronger trans-regional collaboration and cooperation alongside a particular S3 priority (thematic field). In this context, CCIs can strengthen collaboration and serve as crucial interplay, bringing in topical concepts from this industry into the S3 policy design. Indeed, the intertwining of CCIs and S3 design in the sustainability nexus has been so far untapped in the research discourse of this particular field. In this sense, the present research work opens up new research horizons and sets out into future research work. CCIs and social innovators bear potentials to break down existing boundaries in different ways on policy and entrepreneurial levels. With proactive incorporation of social innovators and integration creative brokers into the multi-level stakeholder approach (Quadruple helix), new development paths and innovation ideas can be discovered, thus supporting growing discussion on N-helix emergence and its role for sustainable development expressed through technological, social and specialised innovations (Lew & Park, 2021).

Finally, the thesis enhances the EDP and S3 discourse with the ANT. The interlinkages between this theory and S3 concepts were identified and showcased. Building upon network theories to explain S3 peculiarities, the thesis highlights ANT conceptual strength for the applicable S3 research. Considering the importance of participatory and collaborative approaches to address sustainable development through EDPs in the S3 context, the ANT enables to grasp relations among actors involved into S4. This insight serves as a principal stimulus for the future research. Nevertheless, there is no one size fits it all solution in the S3 policy (Ortega-Argiles, 2022). As a result, practical contributions delivered paid great attention to individual adaptability of the developed concepts in order to facilitate future focus on sustainable transformation, which is meant to deploy S3 design, implementation and potential with multiple actors and stakeholders involved.

6 Conclusions

The main research objective of this thesis was to improve the understanding of EDPs positioning for sustainable development within the S3 nexus. Given the urgency to re-shape S3 policies and action plans, as the transition phase to the new funding period 2021–2027 is taking place now, the thesis claims to provide crucial hands-on tools and a mind-changer supporting integration of different approaches towards overall future S3 design. This is covered through comprehensive theoretical contributions made during the individual work. The existing literature is now enhanced with a conceptual framework dedicated for S3 design and application and improving EDPs' positioning within S3 application. In addition, practical contributions are made in developing and introducing adaptive tools and concepts to improve EDPs and S3 design and implementation in the future and. In this manner, the present work addresses and reduces the existing research-to-practice gap existing in the S3 discourse. Here, each of the contributing articles of this thesis touches upon a particular S3 research field, by stating clear research problems, formulating research questions and delivering results for both theory and practice, thus paving the way for sustainable development based on improvement performance potential of EDP within the S3 context.

From a theoretical point of view, the researcher designs a necessary shift from place-based approaches towards more network-based theories, as transition towards sustainable development requires new models and concepts, which cannot be completely justified by mainly used place-based theories. In doing this, the work builds upon the concept of EDPs for S3 innovation and enhances EDPs and S3 conceptual foundation by new perspectives and approaches linking innovation and entrepreneurship with social innovators, cross-border cooperation and CCIs. As a result, the theoretical discourse is enlarged by the so-called ANT. By showcasing potential synergies of the ANT for S3 design and implementation it turns to be a valid theory for future S3 analysis and design. Although the present work delivers strong propositions supporting deployment of this theory for the present research context, it remains necessary to further elaborate the theory and its applicability for S3. The becomes crucial considering the fact that the overall work of the author was based on individual articles, which of them followed individual research path in terms of methodology chosen depending on the problem identified and question raised. However, by looping these individual research paths into a comprehensive picture, the overall research deployed a longitudinal qualitative multi-method approach in line with the philosophical stance of constructivism and interpretivism. By applying this methodology, the thesis developed contributions that enable to answer the proposed three research questions as well as the CRQ. In the following two sub-chapters, the results are subsumed into concluding remarks for the principal actors being addressed in this thesis – entrepreneurs and policy-makers.

6.1 What's in there for Entrepreneurs?

On the entrepreneurial level, S3 as a European policy supporting regional innovation might not be well-known on a daily basis. Nevertheless, in order to support management and strategic positioning of businesses, several aspects can be capitalised on to improve or grasp competitive advantages and / or sustainable transition potentials.

S3 qualifies as a core concept pushing forward the implementation of the EGD, which sets ambitious goals for European regions, but also imposes new economic regulations, which, in turn, implies changes to current business practices. As a result, further policies

and legislations can be expected in the next future to be endorsed in order to achieve objectives defined in the EGD. Since more than a half of European businesses are not aware of or not ready to contribute and prepare for the EGD, this clearly emphasises a need for acting now (Geerts et al., 2022). In this manner, S3 and its concepts can support entrepreneurs in preparing for and initiating transition of their business towards more sustainable one. In this particular task, entrepreneurs need to be aware of the S3 and EDP concepts, but at the same time capable to integrate them into own business practices and its future modelling. The same applies to awareness raising and improving command of key S3 priorities stipulated in the respective regional strategy. Since S3 policy aims at improving distribution capacity and performance of EU funding on the entrepreneurial level, knowledge of and deployment of the hands-on concepts in the S3 context can also improve own funding capabilities and boost own business.

From an operational perspective, EDP is the main concept in the S3 discourse that can be deployed on entrepreneurial level. From a business point of view, EDP should replace kind-of in-house innovation processes. However, the shift towards EDP design and implementation in businesses requires an open mindset of entrepreneurs and readiness to commit to Open Innovation. In this light, involvement of social innovators, reinforcement of cross-border cooperation and engagement into collaboration with CCIs have clearly shown contribution to sustainable development on entrepreneurial level. By doing so, entrepreneurs can be equipped with an additional hands-on innovation method and their innovation capacity respectively enhanced. for the purpose of extensive methodological and tooling overview, individual articles provide more specific approaches and examples on how to incorporate those mentioned concepts, resources and methods into own businesses.

Overall, to benefit from the positive effects offered by EDPs and S3, entrepreneurs need to be proactive. As explored during the longitudinal research journey, EDPs' success is linked with active participation of multi-level actors in networks. This requires either engagement into or building a new network of entrepreneurs. Moreover, as S3 priority setting provides a binding funding allocation framework for entrepreneurs to fit into, proactive engagement in designing the strategy is also highly recommended in order to avoid further mismatches of theories being included in the strategy as well as for the purpose to align funding distribution to the real needs of entrepreneurs and to support entrepreneurial development within a given region.

6.2 What's in there for Policy-Makers?

Despite the main research focus placed on EDPs, policymaking has been addressed in the present work as well, as regional S3 is setting the principal framework, which applies EDPs for S3 design and implementation. Therefore, when analysing the set-up of more sustainable EDPs, the work shows that regional policy level and its governance are strongly with EDP potentials. Moreover, as an EDP is presupposing policy participation, proactive engagement and mindset is as important on regional as on entrepreneurial level as well. In this matter, an on-going dialogue of policy-makers with the entrepreneurial level is important, including potential new entrepreneurs into S3 design.

This dialogue is also important when setting S3 priority areas within regional S3. As mentioned before, the thesis favours harmonisation of the S3 priority selection among European regions. Nevertheless, a dialogue would not fully reduce a potential mismatch when selecting S3 priority areas and reflecting real entrepreneurial needs. A recent study has proven this mismatch empirically (Marrocu et al, 2022), pinpointing the need to

better implement participatory approaches into S3 design. Moreover, actor involvement is a crucial denominator, implying a principal change in thinking and acting among policy-makers in order to seize sustainable development potentials. S3 success relies on sufficient priority selection. Furthermore, S3 priority selection serves as a paramount enabler for sustainable development for the S3 policy for the upcoming funding period and, thus, should play a central role for regional S3 design. For the purpose to monitor EDPs and S3 performance, which are crucial for the future, a monitoring model was developed, which enables monitoring in S3 priority performance and benchmarking of regional achievements in innovation. Here, again, proactive engagement on policy and regional level is required to initiate changes in the current systems. In sum, sustainable EDPs should be based on collaboration and participation, as highlighted in this thesis. Thus, all affected actors – including policy-makers – are meant to be engaged into open mind mapping and exchange in the current design and implementation of EDPs in the context of S3.

6.3 Research Limitations and Future Research Avenues

Despite sound theoretical and managerial contributions made, the present work also suffers from some research limitations. To begin with, from a methodological point of view, the number of implemented audits with S3 representatives, which served as a basis to ground research results could have been higher. This could have also improved heterogeneity of the research. However, at the beginning of the research work, low accessibility and missing contacts to S3 actors hindered a more extensive auditing process. Due to a newcomer position in this particular research field, neither a research, entrepreneur nor policy network was available to capitalise on in the research design. Especially for proposed research questions, targeted qualitative interviews across different governance levels would have served as a very sufficient research method to gather additional qualitative primary data for the own research. Even though interviews were conducted at the very beginning, the interviewees were not purposively selected by the researcher. Therefore, the answers delivered by the interviewees and, in particular, formulated research gaps need to be interpreted quite sensitively for the purpose of results' generalisation and conclusions' formulation of the thesis. In addition, the audited actors represent different fields in S3 application. This means that in some cases the experts where not appropriate to evaluate the cross-border cooperation for the region they represent. Hence, in terms of the data portfolio originating from audits, a potential bias is worth mentioning due to missing topical knowledge or specific information of participating experts. Moreover, since gathering audit data was one of the first attempts by the author in primary data collection, a design of the questionnaire and the overall audit implementation process might have overlooked additional check-ups or might have misinterpreted crucial knowledge and information from the experts. The same limitations apply to the Transnational RIS3 Observatory Model, which is grounded upon insights gathered from ten different European regions.

Further limitation of the work can be associated with the research methods chosen and implemented to the best of knowledge by the respective author(s). A methodological choice was based on a principal identification of particular research problems and research questions proposed in the concerned articles. Even though the author of this thesis aimed at sticking as closed as possible to the thesis research design, two articles were developed and published in a research team, thus considering deviating approaches and methods used by the research team. In this sense, it cannot be excluded

that different research methods can lead to different results, which, in turn, might require a new interpretation and discussion in the prevailing research discourse.

From a longitudinal perspective, the research yields some limitations. On the one hand, only a certain amount of time was made available to conduct this thesis, thus limiting author's possibilities to join longer scientific discussions with other experts in the field and at the same time increasing pressure to create research results fast. This, indeed, might have influenced an in-depth level and scope of the complex research topic touched upon, when it comes to a comparison with scholars who have been involved for several years into one specific topic. On the other hand, the timing of the thesis is limiting one crucial element being thematically covered – S3 monitoring. The monitoring process is not yet finalised for regions in terms of their S3 performance for the period 2014–2020. As a result, the presented insights are crucial to re-shape monitoring processes and concepts. Yet, the overall insight portfolio was not possible to deliver to its full extent at the timing of thesis development, which means that monitoring results cannot be fully utilised in the research. Recalling the current status of the published S3 documents for the funding period 2021–2027, the majority of applicable European regions was not able to update and redefine their S3 yet (European Commission, 2023).

Finally, the implemented research and its findings has some scope limitation. Since S3 is referred to as a specific tailored regional innovation policy, insights and findings outside the S3 research realm, which cover topics, such as regional development, innovation processes and policies as well as actor engagement might have been consulted, thus leading to development of new aspects, concepts or methods being beneficial for S3, both from theoretical and practical perspectives. In the same vein, the topic of sustainable development is manifold and linked to other concepts as well. Especially the concept of resilience strongly correlates with sustainable development. Despite the fact that one article addressed the interplay of EDPs and resilience (rf. Appendix – Article IV), the resilience concept itself has been subject to the doctoral research, although having in mind that resilience bears an important topic, which is linked with sustainable development (Reyers et al., 2022) and S3 (rf. Appendix – Article IV; Gañán de Molina et al., 2022).

Recapping the status quo of the S3 research at the thesis finalisation, only few updated S3 documents for European regions have been published on the official European Commission website. In detail, only 12 strategy documents have been published so far, whereas four of them represent innovation strategies dedicated to the national level (European Commission, 2023). Therefore, a comprehensive analysis reflecting a distinct change within the S3 policy for the new funding period is not possible. Therefore, improvements towards sustainable development as exploited in the thesis cannot be cross-checked with the implementation strategies available.

Overall, the thesis in hand offers both theoretical and practical contributions to enhance S3 design and implementation as well as to enlarge upon the scant research discourse of sustainable development under S3 policy. In this way, the thesis opens up new discussions and paths for future research on this particular theme. Consequently, a transfer of the developed models and explored conceptual intertwining would be a logical next step in the following research to fully cover the research-to-practice-gap, when it comes to EDPs as well as S3 design for sustainable development. More precisely, the Transnational RIS3 Observatory Model could be implemented within a limited number of participating regions to exploit its feasibility as well as gain feedback on the model improvement for the future generations. This drafted research track would imply

a science approach, but at the same time would also pinpoint the missing link between theory and practice in the S3 research discourse. From a theory development perspective, the integration of the ANT into EDPs and S3 research were revealed as promising one and will be further continued in the future research work. The interlinkage of S3 concept with sustainable development is still an underdeveloped field in research and serves as a principal impetus for the author to continue this research journey. S3 research is complex and there are still mushrooming gaps and problems to be addressed in the next future, in particular, by considering the rapid pace of change. In this sense, sustainable development will most probably, if not certainly qualify as a holistic concept and a hands-on approach in designing and implementing future EDPs and S3, which delivers meaning and value on the regional and European level.

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Abstract
Entrepreneurial Discovery Process Design for Sustainable Development within Smart Specialisation Strategies

The thesis aims at examining and improving understanding of Entrepreneurial Discovery Process (EDP) set-up and its positioning within Smart Specialisation Strategies (S3) design and implementation, thus enabling regional sustainable development. S3 as well as Research and Innovation Strategies on Smart Specialisation (RIS3) receive increasing interest in regional innovation policy planning and governance, in particular, considering the current transition of this policy from period 2014–2020 towards 2021–2027. In this sense, regional decision-makers do not only have to learn from the first implementation period, but also to develop capacity to re-shape those strategies in order to meet future demands as well as to achieve objectives, as set in the European and international agendas, e.g. the European Green Deal, UN Sustainable Development Goals and Agenda 2030, New European Bauhaus or Fit for 55 Package. In other words, European regional policy-making is under pressure to set up the path for future S3 design and implementation for 2021–2027 and beyond, keeping in mind the objective to accelerate both multi-scalar and multi-layer sustainable development.

Nevertheless, as the literature and available research initiatives demonstrates, the nexus of EDPs, S3 and sustainability stays rather below the radar. S3 design shows tangible drawbacks in finding the link between theory and practice, and EDP implementation misses sound theoretical foundation. At the present moment, S3 idea is still strongly connected to technology-driven innovation thinking and acting, which, in turn, ignores crucial aspects and wastes innovation potentials, thus jeopardising sustainable transition in a region. Unfortunately, social innovation concepts or socio-ecological tenets and their impact towards sustainable development have not been elaborated or incorporated as key building blocks into S3 design and implementation yet. The same applies to Cultural and Creative Industries (CCIs), which have proven paramount innovation capacities and competences to moderate relations between involved actors in a function of creative brokers, thus guiding and facilitating development and implementation of EDPs, which are, indeed, one of the core concepts in S3 policy-making.

The thesis is based on Qualitative Content Analysis research strategy. To answer the Central Research Question (CRQ), three Research Questions (RQs) are introduced and individually addressed throughout sufficient research methodologies. Thus, the thesis delivers results, which are based on multi-method approach. This approach deploys different research methods, the selection thereof being based on the specific research question to be answered. As a result of the implemented research methodology, this thesis provides different insights to address the EDP set-up and its improvement both from regional and entrepreneurial level. First, a Transnational RIS3 Observatory Model is developed and introduced. The model is based on the introduction of a harmonised procedure dedicated to choose S3 thematic priorities in European regions. As a result, the model enables to effectively overcome well-known research problems of S3 monitoring in terms of covering aspects of comparability, multi-level approach and performance measuring. In this vein, the thesis in hand undertakes a novel research path in conceptualising S3 monitoring model and thus enhancing to available scientific literature.

Furthermore, the present work connects social innovation and CCIs to the S3 domain, including spill-overs on how to utilise those concepts for sustainability transition in innovation policies. In both cases, the thesis calls for a higher involvement of social capital and creative brokers, which qualify as key actors and regional assets within S3 design and implementation based on Quadruple helices. In addition, the deployment of regional assets for innovation application and EDPs is a crucial aspect in the place-base theory realm to be used to explain and discuss S3 phenomena. However, an analysis undertaken for the Blue Economy – which in its innovation and sustainable development meaning shows conceptual overlaps with S3 priority of Blue Growth – shows rather low utilisation of those potentials for S3 policy implementation. More precisely, the analysis yields low uptake of ports as regional assets and innovators into S3 priority set-up, although once integrated into regional S3, ports as Blue Economy actors enhance their innovation capacity and might generate higher positive effects in terms of better placed-based port performance.

The present work also offers a first attempt in promoting cross-border cooperation as a contributor to S3 design and implementation. Despite the fact that cross-border cooperation is a well-known concept facilitating innovation, it has neither has been connected yet to the S3 discourse, nor its potential unveiled for S3. These potentials are addressed and showcased for EDP design and implementation by exploring a particular sector of multi-functional agriculture, which conceptually merges under one roof several S3 objectives.

In sum, the thesis offers both theoretical and practical contributions dedicated to current EDP and S3 research and enhances the scant literature on the intertwining of EDPs and S3 with sustainable development. Indeed, sustainable development serves as a principal impetus for the researcher to continue this path in future discussion and incorporation of new concepts into S3 design and implementation.

Lühikokkuvõte
Ettevõtliku avastusprotsessi kavandamine säästva arengu jaoks aruka spetsialiseerumise strateegiate raames

Käesoleva doktoritöö eesmärk on uurida ja parandada arusaamist ettevõtluse avastusprotsessi (EDP) ülesehitusest ja positsioneerimisest aruka spetsialiseerumise strateegiate (S3) kavandamise ja rakendamise kontekstis, et võimaldada piirkondlikku jätkusuutlikku arengut. S3 ning aruka spetsialiseerumise teadus- ja innovatsioonistrateegiad (RIS3) leiavad üha suuremat huvi piirkonna innovatsioonipoliitika kavandamisel ja juhtimisel, kuna praegu toimub üleminek ajavahemikust 2014–2020 ajavahemikule 2021–2027. Seejuures peavad piirkondlikud otsustajad mitte ainult õppima esimesest rakendusperioodist, vaid kujundama strateegiad ümber, et vastata tulevastele nõudmistele, ning andma piirkondliku panuse Euroopa ja rahvusvahelistesse tegevuskavadesse, nt Euroopa rohelise kokkuleppe, ÜRO säästva arengu eesmärkide ja Agenda 2030, Euroopa uue Bauhausi või "Fit for 55" paketi raames. Teisisõnu peab Euroopa regionaalpoliitika kujundamine rajama S3-strateegia ja rakendamise tee aastateks 2021–2027 ja pärast seda, et algatada nõutud säästev areng mitmel tasandil.

Sellest hoolimata on kirjandus ja teadusalgatused, milles käsitletakse ülemäärase eelarvepuudujäägi menetluse, S3 ja jätkusuutlikkuse seost, vähesed. Lisaks sellele on S3 kujundamisel ikka veel lüngad teooria ja EDP praktilise rakendamise ning teadusliku teoreetilise kontseptsiooni vahel. Lisaks on S3 idee endiselt tugevalt seotud tehnoloogiapõhise innovatsioonimõtlemise ja -analüüsiga, mis omakorda jätab tähelepanuta olulised aspektid ja innovatsioonipotentsiaali, et algatada piirkonnas jätkusuutlik üleminek. Sellest tulenevalt ei ole sotsiaalseid innovatsioonikontseptsioone või sotsiaal-ökoloogilisi nõudmisi ja nende mõju säästvale arengule veel välja töötatud ega kaasatud S3 kavandamise ja rakendamise põhiosana. Sama kehtib ka kultuuri- ja loomemajanduse kohta, millel on tõestatud innovatsioonivõime, pädevus reguleerida asjaosaliste vahelisi suhteid loominguliste vahendajatena ning suunata ja hõlbustada ülemäärase eelarvepuudujäägi menetluste arendamist ja rakendamist, mis on tõepoolest üks S3-poliitika kujundamise põhikontseptsioonidest.

Lõputöö põhineb kvalitatiivse sisuanalüüsi uurimisstrateegial. Kesksele uurimisküsimusele vastamiseks esitatakse kolm alaküsimust, mida käsitletakse eraldi piisavate uurimismeetodite abil. Seega põhinevad väitekirja tulemused mitmemeetodilisel lähenemisviisil, kasutades erinevaid uurimismeetodeid, mis on seotud konkreetsete välja töötatud uurimisküsimustega.

Rakendatud uurimismeetodite tulemusel annab käesolev töö erinevaid tulemusi, et käsitleda elektroonilise kontrollisüsteemi täiustamist nii piirkondlikul kui ka ettevõtlustasandil. Kõigepealt töötati välja ja tutvustati riikidevahelise RIS3 vaatluskeskuse mudel. Mudel põhineb Euroopa piirkondade temaatiliste prioriteetide valikul nende S3-s, mis võimaldab ületada S3-seire üldtuntud uurimisprobleemid: võrreldavus, mitmetasandiline lähenemisviis ja tulemuslikkuse mõõtmine. Sellega pakub doktoritöö teaduskirjandusele uudsust sellise seiremudeli kontseptualiseerimisel.

Lisaks sellele ühendab väitekiri sotsiaalse innovatsiooni ja kultuuri- ja loomemajanduse S3-arutelu, sealhulgas ka selle, kuidas kasutada neid valdkondi innovatsioonipoliitika jätkusuutliku ülemineku suunas. Mõlemal juhul kutsutakse doktoritöös üles kaasama sotsiaalne kapital ja loov vahendaja kui võtmetähtsusega

osalejad ja piirkondlikud ressursid S3i kavandamisse ja rakendamisse, mis põhineb neljakordse spiraali perspektiivil.

Lisaks sellele on piirkondlike varade kasutamine innovatsiooni rakendamisel ja ülemäärase eelarvepuudujäägi menetlustes oluline aspekt üldiselt kasutatavas kohapõhises teoorias S3 nähtuste seletamiseks ja tõlgendamiseks. Siiski pakub sinise majanduse jaoks tehtud analüüs – millel on kontseptuaalsed kattuvused S3-ga innovatsiooni ja säästva arengu osas sinise kasvu idees – nende potentsiaalide vähest kasutamist S3-s. Täpsemalt öeldes näitab analüüs sadamate kui piirkondlike varade ja uuendajate vähest kasutamist S3 prioriteetide valikul ning vastupidi positiivset mõju sadamate tulemuslikkusele, kui need on integreeritud piirkondlikku S3-süsteemi.

Lisaks sellele pakub käesolev väitekiri esimese lähenemisviisi piiriülese koostöö edendamiseks, mis on S3 kujundamise ja rakendamise oluline osa. Kuigi see lähenemisviis on innovatsiooni soodustajana hästi tuntud, ei ole see veel seotud selle võimalustega S3 jaoks, mis jällegi pakub uudsust praeguses kirjanduses. Need võimalused tulevad esile seoses EDP kavandamise ja rakendamisega konkreetses multifunktsionaalse põllumajanduse valdkonnas, mis hõlmab kontseptuaalselt mitmeid S3 eesmärke ka selles sektoris.

Sellega pakub käesolev töö nii teoreetilist kui ka praktilist panust praegustesse EDP ja S3 uuringutesse ning täiendab väheseid kirjandusväljaandeid säästva arengu seose kohta. Seega rajab väitekiri ka tee tulevastele aruteludele ja uute kontseptsioonide kaasamisele S3 kujundamisse ja rakendamisse.

Appendix

Article I

Meyer, C. (2020). Reinforcing comparative monitoring of Smart Specialisation performance across European regions: transnational RIS3 observatory model as a tool for Smart Specialisation governance. *Entrepreneurship and Sustainability Issues*, *8*(2), 1386–1400. http://doi.org/10.9770/jesi.2020.8.2(81)

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REINFORCING COMPARATIVE MONITORING OF SMART SPECIALISATION PERFORMANCE ACROSS EUROPEAN REGIONS: TRANSNATIONAL RIS3 OBSERVATORY MODEL AS A TOOL FOR SMART SPECIALISATION GOVERNANCE*

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Abstract. Smart Specialisation is dedicated to be a key driving force for entrepreneurial discovery and innovation in the European innovation policy paradigm in line with the European Strategy 2020 and the funding period 2014-2020. At the current stage, all EU NUTS-2 regions are monitoring their individually developed Regional Innovation Strategies on Smart Specialisation (RIS3) including monitoring systems that are needed to adjust upcoming future RIS3 strategies in the new funding periods. Despite the thematic topicality, the procedure of RIS3 evaluation and monitoring lacks a sound supra-regional approach when it comes to RIS3 implementation performance governance and institutional arrangements across all European regions. In fact, the blurring of RIS3 monitoring can be traced back to the policy nature that monitoring systems are set up, implemented and evaluated on individual regional and or national basis including a set of regionally tailored regional and national indicators. With regard to the policy challenges and research gaps of developing, and, later, using a joint macro-regional systemic institutional approach towards RIS3 implementation and monitoring, this paper provides a conceptual model for RIS3 performance, evaluation and monitoring governance based on case study analysis, best practices from RIS3 research and policy stakeholders' interviews. It is intended to serve as a comprehensive and comparative governance model on regional, national and

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European level, which fosters the institutional thickness and institutional multi-level horizontal cooperation among institutions involved in RIS3 performance and monitoring implementation. Within the empirical narrative, 10 NUTS-2 regions within the INTERREG Central Europe Programme area and in the frame of the "SMART_watch" project were subject to the analysis pertaining to their strategy design, priority axes and monitoring indicators. As a result, the so-called Transnational RIS3 Observatory Model was designed, which yields conceptual linkages to theoretical concepts using cluster theories as well as builds upon practical policy-driven approaches mushrooming in the innovation policy paradigm of the European Union. Furthermore, recommendations to foster the RIS3 policy implementation in the upcoming funding period are introduced in line with the setup of the observatory structure and its institutional embeddedness.

Keywords: Smart Specialisation, RIS3 Evaluation and Monitoring, RIS3 Observatory, Transnational Model, Regional Development, RIS3 Governance

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JEL Classifications: O21, O32, O36, P25, P35

Additional disciplines: political sciences; information and communication

1. Introduction

The Smart Specialisation approach is one of the key pillars of the Europe 2020 Strategy in terms of economic development and growth policy thinking (McCann & Ortega-Argilés, 2011) as well as an approach to avoid dissipation of European Union (EU) funds among regions (Rusu, 2013). The basic idea can be traced back to the rising productivity gap between Europe and the USA in mid 90's, when European policy makers had to look for alternative policies to impede further economic decline. After announcing the Regional Innovation on Smart Specialisation (RIS3) initiative as a new novel policy on European level, all NUTS-2 regions were given an opportunity to develop individual strategies according to the available top-down policy agenda as well as design sufficient monitoring systems. With the ending of the funding period 2014-2020, RIS3 strategies will be monitored on achievements regarding successful RIS3 policy implementation. As a result, a bunch of recommendations to amend RIS3 shall be provided for the future EU funds' programming period and respective institutions and bodies involved in strategies' future design and implementation.

To continue sustainable development in Europe, the European Green Deal was announced as the new growth strategy for the EU towards a more sustainable economic and society (European Commission, 2019). This strategy aims at covering all key driving EU economic sectors by introducing new growth opportunities and activities. However, new strategic governance capacities are required for successful implementation (Larosse et. al., 2020). The Smart Specialisation approach follows the same idea to identify and use regional potentials to support innovative and competitive development. Therefore, Smart Specialisation policy can serve as a key pillar in the European governance transformation to reach the objectives of the European Green Deal until 2050. Thus, a specialisation by the regions using Key Enabling Technologies (KETs) or Knowledge Intensive Business Services (KIBs) to particular fields or priorities is unavoidable. The Baltic Sea Region serves as a flagship region among other EU macro-regions showing efficient and effective resource pooling and utilisation of capacities to reduce current challenges, e.g. in the maritime shipping and transportation area or innovation development in SMEs (Gerlitz, 2016). Currently, all European regions are revising their strategies for the next funding period starting in 2021 and pertaining to future regional innovative growth, including the elaboration to improve the RIS3 policy implementation (Gianelle et. al., 2020). Within this discourse, monitoring experiences frame a key focus and serve as an information pool for any potential future changes needed to be introduced by policy makers.

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Therefore, it is crucial moment right now to revise the monitoring systems of the regions in between the funding periods.

Due to the existence of individual region-based monitoring systems according to regional requirements, the results of current monitoring approaches lack any comparability. This bears a clear *problematic nature*. Moreover, some European Member States have introduced national strategies reinforcing regional ones or substituting them. As a result, the regional and national level considerations cannot be excluded from the current research discourse. Controversy, regional policy-making involved in innovation has a very limited impact on the Research and Innovation Strategies on Smart Specialisation (RIS3) programming (Marques and Morgan, 2018) due to risk-averse behaviour that restricts experimentation, flexibility and public initiatives as well as leads to being threatened due to the transparent bottom-up approach in the programme (Landabaso, 2014). Nevertheless, regional bodies play an important role for informal factors in institutions such as trust, responsibility, partnerships and regional leadership (McCann & Ortega-Argilés, 2014). In addition, innovation systems are proved to have the strongest impact on NUTS-2 levels (Ruhrmann et. al., 2020). Thus, a lack of successful and open-minded innovation policy governance impedes the set-up of Smart Specialisation strategies and their monitoring. Albeit, the European Smart Specialisation approach does not provide a framework on policy governance (Capello & Kroll, 2016). Hence, the need for an acceptance of the mutual action and reaction roadmap among institutions forging regional development and innovation is growing, including actual positioning, responsibilities' sharing as well as pinpointing cause and consequence relations, which at the current stage are unknown (Morgan, 2016). In this light, the practice-based model that is acknowledged among 10 NUTS-2 regions and is proposed by this research is seen as referred to as a contribution surpassing a simple necessity to meet this particular challenge.

The paper in hand displays the research done on evaluation and monitoring processes in line with RIS3 implementation by addressing the *research gap* of a missing comprehensive and comparative monitoring method and concept for RIS3 implementation across the whole European Union (EU). As a result, the present research contributes to the still missing theoretical and conceptual framework when it comes to Smart Specialisation (Andersons & Bushati, 2019). In the current funding period, the European Commission used a benchmarking based on structural similarities only (Navarro et. al., 2014), but did not focus on the actual implementation performance. Therefore, this research raises the following research question: *How can a functional model be implemented across the EU on all necessary levels (European, National [optional] and Regional) that enables Smart Specialisation monitoring for the regional innovation policy implementation?*

This paper is organised as follows. In the next chapter, the main theories used for this research will be presented. Key references to underline the theories as well as research gap are incorporated to this chapter. Next, the used research methodology including its scope and characteristics is provided. The fourth chapter includes the research results and the actual development of the Transnational RIS3 Observatory Model as tool of Smart Specialisation governance, ending with a concluding section summing up main insights and further research proposal.

2. Theoretical Background

The monitoring of RIS3 performance was not tackled in detail by previous literature. Mora et. al. (2019) identified current scientific trends in research on smart specialisation, but did not indicate any increasing numbers of scientific work on monitoring activities, despite the fact that monitoring became more relevant at the end of current funding period. Gianelle & Kleibring (2015) arrange monitoring activities in the overall implementation context for smart specialisation implementation. Further, Marti et. al. (2020) analysed the key next steps to

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support region's capacities in evaluation and monitoring of smart specialisation outputs. In addition, they highlighted the need to introduce better mechanisms to compare the processes and outcomes across regional borders. In this light, the present paper aims to fill this identified gap of missing monitoring approaches that integrate all relevant actors on regional, national and European level.

Further literature proposes solutions to foster or analyse the individual monitoring processes on regional or national level, such as Gulc, 2015; Angelidou et. al., 2017; D'Adda et. al., 2019; Cismas et al., 2019;; Jasinska, & Jasinski, 2019, Rane Santosh,& Thakker Shivangi, 2019). Kogut-Jaworska & Ociepa-Kicinska, 2020; Adeleke Abayomi et al., 2020).

Masana & Fernández (2019) introduce the term "learning" to the monitoring process and the European Commission indicates examples as best practices for regional monitoring (European Commission, 2020). However, all screened literature proposals lack performance measuring comparability with (all) other European regions in terms of RIS3. Acevedo (2019) presents dimensions to compare smart specialisation development of one specifically chosen region with others, but the approach is not transferable on a general level. Furthermore, innovation measurements like the EU 2020 Innovation indicator cannot be seen as a feasible instrument for RIS3 performance measurement due to the focus on innovation outcomes only (Janger et. al., 2017).

The present paper proposes a model filling the identified research gap with the transnational RIS3 Observatory Model approach by using clustering construct. Clusters are interconnected companies and institutions in a particular thematic field with a certain geographic concentration (Porter, 1998), but can also be elaborated as tools for regional development as a reduced scale innovation system (Gagnidze, 2015). The European Commission highly supports cluster strategies within the European growth strategy 2020 (European Commission, 2016a; Ketels & Protsiv, 2016; El Idrissi et al., 2020). Pavone et. al. (2020) recently published an analysis on clustering NUTS-2 regions according to their specialisation strategies.

In addition to cluster theories, innovation policy governance concepts are considered for the model development. Innovation policies in line with RIS3 are meant to be a multilevel approach, containing stakeholders' involvement according to the quadruple-helix approach that pools together various actors within the innovation system governance (Aranguren et. al., 2019). Mainly, the Entrepreneurial Discovery Processes (EDP) combines the interaction of all actors and their different levels under one innovation policy and transforms the strategy to reality in the regions (Grillitsch, 2016). Another key pillar is the RIS3-driven policy learning (Gianelle et. al., 2019), the ability to transform theoretical concepts to innovation policies and implement policy changes to support the regional (innovative and sustainable) development.

The presented model is based on both theoretical concepts – cluster theories and innovation policy governance – and pinpoints synergies from both concepts which can generate further add-value. In addition, enhancers of smart economic development such as networking, learning, innovation and knowledge facilitation are considered to be inherent in the model (Dagiliene et. al., 2019). Furthermore, the transnational RIS3 observatory Model fulfils the proposed requirement by the European Commission (2016b) that any Smart Specialisation Strategy programme demands a multi-scalar-co-ordination among supra-national, national and sub-national actors in Europe.

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3. Research Methodology

The present paper provides inductive perspectives, analysing chosen regions on their strategy design, implementation and monitoring to identify key insights to explain a phenomenon on the European level. Furthermore, with the analysed cases, this research paper deviates and constructs applicability and transferability options for all regions of the European Union.

Taking the proposed research gap into account, the argumentation of Creswell (2014) using qualitative approaches to explain and analyse a concept or phenomena can be followed. In the field of Smart Specialisation research, qualitative research approaches are preferred to explain political interventions on innovation governances (such as Björn & Johansson, 2017; Georghiou et. al., 2014; Komninos et. al., 2014; and Kroll et. al., 2016). The research strategies implemented can be classified according to the research onion of Saunders et. al. (2009) as the following:

- Case studies,
- Action Research, and
- Grounded theory.

The conducted research paper is using case studies of the "SMART_watch" project and participating regions representing European NUTS-2 regions. At a first glance, the regions were analysed individually using their published Regional Innovation Strategies on Smart Specialisation. Especially the chosen priority axes and monitoring systems with used indicators were scrutinised in the analysis, developing an overview on same priorities among the regions. In the next step, responsible bodies and their duties within the strategy implementation were considered, investigating for best practices to be adopted and transformed for other regions. Therefore, the case studies were highly funnelled into the main part of the implemented research, while action research and grounded approaches accounted for rather a lower share on the overall research process.

Action research was used after the first analysis of the strategy document of individual EU region to explore structural units within the model as a problem-solving approach. The stated issue on a missing comparability with existing monitoring systems can only be overcome with major organisational and governmental changes in line with the Smart Specialisation policy. The necessary information and insights have been gained in cooperation with practical actors (Huang, 2010) within the work done in the "SMART_watch" project and conducted short surveys and expert interviews. In contrast, grounded theory, according to Charmaz (2014), perceived as method to construct theories and recommendations from analysing qualitative data was incorporated to the research when developing conclusions and theories on improvements for Smart Specialisation monitoring systems based on the actual existing data within the regional strategies.

Based on this multi-method research methods, further literature reviews identified the mentioned research gap as well as actual regional needs and circumstances to implement a sufficient monitoring model, which ensures regional performance comparability of all European regions. Therefore, four research techniques can be summarised as basis of this paper:

- Research scope: 2018 – 2020, SMART watch applied research project
- Research methods: case studies, action research and grounded theory
- Research actions: desk research, empirical data analysis followed by comparative analysis, surveyed regions, expert interviews and relating document analysis
- Research approach: qualitative
- Research types: analytical, qualitative, exploratory, practice-based and conceptual.

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As a result, this paper is regarded to contribute to inductive research streams, and can be found within the philosophical perspective of constructivism and interpretivism of the researcher (ref. to Creswell, 2013).

In sum, in order to construct a practice-driven model that is intended to be used in the future, a mixed approach is at the heart of the research, where the researcher is obliged to compare, balance out and pick up the right approaches. Since this paper is a result of the applied research project, it heralds rather high applicability and transferability potential, which, indeed, can be underpinned through a systemic combination of methods, tools and approaches in the research methodology journey, as discussed above.

4. Designing the transnational RIS3 observatory model and positioning it within the current discourse

As introduced, cluster theories are used to build up the structure of the presented transnational RIS3 Observatory Model. Having the used definition of cluster by Porter (1998) and earlier mentioned recommendation to unify priority axis in mind, it is possible to align several clusters within a NUTS-2 region according to the individually chosen priority axis. As an example, the region of Mecklenburg Western-Pomerania has identified six priority axes in its RIS3 document for 2014 - 2020, so we would introduce six so called "RIS3 cluster" for it according to our model, which of course interact between each other as well on a sub-national level.

Based on the implemented qualitative analysis (case studies) in line with the "SMART_watch" project and 10 NUTS-2 regions analysed, several similarities of RIS3 implementation were indicated, e.g. in chosen priority axes, monitoring systems, observatory structures, etc. A comparison of the chosen regional priorities led to the conclusion that NUTS-2 regions have very similar axis and themes that partly only differ in their labels (e.g. "Health & Life Sciences" vs. "Life Sciences"). For the upcoming funding period, an early recommendation to be made is an unification of priority axis to create more common particular fields in the smart specialisation implementation. For the model development, this unification is one of the main requirements to create sufficient clusters between European NUTS-2 regions.

The structure of the conducted model is built around a main actor as managing body – the Transnational RIS3 observatory. It could be interpreted as managing position for a certain number of regional RIS3 clusters. This kind of cluster management structure was indicated as "cluster of clusters" by Keller (1996). Portnoy (2004) emphasises such structure as managing a cluster of classic. However, a thematic managing body on a trans-national level to coordinate the regional RIS3 clusters.

The conducted model is considering any individual regional preferences in terms of Smart Specialisation. Therefore, every region is still developing an own strategy, integrating a detailed regional SWOT-analysis (or similar tools) to derive priorities like it is recommended by the European Commission (Foray et. al., 2012) and includes the involvement of regional stakeholders as vertical and horizontal network (Roman et. al., 2018).

In addition, as a result from the case study analysis, the model proposes to announce one representative / institution responsible for one specific priority axis. Some regions already follow this recommendation, but for a sufficient model implementation it is necessary to have such experts acting as contact and decision maker for each priority. The Trans-national RIS3 observatory body is the key element in conducted model structure and could be understood as a cluster organisation or platform. Such institutions shall be implemented to improve innovation and competitiveness of a specific cluster (Christensen et. al., 2012). From the authors' point of view, a Trans-national RIS3 observatory needs at least the mentioned three main bodies below:

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Management Committee:

Implementing a Management Board is a well recommended aspect for strategic leadership and competitiveness (Elenkov et. al., 2005) and already included in all analysed RIS3 documents as case studies. The Management Committee should consist of the representatives from each region under the observatory.

The main task for this committee is the administrative management of all actions in relation with the respective priority in their regions. In addition, the committee is responsible for coordinating the Smart Specialisation implementation activities in a cross-regional cooperative way. Furthermore, the on-gong implementation of the monitoring system is one of the key actions to be done by this committee. This includes to indicate future trends and obstacles for the respective thematic priority.

EU – cross communication body:

The second body is mainly responsible for the external communication of results, action plans, events, success stories etc. Through the individual implementation of regional strategies, European NUTS-2 regions tend to act like islands in terms of RIS3. To avoid such development, external (and internal) communication and networking activities are required. Therefore, a precise networking schedule with other trans-national observatories has to be developed and implemented by the communication body.

Furthermore, this body is the interlink to European level and responsible to exchange all necessary information, trends and results. Therefore, the cross-communication body should consist at least one representative from European level to ensure fast communication channels and communication managers from the regional level.

Thematic experts / stakeholder:

As mentioned earlier, the involvement of regional stakeholders is an important requirement to develop sophisticating strategies. This includes academics as well to foster regional development (Risár et. al., 2018). Though, the integration of thematic experts should be an on-going process in Smart Specialisation implementation. Therefore, the third body play a consulting role for the Managing Committee.

Another structural body to be included to the model is the management on national level. Analysing the case studies concludes only partly existence of national strategies. Therefore, this body is seen as optional and should focus on the support and coordination of all regions in the country.

For the model illustration in Figure 1, we assume a showcase having three regions from two different European countries (red and green frames). As mentioned, another assumption is a unification of priority axis which creates a defined set to choose from – illustrated by numbers. In this case, all three regions have chosen priority No. 11 as one of their smart specialisation axes as result on individual and regional analysis between several others. Thus, the regions are part of the cluster managed by the Transnational RIS3 observatory No. 11 with all mentioned characteristics and their representative for priority No. 11 will enter the Management Committee.

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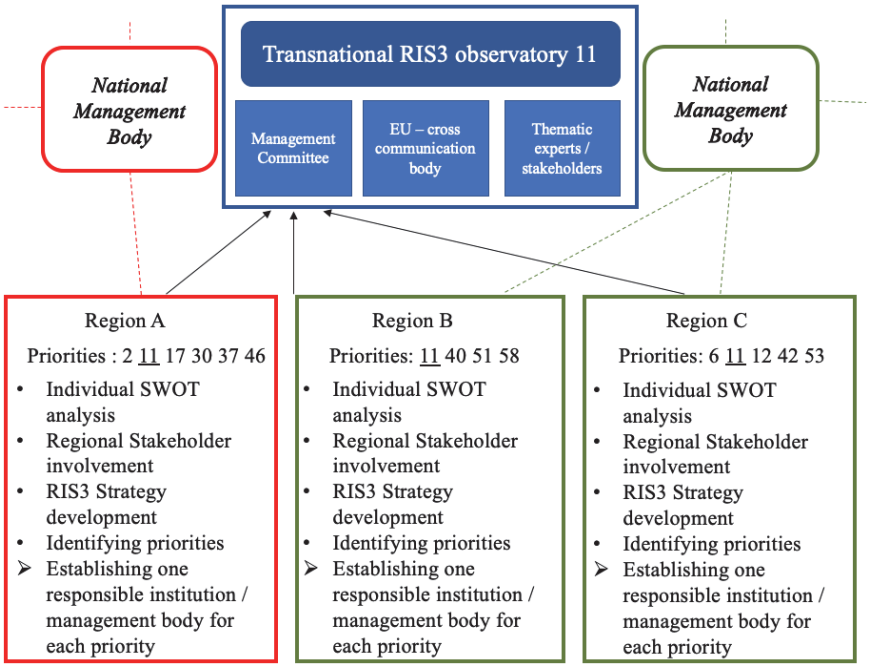

Figure 1: Transnational RIS3 Observatory Model including interlinks between structural bodies

Source: Compiled by the author

As shortly mentioned, the Transnational RIS3 observatories need to build up a network among each other via the communication body to connect all acting levels from regional to European. On European level, the responsible directorate need to be included to the overall Smart Specialisation implementation, namely European Commission, S3 platform and Joint Research Centre. Figure 2 illustrates possible connections between the actors, having three observatories as examples. This structure is necessary for regular information exchange as well as on-going monitoring on European level, including an evaluation of funding programmes and their results in terms of the RIS3 approach.

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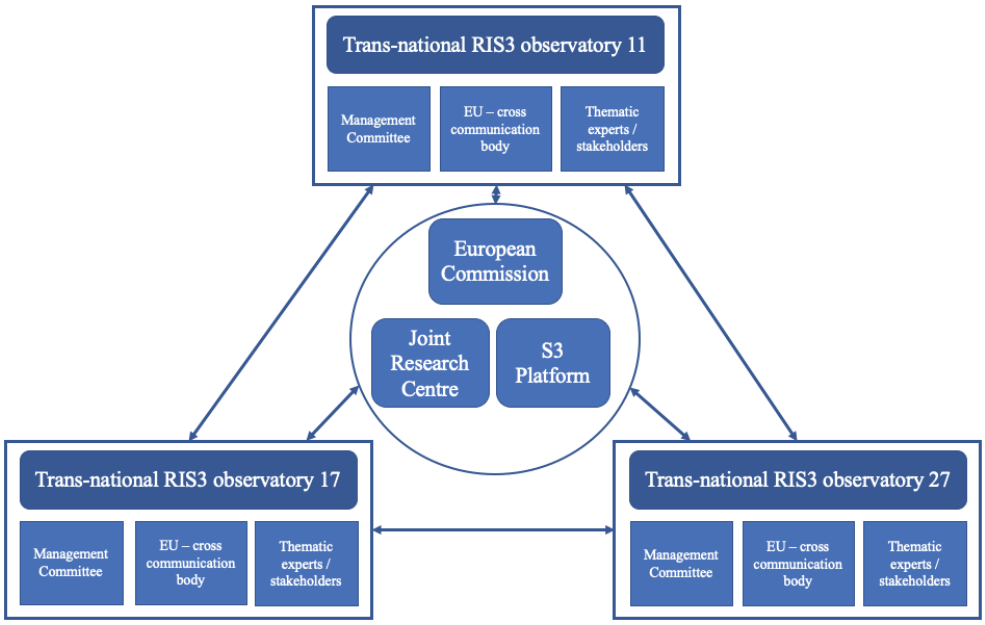

Figure 2: Classification and interlinks of Transnational RIS3 Observatories on European level

Source: Compiled by the author

To make sure a well-balanced number of regions within the observatories and avoid large-scale observatories, a geographical limitation could be implemented, also socio-economic characteristics could be reasonable allocation of the observatories (Pavone et. al., 2020). Another option is to implement classifications following the European funding areas, e.g. Central Europe or Baltic Sea Region. This ensures that the regions may have several similarities and their different circumstances are not too high obstacles for joint activities.

Monitoring System for the Trans-national RIS3 observatory

The proposed monitoring characteristics in the model is not part of the structure-oriented Figures 1 and 2. Following the earlier introduced approach to rely on cluster theories, the monitoring of a Trans-national RIS3 observatory itself should follow the Cluster policy cycle of the European Commission containing three stages: Analysis, Strategy and Action (European Commission, 2016a). This three-step approach is already implemented in several regional strategies and has been proven as sufficient process.

As key obstacle for a useful and sufficient monitoring system is the selection of indicators. In the case studies of the "SMART_watch" project, the author proposed a methodology to choose a set of indicators to measure Smart Specialisation performances of a limited number of NUTS-2 regions. In the presented model, the monitoring responsibilities are transferred completely to the Transnational RIS3 Observatory Model and its bodies. This allows a comprehensive comparison of the individual performances of the RIS3 implementation of each region under the observatories. As mentioned earlier, the national body is seen as optional unit so is the national

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monitoring system. If countries decide to set up individual national monitoring system as well, the requirement to have a comparable system across all European regions would fade away, which is one of the main problems to overcome in the model, therefore, individual (national) monitoring systems are not recommended.

Besides the recommendation and assumption to unify the priority axis to choose from, a more unified approach in choosing the right indicators for Smart Specialisation performance measuring is the second key recommendation in line with the. Structural model. In the current implementation processes, each region chooses indicators by itself, which creates biased performance comparisons among regions. To avoid this bias, the selection of indicators should not be initiated on regional but on the European level in dialogue with the Transnational RIS3 observatories. In this sphere, indicators have to be distinguished with focus on Smart Specialisation performance measuring that serve as basis for all European regions monitoring – Set of Indicators for RIS3. This ensures high comparability among all regions and avoid biased individual monitoring activities. As the best practices have shown, at least context, output and result indicators have to be implemented in the set (European Commission, 2020).

As Figure 3 illustrates, the chosen set of indicators needs to be expanded by another category of indicators which are chosen specifically for the respective priority axis. As explained, the Transnational RIS3 observatories are set up in line with the thematic axis and though the observatories are in charge to select sufficient indicators to measure regional performances in the thematic fields – Priority specific indicators.

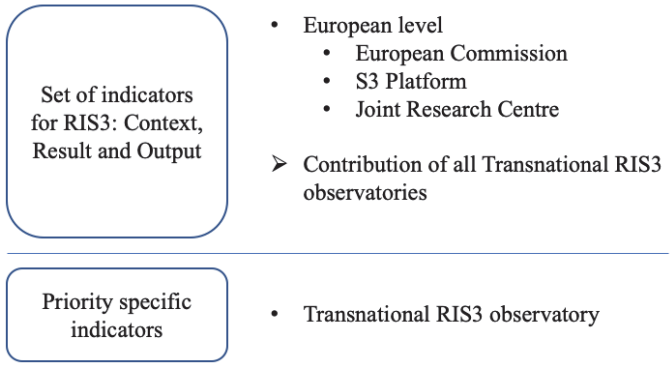

Figure 3: Monitoring indicators and responsibilities

Source: Compiled by the author

To finalise the set-up of proposed monitoring system in line with the Transnational RIS3 Observatory Model the regional capabilities need to be considered. At this point, the model considers the heterogeneity of European NUTS-2 regions. For each indicator of both categories, base values and target values have to be defined according to the region's economic, innovative and competitive circumstances and potentials. In line with this set-up, the data sources of indicator values have to be clarified to avoid any missing data in the on-going implementation and monitoring processes.

5. Conclusions

The objective of this research paper was to examine, how a functional model can be implemented across the EU on all necessary levels to enable Smart Specialisation monitoring for RIS3 implementation. The conducted Transnational RIS3 Observatory Model as a tool introduces a sufficient structure that needs to be implemented and integrates main actors on regional, national and European level. Case study analyses were used building upon 10 European NUTS-2 regions' cases. In addition, the research delivers a macro-region and transferable concept of RIS3 policy governance that sets up the model structure as well as provides a portfolio of opportunities to foster collaboration across Europe on Smart Specialisation implementation, its evaluation and monitoring. The involvement of actors from the European level was introduced in line with the existing network participation in all Transnational RIS3 observatories interacting between each other and representatives of the European Commission, the Joint Research Centre and the S3 Platform as main contact points for Smart Specialisation.

Besides the structural description, the characteristics of the set of indicators as a key factor driving monitoring were described in detail including the responsible bodies for setting up and monitoring. At this point, the model pays tribute to the heterogeneity in terms of RIS3 monitoring discourse of European regions by providing room of action for individual optimisation. In addition, the model postulates the institutional responsibility for setting up regional target values for each indicator of the two categories: Set of Indicators for RIS3 and Priority specific indicators. As a result, this ensures a better evaluation of Smart Specialisation implementation success and a more efficient usage of regional capabilities.

The proposed model can be implemented initially in the current Smart Specialisation process supported by the online tool as proposed by Panori et. al. (2017). Required bodies and institutions are mainly established already across the regions. Therefore, a change to the proposed model can pushed fast and with low costs. It requires only resources regarding capacity reallocation and perspective change. Though, as next step, a feasibility study of the model with several NUTS-2 regions participating is recommended to test the structure and monitoring system to foster the regional RIS3 implementation performances.

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Article

Integration of Baltic Small and Medium-Sized Ports in Regional Innovation Strategies on Smart Specialisation (RIS3)

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Abstract. Small and medium-sized ports in the Baltic Sea Region experience to echo themselves in a dilemma to participate and utilize of governance innovation policies such as Smart Specialisation. The Smart Specialisation policy introduced by the European Commission supports regional economic and innovation development focusing on regional strength through selection of defined priorities, offering smaller ports an opportunity to overcome their dilemma. Currently, all European regions are monitoring and evaluating their performances alongside with the Smart Specialisation policy to make adjustments for the upcoming funding period. The Blue Growth concept entitles a large contribution to reach the emphasized goals and thus, ports can be an important actor and key driver for a sustainable and green future development. Hence, this paper analyses the current significance of smaller ports in Baltic Sea NUTS-2 regions reflected in the individual RIS3 maritime and / or logistic priorities as well as Blue Growth sub-sectors from the funding period 2014 – 2020 to contribute to the future design of RIS3. Yielded results will illustrate whether regional governances are aware of the potentials small ports bring up to their economies with consideration to Smart Specialisation, Green Deal and Blue Growth Strategies and how RIS3 might effects small port performances.

Keywords: Small and medium-sized ports, Baltic Sea, Blue Growth, Blue Economy, Smart Specialisation, RIS3, Regional development

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1. Introduction

The Baltic Sea is one of the top seas worldwide regarding maritime traffic [1],putting seaports into focus as regional nodes and gateways for economic and social interactions, thus, playing a key role in distribution and transportation of goods and services. Nevertheless, Small and Medium-Sized Ports (SMSPs) recognize a specific role for regional development as well as partly individual challenges and obstacles in the maritime sector. However, besides the growing economic pressure, SMSPs lack on policy conformity and compliance [2] when it comes to governmental strategy exploitation such as the Regional Innovation Strategies on Smart Specialisation (RIS3). This especially includes disadvantageous positioning for fund allocation [3].

In line with the Europe 2020 Strategy, the RIS3 approach was launched as one key pillar for regional economic development as well as growth policy thinking [4]. As an instrument to enable efficient fund distribution among European regions [5], this governance innovation policy approach contributes to Smart Growth, Sustainable Development Goals of the UN and the recently launched European Green Deal [6-8]. The core elements of RIS3 implementation are the individually developed and implemented strategies determining the key priorities of a NUTS-2 region, which are currently elaborated and revised for the upcoming funding period [9] using gained experiences and knowledge [10].

Additionally, the Blue Growth Strategy of the European Union was introduced in 2012 aiming to foster sustainable growth in the blue economy sector [11]. A breakdown of both policy concepts reveal synergy opportunities and overlapping principles such as sustainable and innovative development, strengthening regional value chains, sharing infrastructure or support of clustering and networks [12]. Within the RIS3 approach, the selected priorities structure the distribution of European funds available [13-16] for the involved actors and stakeholders [17,18]. Thus, RIS3 is an important instrument to support investments and funding for the blue economy [19] and its actors – small and medium-sized ports.

In this context, SMSPs can contribute to regional development [20], being a regional capacity and main actor of RIS3 with high potential to enhance regional growth through strong and sustainable connections with the hinterland [21]. However, SMSPs tend to suffer from lower trade volumes and freight turnovers compared to bigger seaports, but also face economic, geographic and environmental disadvantages [22,23]. Despite the fact that there is no common definition of a small port [24], three main functionalities can be deviated for SMSPs: i) enhancing blue economy competitiveness, ii) being an actor in regionalization processes and / or iii) acting as key capacity to set up multiport gateway regions [25-27].

Especially, the logistic role of a port as a gateway can accelerate regional innovation, since multimodal transport nodes are highlighted in literatures as opener for economic and social welfare in countries [28-30]. Recent researches have elaborated the consideration of Blue Growth related priorities in RIS3 [12,31,32], but did not incorporate ports and especially SMSPs as regional infrastructure and capability, nor the transport and logistic related function as crucial driver for regional development as well as the synergy effects from RIS3 approach on port performances. Furthermore, a gap in legitimizing so called blue actors in coastal regions can be identified in the context of blue growth under RIS3 [33] (pp. 88,89). Therefore, this paper in hands addresses this research gap by proposing two research questions:

- ⇒ *How are small and medium-sized ports reflected as driver for regional innovation and development in RIS3 in the Baltic Sea Area?*
- ⇒ *How does a consideration of Baltic small and medium-sized ports in RIS3 affect their port performances?*

Accordingly, this research aims to provide an overview of the selected priorities in RIS3 of Baltic coastal areas with regard to the availability of SMSPs in the region to elaborate the utilization of potentials in line with regional development based on port capabilities. In addition, the impact of priority setting will be analyzed vice versa on the port performances using available data from Eurostat at the beginning and end of the funding period 2014 – 2020 on waterborne trades (cargo and ferry). As European regions are revising their strategies through performance evaluation and monitoring, knowledge generation on potentials for facilitating sustainable development from past funding period is now crucial for new strategy designing [34,35].

The paper is structured as follows: the next chapter presents a theoretical background of necessary key insights in the particular research field. The third chapter illustrates the applied research methods for data gathering and explains the philosophical assumptions of the author for this paper. Afterwards, the main results of implemented research are presented including yielded result theorems. Consequently, the gained results are discussed and put into context with other researches in the particular field in the fifth chapter before concluding the paper in last chapter.

2. Theoretical Background

The concepts of Smart Specialisation as policy innovation have been analysed and exploited well in existing research [4,36-42], including its literature reviews [43-46]. However, researchers also emphasized still missing scientific theoretical conceptualization for this innovation policy [34,43, 47]. In context of such researches on the Smart Specialisation

paradigm, articles highlight the importance of stakeholder involvement on several levels including vertical and horizontal perspectives [48-50]. Smart Specialisation and RIS3 were used to serve for implementation of the Europe 2020 strategy and its goals, among them to harness the potential for Smart Growth from targeted support to areas with investments, thus prioritizing direction and contribution for achieving Smart growth in Europe [51]. The futured concept of Smart Specialisation for the next programming period 2021-2027 highlights the sustainability, which is regarded as a key driver in achieving sustaining European competitive edge, also in line with the European Green Deal [52]. The concept enjoyed a growing interest on the European agenda, especially in order to ensure sustainable and efficient use of EU Structural Funds, improve an outdated perception of regional innovation policices [40] and introducing a more structured and legitimized option of distributing EU funds [13].

In line with RIS3 analysis for NUTS-2 regions, cluster conceptualizations for elaboration of innovation systems are a sufficient theoretical concept [53] using the definition of Porter [54] for clusters being an interconnection of companies and institutions in a particular field with a certain geographic concentration. NUTS-2 regions can be classified as clusters under the implementation of RIS3 [55,56] as well. Thus, maritime cluster are the conceptual connection between RIS3 and SMSPs, bearing in mind that cluster can be seen as tools for regional development as a reduced scales innovation system [57]. Such maritime cluster can be defined and build up on three conceptions: as industrial complex, agglomeration of interlinked industries or community-based network [58]. SMSPs may contribute to each of the three conceptions, based on their nature – being ferry, cargo or mixed port. However, the linkage between maritime cluster and the existence of (small and medium-sized) ports is strong, bearing in mind similar objectives to improve competitiveness [59,60] and hinterland connections [61] for all affected actors. Therefore, maritime clusters contribute as important institutions to regional development and thus to RIS3 as well [62].

Subsequently, maritime cluster are key driver to enhance Blue Growth and Blue Economy [12,63,64]. The concept of Blue Economy was defined within the Blue Growth Strategy of the European Union, covering the following sub-sectors [65]: Aquaculture, Biotechnology, Coastal and maritime tourism, Fishery, Mineral resources, Offshore oil and gas, Renewable energy, Shipbuilding and ship repair, Transport (cargo and ferry).

One key pillar of the Blue Economy is the on-going support of transnational cooperation [66]. For the maritime sector, seaports are the connecting points to other countries increasing their interconnection between different countries [67] and therefore playing a key role for cross-border connectivity of the region. Consequently, consideration of SMSPs in RIS3 potentially increases the cross-border character, which is still one key challenge for RIS3 implementation [50,68].

When analyzing place-based specialization knowledge, technology and innovation capabilities are key resources to initiate sustainable development [69,70]. Hence, an institutional perspective view is crucial [71] since established regional institutions are key actors in support learning, knowledge creation and spill-overs as well as place-based specialization itself. Thus, innovation policy governance concepts as multilevel approaches need to be considered affecting several actors of the respective innovation system governance following the quadruple-helix approach [48], which adds the public dimension to politics, economy and research in an innovation ecosystem [72]. More precisely, regional stakeholders and institutions on vertical and horizontal network perspectives need to be involved into RIS3 [49] as well as in Blue Growth [73] development and implementation. Moreover, new challenges arise when introducing a cross-border approach in stakeholder involvement to innovation governance policies, which is still lacking on sufficient application for RIS3 [71,74]. In the same vein, blue growth lacks on common or holistic goals [75], but on the other hand side actively supports cross-border cooperation approaches [76,77]. Hence, SMSPs as cross-border connection and established regional institution are

the subsequently logical cases of (research) interest to elaborate innovation governance concepts under RIS3 and Blue Growth approaches.

As shortly mentioned in the paper introduction, a common definition of SMSPs does not exist. From the statistical perspective of the EU, port authorities handling up to 10 million tons annual volume of goods are referred to as small ports, while ports handling more than 10 and up to 50 million tons of good are classified as medium ports [78]. Additionally, this research follows classification of the European Commission following the TEN-T concept [79]. Also, seaports' classification of being small and medium-sized can be defined by their limited position in existing port clusters [27] as well as due to their lowermost position in port hierarchy when it comes to costs and efficiency [80]. Nevertheless, empirical statistics have proven positive correlation between SMSPs and regional economies [81]. However, in topical research the broader view of SMSP definition has been enforced based on SMSPs' functionalities, being i) enhancer for Blue Economy, ii) actors in regionalisation processes and / or iii) capacity units for multiport gateways [25-27]. Thus, the conducted research exploits the functional perspective to deduce RIS3 "port priorities", which are not only maritime focused but also include economical and logistic perspectives to be analyzed in the result chapter flanked by the listed sub-sectors of the Blue Economy.

3. Data & Methodology

In total, 37 European NUTS-2 regions located at the coast of the Baltic Sea have been analyzed regarding their Smart Specialisation Strategies for the funding period 2014 – 2020 with focus on the individual selection of priorities. In addition, the Smart Specialisation Strategies on national level (if applicable) have been taken into account for all eight EU countries located at the Baltic Sea. In line with the analysis of SMSPs being reflected in the chosen priorities, keywords according to the definition and function of ports as described in the theoretical part were considered, covering mainly maritime development and logistics – so called "port priorities".

Furthermore, the analysis included the consideration of ports for each of the 37 reviewed NUTS-2 region, using the classification and list of the TEN-T network [79] as well as the database provided by World Port Source [82]. Additionally, for dedicated regions based on first research results, further data was gained using Eurostat database on cargo and ferry volumes being available on regional and national level.

In a first step, existing RIS3 priorities have been analyzed to be included to conducted research scope. As introduced, the subsectors of Blue Growth have been considered as priorities, flanked by deduced "port priorities" following the defined functions and understanding of SMSPs. Therefore, content analysis of the existing priority database have been implemented, using S3 Platform [83] as well as the Metadata of Eurostat for statistical classification of economic activities [84] retrieving more detailed information on the RIS3 priorities as several regions offer only short descriptions of their chosen priorities. For the scope of this research, the existence of "port priorities" might contribute with higher importance than the nine Blue Economy subsectors, since the priorities were chosen according to port functions. Thus, an incorporation of ports to the RIS3 implementation can be accepted, while the subsectors do not necessarily include port operations but do enhance the interpretation and discourse on the port reflection in the regions.

As argued in the previous chapters, Blue Growth and Smart Specialisation offer synergies in their implementation, hence the analysis was enlarged with the defined sub-sectors for Blue Economy [65]. However, the sectors have been considered only if references to the maritime sector have been made within the detailed description of the RIS3 documents and database – e.g. Marine / Ocean Renewable Energy [85-87].

Consequently, all published RIS3 documents of the 37 coastal Baltic Sea regions have been reviewed with focus on the chosen priorities of each affected region. By doing so, the analysis offers hints on the integration of SMSPs in RIS3, enabling further interpretation

and analysis towards policy recommendation and research contribution in the particular field of interest.

Following the analysis of SMSP reflection within RIS3 documents, only the indicated regions supporting existing ports will be exploited regarding their marine turnover in cargo and ferry using data from Eurostat for 2014 as well as 2019 (data codes: TGS00076, TTR00009, TGS00075, MAR_MP_AA_CPH). The comparison to national and European data allows an interpretation whether the impact of being fostered within the Smart Specialisation approach can be proven for ports. Thus, recommendations for future priority setting can be formulated considering regional development and the role of ports as blue actors within this policies.

Hence, SMSPs are considered as case studies for this inductive research using qualitative data in the first step [88] applying highly exploratory research especially in the documents analysis, being applicable for undiscovered or new aspects [89-91]. In this vein, the research builds up on the understanding of cases studies as an investigation by addressing "how" questions in the field of interest – as stipulated in the introduction, by following the Yin's definition of a case being a phenomenon in real life context with unknown relationship and little control by the researcher [92,93], which also recommends to combine qualitative and quantitative evidences as this research in hands does. The quantitative research path is based on open accessible data, thus, the criteria on the data to be valid, reliable, replicable and generalizable [94] are fulfilled from the author's perspective.

Though, the conducted research paper uses mixed methods approach with qualitative priority analysis and quantitative performance data. As mentioned, the qualitative analysis followed the Statistical Classification of Economic Activities in the European Community [84], which is used to classify the RIS3 priorities of European NUT-2 regions as well. The analysis included the review of logistical and / or maritime priorities of each region accordingly to this classification system.

The conducted research methodology can be summarized in five dimensions:

- Research approach: mixed-methods (qualitative and quantitative)
- Research tool: RIS3 documents of 37 coastal Baltic Sea regions
- Research scope: 11/2020 – 04/2021; data of funding period 2014 - 2020
- Research types: analytical, exploratory, qualitative, quantitative and practice-based
- Research methods: qualitative – case studies, desk research, document analysis; quantitative – data of regional maritime performances

Hence, the inductive research and its results is based on positivism, interpretivism and constructivism of the researcher [95,96]. The research was undertaken to the best of researcher's knowledge with attention to research ethics and habits. As the used data is available in open access form, it is accessible to any person of interest.

In sum, the implemented research followed a comprehensive journey, by addressing different aspects and combining two European growth policies with focus on potential key actors in RIS3– small and medium-sized ports.

4. Interdependencies between Baltic small and medium-sized ports and RIS3

Following the proposed research questions, the document analysis of the chosen RIS3 priorities for coastal Baltic Sea regions will embrace insights on the interdependences. Firstly, an overview for all affected regions and their selection of priorities is presented to elaborate the significance of SMSPs in their RIS3 development and implementation. Secondly, logistical data will be used to examine the add-value and impact of the port sector being part of a RIS3 priority.

4.1. RIS3 priority analysis of Baltic Sea regions on Blue Economy and "port priorities"

Following the presented research pathway, "port priorities" have been identified from the available dataset on RIS3 documents and supporting database. Together with

the nine sub-sectors of the Blue Economy, chosen priorities are illustrated in Table 1 below, being the main objects for document investigation.

Table 1. Overview of priorities for document analysis

RIS3 "port priorities"	Blue Economy sub-sectors
(1) Blue Growth	(10) Aquaculture
(2) Maritime Sector	(11) Biotechnology
(3) Maritime Economy	(12) Coastal & maritime tourism
(4) Water Economy	(13) Fishery
(5) (Multimodal) Transport & Logistics	(14) Mineral Resources
(6) Mobility	(15) Offshore oil & gas
(7) Off-shore and port technologies	(16) Renewable Energies
(8) Logistics of goods & services	(17) Shipbuilding & -repair
(9) Boat design & construction	(18) Transport (cargo / ferry)

Source: compiled by author.

In total, 18 potential priorities can be identified to be claimed to have a direct relationship to port operations as well as meet their previously introduced definition through their functionalities. Accordingly, the RIS3 documents of all 37 affected NUTS-2 regions with seaports have been deeply analyzed on the existence of shown priorities. Table 2 provides an overview of the yielded results from the research analysis. It consists of three main parts which need to be reviewed in more detail:

1. The first two columns list all coastal NUTS-2 regions and the eight EU countries located in the Baltic Sea in alphabetical order. The Baltic States Estonia, Latvia and Lithuania are listed as countries only, since they are implementing National Strategies on Smart Specialisation [97-99]. Regions written cursive are following the national strategies as well and did not develop nor implement an individual regional strategy, which is applicable to Sjaelland in Denmark and nine Swedish regions. For those regions the respective national strategy of Denmark and Sweden was considered to be valid. Additionally, two Swedish regions without direct access to the Baltic Sea are incorporated to the analysis, due to the fact that their ports have been identified as seaports [79].
2. As second part, port priorities and Blue Economy sub-sectors follow as individual columns. The indicated enumeration in this columns follows the allocation to the introduced priorities shown in Table 1. If no numbers are listed in the respective cells for a region, no priority could be aligned to the published RIS3 documents of the region.
3. The third part integrates the existence of small, comprehensive (middle-sized) and core ports aligned to the geographical positioning in the NUTS-2 regions. The classification and listed ports follow the TEN-T framework as published by the European Commission [79]. For the group of small ports, only a number of known ports in the regions is listed. It is because of the variety regarding the definition of small ports, thus, the used database [82] might not be able to ensure full completeness when exploiting different definitions on what a small port actually is. Eventually, the illustrated numbers provide useful insights of the approximate amount to initiate a sufficient analysis to deduce key assertions for the research problem and questions.

Table 2. RIS3 priority & port presence analysis in 37 Baltic NUTS-2 regions.

Region	Port Priorities	Blue Economy Sub-Sectors	Core Ports	Comprehensive Ports	Small Ports

DENMARK	Hovedstaden			Copenhagen	Helsingor, Ronne	>25
	Midtylland			Aarhus	Ebeltoft, Fur	>20
	Nordtylland	(2)	(10), (13), (17), (18)		Aalborg, Branden, Frederikshavn, Hirtshals	>20
	Sjaelland				Gedser, Kalundborg, Koege, Rodby, Sjaellands Odde	>35
	Syddanmark				Esbjerg, Fredericia, Odense, Nordby (Fanoe), Spodsbjer, Tars (Naksov), Velje	>30
ESTONIA	Estonia		(11)	Tallinn	Heltermaa, Kuivastu, Pärnu, Paldiski South Harbour, Rohuküla, Sillamäe, Virtsu	>20
FINLAND	Central Ostrobothnia	(9)	(17)		Kokkola	0
	Helsinki Uusimaa		(16)	Helsinki	Hanko, Kilpilahti	>10
	Kymenlaakso			Kotka, Hamina		0
	Lapland				Kemi	4
	North. Ostrobothnia				Rautaruukki / Rahe, Oulu	5
	Ostrobothnia		(13)		Kaskinen, Pietarsaari	4
	Satakunta	(1)	(10), (12), (13), (16), (17), (18)		Pori, Rauma	5
	Varsinais-Suomi	(1)	(10), (11), (15), (16), (17), (18)	Naantali, Turku	Eckerö, Maarianhamina	5
GERMANY	Mecklenburg - Vorpommern	(6)	(13)	Rostock	Sassnitz / Mukran, Wismar	5
	Schleswig-Holstein	(3)	(11), (12), (14), (15), (16), (17), (18)	Lübeck	Brunsbüttel, Kiel	>20
LATVIA	Latvia			Riga, Ventspils	Liepaja	5
LITHUANIA	Lithuania	(5)		Klaipeda		0
POLAND	Pomorskie	(7)	(10), (13), (15), (16), (18)	Gdansk, Gdynia		4
	Warminnsko-Mazurskie	(4)	(12), (13), (17), (18)			1
	Zachodniopomorskie	(5)	(18)	Szczecin, Swinousjscie	Police	2
SW	Gävleborg				Gävle	7
	Östergötland	(8)			Norrköping	1

Skane		Malmö, Trelleborg	Helsingborg, Ystad	8
Södermanland			Oxelösund	1
Värmland (inland region)				4
Västerbotten			Ulmea	4
Västra Götaland	(2)	Göteborg	Stenungsund, Strömstad	10
Blekinge			Karlshamn, Karlskrona	4
Gotland			Visby	5
Halland			Halmstad, Varberg	2
Kalmar			Oskarshamn	6
Norrbetten		Lulea		4
Stockholm		Stockholm	Grisslehamn, Kapellskär, Nynäshman	0
Uppsala				3
Västermorrland			Sundsvall	3
Västmanland (inland region)			Köping, Västeras	3

Source: Compiled by author (database: World Port Source)

In total, 12 regions can be indicated covering RIS3 priorities corresponding to their available ports. 14 regions incorporated priorities in line with the Blue Economy subsectors. Except a few, namely Lithuania, Estonia, Helsinki Uusimaa, Ostrobothnia, Östergötland and Västra Götaland, analysed regions reflect both priority categories in their RIS3 documents. Furthermore, it stands out that regions with Blue Growth / Blue Economy as priority in RIS3 also cover the majority of the subsectors.

Seven regions with "port priorities" do have a Core port available in their region, being out of the main scope of this research. Thus, only Nordjylland (DK), Central Ostrobothnia (FI), Satakunta (FI), Warminnsko-Mazurskie (PL) and Östergötland (SE) consider port related priorities within their RIS3 documents, having no core but small and /or comprehensive (middle-sized) ports in the European TEN-T network.

Nevertheless, besides the identified regions fostering ports and / or Blue Economy, those without any relation to the maritime sector or logistics become important as well. Or in other words, the burst of empty cells is offering a clear statement towards the research questions proposed.

Only one region can be identified choosing at least one "port priority" for RIS3 having no core and no comprehensive (middle-sized) but small port – Warminnsko-Mazurskie (PL). Additionally, the majority of regions with core ports (nine) are not considering any prioritization of the port sector in their RIS3 compared to those who selected such "port priorities" (seven regions). The same applies for comprehensive ports with an even higher difference (21 against nine).

One special case needs to be reviewed – Denmark. The Danish government included a specific priority called "The maritime sector – the blue Denmark" to the national RIS3 document [100]. Nevertheless, the regions missed any specification of this approach within their RIS3, thus a concrete support on regional level for SMSPs or Blue Economy can't be justified with the available and published information on priority setting for Danish regions.

Having the first research question in mind, the analysis exposed a very low contribution of SMSPs to RIS3 in the Baltic Sea Region. As illustrated in Table No. 2, the majority does not include any "port priorities" nor subsectors of the Blue Economy for the regional development in line with Smart Specialisation as innovation policy governance. This applies for small, comprehensive (middle-sized) as well as core ports. Thus, an early statement can be made: ports' regional innovation potentials as introduced in this paper were not considered in the funding period 2014 – 2020 for analyzed Baltic regions. This clearly

offers that ports are not seen as driver for regional innovation worth to be strengthen under the umbrella of RIS3 by the regional decision-makers.

4.2. Effects of RIS3 policies on small and medium-sized ports' performances

It is worth to further analyze only those regions considering port as important blue actors for RIS3 as well as to create inferences from Smart Specialisation policies to port performances. For this purpose, data on cargo turnover and ferry passengers for all regions covering "port priorities" or Blue Economy sectors was collected for the years 2014 and 2019 (latest available). To enable an interpretation whether Smart Specialisation affects the performances, national and European data as mean value is added to allow a short benchmarking. The data is provided in Table No. 3.

Table 3. Regional development on cargo and ferry for selected NUTS-2 regions and countries

	Cargo turnover in thousand tones			Ferry passengers in thousand		
Countries & Regions	**2014**	**2019**	**Changes**	**2014**	**2019**	**Changes**
European Union	3.790.381	4.073.351	6,95%	398.127	436.888	8,87%
Denmark	92.244	93.727	1,58%	41.353	43.774	5,53%
Nordjylland	8.264	9.893	16,47%	5.470	5.409	-1,13%
Estonia	43.578	37.760	-15,41%	11.353	12.332	7,94%
Finland	105.537	120.488	12,41%	18.471	19.218	3,89%
Helsinki Uusimaa	39.433	48.002	17,85%	11.456	11.615	1,37%
C. Ostrobothnia, Ostrobothnia, Satakunta	13.294	12.979	-2,43%	161	209	22,97%
Varsinais-Suomi	25.481	31.097	18,06%	3.382	3.331	-1,53%
Germany	303.742	294.553	-3,13%	30.780	30.687	-0,30%
Mecklenburg-Vorpommern	25.564	26.298	2,79%	2.842	2.788	-1,94%
Schleswig-Holstein	36.216	37.922	4,50%	11.020	11.361	3,00%
Lithuania	41.105	52.244	21,32%	280	343	18,37%
Poland	68.744	93.864	26,76%	2.224	2.720[1]	18,24%
Pomorskie	45.715	64.940	30,67%	870	1.073[1]	18,92%
Warminnsko-Mazurskie	No data available			No data available		
Zachodnoppomorskie	22.286	26.621	16,28%	971	1.157[1]	16,08%
Sweden	167.530	170.557	1,77%	29.244	30.055	2,70%
Östergötland	12.527	13.003	3,66%	No data available		
Vastra Götaland	46.526	49.231	5,49%	3.035	3.464	12,38%

[1] Data taken from 2018 due to no availability of data for 2019.
Source: Compiled by author (database: Eurostat, codes: TGS00076, TTR00009, TGS00075, MAR_MP_AA_CPH).

Due to the availability of data, three Finish regions had to be subsumed together, while data indicated for Varsinais-Suomi covers two further Finish regions as well. Therefore, the respective values should be interpreted more carefully not to deduce false or biased conclusions. Additionally, the ferry passenger data on national level as well as Polish regional level was taken from 2018 as latest available data.

As the illustrated data in Table 3 shows, all regions with "port priorities" were able to increase their cargo handling between 2014 – 2020, except the consolidated three Finish regions. The highest growth can be allocated in Pomorskie (PL) with 30,67%. Furthermore, all regions were able to outgo the values on national level. Again, one exception has to be highlighted, since the national data for Poland has to be seen as sum of the two regions

Pomorskie and Zachopodniopomorskie leading to the logical consequence, that the percental change on national level is the average of the two listed regions. However, the fact that majority of regions with "port priorities" outperform the respective national changes in increasing values of cargo turnover and partly the European average as well should stay as main conclusion and result from this analysis.

Reviewing the data for ferry passenger changes between 2014 and 2020 reveals the subsumed Finish regions as best performing (22,97%), while having the lowest score in cargo handling on sub-national level, indicating a specialization process in Finish ports [101]. This contrast between high performances in one category and low ones in the other can be figured out for all Finish regions as well as for Nordjylland (DK). Polish regions exhibit high performances for changes in ferry passenger appearances, outperforming European average in both categories. Analyzed German regions are not able to catch up the European benchmark, but Schleswig-Holstein achieves well performances compared to the National level.

On the national level, Poland and Lithuania have to be highlighted. Both countries feature high performance increases in both analyzed categories. Besides the lead to European average, no other country can offer comparable values on the increased changes.

In a sum, two main insights can be deduced from Table No. 3. Firstly, all regions have been able to outperform their national level in cargo turnover and ferry passenger in the funding period 2014 – 2020, the special case of Poland has been described. Except Estonia and Germany, national performances have been positive for both categories. Secondly, large slopes can be figured out for several regions between increases of cargo and ferry passengers, underlining the basic idea of specialization on a certain field in maritime sector [102].

As mentioned earlier, to deviate conclusions on SMSPs for RIS3, only five regions of all coastal Baltic Sea regions can be used as direct case studies. Due to the missing data for Östergötland (SE) and Warminnsko-Mazurskie (PL), three regions serve as source to gain insights. Interestingly, Nordjylland (DK) as well as Central Ostrobothnia / Satakunta (FI) offer remarkable value in Table No. 3. On the one hand, Nordjylland (DK) achieves the highest lead compared to its national level on cargo handling. As mentioned earlier, Denmark included the maritime sector as key priority for Smart Specialisation on national level, thus, all Danish regions experience support in their maritime development. However, Nordjylland (DK) outmatches the national performances underlining the necessity to include "port priorities" and transfer the view from national to the regional RIS3 to benefit from maritime capabilities – small and medium-sized ports. On the other hand, the Finish regions reached the best values of all analyzed cases for increasing their ferry passengers in the funding period according to available data.

As mentioned, all regions covering "port priorities" were able to outperform the national values. Thus, successful implementation of this RIS3 priorities in the funding period 2014 – 2020 can be emphasized. On the national level Lithuania and Poland offer the highest performance rates of all Baltic countries. However, consideration of "port priorities" for National Innovation Strategies on Smart Specialisation can't be supported as a result of this research, since the case of Denmark reveals low growth performances for the port sector on national level, while the only Danish region considering "port priorities" in RIS3 is outperforming.

Through the conducted research and gained knowledge through data analysis, the following theorems can be reasoned with reference to the proposed research questions:

- The majority of Baltic coastal NUTS-2 regions does neither consider "port priorities" nor Blue Economy subsectors as priorities for their RIS3. This applies independently from the existence of core, comprehensive and / or small ports in the regions, leading to the conclusion of missed potentials through ports as location and competitive advantages and thus for regional development. Regions with selected "port priorities" mainly cover the subsectors of the Blue Economy as well.

- NUTS-2 regions considering "port priorities" of Blue Economy subsector within their RIS3 documents outperform the national and European benchmark in development of cargo turnover and ferry passengers between 2014 – 2020.
- Considering the availability of SMSPs in Smart Specialisation Strategies for priority selection can lead to higher port performance increases on maritime cargo and ferry handling in a funding period compared to other comparable regions.

Thus, the conducted research and analysis underlines the role of SMSPs in regional development and demonstrates the add-value of Smart Specialisation approaches for the Blue Economy.

5. Discussion

The two regions of Nordjylland (DK) and Central Ostrobothnia / Ostrobothnia / Satakunta (FI) are serving as ideal case studies for this research scope - having SMSPs only and selected "port priorities" in their RIS3. They achieved remarkable performance growth values, revealing a successful specialisation to either cargo or ferry passengers, supporting the idea of competitive advantages through RIS3 [103].

In general, the conducted research identified high growth in port performances for Baltic coastal regions considering SMSPs in their RIS3 priorities. Even though key port performance indicators are discussed in related literature [104], cargo and ferry passenger values are reflected as key indicators in the discourse [105-108]. Hence, drawing inferences from the presented data in Table 3 about port performances in the region can be deduced. Nevertheless, the research does not allow to draw back conclusions for an individual SMSP – only conclusions for the regions on NUTS-2 level can be made accordingly to the research design. Thus, the conducted research allows to formulate the following policy recommendations:

- Utilisation of natural resources and capabilities in RIS3: The research has exposed the low consideration of Blue Economy in RIS3 for Baltic coastal areas. Thus, the existing capabilities (SMSPs) and natural resources (marine resources) as well as the potential for regional development through competitive advantages are not utilised and shall be focused on more intensive for the next funding period.
- Using RIS3 as tool to support SMSPs: The analysis revealed positive effects on cargo and ferry for regions with SMSPs only when reflecting their capability in RIS3. Thus, RIS3 can be a successful tool to sustainably specialize available SMSPs in a region and overcome competitive disadvantages in comparison to core port regions.

The first recommendation is in line with other researches when analysing improvements on the development and implementation of RIS3 policy [109,110]. Additionally, the research offered the low recognition of seaports, being small, medium or large, in RIS3 as innovation governance policy. Thus, seaports can't be identified as so called blue actors in the Blue Growth paradigm for the Baltic Sea Region. Hence, future research on blue actor identification is required when it comes to innovation and growth policies and especially RIS3. Thus, the conducted research is confirming current gaps in this particular research area [33].

The second recommendation is coherent with other researches and confirms the potentials of RIS3 to be used as a tool for regional politics [50,111], but can also be considered as helpful tool for SMSPs themselves putting RIS3 into business strategies for maritime institutions [112]. Hence, this needs further elaboration and future research, taking into account the low access for SMSPs to funding opportunities [3] which can be mitigated by utilizing from RIS3 [13,14,16,113].

Also, Table 2 revealed a huge potential for improvements on the integration of ports as structural units in a region to the respective RIS3 priorities. Even though, a lot of regions can utilize from a strong maritime sector and the existence of ports as logistical hubs, these blue actors are not represented in their respective regional innovation strategy. Further research is necessary to elaborate the reasons why critical blue infrastructure is not represented in regional innovation policies.

Despite the research was implemented and prepared to the best of knowledge and belief, some limitations need to be described as well. In general, the Smart Specialisation strategy design and actual implementation are two separate steps. The transfer of the strategy to actual actions in the regions is a challenging process offering individual obstacles on regional level [14,48,114,115]. Thus, other theoretical concepts or growth strategies might contribute to the data received from the analysis as well, such as the theory of higher growth potentials for countries with lower GDP values [116,117].

Hence, further research on this particular topic of the paper in hands should be addressed as well. As a first recommendation the extension of the sample is necessary to identify further regions with RIS3 "port priorities" and SMSPs only. Thus, the recommendations of this research would receive further arguments and (possibly) justifications. Furthermore, the recently mounted term of "sustainable blue de-growth" [118] as contractual idea to the economic growth domination focusing on environmental and social sustainability [119-121] could be taken into account in further research on RIS3 and Blue Economy.

The analysis of SMSPs as institutions and actors in the frame of innovation growth policies is also underlining the current research discourse on framing a deeper view on seaports as ecosystems [104]. Through their functional role of gateways and regional economic centers [122] SMSPs as well as bigger seaports are becoming nodes of social, environmental and economic actions, including entrepreneurial, operational, technological and legal dimensions integrated as ecosystems [123-127]. Under this view, SMSPs as ecosystems might enable new interactions with existing innovation policies and open new pathways for sustainable development of SMSPs on ecosystem perspective rather than a single entity.

6. Conclusion

The purpose of this research paper was to examine the SMSPs integration into RIS3 policies of coastal Baltic NUTS-2 regions as well as an elaboration of regional port performances when SMSPs are integrated to this innovation governance policy (research questions). Through a deep analysis of the priority selection for 37 affected regions, the results illustrated in Table No. 2 have exposed a very low recognition of SMSPs as driver for regional innovation in the Baltic Sea Area under the RIS3 policy. Only 12 regions covered one of the introduced "port priorities" deduced from the main functionalities of SMSPs being maritime accelerator and logistical nodes. Furthermore, the analysis revealed that non-consideration of "port priorities" is an issue for any kind of port classification in the regions, even though one or two core ports are existing.

As a next step, the analysis examined the performances dedicated to port operations using available cargo and ferry data for the funding period 2014 – 2020 on NUTS-2 level. As introduced in the first two chapters, RIS3 and Blue Growth as innovation policy concepts offer synergy opportunities and affect each other. Thus, the effect of incorporation "port priorities" to RIS3 on actual performance indicators was elaborated and illustrated in Table No. 3 for affected regions. Besides the general growth in cargo and ferry as well as outperforming the European averages, the analyzed regions revealed outperforming regions against the national and European averages.

Following yielded results from presented datasets, two main recommendations were highlighted by the author. At first, future RIS3 development and implementation shall consider available regional resources and capabilities – in this case SMSPs and access to marine resources, which was exposed by analyzing introduced "port priorities" on the one hand and Blue Economy sub-sectors on the other hand in the frame of RIS3. Secondly, RIS3 shall be used as a tool by regional policy maker, but also SMSPs management level as well, to foster regional innovation and sustainable development.

Bearing in mind presented relations between RIS3 and Blue Economy, this paper in hands theoretically contributes to the elaboration of SMSPs' significance in coastal Baltic Sea regions' Smart Specialisation Strategies as well as the regional utilization of available maritime capacities, but also on proofing the positive effects of RIS3 as innovation

governance policy on regional blue actors' (SMSPs) performances. Furthermore, through conducted analysis, this research practically contributes by underpinning policy recommendations for the Baltic Sea Region such as establishment of regional innovation ecosystems, identification of key actors and cross-border collaboration [128,129] by highlighting the potentials of SMSPs in this discourse and practical pathway to regional sustainable development.

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Article III

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Cross-Border Cooperation Concept in Multifunctional Agriculture under RIS3

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***Abstract* – Multifunctional agriculture holds several potentials for applying new technologies and innovative processes to reduce its environmental impact in line with the European Green Deal. Though, new cooperation concepts are a sufficient tool to enhance these potentials, using interdisciplinary and cross-border approaches. Hence, Regional Innovation Strategies on Smart Specialization (RIS3) can play a key role on political level to foster regional innovation development on agriculture in rural areas. By analysing Smart Specialization priority areas, potential crossovers between this innovation policy and actual implementation in practice can be deduced for cross-border cooperation approaches. Thus, the conducted research offers a comparison of priorities for German regions involved into the RUBIN program as use cases, supporting rural and less developed regions. Through these introduced use cases and strategy analysis, the inductive and deductive research offers a cross-border cooperation concept for legume food production, exploiting spillover effects to other priorities related to multifunctional agriculture. The core element of the concept is the introduction of knowledge hubs with an interdisciplinary view to enhance and apply innovation potentials in line with RIS3, which create positive effects on the environmental impact from the start with legume as raw materials until an improvement of its product portfolio for consumption at the end.**

***Keywords* – Case study; conceptual cooperation framework; environmental spillovers; innovation policy; legume supply chain; smart specialization; rural development**

1. INTRODUCTION

The European Green Deal is setting the scene for the green transition of European society in various fields. On core pillar of the initiatives is the Farm to Fork Strategy to support the European food system and enable a fair, healthy and environmental-friendly agricultural sector [1]. This objective is also congruent to the UN Sustainable Development Goal No. 12 [2]. However, the actual implementation of the European initiative at local or regional level is not specified. Thus, the interdependencies to the regional integration of Smart Specialization as innovation policy to identify potentials for regional innovation achievements for transformation and sustainable growth become significant to be analysed in this matter [3].

Regional Innovation Strategies on Smart Specialization (RIS3) were introduced as innovation policies by the European Commission to foster regional strength and competitiveness [4]. After expiration of the funding period 2014–2020, European regions are

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monitoring and evaluating their individual performances to adjust their strategies, set up new monitoring measures and choose aligned priorities for the new funding period 2021–2027 [5].

These European policy initiatives apply, needless to say, for rural areas as well. They are characterized strongly by agricultural economies [6], [7]. This particular sector contributes with 9 % to global Greenhouse Gas emissions in 2020, thus, agricultural activities still bear potentials for improvements on its environmental impact [8]. The aforementioned policies aim to foster innovation and technology application to capitalize on those potentials. However, the pure introduction of new technologies as promoted in past innovation policies becomes detached by new experiences of innovation application in rural areas' agriculture resulting from diversification and technology combination [9], [10]. Besides diversification, additional new trends emerged when it comes to policy design in rural areas, namely focus on entrepreneurship and innovation, relevance of multilevel governance policies and focus on local specifies [11]. These trends are identical to core aspects of the Smart Specialization approach highlighting its significance for rural development.

In this context, the concept or multifunctional agriculture was introduced as perspective to assign agriculture more functions than simple food production. Basically, two forms of multifunctional agriculture are discussed in literatures, being either a tool of agriculture policies or a concept for rural development and agricultural change [12], [13]. However, in both cases the application of Key Enabling Technologies through innovation policies such as Smart Specialization is a crucial aspect for future development. Consequently, Entrepreneurial Discovery Processes (EDPs) as one of the key concepts in Smart Specialization approaches should be put into focus for agricultural sector [14], [15]. Paradoxically, farmer-driven innovation processes – being the counterpart of EDPs in agriculture – are underrated in rural area multifunctional agriculture development [16], which identifies a research problem in this particular field that is underlined by regional policy's task to sustainably develop multifunctional agriculture for protection agriculture environment [17].

Nevertheless, cooperative approaches are necessary to apply innovative knowledge and technologies in agriculture [18], which results from insufficiency of linear transfer from research to farmers [19]. Thus, co-creation and cross-border cooperation approaches are promising concepts for innovation policy application in agricultural activities. However, for multifunctional agriculture the comprehension of co-production/co-creation to strengthen resource base and enable multifunctional agriculture misses conceptual frameworks [20]. In addition, RIS3 also lacks on sufficient cross-border concepts for research, innovation and application as driving innovation policy applicable for rural area development [21] even though cross-border cooperation is a key factor for regional competitiveness [22]. This crossover clearly postulates a research gap of missing cooperation concepts under the umbrella of RIS3 for innovation support in the particular field of multifunctional agriculture.

In this vein, audits with 21 triple helix actors involved in RIS3 development and implementation were implemented in the SMART_watch project, part-financed by INTERREG Central Europe Program 2014–2020 and revealed low cooperation measures between regions. Almost one third of the participants rejected any cross-border cooperation for RIS3 in their region. The existing cooperation were evaluated in average with middle intensity, while cooperation with neighbour regions average score tends towards low scores. Therefore, a practical gap can be concluded based on implemented audits supplementing the introduced research gap.

Following this gap, this paper will introduce a sufficient cooperation concept for multifunctional agriculture and its impacts to existing Smart Specialization Strategies of selected German regions, by analysing a use case for co-production and Key Enabling

Technology (KET) application on the specific example of legume food production. The conducted research was implemented alongside a project development for the RUBIN program of German Ministry for Education and Research aiming to foster strategic partnerships between entrepreneurs and academics to foster innovation application in less developed/rural areas in Germany [23]. The concept will introduce interaction between the different actors on cross-border level, identify potentials in transformation into multifunctional agriculture for legumes and reveal spill-overs to RIS3 implementation of the participating regions.

Setting this scene, RIS3 merges multifunctional agriculture and innovation policies in this particular field. Thus, this policy retrieves potentials for sustainable development for regional and rural regions in terms of agriculture by promoting local entrepreneurship [24], applying new KETs and innovation measures [25] and on the same track reduce emissions on this sector [3]. However, a key pillar in regional strategy design is the selection of priorities on individual basis [26]. This is a crucial decision by the regions, since the allocated and distributed funds are following directly according to the priority selection [27]. Thus, it is necessary to analyse the chosen priorities by participating regions of the program in advance. If no relating priorities are reflected in published innovation strategy document, conclusions from a cross-border cooperation to RIS3 implementation can't be made. Also, equal priority selection in terms of RIS3 is expected to better enhance cross-border cooperation activities [28].

Consequently, to previous argumentation as well as the identified research gap, two research questions are the backbone of conducted research. Firstly, according to the specified condition for equal priority selection in RIS3 to develop a sufficient cross-border concept, the paper will analyse how selected priority areas of RIS3 are equally chosen by regional government of participating program regions. Secondly, following the identified research gap this paper examines how a cross-border cooperation concept enhancing multifunctional agriculture under RIS3 policies can be established. The concept will be based on an applied use case for legume food production in German less developed regions within the RUBIN program [29].

By answering the proposed research questions, this paper contributes both theoretically and practically to the existing research. First, theoretical contribution will be done by exploration of existing priority setting under RIS3 for a certain number of regions to identify future cooperation potentials and establishment of a cross-border cooperation approach uniting multilevel actors. Additionally, policy recommendations for future RIS3 design and implementation will be deviated from this research. Second, theoretical contribution is also provided for improvements and new insights of multifunctional agriculture resulting from a new perspective and crossover with RIS3 as political intervention. Third, practical contribution is emphasized in the cross-border cooperation concept for the use case of legumes in the RUBIN program area. The cooperation concept application in practice is already under development, thus, the conducted research has a theory-to-practice character as well. Therefore, in a sum, the conducted research contributes in both theoretical and practical ways to organizational improvements in the agricultural sector, which implicit offers potentials in reducing environmental impacts in the specified research area and a shift towards circular economy being a key objective for the European Union, which implementation process is also limited due to missing KETs [30].

This paper is structured as follows: following the introductory chapter used methods and methodology will be presented before key results of the research are offered in the chapter hereinafter. At the end of this paper, a discussion on key findings including derivative recommendations is offered including some concluding remarks and research limitations.

2. Methods and Methodology

The conducted research is based on inductive and deductive perceptions, though, regarding the proposed objectives of the research it can be argued to be exploratory as well. In general, exploratory research methods are based on qualitative approaches, facilitating assessment of discovering new insights and crossovers [31], especially qualitative approaches are favoured to analyse political innovation changes [32], [33]. Summarizing all implemented methods, the conducted approach can be labelled as hybrid research approach [34] as a mix of deductive and inductive perceptions for exploration.

Firstly, the research is based on implemented audits in line with the SMART watch project, part-financed by INTERREG Central Europe Program. Structured audits were conducted by the authors and implemented with practical actor as action research [35] in the field of RIS3 development and implementation from different regions. The participants are following triple helix approach representing business, academics and political level [36]. For this research, only questions on cooperation of their regions were incorporated, asking for any cooperation in general as well as their density in terms of RIS3 implementation. The scale followed scores from 1 (statement not true) to 5 (statement fully true) with the option to skip a question if no evaluation of statements is possible by the participant. This yielded primary data initiated further research in the particular field of cross-border cooperation in RIS3 as a first step of the final research process.

Secondly, from a deductive perspective the research builds up on RIS3 strategy documents with focus on the selection of priority axis. Thus, the S3 Platform as main Smart Specialization database hosted by the Joint Research Centre was used as core database to retrieve necessary secondary data for research purposes [37]. Due to the research boundaries stipulated through the RUBIN program area [29], case study methods are serving as research method [38] in combination with thematic and content analysis methods [39], [40].

Thirdly, the mainly driving research impulse is the construction of knowledge by using methodological actor's approach. Hence, reality and facts are created independently of affected observers – individuals. Thus, knowledge is constructed by an amount of denotations shared by a larger number of people [41]. Therefore, understanding of experienced, observed and analysed reality as an interdisciplinary and social construct is the driving impulse of the present research, including business and management, innovation policies, policy making, multifunctional agriculture and co-creation concepts. In this, the research develops a conceptual approach and model breaking boundaries of single disciplines and domains emphasizing synergetic insights with potentials to contribute to existing global environmental changes at the very end.

The presented methods were expanded by deep literature review and desk research on latest findings and related articles in the particular field. The postulated research questions have been basis for further research method implementation with the researcher's aim to increase the quality of results by mentioned combination of different disciplines and concepts. Fig. 1 illustrates the research path undertaken.

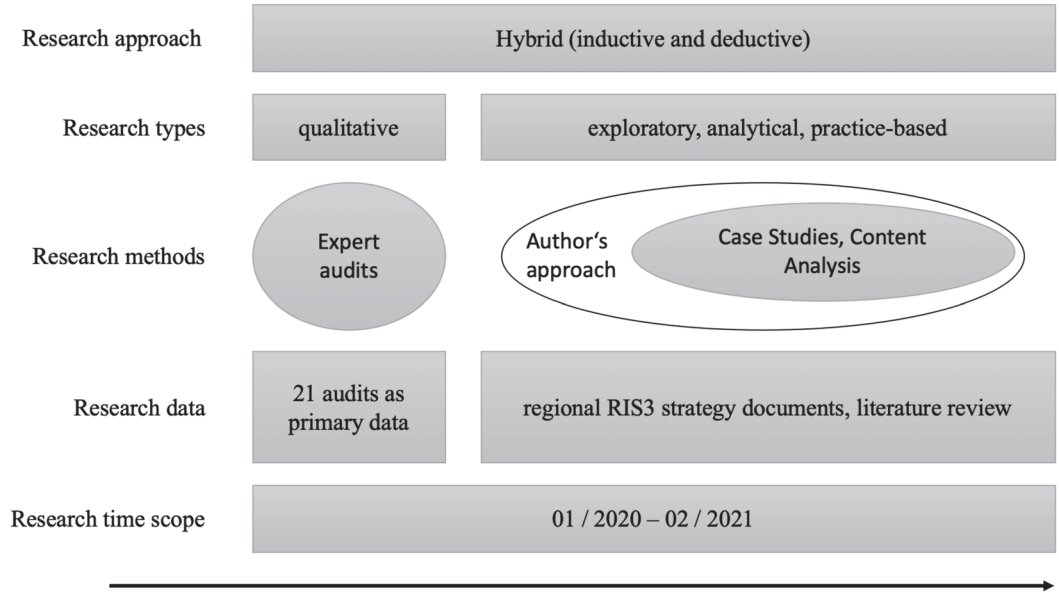

Fig. 1. Research methodology (compiled by authors).

Hence, the hybrid research and its results are also based on constructivism and interpretivist of the researchers [42], [43]. Both philosophical perspectives are the background of the following chapter and the provided insights to set up a sufficient cross-border cooperation concept under the umbrella of RIS3 as innovation policy using the particular use case of legume food production as potential multifunctional agriculture phenomena in the German RUBIN program.

3. Results

In the following subsections the results of introduced research methods are presented. First, a comparison matrix is provided for the selected priorities of affected German regions in the present use case for multifunctional agriculture co-creation through cooperation. And second, the actual cooperation concept framework illustrates the interactions between actors on a cross-border basis and how they affect RIS3 as well as enhances potentials for multifunctional agriculture, using the use case for legume food production.

3.1. RIS3 priority selection comparison of participating regions

Reviewing the German regions being able to join the RUBIN program for rural development reveals a strong trend to former German Democratic Republic (GDR) regions, since they are claimed to be less developed which is the backbone of this national development program [44]. Besides all former GDR regions and parts of Berlin, the majority of Federal States of Lower Saxony and Schleswig-Holstein are indicated to be less developed in terms of their economies. Thus, both states have been incorporated to this research analysis with their respective Smart Specialization Strategy documents. In contrast, for Bavaria, Hesse, North Rhine-Westphalia and Rhineland-Palatinate only a few regions have been identified as less developed. Thus, those Federal States were not included to the analysis.

Furthermore, the state of Saarland as a whole was typed as less developed, but no regional Smart Specialization Strategy exists [37] hence this region was excluded from the analysis.

Following this containment of regions based on the RUBIN program formalities, a comparison of selected RIS3 priorities between the regions was implemented. Even though, the regions choose their priorities on individual basis, a lot of common priorities have been identified, which might enhance close cooperation initiatives for innovation applications in the particular field. As indicated earlier, the research was aligned with a use case for multifunctional agriculture using an example of legume food production. Thus, priorities concerning Nutrition, Agriculture, Health and Life Sciences, Manufacturing, Circular Economy, Medicine as well as social industries were in the focus of the research since they are affected areas of multifunctional agriculture [45]–[48].

Table 1 illustrates the results of conducted comparison in three regions being able to utilize from the National RUBIN program, namely Berlin/Brandenburg, Lower Saxony and Mecklenburg Western-Pomerania.

TABLE 1. RIS3 PRIORITY COMPARISON OF BERLIN/BRANDENBURG, LOWER SAXONY AND MECKLENBURG WESTERN POMERANIA

Regions	Berlin / Brandenburg	Lower Saxony	Mecklenburg Western-Pomerania
Berlin / Brandenburg		Healthcare; Transport, mobility and logistics; Power engineering; ICT	ICT; Healthcare; Transport, Mobility and Logistics
Lower Saxony	Health and social industry; Mobility economy; Energy industry; Digital and creative economy		Mobility economy; Health and social industry; Agriculture and food industry; Energy industry; Digital and creative economy; New materials and manufacturing
Mecklenburg Western-Pomerania	ICT; Health and life sciences; Mobility	Mobility; Health and life sciences; Nutrition; Energy and climate; ICT; Sustainable production techniques [...]	
Saxony	ICT and digital communication; New materials	ICT and digital communication; New materials	ICT and digital communication; Advanced production technologies
Saxony-Anhalt	Resource efficiency and circular economy; Mobility and logistics; Health and medicine; Renewable energy and sustainable energy production	Health and medicine; Renewable energy and sustainable energy production; Plant and machine engineering	Mobility and logistics; Renewable energy and sustainable energy; Health and medicine; Mobility and logistics; Smart production and industry 4.0
Schleswig Holstein	ICT and media; Life Sciences; Renewable Energies	Maritime economy; Life sciences; Nutrition industry; ICT and media; Renewable energies	Renewable energies; Life sciences; ICT and media; Nutrition industry
Thuringia	Healthy Life and health industries; ICT and innovative services close to production; Sustainable energy and resource use; Industrial production and systems	Healthy life and health industry; ICT and innovative services; Sustainable and smart mobility and logistics; Sustainable energy and resource use; Industrial production and systems	Sustainable energy and resource use; Healthy life and health industry; ICT and innovative services [...]; Industrial production and systems

Source: compiled by authors.

Each cell is providing a list of chosen priorities being identical between the two regions in the first column and table heading. However, the labelling is chosen from the official

documents of the region in the first column. Thus, another crucial aspect for RIS3 can be emphasized: even though the content of priorities is strongly overlapping, the regions are choosing different labels for their priorities. Also, the research revealed that mixture of priorities is offered by some regions, while others are using a clearer differentiation between related areas, e.g. 'ICT' vs. 'ICT and media' vs. 'ICT and innovative services close to production'. Hence, the analysis offers the respective denotations of all analysed regions in the following illustration. Despite Berlin and Brandenburg are two separated Federal States, both states are developing and implementing a joint strategy for Smart Specialization [49].

As aforementioned, the focus of conducted research are cooperation potentials on multifunctional agriculture, thus, the listed priorities affecting it are highlighted in Table 1 by being written in cursive letters. It is obvious that all three analysed regions provide potentials for cross-border cooperation initiatives with all other program regions under the umbrella innovation policy RIS3. Reviewing the listed priorities, ICT related priorities appear in highest amount, confirming the trend towards digital transformation in regional development [50]. In addition, at least two priorities under RIS3 are identical for each combination of the listed regions. Hence, cooperation potentials are not limited to one particular sector of interest. Therefore, this analysis opens up further research approaches on collaboration in other sectors as well.

The same procedure applies for Table 2, offering the comparison against all program regions for the four remaining regions of Saxony, Saxony-Anhalt, Schleswig-Holstein and Thuringia. Again, ICT related priorities have the highest amount of consensus between the regions. Also, for each combination of the four illustrated regions with all other program regions, at least one match in RIS3 priorities can be identified.

As both tables illustrate, for each combination of regions, identical priorities have been identified. Thus, all regions own large potential to enable cross-border cooperation for innovation initiatives alongside their RIS3 development and implementation.

Additionally, with the exception of Saxony, all regions have common priorities in the frame of multifunctional agriculture, which, again, enables cross-border cooperation option in this particular field. Additionally, on the one had side it might be quite obvious that regions with rural areas are focusing on agricultural specialization [51], [52], but on the other hand side the analysis demonstrates the innovation policy support and legislation behind as well.

TABLE 2. RIS3 PRIORITY COMPARISON OF SAXONY, SAXONY-ANHALT, SCHLESWIG-HOLSTEIN AND THURINGIA

Regions	**Saxony**	**Saxony-Anhalt**	**Schleswig-Holstein**	**Thuringia**
Berlin / Brandenburg	ICT; Materials	ICT and innovative services close to production; Industrial production and systems	ICT; Healthcare; Power engineering	Healthcare; ICT; Clean technologies; Production and automation technology
Lower Saxony	Digital and creative economy; New materials and manufacturing	Health and social industry; Energy industry; New materials and manufacturing	Maritime economy; Health and social industry; Agriculture and food industry; Digital and creative economy; Energy industry	Health and social industry; Digital and creative economy; Mobility; Energy industry; New materials and manufacturing
Mecklenburg Western-Pomerania	ICT; Sustainable production techniques [...]	Mobility; Energy and climate; Health and life sciences; Mobility; Sustainable Production techniques [...]	Energy and climate; Health and life sciences; ICT; Nutrition	Energy and climate; Health and life sciences; ICT; Mobility; Sustainable production techniques [...]

Saxony		Advanced production technologies	ICT and digital communication	ICT and digital communication; New materials
Saxony-Anhalt	Efficient and intelligent manufacturing techniques		Renewable energy and sustainable energy production; Health and medicine	Renewable energy and sustainable energy production; Health and medicine; Mobility and logistics; Plant and machine engineering
Schleswig Holstein	ICT and media	Renewable energy and sustainable energy production; Life sciences		ICT and media; Renewable energies; Life sciences
Thuringia	ICT and innovative services close to production; Industrial production and systems	Sustainable energy and resource use; Healthy life and health industry; Sustainable and smart mobility and logistics; Industrial production and systems	ICT and innovative services close to production; Sustainable energy and resource use; Healthy life and health industry	

Source: compiled by authors

3.2. Cross-border cooperation concept for multifunctional agriculture under RIS3

In the following subchapter, the cross-border cooperation concept will be illustrated, using a case for legume food production in the frame of the German RUBIN program. Based on the gained insights from previous chapter, cooperation initiatives based on identical priorities are available for all regions. However, business innovation potentials can be utilized more effective in interdisciplinary approaches [53], [54]. In addition, RIS3 implementation introduces complex multi-level actor involvement as well [55], [56]. Though, innovation was regarded as emerging in businesses only, multi-level actors became crucial in innovation processes and enabled combination of internal and external knowledge [57], [58], approaches to include actors from various spatial fields [59] and focus on local available capabilities and knowledge [60], [61]. Therefore, a cross-border approach on cooperation incorporating actors as knowledge hubs from different disciplines is set up to identify potentials for improvements on multifunctional agriculture for regional food production of legumes. Knowledge hubs can be understood as institution incorporating different knowledge and interests with the overall objective to transfer knowledge but on the same track exchange knowledge between academics, local businesses and politics [62], [63].

According to this argumentation, the cross-border cooperation concept is illustrated in Fig. 2 with three involved regions using a use case for regional legume food production, which is also the available raw material crafted locally. In this concept, region B is represented by the local agricultural business with the ‘usual’ food production using the raw material legumes including the manufacturing process (Agricultural reactor) and supply on the market. Based on the cross-border cooperation idea, two different knowledge hubs, specialized in line with the priorities of the regions they are representing, are incorporated to the legume production supply chain.

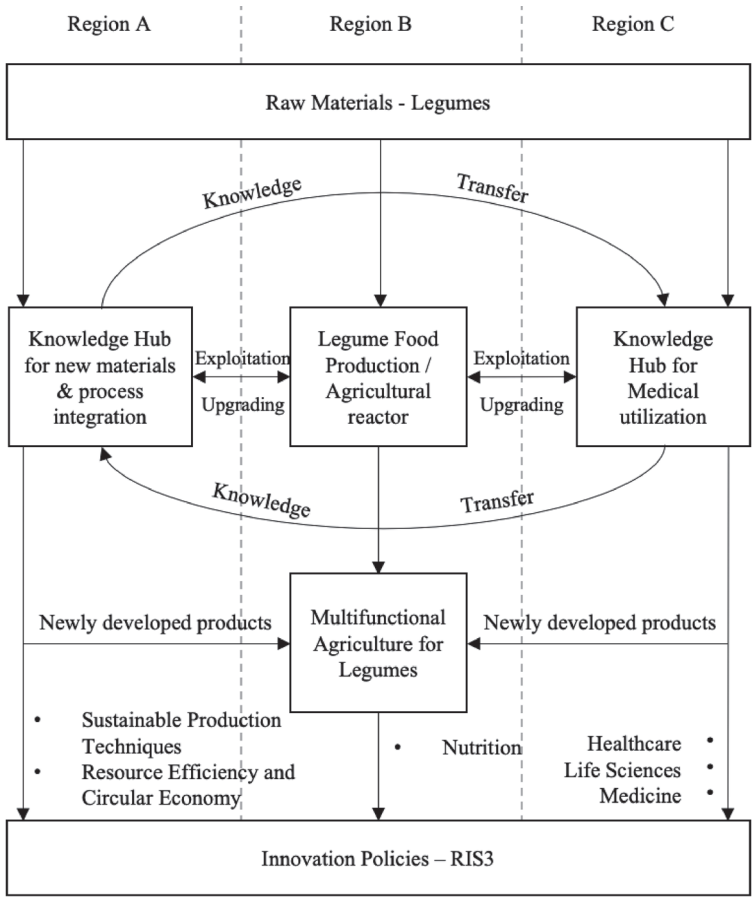

Fig. 2. Cross-border cooperation concept as use case for legume multifunctional agriculture and impacts on RIS3 (compiled by authors).

In this concept, the knowledge hubs have three main functionalities:

1. Exploiting insights from the actual production process with the objective to improve and upgrade the process developing and applying KETs and innovation in close cooperation with the producer in region B.
2. Sharing knowledge with other incorporated knowledge hubs as this is considered to be a crucial aspect in successful innovation and technological development [64], but in close cooperation with the business as well to meet actual market needs [65].
3. Contributing to improvements for multifunctional agriculture by utilization of gained knowledge and increasing the available product (service) portfolio of the raw material – here: legumes.

In this particular use case, both knowledge hubs are exploring innovative manufacturing technologies based on biophonic to upgrade legume ingredients for potential exploitation in the whole supply chain and utilization as pharmaceutical material. Arising synergetic effects will enable and support low emission and local production of a larger product portfolio.

As mentioned in the previous chapter, this cross-border cooperation concept does not only hold potentials for innovation and KETs application in the field of multifunctional agriculture, but also fosters the implementation of regional Smart Specialization approaches.

This is the final step illustrated in Fig. 2 showing positive contribution to specific priority areas of RIS3 from the full progress.

As mentioned in the introduction, by application of the concept in practice, several potentials for reducing environmental impact in the particular use case can be emphasized, e.g. enhancing the potential for usage of the locally crafted raw material legumes, lowering the demand for import products in food and health sector as well as a shift towards more circular economy as a key objective of the European Union in the frame of the Green Deal [66].

4. Discussion and Conclusion

The conducted research aimed to analyse two core research aspects of RIS3 priority setting as starting point for cooperation and cross-border cooperation concepts. Both aspects were exploited with a use case for multifunctional agriculture in legume food production in the RUBIN program area. In the frame of multifunctional agriculture case study analysis are quite common and accepted in existing literatures [45], [67]–[69]. However, additionally to the presented results some practical recommendations can be made by the authors for future sustainable implementation.

Theorem 1. Currently, European regions are revising their Smart Specialization strategy documents for the new funding period 2021–2027 [5]. Thus, it is crucial to learn from previous period and adapt lessons learned and best practices. As mentioned in 3.1, RIS3 priorities are covering each other strongly in their subjects but still have slight differences in detailed description as well as labelling. However, as identification can be a crucial starting point for cross-border cooperation under RIS3, it is highly recommended by the authors to unify the priorities to a certain degree to make policy application easier for involved actors. This recommendation was already made by main author [70] and is again confirmed by yielded results of the conducted research. In this vein, the high consensus of RIS3 priorities identified in Table 1 and 2 should be a starting point for discourse on political level for future cooperation potentials among the regions. Hence, this research is contributing as well through offering a cooperation concept to improve innovativeness and economic development in rural areas [71].

Theorem 2. Cross-border cooperation enables potentials for regional diversification – in the analysed case towards multifunctional agriculture – and therefore enables innovation potentials in different areas. This is also in line with existing literature of cooperation improvements in the field of Smart Specialization [72].

Theorem 3. Cross-border cooperation should include knowledge hubs on an interdisciplinary approach to seek for innovation and KETs application in existing agricultural processes. Integrating sufficient knowledge transfer between the hubs and consideration of business sector offers further innovation potentials for existing systems [64], [65].

Another aspect indicated at the end of chapter 3 are spillover effects resulting from the implementation of the cross-border cooperation concept for the use case of multifunctional agriculture using legume food production. Even though such spillovers were not part of the conducted research, they can be emphasized implicitly from it.

1. The concept is supporting an improvement in utilization of locally produced raw materials. Increasing the degree of efficiency of this raw material has positive effects on imports and transport sector by reducing its demand in agricultural sector. This is not only pushing circular economy application and autarkic production forward, but also holds potentials in

reducing environmental impact [73].

2. Contributing to RIS3 positively can improve regions' performance sustainably. As allocated funds to the regions also depend on their performances alongside Smart Specialization priorities and performances, it might be reasonable to alleviate future access to funds for other innovation driven processes in agricultural field.
3. The cross-border cooperation concept is seen as enabler and developer for innovation and KETs application. Thus, best practices and lessons learned can be generated on innovation demonstration level. It is crucial to focus on innovation application on demonstration level to achieve the published environmental targets for 2050 [74].

Hence, the research faces limitations. The practical application of the cross-border cooperation concept needs to be proven. Even though, the cooperation concept is on development in practice, its efficiency and positive effects have to be elaborated in a later stage or in other words, the theory to practice adaptation is not proven yet. In addition, the logical crossover between the cooperation concept for multifunctional agriculture and impacts on RIS3 might not be a core aspect for affected actors in practice [75], especially for businesses. Nevertheless, the positive spillovers can appear anyways.

In a sum, the conducted research tackled two proposed research questions. At first, a comparison of selected priority axis under RIS3 implementation for the RUBIN program regions was illustrated. Herewith, several common priorities were identified as basis for potentials on cross-border cooperation for RIS3 with focus on multifunctional agriculture being employed as use case of legume food production. Second, a cross-border cooperation concept was deviated for this use case in multifunctional agriculture including interdependencies with RIS3 implementation. The core of conducted concept is the integration of specialized knowledge hubs to exploit potentials on usage of the raw material legume and its spillovers to other priority areas of RIS3 as well as opportunities for reduction of the environmental impact resulting from this particular agricultural field.

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Article IV

Meyer, C., Gerlitz, L. & Klein, M. (2022). Creativity as a Key Constituent for Smart Specialization Strategies (S3), What is in It for Peripheral Regions? Co-creating Sustainable and Resilient Tourism with Cultural and Creative Industries. *Sustainability*, *14*(6), 3469. https://doi.org/10.3390/su14063469

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Creativity as a Key Constituent for Smart Specialization Strategies (S3), What Is in It for Peripheral Regions? Co-creating Sustainable and Resilient Tourism with Cultural and Creative Industries

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Abstract: Sustainable tourism is one of the key sectors in the South Baltic Sea Region (SBSR), which belongs to the role model for sustainability—the Baltic Sea Region (BSR). In this context, resilience, recovery and sustainability become key common threads calling for new approaches mitigating negative impacts, upscaling resilience capacity and boosting recovery in the post-pandemic era. The present work aims at revealing conceptual and practical pathways for policy makers and businesses in revitalizing sustainable tourism in the region by emphasizing cultural and creative industries (CCIs) as strong contributors to sustainable development and economic ecosystems, such as tourism. Tourism is also one of the key thematic areas of the smart specialization strategies (S3) in the SBSR. However, there is almost no link between CCIs' potential for sustainable and resilient tourism and their contribution to the co-design and co-creation of S3. CCIs are rather absent agents in quadruple helix networks supporting S3 policy implementation. The literature on this topic is still premature, and represents a clear gap in knowledge. By virtue of these circumstances, the present research investigates how CCIs contribute and reveal new linkages between local assets, potential markets and societal challenges by engaging them as proven sustainable innovation and transition brokers in transnational quadruple helix partnerships following S3 policies in accordance with the sustainable development goals (SDGs), thus supporting sustainable and resilient tourism. Moreover, this paper aims at advocating for development of rural and peripheral regions, thus reducing the so-called "rural marginalization". In addition, this paper also supports ongoing recent discussions on related vs. unrelated diversification policy within the S3 realm.

Keywords: CCIs; smart specialization strategies (S3); regional innovation strategies on smart specialization (RIS3); sustainability; resilience; South Baltic Sea Region; peripheral region; quadruple helix; transformative innovation policy; ecosystems

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1. Introduction

The present research contribution aims at revealing the increasing role of creativity and cultural and creative industries (CCIs) in regional policy design and implementation, i.e., smart specialization strategies (S3) within regional innovation strategies (RIS) and regional diversification policies. The literature linking CCIs and S3 is premature. After the popular research treatise of Cooke and De Propris (2011) positioning the role of CCIs for the EU's smart growth and linking it with place-based specialization debates [1], the following 10 years barely contributed to this research pool. Indeed, most research, in addition to practical work, in response to EU regionalization and cohesion policy implementation

in the context of CCIs, avoids twinning S3 and cultural heritage [2–4]. This constitutes a clear gap in the knowledge and serves as an essential impetus for the authors to envisage the role of CCIs in the S3 policy nexus, especially considering the fact that S3 stands for strategic broader innovation orientation and place-based approaches to tackle existing innovation challenges on the one hand, and CCIs being acknowledged for their strategic partner role in innovation development on the other. As a result, this research does not call for providing support to CCIs via policies [5–7], but rather for the endorsement of regional policies through CCI interventions. The authors argue that CCIs' role is much more than that of strengthening cultural heritage integration in S3 policy design.

Screening available project depositories, CCIs' exploitation for regional development has focused on either strengthening a single industry (e.g., CCIs' internationalization, CCIs' innovation capacity and digitalization) or cross-industry innovation (e.g., boosting social or digital innovation capacity in other industries through CCIs). As a result, a large number of projects related to CCIs and cross(industry)-innovation revealed the benefits of multilateral approaches and yielded positive effects on innovation through networks of relationships and alliances [8–10]. However, within this context of either formal or informal collaboration modes, the focus has largely been laid on innovation performance and its outputs. Any projects on CCIs' potential for regional policy design and implementation, e.g., through RIS and S3, are so far scant. Only 10 percent of the 243 S3 strategies give priority to culture [4] (p. 12). In sum, there are almost no projects on the exploitation of CCIs and their strategic partnerships in diverse collaboration models, e.g., quadruple helices, and how helix actors and their collaboration governance patterns shape innovation for civil society. In such a regional policy setting, the exploration of CCIs' role as innovation brokers (mediators, collectors and connectors) is rather absent, and thus this urges the present work.

Against this background, the paper aims at strengthening CCIs' role for innovation policy design and implementation through S3 in rural, remote and peripheral regions, thus reducing the so-called "rural marginalization" [11], which is to be understood as not only geographical, but rather as relational remoteness, characterized by broken or loosening socioeconomic and political connections and interactions, such as industrial decline, an ageing population, low education levels, land abandonment, and unemployment, which are embedded in the process of social change (p. 556). Indeed, the intensifying race for specialization and competition among regions has led to the prioritization of urban and metropolitan development over rural development, and has highlighted growth of industrial regions in the EU through S3. This, in turn, has generated disproportions in the consideration of urban and rural development through policy instruments, while also affecting CCI-related discourse [12–15].

In this light, the research in hand also supports the emerging body of literature on spatial issues of innovation, by positioning CCIs' role for policy development, and its endorsement in particular, in the periphery [16–20], overcoming the isolation and marginalization of locations at the periphery of development, questioning the significance of relationships and interactions in the given environment, e.g., ecosystems, followed by nurturing people-centered approaches to development, strengthening endogenous potential capitalization and local participation and facilitating the rethinking of local resources [21] (p. 159). In this sense, the present paper aims at expanding the existing literature on successful innovative regions by also exploring the benefits that peripheral regions might have and/or develop in innovation modes through CCIs' intervention, thus overcoming poor governance and lack of financing [22] (p. 137). In the light of these pivotal challenges, the potential of CCIs in peripheral regional development and policy support becomes essential in the given study region of the SBSR, in particular by reflecting upon strongly pursued related diversification policy in the frame of S3 [23,24] in the tourism sector. As a result of focusing on this related specialization, the SBSR becomes vulnerable to disruptions, e.g., caused by COVID-19, or, recently, the rapid pace of digital and environmental regulation-driven twin transition. Despite the huge potential associated with the environmental and cultural assets available, the region has failed so far in building

up sustainable and innovative approaches and collaborative models and unleashing the benefits of the peripheral localities [25] (p. 7).

Given both the advantages and challenges linked with CCIs, their potential is associated with collaborative modes and strategic partnerships, in which different actors engage in formal and informal collective decision-making processes aiming at public policy improvement. This exactly applies to S3 as a public innovation policy. Thus, reinforcing CCIs' role through S3 strategies in peripheral and marginalized regions, there is no doubt that they might spur wider economic development, with a huge record of evidence [26–30]. CCIs play a important role in both the urban economy [31–33] and regional or local development [34–37]. Indeed, there is no doubt that CCIs act as drivers and accelerators of the economy at all geographical scales [38–40]. What remain highly disputed are the reciprocal impacts of CCIs on urban and rural development, as they can increase inequalities between places, favoring on average the most developed places [38] (p. 16). Similar inequalities related to CCIs' impacts are also expressed through sustainability performance, as cities with high innovation performance and a strong density of CCIs have the worst social and economic inequality and increased pollution, resource scarcity or paucity of housing. This is because CCIs employ highly skilled workers, leading to a rise in wages and social gaps [41]. By contrast, a lower presence of CCIs in remote regions results in higher vulnerability, low networking and low level of institutional support. Such regions record higher unemployment and higher competition. In this light, within the rationale of this present work to combine CCIs with S3 strategies in the given regional setting by lending more importance to collaboration modes, networks of interrelationships become pivotal, since local conditions, e.g., the environment and interactions of CCIs in the given ecosystems, can differently affect the concerned localities [38] (p. 16). Similarly, since an ecosystem concept integrates operational, environmental, economic, technological, social and legal dimensions [42–44], as well as implying the causality and interdependencies of assets, institutions, knowledge and human capital [45–47], the exploration of social and institutional aspects for sustainable and resilient co-creation through social and institutional interactions and networks of regional development paths is inevitable.

In the face of rising inequality, such environmental, social and economic challenges appear to multiply and push policy makers and all affected actors to the hilt. Indeed, these conflicting interests frame today's business environment and the so-called triple bottom line (TBL) as an interplay of environmental, social and economic components, highlighting the significance of harmonizing business sustainability efforts in these three elements dimensions [48–50]. Extreme disturbances of supply and value chains as well as disruption of economic and social ecosystems due to the COVID-19 pandemic bring about constant fluctuations and create turbulent times. In this context, resilience, recovery and sustainability become key common threads not only in policy discourse, but also in the academic realm, calling for new approaches for mitigating negative impacts, upscaling resilience capacity and boosting recovery [51–54]. Indeed, CCIs could act here as an expedient to instigate transition, aiming at (re)building resilient capacity and finding novel ways to break through the lockdown [55–57], to face personal and professional adversities [58], and take advantage of a gamut of micro-resilience aspects, such as flexible and adaptive environments and creative and human capital [59]. Available diversified networks of CCIs are able to enhance innovation and capitalization through synergies and linkages with economic ecosystems, once supported by public stimulus. This serves as a precondition for the sustainable development of regions [60] (p. 1).

In order to reveal sustainable and resilient pathways for regions based on the case of tourism sector, the paper in hand raises the research question of *how CCIs, already acknowledged as knowledge and innovation brokers, can support and endorse S3 strategies' design and implementation, given the case of tourism sector? How do they engage in and shape Quadruple helix partnerships that are essential enablers of S3?* The investigation starts with building up the interrelated conceptual fundamentals, linking CCIs with sustainability and S3, followed by positioning this intertwining in the theoretical ream. Recalling recent appeals for open

and evidence-based research designs in both the CCIs and innovation policy discourses, the work deploys empirical data from the EU Interreg project "CTCC—Creative Traditional Companies Cooperation" which was implemented under the Interreg South Baltic Program 2014–2020 from July 2017 to December 2021. By implementing innovation prototypes (product, service, marketing and business model development) in the tourism sector in individual regions across the SBSR, the work counts on strong practice-based empirical evidence, which, when analyzed, evaluated and synthesized, enables us to conceptualize and fertilize the co-creation and reinforcement of S3 strategies in the upcoming EU and regional development cohesion period, 2021–2027. By virtue of the practical nature of this paper, the lessons learnt and managerial implications can support policy makers and regional planners in revamping S3-related discourses, principally by bringing in CCIs as strong contributors, accelerators and enablers into recent innovation and regional development policy discourses, in particular in peripheral regions.

2. Linking Up, Intertwining and Synthesizing Conceptual Foundations

Little is known about CCIs' potential for sustainable regional development and their interplay with regional innovation policies, such as S3. In order to underpin this research focus based on the interplay of CCIs, sustainability and S3 policy frameworks in a given regional setting, the authors of this study encapsulate them by reflecting their interlinkage in the available body of literature based on the common ground on the one hand, and by tracing their conceptual vestiges, thus linking up with key theoretical treatises, on the other.

2.1. What Is Common among CCIs, Sustainability and Smart Specialization Strategies (S3)?

Bearing in mind the interplay of environmental, social and economic dimensions in business sustainability efforts, creativity clearly fits into this discourse. Creativity is seen as a strong partner and part of sustainability transition. Creativity can be perceived as the heart of sustainability, rooted in sustainable social, economic, environmental and cultural practices, as well as an enabler and driver of development [61] (pp. 65–66). Considering this, CCIs have been emphasized in global, EU and regional policy discourse, in particular supporting sustainable development in the frame of the Agenda 2030 of the United Nations (UN), aiming at revealing the economic value of CCIs since 2008 [62]. Core strengths of CCIs are also associated with their ability to broker and share knowledge, craft innovative policies, and produce as well as mobilize digital tools [61] (pp. 68–69). Scholars in Europe have also raised the necessity to integrate CCIs into policy discourses and regional development paradigm, by aligning policies of the EU Member States with the UN SDGs [63], including monitoring the contribution of culture to the SDGs and engaging CCIs as a pillar for the sustainable development paradigm on all levels and across disciplines [64] (pp. 65–55), [65] (p. 23).

However, policy endeavors so far miss clear actions recognizing CCIs' value for the SDGs, which can be encountered through sectoral integration, a cross-sector and multi-sector industry partnership [66] (pp. 37–38). The missing link also shapes existing scholarly and practical contributions regarding CCIs for sustainability, which are still to a high extent limited and burgeoning [67–72]. Most of the existing entries avoid the role of culture, instead focusing on overall CCIs and their intervention in sustainable development [73,74]. Indeed, culture as a view of an artistic expression cannot equal the perception of CCIs [75] (p. 153). More endeavors are also needed to strengthen strategic paths of culture [76] and question the role of CCIs for sustainability rather than searching for vestiges of CCIs' sustainability [77,78], which can be traced back to endogenous conditions and resources [79].

Sustainability requires efficient and cross-sectoral partnerships and collaboration among multiple diverse partners [80]. Since CCIs are valued as being enablers and contributors to sustainable development, their role in cross-sectoral partnerships appears to be indispensable. Collaboration with CCIs endorses activities that are linked to social and cultural development of the locality [81] (p. 20). The role of institutional and social aspects

is also important when perceiving sustainability as a means of meeting the needs of today without compromising the ability of the future generations to meet their own needs [82] (p. 43). Indeed, it can be stressed that CCIs can affect and increase the level of resilience in socio-ecological systems, not only at the organizational level [83] (p. 1216). However, little is known about how cross-sectoral collaboration can create value for various collaborating stakeholders, thus enabling transition and overcoming sustainability problems, residing in tensions over social, environmental and economic dimensions [84] (p. 1039). One potential source is related to overcoming human alienation from nature, thus bringing the ecological imperative back to the forefront, harmonizing economic expansion and ecological limits [85] (p. 54), which leads to new social constructs embedded in the system of values, norms and culture.

This, in turn, is encapsulated within the innovation itself, which from the evolutionary perspective is seen as a complex systemic process integrating iterative (evolutionary) interactions from the Shumpeterian cycle perspective between newly produced knowledge, networked learning and institutional support, embedded within functional, geographic and social boundaries of a particular regional ecosystem, thus paving the way for regional adaptation and resilience [86] (p. 114). In this sense, referring to CCIs as having a strongly symbolic (art-based) nature of the knowledge base emerging from complex, dynamic and tacit interactions embedded within local settings might help to underpin regional resilience and boost the long-term ability for adaptation and entering into new development paths. For this reason, support policies, such as S3, should aim at creating interorganizational informal networks, fostering symbolic knowledge exchange and cooperation [87] (pp. 18–19). While developing sustainability strategies and key performance indicators, a more holistic approach is needed, e.g., by including social aspects ranging from tolerance to a climate for doing business, social capital and local leadership [88] (p. 20), cultural awareness, cross-sectoral competency and the structured inclusion of intermediaries, such as innovation mediators and catalysts [81] (p. 28), that, in turn, support local and regional authorities in managing S3 with capacity and resources [89] (p. 1386). This, however, still remains a challenge, since the EU has so far not made any pivotal strategic contributions towards implementing the 2030 Agenda of the UN in the cultural dimension, thus leaving a lot of room for maneuver to make culture an active contributor to sustainability [90] (pp. 86–87).

Acknowledging the strong and long-term influence of institutional support to innovative regions and regional resilience, sustainability has been a common thread and serves as a panacea to step out of the recession and depression caused by external shocks. Therefore, recent S3-related discussions have lent importance to sustainability aspects as well [91–98]. Sustainability will guide S3 policy development for 2021–2027 by refining S3 as a tool for innovative and smart economic transformation [91] (p. 4), building upon active stakeholder engagement, consultation and communication among multi-level actors within the policy design cycles [92] (pp. 38–45), as well as intensifying debates pertaining to the capacity of innovation policy to address complex sustainability problems and transformational change [93] (p. 3). Linking the new S3 policy direction with sustainability also allows one to boost the potential to provide more targeted and tailored support to enhance the recovery from the COVID-19 crisis as well as to accelerate twin (long-term and short-term) transitions [99] (p. 3).

In this context, S3, as a place-based approach, particularly supports economic and social recovery at the local and regional level, as a result of changing resilience and competition conditions [100] (p. 33). Rationally, this policy should be better embedded in lagging or peripheral regions [101–105]. Additionally, the potential of cross-border collaborations to achieve synergies should be further explored [106]. Paradoxically, such regions are facing higher challenges in capitalizing on S3 policy, mainly driven by missing excellence, which rather gives the floor to leading regions to capitalize on regional policies. As a response to this paradox, the revamping of S3 policy needs to focus more on the socio-ecological model of innovation in order to directly affect the quality of life, underpin experimental learning, design and implement business training and assistance models, encourage social

innovation and revitalize coalitions of regional and local actors, supported by intermediary institutions [101] (pp. 87–88). Here, CCIs are seen as crucial intermediaries. Indeed, lagging and peripheral regions show higher potential for social innovation governance, as they are composed of smaller communities that share closer social, political, integrative, cognitive and institutional proximity [107,108], thus becoming strong enough to break down rural marginalization [109] (pp. 59–60), overcoming local challenges through accumulated actions and processes [110] (p. 284), as well as reflecting burgeoning cross-sectoral and trans-local collaboration patterns, thus opening up new potentials and horizons [11] (p. 552). Indeed, research on the application of S3 at the bottom-up level of local governments, industries, clusters and enterprises remains scarce [111] (p. 1). For this task, overall, CCIs come into play as strong potential intermediaries able to break through the isolation lock-in boundaries.

2.2. Conceptual Foundations Advocating CCIs in Sustainable Smart Specialization

While research and policy entries on sustainable development within urban and regional nexuses are rising, CCIs' potential for the design and implementation of public policies, such as S3 in the discourse of RIS, is still stagnating. The screening of the literature yields only a few entries linking CCIs and S3, mainly through the lens of cultural heritage [112–115]. Sadly, the exploitation of creative potential, strategic partnerships and diverse collaboration models enabled by CCIs in the realm of S3 discussions, in particular pertaining to the new EU cohesion policy 2021–2027, is very scant. This represents a pivotal missing link, despite the already visible common traits that CCIs and S3 discourses share when focusing on sustainability (rf. Section 2.1). Sustainability discourses are common for regional innovation and regional studies, therefore also for S3.

Sustainability germinates from the search for new ways out of depressions and shocks caused by the COVID-19 pandemic. For this, actual place-based endogenous strengths and opportunities should be recognized, followed by increasing methodological improvements, which could build upon experimentation, self-discovery, and the inclusion of outsiders to diversify the knowledge base [116] (pp. 1679–1680). Fostering new partnerships between research organizations, enterprises and public authorities is a major concern of S3 strategies, calling for the setting up of new collaborative platforms. On a regional level, a European political answer to globalization, climate change and social exclusion is offered by S3 aiming at innovation-driven development, strengthening each region's competitive advantage, as well as increasing the system assets and the capability to learn [114] (pp. 8–9). Although there exists no direct linkage of CCIs with S3 in the sustainability nexus, practical policy papers have made the first attempts to bring in creative potential into the S3 policy design and implementation, mainly through concepts of design thinking [117], co-creation [118,119], self-discovery [120,121] and partnerships and networks [122]. As a result, by building on the analysis of the concepts and their interlinkages, the authors of this work contend that CCIs' role for S3 in the sustainability and place-based context can be traced back to the following common conceptual grounds: a) processual; b) institutional, and c) output-based.

Both CCIs and S3 are process-driven and output-oriented, seeking and improving innovation outputs and innovation capacity at the regional and local levels. Creativity stands at the core of CCIs, and therefore CCIs are essential enablers and sources of innovation, competitiveness and growth [123]. CCIs can promote manageability and improve understanding, change the entire process, implement new methods, influence strategies and thus affect the entire development process of a product or service [67] (p. 14). Creativity links design (form) and innovation. Indeed, by looping innovation discourse, creativity is a key ingredient for innovation, as coined by Schumpeter. It is a process of "creative destruction"—new ways using existing means, materials and methods. Something new can be created not from a regular basis, but rather from something that is new to the existing value system of a static economy. New is a new kind. It also involves using and/or employing something in a new manner, thus carrying out new combinations [124] (pp. 409–410). Innovation means creativity plus exploration [125] (p. 8). Indeed, in the

sustainability and policy mix context, the combination of old and new is essential [126] (p. 206), [127] (p. 195), giving floor to disruptive action and innovation and providing room for new market opportunities, through access to information, the identification of gaps between supply and demand and the commitment of scarce resources [128] (p. 35f), [129] (p. 287).

Creativity is an essential part of innovation, thus implying a growing need to determine methods, which could be used to generate more and better ideas, which then could be commercialized, thus turning into innovations [130] (p. 2). This links to an output-based common conceptual ground. To utilize creativity for innovations, there is a need to locate and deploy it within the process, i.e., ideation, development and commercialization, with innovation being an output thereof. The creative process goes further than the simple production of visual outputs, as design is inserted into many areas of management decision-making. Design (process) is an internal management process that integrates market research, marketing strategy, branding, engineering, new product development, production planning, distribution and corporate communication policies [131] (p. 18). Furthermore, the design process can facilitate he innovation potential of a conceptual solution with a set of elements, so-called innovation vectors, and improve the decision-making process for a given design problem [132] (p. 59). In addition, it might reveal new avenues for companies to consider and integrate preferences of customers and experts for product innovation through the prioritization and evaluation of product design factors [133] (p. 13). The recent literature confirms that innovation is an outcome of scientific activity and creativity, and that the combination thereof is a key to innovation.

Indeed, this correlates with already existing and confirmed interdependencies stemming from neo-classical discourses in terms of place-based approaches and thus institutional aspects on CCIs: (a) agent cognition and learning; (b) social networks, and (c) market-based enterprise, organizations and coordinating institutions [134]. Since CCIs address market contexts that are much closer to the extreme of networks' effects, CCIs can be referred to as economics of networks (pp. 170–171). Whereas the processual dimension refers to CCIs and, in particular, creativity, implying a process of discovery, S3 design and implementation is subject to entrepreneurial discovery process (EDP) [135]. CCIs are social constructs entailing interactions and creating social and shared value, while S3 legitimacy is also based on successful, open and experimental interactions of quadruple helix actors, as discussed above. Indeed, the importance of social aspects, e.g., social networks on the regional and local scale of CCIs and their relationship with the location, has been ignored for a long time [136] (p. 718), [137] (pp. 162–163). Yet, helix models are crucial, since they understand innovations as complex processes embedded in the nexus of institutional agents and cultural aspects [138] (p. 5), thus making proximity an important precondition for both knowledge generation, exchange and transfer [139] (pp. 1–2). Since creativity is developing across the whole economy, the inclusion of the quadruple helix model is crucial [140].

In this sense, by acknowledging CCIs as knowledge mediators, brokers and coordinators [141], as well as essential enablers in innovation development, they can become principal agents within quadruple helix partnerships for value creation, thus generating innovative ideas and providing novel research trajectories [142] (p. 137), also in the nexus of micro-level value creation mechanisms [143]. Indeed, the engagement of CCIs within quadruple helixes could also improve their functioning. Currently, they are not efficient enough, based on the complexity of interactions, conflicting logics, prioritization needs and compromises of value [144] (p. 15). Collaborative governance, exemplified through the involvement of multiple actors or collective actions, supports S3 implementation, in particular by means of collective knowledge generation and learning, along with endogenous competences [145]. Collaborative networks are an indispensable tool to improve idea generation and accelerate positive results of the creative process based on the expertise diversity of the involved social actors [146]. CCIs are also driven by demand, diversity, locality, education and skills, networks, the public sector, and business capacity, which, in turn, build up classical helices [147] (p. 344). CCIs aims at creating new or refining old.

Innovation-oriented S3 aims at policy implementation and improving regional innovation systems, with innovation being at the core. Bearing the aforementioned in mind, it is pivotal to strengthen both the conceptual as well as the practical alignment of CCIs, S3 and sustainability within place-based discourse, as already demonstrated in preceding scholarly entries.

3. Materials and Methods

The present work presents itself as an interdisciplinary research project that seeks transdisciplinary solutions by linking different competences. Its interdisciplinary nature was already clearly delineated in the introductory and theoretical parts, by linking up CCIs for S3 within the sustainability nexus and regional setting. Creativity and sustainability can be approached from different transdisciplinary and cultural perspectives [61]. Methodologically, the research builds upon actor-network theory [148] and a social system-based perspective [147], including the recording and evaluation of cooperation patterns in the given peripheral region of the SBSR. The actor-network theory (ANT) provides a research framework that enables one to explore dynamic and socially constructed phenomena and their interactions [148] (p. 1026). Indeed, for the present research, due to its complexity and the intertwining of different social constructs, it appears to be feasible to choose this research framework. In addition, this approach is suitable for project management purposes [149]. Given the presence of the applied research project "CTCC", which provides the fundamentals for the empirical inquiry, ANT fits well here in order to trace the intertwining associations between human participants, objects and processes at all levels of the project [150,151]. Indeed, social interactions are usually studied on the basis of empirical case studies [109] (p. 43). Moreover, S3-related exploration also advocates for institutional learning in place-based pilot projects [144] (p. 16).

Since this work aims at contributing to future projections and explores regional potential, it is evident that future research should remain problem-oriented and participatory. The latest studies emphasize that nowadays, scientists should choose super-disciplinarity as a research approach and collect new findings from different research fields in order to look at the topic holistically. Indeed, in the nexus of S3 and EDP, self-discovery should be open to techniques known from cultural anthropology [121] (p. 1808), e.g., participatory observation [152], as a way of developing insights through contexts and first-hand experiencing [153] (p. 238). Here, social anthropological processes should be strengthened in the research, in particular in qualitative research, within which connections, interdependencies, components and dynamics in the given ecosystem are investigated [154] (p. 17). Indeed, S3-oriented research needs to go beyond quantitative studies and provide room for new paths of deploying qualitative research methods in different regional contexts [127] (p. 196), [155] (p. 1642), [156] (p. 1). Overall, this work adopts an exploratory qualitative approach [157,158]. Taking the research gap into consideration, following Creswell (2014), the authors highlight that if a concept or phenomenon needs to be explored and comprehended, since only scant research in this area has been performed, then a qualitative approach appears to be feasible. Additionally, qualitative research is especially useful when the researcher does not know the important variables to examine [159] (p. 50). Therefore, the impetus of inductive reasoning and conceptualization qualifies the use of this overall methodological approach [160].

An action research approach was employed throughout the entire research trajectory [161–164], as the research lasted over a longer period (2020–2021) and the research results were recalled and reconciled in several progress phases. This approach fits the present research effort, since it is able to provide a way to act in a holistic and complex way. It supports the dualistic and dialectic view employed here and discussed above, as well as opening up opportunities to bridge both science and practice. Furthermore, it enables one to intertwine different research methodology categories [165] (p. 151). This is of particular importance, since the researchers of this paper were directly involved in the ongoing project as innovation brokers—creative brokers—and undertook an observation and assessment

of the innovation phenomena concerned. Preceding learning cycles were integrated into the upcoming research activities, which, in turn, also constitute an important research component [166] (p. 281).

The present research deploys a case study. The multi-case study is based on the Interreg V A project "CTCC—Creative Traditional Companies Cooperation" (2017–2021) (rf. Table 1). The CTCC project investigates cooperation models between creative and traditional companies by developing cross-sectoral innovation in the product, service, organizational and marketing areas (here, the demand of creativity by traditional small and medium-sized enterprises—SMEs) in different industry sectors within the S3 policy in the SBSR. For the purpose of the present research, individual cross-sectoral collaboration patterns resulted in the development of individual innovation prototypes in the concerned sectors, in which quadruple helix actors, such as researchers, CCIs, traditional businesses and policy makers, were involved. In total, the innovation journey yielded 33 prototypes for 32 traditional SMEs achieved in the time frame starting in April 2019 and finishing in September 2021. Out of 33 prototypes, seven concern innovation efforts in the marine and coastal tourism sector. As a result, seven topical prototypes were subject to this research, and thus build up the empirical body. Therefore, the sampling of this research is purposive [167]. The availability of the seven individual cases (innovation prototypes) enable within-case as well as cross-case analysis, following case study content analysis [168,169]. The cases refer to a new phenomenon, and therefore they rely on abductive reasoning embedded in empirical data and bridge rich qualitative evidence to mainstream deductive research [170] (p. 25). Thus, a methodological conceptualization builds up the first step of the overall research design and enables us to analyze and evaluate CCIs potential for sustainability and resilience of tourism sector in the S3 policy nexus. This is consistent with future research efforts that should be made in terms of S3, namely exploring micro-level and place-based effects in quadruple helix partnerships [171] (p. 1070). In addition, this work aims at delivering not only theoretical but also practical insights and recommendations as a result of the applied research project. Therefore, pure conceptual arguments are underpinned with illustrations. In this way, the research aims at showcasing the real world and not just the literature [172] (p. 23). Overall, the research focuses on current phenomena and addresses research questions of "why" and "how" [173] (p. 2) (rf. Introduction), [174] (pp. 4–6), thus underpinning the rationale of the overall case study methodology utilization, which is highly recommended to perceive behaviors in intersectional relationships in network studies [175].

Table 1. Research setting and case allocation.

Research Design Item	Research Response
Research scope	Interreg V A project CTCC—Creative Traditional Companies Cooperation
Geographical coverage	South Baltic Sea Region—Danish, German, Lithuanian, Polish and Swedish coastal regions
Research scale	Seven innovation prototypes for marine and coastal tourism
Research approach	Inductive
Research methods	Shadowing, co-creation, expert interviews, participatory observation
Research data	Qualitative
Research techniques	Innovation prototype analysis, cross-case (prototype) comparison, template analysis, self-discovery
Research validation	Quadruple helix experts, customers, external experts

Source: compiled by the authors, own illustration.

The case study methodology of this work followed the empirical triangulation approach [176–178], and aligned such empirical qualitative methods as (a) seven individual innovation prototype cases of the project SMEs, followed by innovation development utilizing individual shadowing, supported by data provided by innovating SMEs and other

quadruple helix actors concerned with the innovation under development; (b) participation in innovation sprints aimed at recalling and revamping the innovation development progress of each SME through co-creation; (c) 32 expert interviews conducted during and after innovation development projects in 2020–2021 and linked to challenges and sustainability efforts of SMEs; and (d) participatory observations of workshops and focus group meetings.

Due to the outbreak of the COVID-19 pandemic, some of the interviews were undertaken in online formats [179]. The triangulation or double-source methods reduced biased information, in particular through the validity and heterogeneity of the multiple data, and therefore necessitated a full understanding of a complex contexts and intertwined phenomena [180–182]. All collected data and participatory information were subject to content analysis [183–187], by deploying thematic coding based on the anticipated research aim following interdependencies of CCIs, sustainable and resilient tourism in the S3 nexus. The research journey encapsulated the following process steps, such as participating in the project, developing templates for data gathering, gathering the data (field research, cases analysis, expert interviews, secondary data), decoding, analyzing the contents and synthesizing, amalgaming and iterating the empirical results with the literature. Consequently, conceptual insights for the scholarly community and practical considerations were elaborated on, followed by positioning the present research within future and research avenues.

4. CCIs for Sustainable and Resilient Tourism in the SBSR within S3 Policy Discourse

Following research analysis and evaluation, this paper presents research results and showcases CCIs' potential for designing and enabling sustainable and smart regional development based on the purpose sector–marine and coastal tourism. Since this sector represents one of the key economy drivers of the South Baltic Sea Region (SBSR) on the one hand, but bears a series of risks due to the lockdown situation, the inability to step out from the depression and the missing capacity to respond to new technological trends and the increasing impact of a twin (environmental and digital) transition in the frame of the European Green Deal (EGD) on the other, searching for and finding potential new innovative pathways represents a substantial step forward. A second step can be linked to the research effort to explore the potential of peripheral lagging regions within the EU innovation policy framework, in particular by aligning it with the S3 policy for 2021–2027 in terms of exploring innovation potential and shared value creation involving quadruple helix actors and shedding light on micro-level collaboration patterns and their results. The results are presented, first, by yielding CCIs' interventions for sustainability and resilience in place-based innovation projects, followed by, second, a reflection upon those results and their impact on S3 policy design and implementation in terms of micro-level constellations in processual and institutional arrangements, and, third, by adopting innovation prototyping tools co-created with the CCIs to streamline S3 policy.

4.1. Exploring CCIs' Potential for Sustainability and Resilience via Regional Innovation Cases

As already mentioned above, the research sampling is purposive, and seven innovation prototyping projects are referred to as cases within this research frontier (Table 2). This is traced back to the project's nature, which is characterized by a variation of priority areas (S3 priorities) chosen, e.g., ranging from sustainable food processing to offshore wind energy, marine and coastal tourism, ship building and marine transport. Since the tourism sector represents a key building block in the region under scrutiny, for a better positioned purpose, only cases from marine and coastal tourism were selected. However, due to the sectoral linkages of tourism with other regional industries, such as nutrition, mobility and transport, other cases were interlinked for comparison purposes.

Table 2. Tracing sustainability and resilience in the SBSR tourism sector through CCIs' intervention.

Case ID	Case Maxim	Location (NUTS-2)	CCIs Potential for Sustainability	CCIs Potential for Resilience
DE1	Plastic free City of Rostock	Mecklenburg-Western Pomerania	Environmental Institutional	Preparatory Adaptive
LT1	Sustainable rural forest tourism	Central and Western Lithuania	Environmental Economic Social	Preparatory Adaptive
LT2	Solar-energy driven water ride	Central and Western Lithuania	Environmental Economic Social	Preparatory Adaptive
LT3	Improved marine related festivities	Central and Western Lithuania	Social Institutional	Recoverable
PL1	Gamified group trip offer	Pomorskie	Environmental Social	Absorptive Adaptive
PL2	Online Platform as way of visiting historical sites	Pomorskie	Economic Social	Absorptive Recoverable
PL3	Attractive children water sport	Warminsiko-Mazurskie	Economic Institutional	Preparatory Absorptive

Source: compiled by the authors, own illustration.

According to the content analysis of the innovation prototypes (cases), CCIs' engagement within the innovation development process with each single SME reveals both sustainability and resilience attributes. Within this research, the authors differentiate between the potential of CCIs for sustainability and resilience, although there exist myriads of research streams, mainly driven by discourses about resilience as a component of sustainability, sustainability as a component of resilience and sustainability and resilience as separate paradigms [188] (p. 1275). Recalling the contextual intertwining of CCIs and S3 in the sustainability nexus expressed through process and institutional dimensions, this research builds upon the precept of separating sustainability and resilience spheres. This contributes to better embeddedness of CCIs in both sustainability and resilience-related discussions. In addition, it is believed here that, whereas sustainability addresses social and institutional aspects, also raised within S3 policy design and implementation, resilience refers to capabilities built up in the time lapse (evolutionary). For this, CCIs can reveal both institutional and process-driven benefits in the regional setting.

Building upon a synoptic view of the cases, it can be contended that CCIs' intervention leads to improved sustainability performance in SMEs and at the regional level, in particular leading to enhanced environmental consciousness, social responsibility, improved economic efficiency and institutional thickness (social coherence). CCIs' contribution in innovation projects is evident as initiating the changing of minds, advocating for the growth of integrity, reviving connections with and the recognition of customers and users, boosting circularity, and promoting regional identity and adaptive capacity. In doing this, CCIs are clear contributors and promoters of resilience capacity building. Following innovation development projects with CCIs, participating SMEs are better at absorbing the potential impacts, recently, as a result of the COVID-19 pandemic, recovering through new pathways detected in the frame of co-creation with CCIs and being better equipped for any potential future environmental, economic, social and institutional shocks and disturbances. This is very true for the present research. Despite the COVID-19 outbreak, which disrupted individual innovation development by SMEs in collaboration with CCIs, all initiated innovation projects were accomplished, although with a delay, thanks to CCIs' intervention and the continuation of partnering and support for traditional SMEs. Moreover, CCIs also supported traditional SMEs from the region in the face of the newly released European

Green Deal Strategy and anticipated the engagement of all economy and social agents in the environmental and digital transition.

In terms of environmental sustainability efforts, the DE1 case SME (local food service provider for locals and tourists) engaged in the prototyping process with a focus on a new initiative, namely, to move the city of Rostock towards the status of a plastic-free city. For this, the network-based entrepreneurial initiative aimed at the reduction in the consumption of disposable plastics. To make this concept real, the DE1 case SME needed to overcome the main challenge of finding, engaging with and securing long-term sustainable behavior and coordination, first by reducing disposable plastics in a self-responsible and self-organized way within its own organization. In addition, the succeeding question was how sustainable behavior could also be achieved among customers by actively engaging them into engaging with the alternative and sustainable waste disposal mechanisms. Together with CCI representatives, mainly graphic and web designers, the DE1 case SME was able to develop a toolbox consisting of three instruments, i.e., an individual tool (website with manual and calculator for disposal plastics), an internal expert tool (workshop) and a networking tool (enabling interlinkage with other entrepreneurs). At the end, all tools were transformed also into a digital format, in the form of an explanatory video illustrating the essence of each of three instruments. By doing this, the DE1 case SME was able to unveil its sustainable potential through intervention with the CCIs, as they helped the public to understand and perceive not only internal, but also external (environment, tourists, city citizens) needs and expectations. Moreover, CCIs contributed to making the location (city) as well as the entire region environmentally conscious by strengthening target group (tourists and citizens) participation, delivering digital implementation formats (such as videos) that enable a broader reach out. With these sustainability efforts, CCIs drove co-creation, facilitated planning and adaptive capacity building for a changing market and societal behavior, such as EU plastics bans in force or in the future, generated societal movement towards unpacked products, and provided discounts for disposable plastics, etc.

A similar environmental sustainability footprint was achieved in the LT1 case. Within this case, the SME faced higher competition and challenges to attract tourists to the region, since it is not directly located on the Baltic Sea, but in the periphery of the coastal region of Lithuania. For this reason, providing an attractive touristic destination beyond the coast bears a clear challenge. For this reason, in the collaboration with CCIs, the main aim was making the touristic destination in the forest area attractive through ecological and social consciousness, i.e., making the stay in the forest use as few resources as possible, i.e., staying in a wooden house by the water without any Wi-Fi, electricity and water supply, using a zero waste practice and solar energy, and thus becoming part of nature on the one hand as well as improving human health conditions on the other. The co-creation resulted in the business model "forest adventure", claiming higher value proposition and positioning it in a higher price segment, due to the unique touristic location. With the creation of the new business model, opportunities for diversification via franchising into other regions was also seen as a feasible business option and additional business growth alternative, thus fostering employability and job creation opportunities. As a result, the prototyping process delivered a business model that can be used for green slow sustainable tourism, providing revenue and at the same time having a social function, including inclusion and gamification, because potential tourists receive the address of the location just before arrival. Moreover, local artists and small craft service providers are involved on the road to the location, either directly or indirectly. Creative brokerage, service design methodology and the incorporation of smart technological solutions into the business model appearance (design) (online platform, video) made it possible to address both environmental, economic and social dimensions of sustainability and to prepare for the zero emissions economy that must become a reality by 2050.

While the LT1 case SME focused on innovating rural tourism, the LT2 case SME aimed at strengthening environmental performance of water tourism in the region/city of Klaipeda. Belonging to the EU coastal region, Klaipeda is also encouraged to comply

with all environmental regulations regarding transport and mobility, as well as to engage in initiatives fostering marine resource conservation and contributing to blue growth. The main challenge for this SME was missing graphic design skills and technological capacity in transferring the ideas into a feasible form. While having a long-term goal to become a mind changer in the cargo shipping industry in the region and beyond it, the LT2 case SME co-developed with CCIs a solar-powered catamaran designed to be used in urban waters for sightseeing, transportation and leisure activity. The prototype consists of two parts—visualization (form) and 3D printing of the prototype. As a result, the innovation development project yielded the benefits of simultaneously providing functionality and interacting, facilitating communication and engaging with customers, users as well as potential investors more actively through the activated human senses (see, touch), improving the efficiency of product design through the 3D printing outcome using ecological materials (corn plastic) and other construction parts made of wood and metal, reducing material wastage, product development time and production costs. One of the main disadvantages is having a not real-size prototype, as it was reduced 22 times in scale. Nevertheless, the innovation prototype represents the functionality and appearance of the anticipated final product, in addition saving energy and material sources for its printing. Overall, the joint cross-sectoral collaboration between the LT2 case SME and participating CCIs (graphic and service designers) contributes to environmental, economic and social aspects of sustainability, principally through cost and time reduction, material savings, improved product process efficiency, and increased quality and customer satisfaction. Building up preparatory resilience capacity in terms of upcoming environmental regulations and in the face of increasing environmental compliance for the tourism industry can be expressed through CCIs' intervention in providing and sharing knowledge relevant for environmental consciousness and customers' environmental thinking, translating complex product data into simplified forms, unlocking decision-making and learning processes, providing opportunities for early testing and analysis, enabling the testing of futuristic contents, evaluating safety-critical risk management tasks and improving social conditions (reducing CO_2 emissions and making the region more attractive). By virtue of this innovation prototype, new environment-driven business diversification opportunities can be linked with this disruptive innovation coming to the region, such as renewable energy providers and technological component suppliers, the attraction and settlement of environmental experts in the region, as well as follow-ups by other tourism service providers.

Compared with the preceding innovation prototyping case, a softer tourism-oriented innovation built upon the idea of service innovation was the focus of the LT3 case SME aiming at delivering a service solution for the city of Klaipeda, namely providing a platform for interaction between local craftsmen and artists together with citizens and city guests for the purpose of idea/product generation and creation during the biggest regional and national event—the sea festival—taking place each year. The LT3 case SME (public institution), which is responsible for the implementation of the entire sea festival, engaged in a collaboration with CCIs supporting the initiative of co-creation and co-discovery. For this, analysis of the local/regional position in the tourism market, market segmentation and market needs helped to explore, evaluate and communicate the service prototype "art meadow" as a collaborative, explorative and iterative activity for families and city guests aiming at the active expression of their ideas or searching for new opportunities for talent identification. CCIs contributed with the visualization of the prototype and content generation articulated through workshop organization and implementation in the frame of the sea festival. The main contribution of this innovation case to the regional tourism sustainability is expressed through social and institutional dimensions, in particular by enabling and strengthening the dialog between CCIs, citizens and tourism, thus generating an active participatory tool for learning and expression, which, in turn, leads to the underpinned institutional engagement of local CCIs in place branding and place destination initiatives, simultaneously also strengthening local and regional identity and wellbeing. With this intention, CCIs' intervention in the local/regional touristic initiative can provide local and

regional actors with the resilient capability to recover from the disturbance, such as low local CCI involvement in touristic activities despite the strong creative orientation and expression of the sea festival as the main regional and national cultural attraction.

Linked to marine and coastal tourism and the better utilization of marine resources is the innovation case PL1 and the Polish SME, which aimed at improving the recognition and ecological footprint of group travel services dedicated mainly to businesses (employees, contractors and business partner groups), thus also closing the gap between touristic offers that fit into a strong ecological and sustainable mindset. With this offer in mind, the PL1 case SME aims at adapting to the changing behavior of professionals, who usually seek not only economic but also social value creation going beyond attractive salary incentives. In doing this, within the process of co-creation with the CCIs, an interactive platform in the form of a quiz aimed at adapting the group trip offer to the users' needs was generated as an innovation prototype, leading to new service offered in the tourist service sector. In order to better explore the needs and expectations of a group of persons aiming at a joint trip, the interactive platform adjusts a potential cruise trip to the explored needs and expectations of a group of persons, following the quiz. As a result, the service innovation facilitates the personalization of a trip for a group in an accessible and intuitive way, by using questions and algorithms, resulting in an available tailor-made touristic offer package. This, in turn, provides a unique selling point for potential customers and users, since the service is personalized and attached to the group's needs. Personalization tracking and expression is supported through functional and graphic solutions offered by the CCIs, in particular showing possibilities and types of cruise formats, such as meetings, training, and other incentives in visualized formats (a form), thus also increasing customer bonding through the showcasing of opportunities and curiosities attached to the projected group trip. Overall, this innovation prototype claims CCIs' contribution primarily in enabling social inclusion and strengthening bonding among employees of one group aiming at one trip on the one hand, as well as better customer recognition through the personalization of activities on the other. In addition, environmental traits are visible through the focus on ecologically conscious behavior. The observed innovation journey of the PL1 case SME pinpoints absorptive and adaptive resilience capacity building, as changing customers'/users' preferences in the tourism and overall economic performance paradigm enable the SME to absorb and integrate their needs and expectations ex ante any potential disruptions to the market (acting in advance, rather than reacting too late) as well as to adapt to changing tourism business paradigms as a result of both new environmentally and human (behavior)-driven interactions.

Whereas developing a group trip innovative service might help in tourism company business diversification and building up competitive advantages through direct customer targeting (personalization) and entering niche markets (business trip focus), as illustrated in the PL1 innovation case, the internationalization of local products of craftsmen, artists and designers who build upon tradition continuation represents a clear challenge in the highly touristic region of Gdansk, and this is the challenge faced by the PL2 case SME (tourist shop). Moreover, due to increasing overall pressure on tourism, bringing crucial disturbances and a recession as a result of the COVID-19 pandemic and the post-pandemic depression, the PL2 case SME had to cope with pivotal challenges, such as price changes, increasing awareness raising needs and thus costs, and changes to online selling opportunities, that, unfortunately, resulted in the physical closure of the giftshop. By engaging CCIs who are known for being digitally savvy, an online platform was sought as an alternative for business operation and strategic positioning. The main aim was building up a giftshop brand promoting specific values, namely community feeling, such as the handicraft work process and its importance for the region and the origin of the products offered. As a result of the co-creation and innovation prototyping process with CCIs, the PL2 case SME attained a twin business model: while the focus should be kept on developing an online shop, its uniqueness should also build upon a design guide promoting local craftsmen, artists and places worth seeing in Gdansk and its surroundings, thus making it an alternative to other

giftshops as a platform providing not only products (gifts), but also access to other tourism services, such as alternative city tours, alternative places to visit and so on. Moreover, additional selling points of this service/business model can be linked to the promotion of local brands highlighting local handicraft as an alternative to mass production. In sum, this innovation prototype serves as an example of CCI intervention supporting both economic and social sustainability, in particular by enabling the PL2 case SME to find alternative ways out of the lockdown and economic tourism shocks, as well as by promoting regional identity and common belonging through the utilization and facilitation of local natural and cultural resources (local handicraft). As a means for the breaking through the COVID-19 pandemic shock, the PL2 case SME is able to strengthen its resilience capability, in particular by absorbing the impacts of disturbances (COVID-19) and recovering through alternative business models.

Local recognition challenges also hamper the PL3 case SME in business expansion and market penetration. This SME, producing kayaks for children, aimed at improving supply chain linkage, specifically through engagement in new supply chains, e.g., by entering new business collaboration with a bigger company able to produce kayaks in a desired format for the PL3 case SME. The main CCI contribution was made through the visualization of the needs and desires as expressed by the SME, following market research and customer journey. Market niches were recognized during the innovation prototyping, as no other companies were found that produce kayaks for children, and if so, their offer on the market was not diversified (only one option to choose, both regarding color and form). As a result, CCIs helped to provide the competitive edge of the product and to transfer it to a more competitive status, mainly driven by customer/user engagement and the recognition of their needs (children choose personalized and colorful products reflecting their own personality). A tangible innovation result was a product prototype visualized with the creative means in three different forms and colors transferring the meaning of character and behavior, such as an octopus, whale and dragon. Following the gamut of potential forms of children kayaks, the evaluation of the participation of customers was also undertaken, thus supporting the positive acceptance and meeting expectations. Overall, the implementation of this innovation prototype can increase touristic and leisure attractiveness through the inclusion of the young generation, while at the same time strengthening the water-based touristic attractiveness of the region (water sport and leisure activities) and the regional identity in general, thus highlighting the social aspects of the sustainability concept. From the economic point of view, CCIs' intervention supports the diversification opportunities of the project. Institutionally, engagement in new collaboration patterns and thus enhancing participation and recognition in the supply chains contributes to strengthening institutional sustainability. The social, economic and institutional aspects and their interplay helps the PL3 case SME to prepare in advance, by increasing competitive edge as well as adapting to changing/arising new customer product selection behavior.

From the synoptic point of view, all illustrated SME cases show improved sustainability and resilience potential through CCIs' interventions. Therefore, this research clearly supports CCIs' potential for building up sustainability capacity and resilience capabilities on the local and regional level based on the utilization of local (marine and coastal) resources for touristic and recreational purposes. In sum, co-creation among traditional (tourism sector) SMEs and CCIs contributes to both providing capacity and capabilities for the SMEs to find new means for renewal as well as utilizing new business opportunities, transferring regional businesses towards an environmentally conscious, resource-efficient (economic), socially inclusive and institutionally stable status, showing clear tangible contributions to the local and regional economy.

4.2. Amalgamating and Consolidating the Potential of CCIs for S3 Policy Development Pathways

Bearing in mind the analysis and consolidated evaluation of the available innovation cases of SMEs resulting from innovation development prototypes, it is evident that CCIs' intervention can be traceable not only for improving the regional innovation capacities

and capabilities of local and regional actors, but also for strengthening the sustainability performance and resilience capabilities of involved economic agents. Indeed, since sustainability and resilience represent anticipated goals to be reached with regional innovation policy (re)direction, in particular S3 for the upcoming EU cohesion policy period 2021–2027, based on the results of the present research work, a clear interlinkage can be revealed with CCIs' role and contribution in the renewal and revival of the S3 policy. As noted by several scholarly entries, S3 policy design and implementation have so far missed the exploration of potential and effects on the micro-level (partnership, firm-based). Instead, the focus has largely been on contextual analysis (linking up with regional performance, diversification, policy advocacy and battling over sectoral/thematic prioritization) and the quantification of S3's effects for regional and national economies. In contrast, the present research contribution reveals the untapped potential of CCIs and their intervention, which within the pool of the seven innovation cases analyzed is strongly linked with the social (five out of seven cases), environmental (four out of seven cases), economic (four out of seven cases) and institutional (three out of seven cases) sustainability interplay. In terms of resilience dimensions ranging from preparatory/planning to absorptive, recoverable and adaptive capability, following existing conceptual taxonomy [188], CCIs' intervention in seven innovation prototypes contributed to improving and enhancing the preparatory and planning capability of participating SMEs (four out of seven cases), followed by their adaptive (four out of seven cases), absorptive (three out of seven cases) and recoverable (two out of seven cases) capabilities.

The interpretation of these results can be manifold. However, it is clearly visible from the used innovation cases that CCIs are future-oriented, aiming at providing SMEs with tools and capacities to build up capabilities that will drive future business and thus strengthen strategic position, e.g., through specific contributions to adaptive capability and the ability to absorb future needs and expectations of the market (customers, users), as well as changing environmental conditions (through new environmental regulations and environmental/social/legal compliance). Moreover, although CCIs helped participating SMEs from the tourism sector to break through the recession and depression as caused by the COVID-19 pandemic, their potential for recovery remains limited. This can be traced back to several reasons, starting with the fact that the majority of innovation pilots were started before the outbreak of the pandemic, thus leading to the assumption that the majority of participating SMEs already had a clear idea about the innovation journey outcome. Alternatively, the available number of the SMEs cases and their unique characteristics (bound to the local/regional setting) might not be enough to ground this reasoning. In addition, since the tourism sector was heavily hit worldwide and also in the region (it is the most important competitive advantage of the SBSR), it can be assumed that the vast number of the sectoral SMEs participating in the project were coping with overcoming usual (daily and running) business obstacles and challenges, while focusing on positive/future-oriented business opportunities in the frame of innovation projection, which by its nature is future-driven and carries in it futuristic connotations.

Building upon the sustainability and resilience lens and the reflection of CCIs' contribution to the micro-level (firm-level) as well as bearing in mind the demonstrated micro-level impacts on the local/regional setting (environment, expressed through ecological, economic, social and institutional arrangements and their interdependencies), the assessed sustainability and resilience impacts were synthesized and consolidated within the S3 policy nexus, i.e., by positioning the effects within the place-based setting—NUTS-2 regions in the EU (using official NUTS nomenclature coding applicable for respective region identification), in which innovation prototypes were explored. For this purpose, individual case-specific analyses and evaluation attributes were reflected through individual weighting of sustainability and resilience contributions by CCIs on the regional level. Whereas the achievement of all four sustainability (social, environmental, economic and institutional) and, respectively, resilience traits (preparatory/planning, absorptive, recoverable and adaptive) can be expressed by four plus "++++", each missing sustainability dimension out

of the maximum four available leads to one plus less, thus arriving at three, two, one or, consequently, zero sustainability and/or resilience anchoring. This weighting gamut was applied based on the available innovation cases (one to seven).

Following this classification, other proximity types were used as parameters to trace and evaluate CCIs' contribution to S3 policy design and implementation, following Boschma's proximity taxonomy [189,190], such as institutional, social, cognitive and organizational proximity. Based on existing knowledge ties and their effects within and on knowledge networks, a different proximity might result in possible learning, decoupling, institutionalization, integration and agglomeration process effects. By linking up with common conceptual traits established between CCIs and S3 policy and rooted mainly in processual (invention (creativity) and development driven) and institutional (partnerships and networks) arrangements, CCIs' potential can also be seized within S3 process (entrepreneurial discovery process (EDP)) and institutional (quadruple helix networks and collaboration patterns) arrays.

As a result of the analysis undertaken, CCIs' embeddedness in both dimensions can be evaluated by deploying the following scorecard: in terms of processual-level arrangements, CCIs' contribution can be registered through creativity contribution towards the EDP, in particular innovation process efficiency, effectiveness and correlation, expressed through the holistic self-discovery process leading to tangible results (output), through stakeholder engagement (1), ideation/intervention (2), development/design (3), realization/validation (4) and commercialization/capitalization (5). Within the given innovation cases, EDP or self-discovery was achieved through the development of tangible innovation solutions (prototypes). The intensity and/or contribution of CCIs towards the realization of this innovation process can be measured by applying a range recalling quadruple helix actors' interactions and engagement within this five-step process, thus meaning that five plus "+++++" stand for a holistic step-by-step self-discovery process passing all of the above-mentioned phases and engaging all affected environment (ecosystem) actors, such as SMEs, researchers, policy makers and society representatives, who through their successful collaboration patterns can lead to the desired overall sustainability, delivering environmental, economic, social and institutional advantages in that particular ecosystem. Respectively, each plus less implies a less intensive and successful process. In terms of CCIs' potential for institutional arrangements, a similar scale is suggested: whereas the achievement of institutional proximity driven by CCIs' intervention articulated in terms of cognition and learning (1), decoupling (renewal of opportunistic behavior and unblocking/loosening entry barriers) (2), institutionalization (3), integration (4) and agglomeration (5), in total resulting in a potential five scores, can be expressed as five plus "+++++", less efficient knowledge network effects missing one of these five potential social constructs lead to the succeeding deduction of each individual plus. Table 3 presents the yielded evaluation according to the presented classification for each case as well as the respective NUTS-2 region.

Overall, the presented overview in Table 3, by avoiding any repetition of the already analyzed and assessed innovation cases in the previous section, provides a consolidated evaluation of CCIs' potential for S3 policy design and implementation. In detail, innovation case implementation in the German region (DE80—Mecklenburg-Western Pomerania) confirms the achievement of environmental and institutional sustainability (++) as well as preparatory and adaptive capability (++), strengthening local and regional resilience. In terms of CCIs' intervention within processual and institutional arrays, although the innovation prototyping process involved important actors from the quadruple helix partnership, such as SMEs and society (target groups), the innovation journey rather missed policy intervention, which is crucial in terms of environmental (legal) compliance and has high-level impacts on environmental regulative side, thus making it possible to either positively or negatively affect the outcome of the innovation prototype. Considering the fact that the empirical foundation for the German region is grounded in this one innovation case, it should be noted that the overall evaluation of this region might fall behind the

performance of the studied Lithuanian (three cases) and Polish regions (two cases from the same NUTS-3 region).

Table 3. CCIs for S3 policy design and implementation in process and institutional arrangements.

NUTS-2 Region	CCIS Intervention in S3 Yes/No		CCIs for Sustainability	CCIs for Resilience	CCIs Potential for S3 Implementation in Micro-Level Process and Institutional Arrangements	
	2014–2020	2021–2027			Process Level	Institutional Level
DE 80	No	No	++	++	+++	+++
LT02	Yes	n/a	+++	++	++++	++++
LT1			+++	++	++++	++++
LT2			+++	++	++++	+++++
LT3			++	+	+++	+++
PL63	No	n/a	++	++	+++	+++
PL1			++	++	+++	++++
PL2			++	++	+++	+++
PL62	No	n/a	++	++	+++	+++

Source: Compiled by the authors, own illustration.

Similar observations apply in terms of the rather distant involvement of researchers and academics, who can broker environmentally and socially important information through facts and value qualification. Moving towards the CCIs' potential for the Lithuanian NUTS-2 region (LT02—Central and Western Lithuania), the overall regional scoring is better than that in the German region, specifically driven by the fact that the participating Lithuanian SMEs from the same region take a rather opportunistic proactive approach rather than a reactive (regulation-driven, ex post) one when pursuing innovation pathways. Simply said, this means that environmental opportunities are recognized prior to environmental legal frameworks being put in place in this region, mainly by acting on changing customer/user needs and expectations. In sum, this enables this region to equip itself with environmental, economic and social/institutional sustainable business competence (+++) and prepare for any potential future disturbances by means of preparatory and adaptive capabilities (++) through engagement in joint innovation development projects with CCIs.

Finally, placing two Polish NUTS-2 regions' performance (PL63—Pomorskie and PL62—Warminsko Mazurskie) for comparative purposes, CCIs' intervention in the first region is traceable in particular in the environmental and social sustainability (++), pointing out the relevance and promotion of regional identity and place belonging, while at the same strengthening absorptive (+) capability, which, in turn, enables better recognition and integration of local/regional needs into innovation development, and thus potentially into the innovation policy design. From the processual perspective, CCIs' engagement leads to an overall holistic process, touching upon, in particular, environmental, social and economic aspects (+++). Social, cognitive and institutional proximity revealed by CCIs integration makes it possible to achieve knowledge creation and learning, integration and agglomeration. Regarding the latter region, CCIs are able to strengthen economic and institutional sustainability capacity (++). Through the demonstrated product's diversification potential, the strategic resilience capability can be strengthened (++), leading to improved social, institutional and organizational proximity (+++), as well as strong processual integrity, with less participatory integration of policy makers and research community into the innovation process, which, in turn, results in the not fully untapped stakeholder engagement and intervention within the innovation process.

Despite the fact that this scorecard might appear to be purposive and subjective at first glance, its postulation follows a thorough theoretical consideration, as presented in

the conceptual chapters that are both theoretically and empirically grounded. Potential improvement and advancement of this weighting scorecard can be anticipated through its application to a higher number of innovation prototyping cases (replicability and scalability), as well as its deployment beyond the diversified specialization, as in the case of tourism sector in this research work.

4.3. Tooling S3 Policy Development with Creativity-Driven Potential

Following the research results that confirm CCIs' intervention within co-creation and innovation development projects in cooperation with traditional sector SMEs from the SBSR (here, tourism), this research proposes two tools derived from the CCIs co-creation methodology that was developed in the frame of the CTCC project—(a) the Creative Audit Tool (Figure 1), and (b) the Creative Broker Concept (Figure 2). Respectively, these tools, once adapted to conceptual and managerial considerations within the S3 policy nexus, can be applied to S3 policy design and implementation, in particular in micro-level arrangements, in both anticipated processual and institutional dimensions, i.e., in order to improve interactions and collaboration patterns along the EDP and self-discovery governance on the one hand, as well as among quadruple helix partnerships and their actors on the other. As a result, building upon SME innovation case analysis and assessment, the developed tools can be adapted to the S3 policy context and be applied either on the entrepreneurial firm level (for innovation development)—policy makers and stakeholders' engagement, learning, achieving desired outputs (innovation, collaboration, capitalization)—or on the macro-level for local and regional planning purposes. Both tools are discussed from the co-creation (processual) and institutional (proximity intensity) perspectives.

Cross-sectoral, interdisciplinary and cross-institutional cooperation might lead to higher innovation outputs, as it has been seen in the SME innovation cases in the tourism sector, where all possible different perspectives are merged together to deliver value to customers and users, thus meeting their expectations and avoiding any unpredicted effects or negative implications on environmental, technological, market and social levels. This is achieved within the innovation development project, the so-called "Creative Auditing" (Figure 1), which is completed by interdisciplinary teams, where traditional sector SMEs cooperate and engage in innovation development together with start-ups, SMEs and freelances from the mentioned CCIs sector.

The Creative Audit Tool (Figure 1) was applied during the innovation prototype development phase that took place for almost two years in the CTCC project. In summary, the project applied a holistic and multidisciplinary approach, where several key tools and methods from the innovation development, creativity and design management were intertwined. The Creative Audit Tool supports the development of specific mechanisms and tools that stand behind the innovation processes [191] (p. 17). Indeed, the current research shows only a very limited record when it comes to practical tools for SMEs, e.g., the design audit tool by Moultrie et al., 2007 [192]. Yet, also existing, these tools mostly concern new product developments, but do not consider recent industry and transformation trends, i.e., digital transformation and Industry 4.0/5.0, as they were developed before industrial changes occurred. In addition, scrutinized approaches remain too theoretical and provide only auditing strategies without any specification of practical implications [193], static tools without a process orientation that deliver the status quo [194] or are oriented towards organizational culture only, i.e., branding and brand audits [195,196].

Figure 1. Creative Audit Tool for co-creation and CCIs' intervention in the S3 self-discovery process. Source: Compiled by the authors, own illustration.

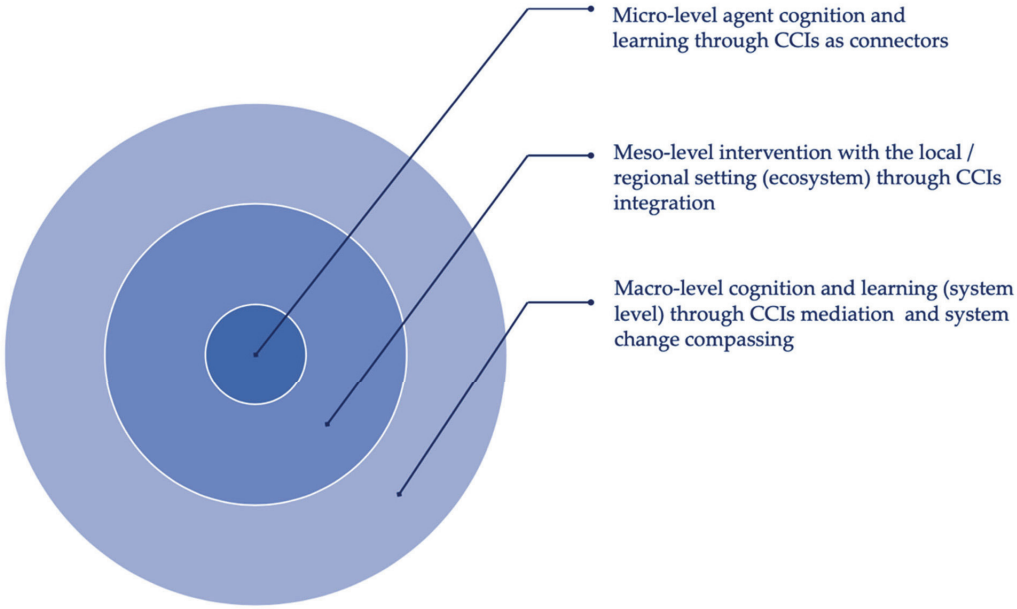

Figure 2. CCIs intervention (brokerage) for S3 policy institutional arrangements. Source: Compiled by the authors, own illustration.

By contrast, at the core of the CTCC, in the delivered Creative Audit Tool (Figure 1), there is an entrepreneur/SME that, by bypassing specific steps and applying given appropriate methods, is able to arrive at solid, tested and sustainable innovation output, be it a product, service, organizational improvement, e.g., change management or the application of new organizational procedures and methods, which optimize SME performance, or a business model aiming at improving the SME's positioning, differentiation and diversification efforts through targeted marketing and branding activities. Significantly, it differs from other similar tools, as it underpins innovation characteristics. Innovation is regarded as a key factor in transformation. By also integrating self-discovery traits from the S3 policy perspective, this toll can be simultaneously utilized for the integration and harmonization of the anticipated innovation process with S3 implementation. The tool becomes universal, and it can be used for any kind of innovation development, problem/challenge solving or company idea maturation.

Creative brokers act within the innovation process as "owners" of the Creative Audit Tool, who are responsible for guidance, counselling between creative and traditional sectors, policy makers and other quadruple helix partnership actors, also including innovation progress monitoring, control and evaluation. Since innovation is a process that requires high complexity, the tool (Figure 2) serves also as a facilitator and bridges diverse processes, actors and stakeholders meeting within innovation development. In particular, having an external source of innovation—a creative broker—a new perspective for improving institutional arrangements within the S3 policy can be introduced (Figure 2).

In order to be able to deliver innovation that enters the market and is used, industry SMEs need to reject their prejudices, learning other working cultures accompanied by different working languages, methods and environments. The same applies for other quadruple helix actors. Principally, an SME aiming at developing innovation should be ready to open up. As Wolfgang von Goethe expressed, "thinking is easy, acting is difficult, and to put one's thoughts into action is the most difficult thing in the world". Indeed, delivering what is desired by customers and users and what is innovative presupposes a high complexity and flexibility, diverse interactions and multi-faceted perceptions with the

readiness of a company for open-ended processes (as the final innovation output is bound to other processes, steps and interactions that influence it).

In order to act in this way, SMEs that usually lack their own resources or departments are able to supply creativity that is bound to external sources of innovation. In this light, a creative broker stands for a company or person engaging in the creative auditing and innovation development process. Rationally, creative brokers usually come from creative industries or possess expertise in innovation, design and creativity management. Creative brokers, as experts in knowledge, tools and methods transfer, facilitate cross-sectoral cooperation modelling, as they integrate creative, industry, policy, societal and environmental realms, advise SMEs in innovation development and manage interdisciplinary teams. Progress monitoring and quality assessment also belong to the task and competence portfolio of creative brokers.

By means of virtual or physical formats, e.g., speed-dating, job shadowing, and analysis of given SME structures, a series of exchanges and participation in the innovation prototyping process of SMEs (both physical and online), creative brokers act as innovation drivers, external observers and mediators within the innovation development process, where different perspectives, diverse expectations (company vs. customer/user), different resources and environments pull together. By doing this, creative brokers implement the so-called creative auditing by using the accompanying the tool, which enables us to understand SME structures and the behavior inside (organizational culture) and outside (market and ecosystem performance) the organization. Diverse methods and specific steps within the innovation process merged into the Creative Auditing Tool support Creative Broker in a progressive and systematic way, moving forward with the innovation development.

The engagement of creative brokers in innovation brings tangible value. They have a particular advantage in knowledge networks because they benefit from diversity at the levels of knowledge of different groups in the network. Creative brokering is not just the transfer of ideas from one source to another (as in the best practice knowledge dissemination, (rf. Gertler [197]); rather, it is the recombination of previous experience from various domains into new hybrid forms. Whatever the size of the agency or the project team, there are several key sites in the array of creativity that are at the root of this innovation [198] (pp. 685–686).

5. Discussion and Concluding Remarks

Indeed, as the current project results showcase, CCIs' interventions within innovation discourse can be manifold. Based on the qualitative innovation cases (case study) from the tourism sector, this work reveals CCIs' intervention within the S3 policy nexus as well as sustainability and resilience considerations. Project results are disputed in detail in the Results chapter. For this purpose, and in order to not necessarily repeat that already mentioned, the results will be discussed here by mainly linking them to the applicable research streams regarding S3 policy and highlighting CCIs contribution.

This research work is the first attempt to integrate creative potential of CCIs into the S3 policy nexus beyond just linking up S3 and cultural heritage. In addition, the work takes rather an untapped research journey and aims at revealing CCIs' potential for streamlining and improving local and regional innovation capacities through S3 policy, mainly for innovation co-creation with CCIs in the EU tourism service sector. CCIs' brokerage is grasped in the micro-level S3 policy perspective, i.e., on the entrepreneurial/firm-level, as well as placed within the entire eco-system (meso-level) and regional/national system level (macro-level). Given the strong conceptual relatedness of CCIs and S3 (Entrepreneurial Discovery Process), CCIs can be integrated into S3 policy design and implementation as well as from the processual and institutional perspectives. Respectively, processual CCIs intervention is reflected through creative auditing and the adapted Creative Audit Tool for S3-driven innovation on the one hand, and a creative broker strengthening Quadruple helix actors' engagement, integration, co-creation, co-evolvement, integration and institu-

tionalization throughout the entire innovation or, in S3 terms, the self-discovery process. In doing this, this work yields trifold research contributions.

First, the present paper contributes to enhancing the empirical body on micro-level impacts on S3 policy. This is rooted in the exploration of innovation development and co-creation initiatives performed on the entrepreneurial/SME level in the particular region and under the scrutiny of the tourism sector, thus addressing micro-level gaps and exploring the perceptions of stakeholders from quadruple helix partnerships [122] (p. 2). Second, the research undertaken provides new pathways for perceiving and integrating sustainability and resilience dimensions into the S3 policy realm, specifically through CCIs' conceptual interlinkage with sustainability, capability and proximity approaches. The results showcase how CCIs can support entrepreneurial agents and other actors from the quadruple helix engaged in co-creation to build up the capacity, which is necessary for sustainable environmental, economic, social and institutional thinking and acting. Advocating a holistic paradigm, driven by human-centered motives, CCIs are able to broker and transfer ecological consciousness, resource efficiency, social inclusion and institutional stability. With the proposed Creative Audit Tool and with the counselling potential of creative brokers, innovation agents on the local and regional level are able also to build up and/or enhance preparatory, absorptive, recoverable and adaptive resilience capability, thus enabling them to better react to disruptive changes and to prepare for the upcoming future disruptions. With this contribution, the present work fits into the recently challenged oriented innovation policy, which is especially crucial in the face of the commenced twin transition and increase pace for transformation, as multi-scalar and inter-scalar coordination appears to be pivotal for managing regional sustainability transition [199] (p. 1). Thus, this research enhances the understanding and meaning of quadruple helix partnerships and their correlation with the sustainability efforts. In particular, the research positions CCIs within quadruple helix networks and claims that CCIs should be integrated far beyond just simply putting them into the "society" actors' basket, since cultural and creative dimensions do not target any particular helix, but rather the entire environment (ecosystem) itself [139]. For this, creative brokers could be introduced as a fifth dimension in a helix, connecting all concerned stakeholders, integrating, accumulating and transferring knowledge, mediating through conflict resolution and advocacy as well as becoming system changers through intervention and reaching out to all affected actors in the entire ecosystem and beyond this (intra-ecosystem co-existence). This would support early-stage research into N-helix emergence and its role in sustainable development expressed through technological, social and specialized innovations [200].

Bearing in mind the presented and discussed results, the authors claim having delivered both theoretical and managerial contributions. From the scholarly perspective, with the anticipated aim and exploration trajectory, this research contributes to the research stream of responsible research and innovation (RII), through accommodating alternative views and sources (creativity) to sustainable transformation, leading to an increased shared value within the process of innovation and quadruple helix interactions, by engaging, implementing, and delivering innovation, which is in line with sustainability principles. Thus, CCIs' intervention and contribution towards both innovation and institutional arrangements supports transformative innovation policy [201,202]. Moreover, addressing knowledge proximity and networks as well as innovation capacity and capabilities, this work enriches the resource-based view (RBV) and dynamic capabilities related firm level theories [203]. Finally, through local and regional dimension and exploration of S3 policy design and implementation, an overall contribution is made to the economic geography's research streams.

Managerial implications are mainly linked with entrepreneurial/firm competence portfolio enrichment. With this research, local and regional SMEs engaging in innovation development and realization processes are provided with the opportunity to utilize co-creation tools and exploit counselling and creative contribution of CCIs. These tools provide a holistic overview and make it possible in the micro-level system to intervene and connect

with the meso and macro levels in terms of the S3 domain. In addition, this contribution can serve as an inspirational or compassing tool for SMEs searching for new ways to overcome recession and depression, mainly in the tourism sector, as well as turning their touristic services into desirable and creative ones. As a result, this also contributes to growing practical policy contributions on the topic of creative tourism [204]. In addition, SMEs transfer their places of action and wellbeing into places of environmental, social and economic wellbeing, as well as promoting tourism based on creativity as a way to stabilize, recover and advance communities, through the coupling of dynamic creative relationships between people, places, institutions, ideas [205,206].

This research is the first attempt to bring in CCIs into the S3 policy dimension. Rationally, a series of prosperous future research avenues arises. Since this research is based on qualitative data, the next step is to multiply and validate the research contributions. In addition, the following research needs to bring in stronger CCIs' intervention and contribution to the 2021–2027 cohesion and regional policy period. This, however, can be completed upon the publishing of new regional innovation and smart specialization Strategies, which to a large extent are still under development. Practically, the authors recommend increasing cross-sectoral collaboration and the utilization of creative potential both on the micro- as well as the meso- and macro-level industry and policy levels. It is widely acknowledged that CCIs can boost regional development and better equip SMEs with tools and methods to react to future challenges as well as to implement ambitious environmental and social goals as set for 2050. In the short-term, 2030 should mark the next pivotal CCI evaluation period in terms of the implementation of the Territorial Agenda 2020 of the EU and achievements of the Sustainable Development Goals of the United Nations.

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Article V

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Article

Social Innovation Governance in Smart Specialisation Policies and Strategies Heading towards Sustainability: A Pathway to RIS4?

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Abstract: (1) Background: Regional Innovation Strategies on Smart Specialisation (RIS3) receive higher attention due to the start of the new European funding period 2021–2027. Compared to the previous period, RIS3 will focus more attention towards social needs and challenges in their design and implementation to commit themselves towards sustainable regional development and contribute to the European Green Deal and UN Sustainable Development Goals. Nevertheless, RIS3 as innovation policy has not yet incorporated social innovation concepts or socio-ecological demands on its pathway within the constant transition of Europe's society to become more sustainable. (2) Methods: A systematic literature review has been conducted to identify key insights and gaps in existing literature. (3) Results: The review exposed clustering as a policy tool for sustainable development, a lack of integration of social capital and regional assets to RIS3 design to overcome societal challenges and missing political capabilities to utilize social innovation governances under RIS3 towards sustainability. (4) Conclusions: Future research should pick up these gaps to contribute to a better understanding of social innovators in designing RIS3, meeting social needs and forging the pathway towards sustainability.

Keywords: RIS3; social innovation; smart specialisation; sustainability; RIS4; regional development; regional innovation; systematic literature review

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1. Introduction

The current funding period of the European Union 2021–2027 has just started, whereas Smart Specialisation Strategies determine the regional innovation and developmental governance pathways for the next years. On the same track, ambitious goals have been set by announcing the European Green Deal to push Europe's sustainable transition and contribute to the global UN Sustainable Development Goals (SDG) (European Commission 2010b). All three initiatives require an on-going adjustment of regional governance to design the strategic development towards sustainability by incorporating the affected stakeholders from entrepreneurial, academic, political and social spheres (Aranguren et al. 2019; Larosse et al. 2020).

The Regional Innovation Strategies on Smart Specialisation (RIS3) policy was introduced by the European Commission as a governance concept to accelerate regional economic development and growth in accordance with the Europe 2020 Strategy (European Commission 2010a, 2010b, 2010c), but also to ensure sufficient fund distribution among European regions One of the key concepts for RIS3 development and application are individually applied strategies including key priority areas for European regions (McCann and Ortega-Argilés 2015). The strategy implementation for 2014–2020 is currently evaluated and updated on an individual basis by the regions to determine the regional innovation and development for the next funding period from 2021 to 2027 (Gianelle et al. 2020a), based on experiences made and insights gained from the previous funding period (Boschma 2015).

Hence, the "new" strategies are seen as accelerators for sustainable competitiveness in Europe's regions (especially in the context of the European Green Deal) (Gianelle et al. 2020a; Meyer 2021), improvement for an outdated perception of regional innovation and sustainability governance (Landabaso 2014) as well as an introduction into a better structured and justified distribution of European funds (Foray 2014). Based on these aspects, the current research tendency is highlighting and elaborating on the impact of RIS3 on a sustainable development (Kogut-Jaworska and Ociepa-Kicińska 2020; Veldhuizen 2020), resulting in an upgrade towards Smart Specialisation Strategies for Sustainability (S4) (Laranja 2021). Another mushroomed research stream in the particular field is recognizing the increasing relevance of social dimensions in the post-2020 Smart Specialisation discourse towards RIS4, emphasizing the acronym as Research, Innovation and Social Strategies for Smart Specialisation (Neto et al. 2018; Neto and Santos 2020).

One of the core elements on the regional and local level of the Smart Specialisation governance is Entrepreneurial Discovery Processes (EDPs), which aim to optimize the usage of limited resources for certain domains of specialization (key priority areas of the regions) (Mieszkowski and Kardas 2015). An EDP benefits from regional actors being involved in innovation processes and tries to establish multilevel combinations of stakeholders to transform the innovation strategy into reality (Grillitsch 2016). In addition, selected priority areas may support the application of EDPs, while, vice-versa, EDPs have the potential to identify completely new specialization domains (Deegan et al. 2021). The involvement of affected stakeholders on horizontal and vertical levels is very much highlighted by researchers of Smart Specialisation concepts (Aranguren et al. 2019; Roman et al. 2018; Uyarra et al. 2014). However, in the RIS3 discourse, EDPs are often linked to the industry and market-oriented products and services (Coffano and Foray 2014; Del Castillo et al. 2015; Pinto et al. 2019). Nonetheless, EDPs shall be seen as potential specialization mechanisms, whereas available knowledge of academics and research, business, policy (entrepreneurs) and society (quadruple-helix approach) (Gerlitz et al. 2020) will rather be used for a technical invention (Foray and Goenaga 2013) than for the exploration of new fields of innovation and sustainable usage for given regional assets (Foray 2012). Smart Specialisation approaches are still embedded in science and technology-focused mindsets of innovation (policies), which is not in line with the current societal focus on sustainability (Benner 2020). Hence, the concept of social entrepreneurship should be taken into account for RIS3, noting the creation of new combinations of products, services, organizations or processes (Defourny and Nyssens 2010)—regional assets—resulting in innovation approaches (Noruzi et al. 2010). However, social-ecological and social innovation concepts and their impact on RIS3 have been only implicitly mentioned in this context (Hassink and Gong 2019, p. 2049). Noting the lack of scientific justification for RIS3 concepts and implementation (Andersons and Bushati 2019), conducted research offers an approach to overcome this gap of social innovation integration into RIS3 towards sustainability.

In this regard, RIS3 as a place-based approach supports economic and social development at the local and regional level resulting from altering competition conditions (Neto 2020). Consequently, this innovation policy bears great potential for and should be better embedded in peripheral regions (Barzotto et al. 2020; Hassink and Gong 2019; Morgan 2019). However, such regions experience higher challenges in capitalizing on RIS3. For overcoming this, innovation policies shall focus on socio-ecological models for innovation in order to directly affect the quality of life, underpin experimental learning, design and implement business capacity building, encourage social innovation and revitalize coalitions of regional actors (Morgan 2019). Hence, lagging and peripheral regions show even higher potential for efficient social innovation governances since they are composed of smaller communities sharing close social, political, integrative, cognitive and institutional proximity (Balland et al. 2015; Georgios and Barraí 2021).

Whereas existing research promotes entrepreneurial ecosystems covering profit-oriented needs (Stam and van de Ven 2021) and fostering regional knowledge creation and innovation (Carayannis et al. 2018), only little is known about the characteristics of social innovators

(Audretsch et al. 2021) and their incorporation to the RIS3 concepts (Hassink and Gong 2019) as well as the theory background for ecosystem governance (Wurth et al. 2021), underlining the introduced research gap. In this context, social innovation, being defined as "innovative activities and services that are motivated by the goal of meeting a social need" (Mulgan 2006, p. 146), is connected to social entrepreneurship (Phillips et al. 2015), indicating "activities and processes undertaken to discover, define and exploit opportunities in order to enhance social wealth by creating new ventures or managing existing organizations in an innovative manner" (Zahra et al. 2009, p. 519). Considering social innovation as an existing challenge for regional planning (Zahra et al. 2009) but as a potential relevant competitive advantage as well (Castro-Arce and Vanclay 2020), social innovation can be a key driver for sufficient RIS3 implementation (Taliento et al. 2019).

Following the introduced research gap, the research proposes the following research questions:

1. What interdependencies between social innovation and RIS3 have been exploited in existing literature towards sustainable regional development?
2. What is the conceptual background of social innovation on RIS3 implementation and sustainable regional development?
3. Which research gaps can be identified from current literature for future research on social innovation governance under RIS3?

To answer the research questions, a systematic literature review will be introduced for in-depth analysis of existing literature streams towards a better understanding of social innovation as a regional capacity alongside RIS3 towards sustainable development or, in other words, alongside the transformation from RIS3 towards S4 and/or RIS4. Hence, this conceptual paper theoretically contributes to existing research in this particular field, but also provides a sufficient background for future research design and implementation, which means that this article shall be treated as an appeal for more research exploitation in this specific research area, as well.

The article is structured as follows: after introducing the research gap and questions, the upcoming chapter points out the applied research method and assumptions made as well as the inclusion and exclusion criteria for the literature review. Afterwards, main results will be illustrated and answers given for the research questions. Lastly, the yielded insights will be put into context of current and previous literature for discussion.

2. Materials and Methods

Even though the particular fields have been exploited in existing research studies, resulting in several literature reviews on social innovation (Pomaquero-Yuquilema et al. 2019; Phillips et al. 2015) and Smart Specialisation (Fellnhofer 2017; Janik et al. 2020; Komninos et al. 2014; Lopes et al. 2019) themselves, no attempts have been made yet to provide a systematic review of existing literature on their potential interplay towards sustainability. As the main research method applied, a systematic review is based on transparent, reproducible and iterative processes, which allow for overcoming or minimizing the researchers' bias (Phillips et al. 2015). In addition, systematic reviews as evidence-based practices are able to identify key scientific contributions to a particular research area or questions (Tranfield et al. 2003), making them suitable for the introduced research objective of this article.

In the first stage, exclusion and inclusion criteria have been set up to set the research scope for applicable literature to be included in the review. Table 1 introduces the exclusion and inclusion criteria and their justification.

Table 1. Exclusion and inclusion criteria.

Exclusion Criteria	Justification
Pre-2010	The Smart Specialisation Policy was officially introduced in 2010 and conceived within the reformed Cohesion policy of the European Commission, hence, previous research articles are excluded from the systematic review process (European Commission 2010a, 2010b).
Non-European publications	As RIS3 as part of the European Cohesion policy is examined in this research, articles with a focus on non-European territories are excluded from the research scope (European Commission 2010c).
Analysis on national level	National strategies for Smart Specialisation only partly exist for European countries (Meyer 2020); potentially identified articles on national strategies cannot be considered to fill in the research gap.
Conference paper, presentations, books, workshop results	Only peer-reviewed articles in the English language are considered for the systematic review (Phillips et al. 2015).
Inclusion Criteria	**Justification**
Quantitative, qualitative and mixed methods	The applied research approach does not affect the analyzed fields of interest and the developed conclusions. Hence, to receive a broad view of social innovation under RIS3, all types of conducted researches are covered.
Theoretical and empirical studies	The aim of the systematic review is to cover all existing studies; hence, the data background does not affect the selection.
All sectors and areas	One key part of RIS3 implementation is the decision-making on key priority areas. However, all sectors, areas and priorities are included to provide a boundary-less analysis.

For the conducted research, the seven principles for systematic literature reviews were applied (Transparency, Clarity, Integration, Focus, Equality, Accessibility and Coverage (Pittaway 2008)). Based on the identified research field, gap and questions, the search strings were identified to cover the fields of social innovation and RIS3 towards sustainable development. As the different concepts shall be present in the analyzed literature at the same time, the key words are connected using the Boolean operator AND (Boell and Cecez-Kecmanovic 2014) using bilateral and trilateral combinations.

The systematic literature review has been implemented using SCOPUS and Web of Science databases, as utilization of different databases improves the coverage of the conducted search (Kitchenham et al. 2015). Yielded results have been streamlined based on introduced exclusion and inclusion criteria. For remaining articles fulfilling the criteria and search strings, a descriptive analysis has been applied on a first glance to examine the available literature in the scope of the research field, followed by a thematic analysis using the available abstracts of the articles for answering the introduced research questions as well as to provide existing research gaps in current status of the research (Xiao and Watson 2019).

3. Results

Based on the introduced methods, the systematic literature review in both databases has brought up the initial results, shown in Table 2, by using different combinations of keywords without considering the exclusion or inclusion criteria.

Table 2. Search strings and quantification of literature in SCOPUS and Web of Science databases.

Search Strings	SCOPUS	Web of Science
"social" AND "RIS3"	15	11
"sustainable" AND "RIS3"	17	12
"sustainability" AND "RIS3"	3	4
"social innovation" AND "RIS3" (AND "sustainability")	0	1
"social innovation" AND "smart specialis(z)ation"	8	4
"social innovation" AND "smart specialis(z)ation" AND "sustainability"	3	1

As Table 2 already indicates, a low number of research items have been elaborating interdependencies between social innovation and Smart Specialisation or RIS3 in general. By adding the perspective of sustainability, the records are consequently decreasing. However, for the final results in literature quantification of this systematic review, the illustrated exclusion and inclusion criteria (Table 1) narrow down the incorporated research items, as shown in Table 3.

Table 3. Keywords and quantification of literature in SCOPUS and Web of Science databases using exclusion and inclusion criteria.

Search Strings	SCOPUS	Web of Science	Net
"social" AND "RIS3"	7	7	8
"sustainable" AND "RIS3"	9	10	11
"sustainability" AND "RIS3"	2	3	4
"social innovation" AND "RIS3" (AND "sustainability")	0	0	0
"social innovation" AND "smart specialis(z)ation"	1	1	2
"social innovation" AND "smart specialis(z)ation" AND "sustainability"	0	1	1

Whereas the values in SCOPUS and Web of Science illustrate the resulting number using the search strings in the databases after application of the exclusion and inclusion criteria, the Net value illustrates the final number of research items identified after comparison of both database results (excluding duplicates). After eliminating duplicates across the search strings, 20 research articles were identified covering the field of interest as a result of the implemented systematic review. After reviewing the article contents, two research items have been excluded according to their non-relevance for the specific research objective. Therefore, in total, 18 research articles can be selected from the systematic review for further descriptive and thematic analysis.

3.1. Descriptive Analysis

Initially, the identified articles were categorized according to their origin. Table 4 illustrates countries of the institutions with which the authors are associated, according to the information provided in the articles. In three articles (Meyer 2021; Pavone et al. 2021; Secundo et al. 2017), at least one author represents institutions from different countries at the same time, which, in those cases, have been fully included. Furthermore, for articles with authors from different countries jointly published (Barzotto et al. 2020; Montresor and Quatraro 2020; Paiva et al. 2018; Pavone et al. 2021; Pudzis et al. 2018; Secundo et al. 2017), all countries mentioned are recorded.

Table 4. Quantification of origin countries in selected articles.

Number of Appearances	Country/ies
1	Belgium, Estonia, Finland, Greece, Lithuania, Norway, Poland
2	Austria, Latvia
3	Germany, Ukraine
5	Portugal, United Kingdom
8	Italy, Spain

The numbers indicate a stronger interest of the respective research fields in southeastern parts of Europe, with Spain (8), Italy (8) and Portugal (5) leading the statistic together with the United Kingdom. In addition, 7 out of 18 research items were conducted by an international author team, suggesting a tendency to benefit from transnational approaches when elaborating RIS3 research and implementation (Meyer 2020). However, due to the low number of identified articles, a generalizable conclusion should not be drawn from these statistics.

Furthermore, the articles are categorized according to their publishing year. As no records were identified earlier than 2016, the systematic review covers the recent six years in which the number of published articles in the research field slightly increased, indicating a higher scientific interest in social innovation under RIS3 with a focus on sustainability in recent years, as it is illustrated in Figure 1 below.

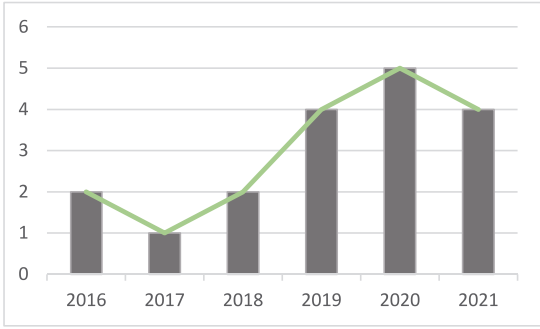

Figure 1. Number of publications identified in timeline (compiled by author).

In addition, the respective research fields might be used as indicators for elaborating the concepts and theories behind in the articles later on (Phillips et al. 2015). The most research items could be identified in Social Sciences (8) followed by Economics and Management (5). Urban Studies (2) as well as Environmental Science, Geography and Engineering, having one record each, are at the end of this sequence. In addition, the journals of *Regional Studies* and *European Planning Studies* are the only ones appearing more than once, indicating a broad distribution of the concepts across different disciplines and research areas, as well.

Lastly, the applied research design and methodologies in selected articles is mainly of a qualitative nature, offering only one quantitative article and three using mixed-methods, whereas only two articles claim to be an empirical study. Six articles used interview (structured and semi-structured) to gather primary data. From a theoretical point of view, mainly place-based, cluster and stakeholder theories have been the background of published articles. In addition, 12 articles applied case studies to create knowledge and insights for the research field, indicating a high share of inductive approaches as well.

3.2. Thematic Analysis

The thematic analysis reveals two different trends of the articles to contribute theoretically to the respective research field. On the one hand, articles analyze a certain phenomenon in a research field and provide interlinkages to social challenges and innovation, RIS3 and/or sustainable development. On the other hand, RIS3 policies are in the center of the studies elaborating the effects on sustainable development with regards to social innovation aspects. Following the thematic analysis as a result of screening the identified articles according to the presented systematic literature review methodology, clustering as a policy tool, social capital and regional assets, as well as social innovation governance, can be identified as key content themes resulting from the systematic review.

3.2.1. Clustering as a Policy Tool for Sustainable Development under RIS3

The conceptualization of clustering is a well-known theoretical concept in RIS3 literatures (Cooke 2001; Meyer 2020; Pavone et al. 2021), which follows Porter (1998)'s definition of cluster as an interconnection of companies and institutions in a particular field with geographic concentration—in the case of RIS3, the respective European region.

In addition, the articles yielded by the systematic literature review indicate clustering as an important theoretical concept to underline public policy measures tackling and over-

coming regional societal challenges (Del Castillo et al. 2021) and, therefore, it is also a sufficient concept for regional governance approaches (Meyer 2020) with a link between cluster policies, social innovation and RIS3 (Trillo 2016). For policy making with a focus on societal challenges of a region, socio-economic clustering is emphasized as a sufficient and applicable method facilitating an increase in regional competitiveness (Del Castillo et al. 2021) as well as policy learning towards sustainable development (Pavone et al. 2021).

3.2.2. Social Capital and Regional Assets

In identified research studies, social innovation is also seen as utilization of available social capital in a region which can contribute to regional development (Estensoro and Larrea 2016). As social capital is strongly connected to social engagement (Secundo et al. 2017), it is a key success factor to ensure the application of the quadruple-helix approach in policy-making towards RIS3, which includes on-going knowledge competence exchange among the actors (Trillo 2016). Thus far, social innovators and actors tend to be incorporated into such processes as outsiders or external experts rather than incorporated as direct actors for sustainable development, e.g., universities as knowledge drivers for the society and policy-learning (Secundo et al. 2017).

When it comes to sustainable development under RIS3 policies, a lack of incorporating available regional assets can be supported (Meyer 2021)—e.g., social capital, which holds great economic potential for sustainable development and therefore should be a core part of regional policy making (Pudzis et al. 2018) rather than available innovation infrastructure (Steen et al. 2019). Nevertheless, positive relations can be identified between the dominating support of technical innovation processes (Barzotto et al. 2020) and social needs (Paiva et al. 2018), especially when regions apply (green) Key Enabling Technologies connecting smart and sustainable growth through RIS3 (Montresor and Quatraro 2020). However, it is worth mentioning that a focus on regional assets only carries the risk of missing new or emerging innovation streams for radical changes needed for regions to move towards sustainability (Steen et al. 2019).

3.2.3. Social Innovation Governance

In general, innovation policies such as RIS3 need to pay more attention to social and environmental challenges towards sustainability. Hence, explicit social needs and contributions to SDG should be at the center of policy making, as well (Hassink and Gong 2019). To achieve this commitment on the policy level, it is necessary to encourage social contribution in innovation processes, utilizing public and regional resources towards sustainable development in RIS3 (Panagiotopoulou et al. 2019; Regueiro-Picallo et al. 2020). The reviewed literature indicates that this process is mainly lacking through insufficient communication and translation of the spatial idea by RIS3 into place-based policies reflecting (social) innovation frameworks, especially for regions failing to clearly emphasize and update their regional policy strategies (Trillo 2016). On the one hand, changes have to be made in the mind-set of political decision makers in terms of the role of social innovators, which are seen as external experts in regional innovation processes rather than as an active part of innovation government models to be applied towards sustainable development (Estensoro and Larrea 2016). On the other hand, policy makers should modify their communication towards social actors and society in general to clearly offer potential contribution at different stages as a supporting measures for successful EDP application (Roman et al. 2020). Following these arguments, and considering aforementioned incorporation of all affected actors to sustainable development processes for European regions, social innovation and social innovation governance foster the development of regional innovation ecosystems, enabling all communities and actors to be involved in the policy process for social and environmental sustainability (Barzotto et al. 2020).

However, the governance capabilities tend to be rather low when it comes to the inclusion of social capital and social innovation (Marques et al. 2019). This bears the risks of denoting less promising priorities for regional Smart Specialisation Strategies,

resulting in an increasing gap for sustainable development under RIS3 (Kogut-Jaworska and Ociepa-Kicińska 2020). To minimize such risks, improving social innovation governance through policy learning can be a key concept to be applied under RIS3 (Barzotto et al. 2020; Pavone et al. 2021).

4. Discussion and Concluding Remarks

The conducted research has shown that the trilateral discourse of RIS3 as an innovation policy as well as the concepts of social innovation and sustainable development have been nary or only partly elaborated on jointly in existing literatures. Nevertheless, several works investigated the concepts themselves, e.g., through a literature review for RIS3 (Fellnhofer 2017; Janik et al. 2020; Komninos et al. 2014; Lopes et al. 2019) and social innovation (Dionisio and de Vargas 2020; Eichler and Schwarz 2019; Pomaquero-Yuquilema et al. 2019; Phillips et al. 2015) as well as sustainable development (Bolis et al. 2017; Mensah 2019; Murphy 2012). The systematic review on their interdependencies has revealed three key themes as being appropriate for conceptualization: cluster as a policy instrument, social capital and regional assets, as well as social innovation governance.

Cluster conceptualizations or cluster theories have already been taken up by several research activities when it comes to regional development (Ablaev 2018), competitiveness (Tallman et al. 2004) and sustainability (Pozdnyakova et al. 2017; Prause 2014). It is well accepted in existing literature that cluster initiatives bear a high innovative environment or ecosystem (Bittencourt et al. 2019). In regard to RIS3, cluster theories are seen as a useful tool for strategy development and implementation on a political level (Citkowski 2020). Even though cluster concepts are strongly and closely related to Smart Specialisation, critiques of this argument have to be mentioned, emphasizing a lack of added value of Smart Specialisation policies in comparison to cluster policies (Hassink and Gong 2019). Other research studies stress the political path dependency of decision-makers, resulting in a mere re-labeling of previous cluster policies (Morgan 2017; Pugh 2018). However, social innovation concepts have the potential to break such policy path-dependencies towards sustainable transition (Olsson et al. 2017).

Whereas the social component in the regional cluster or policy cluster has been narrowed down to social network theories (Neumeyer and Santos 2018; Reid et al. 2008), the conducted research is promoting clustering as a connector between social innovation and RIS3 towards sustainable development. Hence, cluster theories contain the potential to step into the missing scientific conceptualization for RIS3 implementation in the particular research field. This is underlined by recognizing the fact that cluster policies are an appropriate approach for applying challenge-driven innovations (Cooke 2012). Therefore, it is well justified to consider cluster policies for tackling societal challenges towards sustainable development under the innovation policy RIS3. However, following these arguments, the question of how to design such a regional cluster for social innovation under RIS3 can be derived. Even though the conducted research cannot provide a clear answer, the results clearly indicate an active integration of social innovators as being highly important for cluster initiatives under RIS3.

Subsequently, social innovators in regions are a crucial aspect for RIS3 application towards sustainability. The research results have uncovered the lack of utilization of social innovators and social capital as available regional assets. This problem is already well-known from other areas when it comes to the design of RIS3 (Aranguren et al. 2019; Meyer 2020, 2021). Therefore, the yielded results from the systematic review demand new concepts for social innovation governance to efficiently integrate innovators and social capital into RIS3 for complying with the rising social and environmental challenges—or, in other words, to foster the transition towards sustainability. To achieve this, the literature proposes concepts such as transformative governances (Visseren-Hamakers et al. 2021), social mindfulness (Komatsu et al. 2022), co-creation (Ansell and Torfing 2021) or corporate social responsibility (Tibiletti et al. 2021; Triantafyllidis 2022). However, whereas social innovation governance is often used in the context of environmental aspects

towards sustainability (Lagasio and Cucari 2019; Widyawati 2020), its relevance and impact for RIS3 has not been exploited yet, whereas the conducted research clearly indicates linkages between both concepts to accelerate and support regional sustainable development, especially through the concepts of policy learning and EDPs.

Policy learning is a consistently reoccurring concept throughout the discourse of this research, describing the ability or skill of a regional policy maker to transform concepts and strategies from theory into practical policy implementations and changes to support regional innovation and sustainable development (Gianelle et al. 2020b). As the conducted research has exposed, social innovation governance application requires improvements in policy communication and actor involvement. In addition, learning effects, from failures and transformation effects, but also self-improving activities, are the backbone of effective policy learning (Bellini et al. 2021; Kleibrink et al. 2016); hence, policy learning is also driven by path-dependency—just like social innovation (Moulaert and Mehmood 2010).

The conducted research has exposed quite low literature records, elaborating the social innovation idea in RIS3. As the systematic review shows (Table 3), only some records were identified in both SCOPUS and Web of Science databases using the search strings with "social" and "sustainable" towards RIS3, whereas only few items could be identified using "sustainability" in connection with RIS3, as well. In terms of the search string for "social innovation" AND "RIS3", no published research item in both databases could be identified. Only the substitute of "smart specialis(z)ation" for RIS3 yielded a research item in combination with social innovation. Hence, the trilateral search by adding sustainability did, of course, not provide further insights, as the results did not change. Hence, in regard to the first research questions, the research undertaken clearly indicates a lack of incorporation of social innovation into the RIS3 concept. Even though a positive trend can be identified in increasing research interest of social and sustainable elements among RIS3, social innovation has not yet been well conceptualized to narrow down the potential impact for regional sustainable development under RIS3.

However, it shall be mentioned that the relationship between social innovation and policies as well as sustainability in general has been developed and exploited in several research articles (Borzaga and Bodini 2014; Haxeltine et al. 2013; Marques et al. 2018; Repo and Matschoss 2019). However, the research scope is clearly set to RIS3, limiting the amount of potential research items in the systematic literature review.

From a methodological point of view in line with research question two, the systematic literature review has exposed a high share of place-based theory applications for the research field. Taking into consideration place-based activities under RIS3, knowledge, technology and innovation capabilities are key factors to foster sustainable development (Fagerberg et al. 2004; Ferreira and Seixas 2019), demanding the active involvement of social innovators as main actors, being the drivers for knowledge creation, learning facilitation and spill-over identification. Putting this into the context of RIS3, place-based theories demand social innovation governance concepts as multilevel approaches involving all actors of the (social) innovation ecosystem, according to the quadruple-helix perspective (Aranguren et al. 2019). In this light, place-based theories considering multilevel (social) governance approaches are able to affect and explain the transition towards sustainability under RIS3, setting the scene to upgrade the paradigm towards RIS4—Research, Innovation and Social Strategies for Smart Specialisation or Regional Innovation Strategies on Smart and Sustainable Specialisation.

The thematic analysis has underlined the lack of focus on regional assets or, in this particular field of research, social innovators and social capital. Referring to research question three, research gaps drawn from this analysis indicate missing capabilities and competencies at the political level to sufficiently include regional social innovators into designing RIS3, setting up new communication and participation concepts for them, as well as utilizing social innovation governance ideas towards sustainable development under RIS3. Therefore, it is also recommended to include these aspects into future research

to better understand the role of social innovators and social innovation governances for designing RIS3 towards sustainability.

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