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Do Regional Innovation Strategies Meet Societal Challenges?

A Comparative Analysis across Regions in Belgium, Germany, Netherlands and Finland

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Abstract

In addition to traditional, cluster-oriented approaches, both cross-sectional technologies (“key enabling technologies”) and societal challenges (“grand challenges”) are becoming increasingly important for regional innovation strategies. A more complex, multi-dimensional approach of regional innovation strategies requires but a number of adaptations, which need to adjust to various, different regional preconditions. The article raises the research question how societal demands are considered and implemented by regional innovation strategies in four case study regions: Pirkanmaa/Tampere region in Finland, Groningen region in the Netherlands, West Flanders in Belgium, and the Federal State of Bremen in Germany. The four regional case studies are comparable European regions in terms of their innovation capacity and their level of innovation (all are classified “highly innovative” or “strong innovator” by the European Union).

In order to address global societal goals and challenges – in particular climate change and its consequences as well as demographic change – a multidimensional innovation policy spanning sectors and technologies and a close interlinking of technological and societal innovation objectives and strategies, seems inevitable. The analyses revealed that governance structures and the innovation infrastructures in the regions indeed start to adapt to societal needs and to the increasing complexity of regional innovation strategies, though the speed as well as the intensity of transition and adjustment varies greatly across the regions. Interregional learning as is intended by the European Interreg programme could offer meaningful support for the progress of regional measures towards multi-dimensional innovation policies.

Contents

Table of Abbreviations

BreLogIK - Bremer Programm für Informations- und Kommunikationstechnologien in der Logistik

EKAT - Energiaviisaat kaupungit (Energy Wise Cities Project)

EU - European Union

ICT - Information and Communication Technologies

IoT - Internet of Things

IT - Information Technology

KETs - Key Enabling Technologies

LoRaWan - Long Range Wide Area Network

POM - Provinciale Ontwikkelingsmaatschappij (Provincial Development Company)

R&D - Research & Development

RIS - Regional Innovation Strategy

SME - Small and Medium Enterprises

SNN - Samenwerkingsverband Noord-Nederland

SWAE - Die Senatorin für Wirtschaft, Arbeit und Europa, Bremen

TraCS3 - Project title: Fostering Interregional Collaboration and Support for Innovation Infrastructure in S3 key priority areas through the Improvement of Regional Innovation Eco-systems

TUA - Technical University Alliance

1. Introduction: Contemporary Challenges for Regional Innovation Strategies

At European level as well as within European regions, innovation policy currently develops as combination of three strategic approaches: Firstly, the approach of smart specialization (RIS3), secondly, the promotion of key enabling technologies (KETs), and, thirdly, the approach of mission-oriented innovation strategies. Thus, cross-sectoral and cross-technology approaches of key enabling technologies and mission-oriented strategies, do not mean that conventional cluster approaches for promoting innovation become obsolete. However, they will be increasingly connected to the development and application of cross-sectional technologies as well as to societal challenges such as demographic change or climate change. This places new demands for innovation strategies and raises the potential for conflict and contested decisions. This requires a more complex strategic matrix of regional innovation systems including regional innovation infrastructures and strategies.

In this article, we examine how the adaptation to EU guidelines and other conditions contribute to the implementation of multidimensional innovation strategies within four European city-regions: Pirkanmaa/Tampere region in Finland, Groningen region in the Netherlands, West Flanders in Belgium, and the Federal State of Bremen in Germany. Those case studies illustrate the regional specificity and connectivity of strategic approaches and analyze how they unfold through funding programs and the establishment of new or modified innovation infrastructures as practical multi-dimensional innovation policies.

> The considerations in this report are based on regional comparisons conducted throughout the EU-Interreg project TracS3, which was carried out from 2018 to 2023 (https://www.interregeurope.eu/tracs3/). Its main objective was to comparatively examine regional innovation infrastructures and to involve local stakeholders in exchange of experiences, debates and mutual learning about regional innovation strategies. Finally, a Regional Action Plan was set up for each of the participating regions. Besides Pirkanmaa (Tampere region in Finland), Groningen (Northeast Netherlands), West Flanders (Belgium) and Bremen (Northwest Germany) the regions of Vilnius (Lithuania), Iasi (Northeast Romania) and Albacete (Spain) took part as project partners. Unfortunately it was not possible to organize site visits and in depth discussions on the spot in Romania, Lithuania and Spain because of the Corona-Pandemia. Therefore the report is limited to case studies from Belgium, Finland, Germany, and Netherlands.

First we will discuss the relationship between innovation policy and strategies at European and regional level (section 2), followed by an overview of the studys' methodological approach (section 3). We will then present the specific innovation strategies in four study regions and reconstruct their motives, goals and structural conditions (section 4). In particular, the integration of societal challenges into regional strategies is discussed comparatively (section 5). In a brief summary, we will outline key findings on options for modernization and adaptation for regional innovation strategies (section 6).

2. Strategies on European level: Multidimensional Innovation Strategies

2.1 Smart Specialization Strategies (RIS3)

Smart specialization can be described as a multi-level politics approach, in which conditions for innovation are combined with regional structural and political requirements. As a „sector non-neutral“ policy approach (Foray, 2016, p. 1428), smart specialization focusses on “innovation-based endogenous development and growth” and on the potential for innovation of the existing capacities within regions (Foray, 2016). Since 2011, it has been implemented into the European regional cohesion programs (Foray, 2018, p. 817) and since 2014, it is an ex ante condition for innovation-related structural funding (European Commission, 2014, p. 7; Kroll, 2015, p. 2080; Trippl, Zukauskaite, & Healy, 2020, p. 1328). “RIS3 is essentially a governance process comprising both design and evaluation of regional innovation strategies” (Roman, Varga, Cvijanovic, & Reid, 2020, p. 2). It is considered an answer to “one size fits all” innovation approaches (Tödtling & Trippl, 2005; Trippl et al., 2020, p. 1329) that are often criticized for their generalizing across nations, sectors, or regions (Balland, Boschma, Crespo, & Rigby, 2019, p. 1252). In turn, smart specialization is, firstly, considered place-based (Trippl et al., 2020, p. 1329) and differs across contexts (Kroll, 2015, p. 2080). It refers to the specific existing regional strengths, competitive advantages (European Commission, 2014, p. 2) and knowledge bases in order to modernize and diversify the regional economy (Trippl et al., 2020, p. 1329):

> *„…smart specialization strategies reflect rather the capacity of an economic system (e.g. a region) to generate new areas of development and new options through the discovery of new domains of opportunity and the local concentration and agglomeration of resources and competences in these domains“ (Foray, 2016, p. 1431).*

Balland et al. (2018) hereby claim that relatedness and knowledge complexity are key “building blocks” of smart specialization (p. 1253). Secondly, smart specialization is evidence-based (Trippl et al., 2020, p. 1329): As the ground for regional strategy development, it promotes „a bottom-up principle of entrepreneurial initiative and dynamics“ (Foray, 2016, p. 1428) with an “entrepreneurial discovery process” as a key to identify regional potentials and to set the focus for the respective regions (Foray, 2017a). In this, key innovation stakeholders such as businesses, universities, and research centres (European Commission, 2014, p. 7) are to be included into the selection of political priorities (Trippl et al., 2020, p. 1329), as well as civil society (Roman et al., 2020, p. 2).

The designs, implementations, practices, and results of smart specialization in regional innovation policies differ highly across regions (Asheim, Isaksen, & Trippl, 2019, pp. 102-103; Kroll, 2015; McCann & Ortega-Argilés, 2015), depending on regional characteristics and place-based factors (Asheim et al., 2019, pp. 107-108; Trippl et al., 2020). Studies on regional impact and implementation of S3-strategies range from single case studies in specific regions (e.g. (Normann, Strickert, & Knudsen, 2020; Sarkar, Bilau, & Basílio, 2021) to analyses of large datasets across regions, often within particular countries (Trippl et al., 2020, p. 1329). Trippl, Zukauskaite, & Healy (2020) take on a meso-level perspective and discuss interdependencies between regional innovation system (RIS) factors and smart specializa-

tion practices. As influential factors, they refer to differing scopes of action stemming from governance and government structures and the degree of decentralization (p. 1329, 1337-1338, also Kroll, 2015, P. 2095), as well as regional path dependencies in policy-making, the composition and capabilities of regional policy-makers as well as the further actors of the regional innovation system. In line with previous research, they identify regional institutional structures as explanatory factors for the varieties in RIS3 implementation and results across geographical contexts (p. 1330, 1337-1338, also Kroll, 2015, p. 2095). Their findings suggest a certain influence of the RIS3 on processes of stakeholder involvement and policy learning – mainly for less-developed-regions, while in intermediate and advanced regions they rather find incremental changes (p. 1337-1338, also Kroll 2015, p. 2095). Further, for advanced regions, they state challenges to develop new innovation practices that go beyond the existing practices and the so far involved stakeholders (p. 1338). Kroll (2015) discusses policy failures in RIS3-processes and highlights challenges for policy-makers and problems in RIS3-processes within regions of weak institutional environments and difficulties of implementation (p. 2082-2083). Further, empirical studies identify problems in smart specialization policy processes regarding too broadly selected fields of specialization, lack of professional capacities, and the integration in multi-level governance which limits regional autonomy (Kroll, 2015, pp. 2082-2084).

Interregional connections, especially to those regions with complementary capabilities, are relevant with regards to the diversification of regions and the operationalizing smart specialization (Balland & Boschma, 2021). Further, Ruhrmann et al. (2021) highlight the relevance of local autonomy in "context-specific regional innovation policy-making", balanced and combined with coordination and control at higher levels of governance and from there the facilitation of capacity-building at lower levels of governance (Ruhrmann, Fritsch, & Leydesdorff, 2021, p. 9).

2.2 Key Enabling Technologies (KETs)

Coping with upheavals due to structural change as well as the expansion of research and science potential and, last but not least, the funding strategies of the European Union have strengthened the role of state activities and interventions in the design and development of regional innovation systems – in the case study regions as well as in Europe.

In particular, the specifications of the EU for Smart Specialization (RIS3) aimed to promote the "intelligent specialization" of regional economic structures and to support the regional actors in further developing the specific strengths and potentials of their regional economic structures by improving their innovative capacity. To the extent that technological developments accelerated and led to the dissolution of the boundaries between traditional economic sectors, however, it became clear that the focus on former strengths of regional economic structures encounters its limits. For this reason, regional innovation strategies are increasingly promoting the development and application of cross-sectoral key enabling technologies, for example advanced production techniques, nanotechnology, biotechnologies or the development of new, high-performance materials (European Commission, 2015b, p. 6; 2019, p. 12). Such a cross-sectional technology par excellence is represented by the various links between digitization, robotics and artificial intelligence, which are ascribed the potential to provide a massive surge of modernization across almost all economic sectors (Verhoef et al. 2021).

Establishing the concept, the EU currently prioritizes "foster[ing] research and capacity building around KETs" (Wanzenböck et al., 2020, p. 4) and recommends regions to include KETs into their smart specialization strategies (Evangelista et al., 2018, p. 275, see also Sörvik & Rakhmatullin, 2013), considering KETs "a key instrument within the RIS3 to address the technology and innovation challenges, but also the broader societal challenges within each region" (European Commission, 2015a, p. 7). For 2014-2020, as "indispensable technology building blocks, with the potential – especially in combination – of unlocking innovation, providing added value and underpinning a wide range of product applications in strategic European value chains", the following six KETs have been identified: "advanced manufacturing technologies, advanced materials, industrial biotechnology, micro- and nanoelectronics, nanotechnologies and photonics" (European Commission, 2015b, p. 6; 2019, p. 12).

As defined by the European Commission, *key enabling technologies* are

> *"…knowledge intensive and associated with high R&D intensity, rapid innovation cycles, high capital expenditure and highly skilled employment. They enable process, goods and service innovation throughout the economy and are of systemic relevance. They are multidisciplinary, cutting across many technology areas with a trend towards convergence and integration. KETs can assist technology leaders in other fields to capitalise on their research efforts." (European Commission, 2012, pp. 2-3).*

Evangelista et al. (2018) analyze the contribution of KETs to regional development. Empirically, they find positive impacts of KETs on regional growth measured in capita GDP (p. 281), with the highest impact in technological laggard regions (p. 284). Thus, they consider the KET approach consistent with European Cohesion Policy (p. 285) and support KETs to have a "a pervasive influence in enabling process, product and service innovations throughout the economy" (p. 284). Wanzenböck et al. (2020) empirically analyze the impact of regions' embeddedness into KET-related, technology-specific R&D networks on regional knowledge creation in KET fields. While generally they find positive effects, they highlight that these differ, depending on the region's own endowments and on the specific field of technology, with a higher relevance in "science-based" fields than in technical fields based more on engineering and on-site industrial production (Wanzenböck et al., 2020, p. 14).

2.3 Mission-oriented Innovation Strategies

Mission-oriented innovation strategies and policies directly address specific societal challenges, such as health risks, climate change, social cohesion, education, demographic change (Mazzucato, 2016, p. 140). Accordingly, innovation policies are expected to answer those challenges and contribute to reveal relevant solutions (Mazzucato, 2016, p. 140). It lies in the nature of mission-oriented strategies that, like strategies of smart specialization, they are non-neutral innovation policies, because they intentionally seek to influence the direction of innovation (Foray, 2018, p. 822). A mission-oriented policy "is designed according to specific technological, industrial, social or environmental objectives, whose fulfilment requires clusters of innovation oriented in an appropriate direction" (Foray, 2018, p. 822). According approaches need to be systemic in that they "address questions of complementarities between different types of capacities, coordination between actors and between investments, or connection between innovation and diffusion" (Foray, 2018, p. 822). Mazzucato (2016, 2021) proposes a framework that complements "traditional" policies directed against market failure

with approaches of market-creation in order to shape, not fix, markets (Mazzucato, 2016, p. 153). She claims that this would actively open up new directions of change and technological opportunities (Mazzucato, 2016, pp. 140, 150). As critical issues, she raises "(1) the direction of change promoted by policy; (2) the nature of (public and private) organizations that can welcome the underlying uncertainty and discovery process; (3) the evaluation of mission-oriented and market-creation policies; and (4) the ways in which both risks and rewards can be shared so that smart growth can also result in inclusive growth", with the integration of stakeholders – beneath the state – as a key necessity regarding decisions on investments and addressed challenges (Mazzucato, 2016, p. 153). As characteristic beneath the creation of markets as discussed by Mazzucato (2016), Georghiou et al. (2018) in their European Commission policy brief, highlight a "challenge based approach" and specify the relation between societal challenges and mission-oriented innovation (p. 5). In their view

> *"…the challenge will refer to the wider problem, aim or benefit that is faced while a mission will describe a specific package of measures and activities that can deliver a verifiable result, which successfully exploits, resolves, mitigates or makes defined progress against the challenge." (Georghiou et al., 2018, p. 5).*

For the European Innovation Policy five missions were identified: "Adaptation to climate change including societal transformation, cancer, climate-neutral and smart cities, healthy oceans, seas, coastal and inland waters, [and] soil health and food" (European Commission, 2021). With regard to "outcome for society", mission-oriented policies are considered to need engagement and "concerted action" of "all levels of society" (Georghiou et al., 2018, p. 11) – or, as Mazzucato (2018) puts it, "different actors (both public and private) and different sectors" (p. 809). As possible forms of engagement Georghiou et al. (2018) name "social dialogue", "polling", or "engagement by design", with the latter expected to be the "most powerful" (p. 11). Mazzucato (2018) refers to "bottom up experimentation and learning" as success factors for the according innovation process (p. 803). She states the need of an alternative "policy making toolkit" for mission-oriented innovation policy makers:

> *"Successful mission-oriented policy experiments […] require a more dynamic framework of key questions: less about picking or not picking, and more about the institutional and organizational capacity of forming broadly defined directions, through strategic deliberation. Less about static cost-benefit metrics which so often result in accusations of "crowding out" and more about dynamic assessment criteria that can nurture and evaluate market shaping processes and capture the spillovers that are created across sectors." (Mazzucato, 2018, p. 813)*

Resuming the political debates and developments on different levels of European Regional and Innovation Politics, the conceptual framework of innovation strategies has (1.) become much more complex during the recent decades, (2.) needs a much stronger engagement of public institutions than in former times and (3.) requires an approach more open to different sectors and civil society (see Table 1).

Table 1: Development towards multidimensional innovation strategies

Regional Innovation-strategies	Functional Orientation	Governance-mode	Infrastructures
Cluster-based: "strengthening strengths" through smart specialization	- Specialization on industrial clusters/ economic sectors - Access to existing markets	*Double helix:* co-operation of economy and science; supported by public finance and services	- Specialized R&D-Capacities - Incubators - Consulting services - Public finance
Cross-sectional: "developing new strengths"	- Extended innovation clusters/clusters of competence - Diversification - Science-based - Extension/ enlargement of markets	*Triple helix:* private companies, scientific institutions, policy and public services in close co-ordination	- Technology parks - Hubs - Academies and business parks of the future
Mission-oriented: "coping with societal challenges"	- Problem-solving oriented clusters - Policy based - Emergence/ Shaping of markets - RIS4 (sustainability as additional component of RIS3)	*Quadruple helix:* additional integration of actors from civil society	- Open innovation - Living Labs - Urban Labs - "bottom up – design"

Source: Self generated

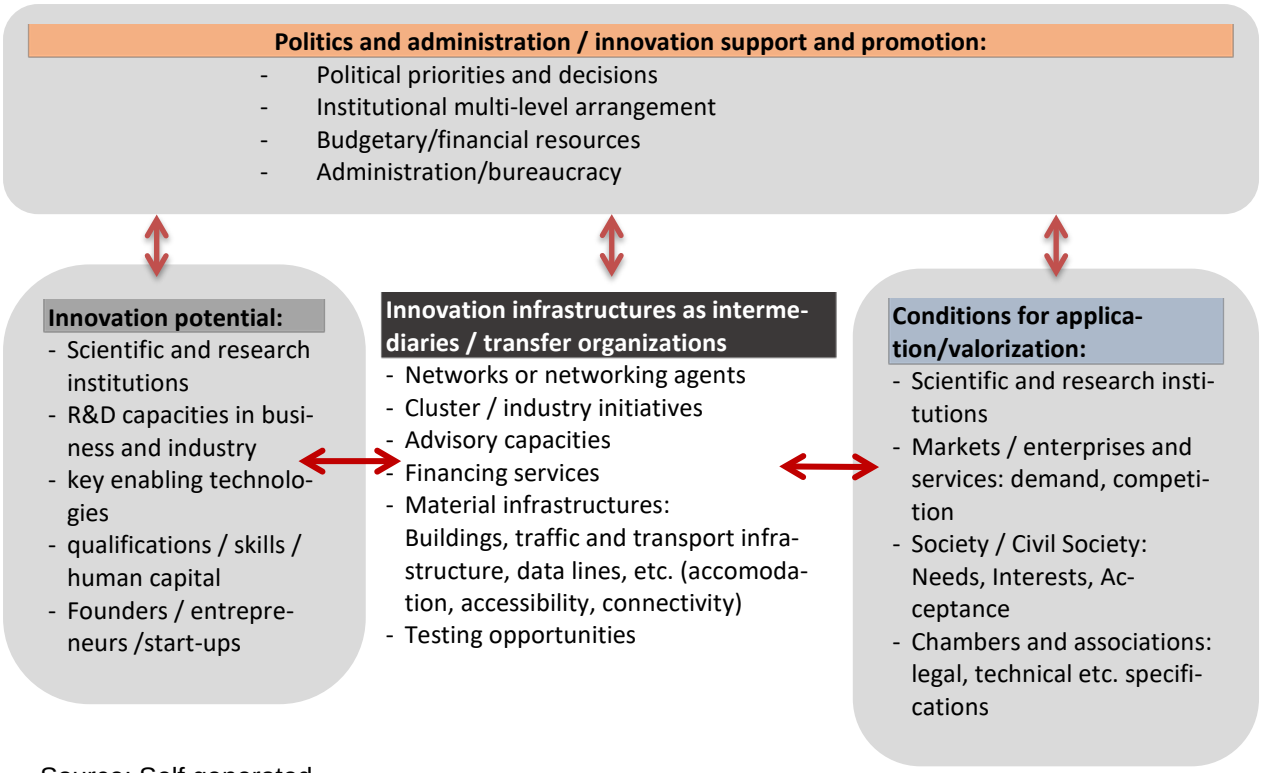
3. Methodological Approach

For the regional analysis, information on strengths and weaknesses as well as the needs of the innovation infrastructures in the regions of Bremen (Germany), West Flanders (Belgium), Groningen (Netherlands) and Tampere (Finland) was gathered and analyzed. A mixed-method design was used which included internet research, a series of expert discussions, stakeholder workshops and site visits in the four regions. Data and information served to reconstruct the regional innovation infrastructures as complete as possible (mapping) and to identify starting points for their optimization. For this purpose, the project partners of TraCS3 jointly developed a questionnaire that was used in each of the case study regions for topic-centered expert interviews or as framework for an online questionnaire. In all regions interviews were held during the second half of 2019 with leading experts in various innovation facilities on the function of their own organization, how it is embedded in the regional innovation system and on the strengths and weaknesses as well as challenges for the regional innovation infrastructure. In addition to this survey, the findings of the regional comparison are based on the evaluation of internet research and statistical data. Further information and findings were obtained in two to three-day visits in the four regions with on-site presentations and site visits of innovation infrastructures as well as stakeholder workshops and world café discussions including local stakeholders from the innovation ecosystem.

Main goal of the analyses was to identify differences and similarities between the regions, regarding both, the structures and the functions of the regional innovation systems, which we could attribute to various causes. In addition to market conditions and specific structures of the regional economy, above all the largely publicly financed and controlled innovation infrastructures play an essential role: The politically fixed innovation strategies and funding objectives are implemented through their operational transfer functions. These transfer functions include specialized consulting, networking and financing services as well as the provision of material infrastructures such as rooms, computing capacities and data access or laboratory facilities and test sites.

The regional innovation infrastructure is shaped by these intermediary functions and their respective supporting and connected organizations. Transfer of knowledge, intermediary functions and the way they are implemented differ regionally, depending on various regional-specific constellations and conditions, and reflecting the economic structures and innovation strategies, for example in terms of scope, structure, and organizational form (see below, fig. 1).

Fig. 1: Innovation infrastructures as intermediaries within regional innovation systems



Source: Self generated

4. Regional Innovation Strategies and -Systems

4.1 Economic Development and Regional Clusters in the Surveyed Regions

In all four regions, the effects of ongoing structural change are notable, which since the 1980s has resulted in a serious decline in industrial employment, a growing proportion of the service sector, and an enormous increase in the importance of knowledge-based functions. Nevertheless, the manifestations of structural change in the case study regions and their consequences on the regional economic structures are highly specific:

In the Federal State of Bremen, the formerly dominant shipyards and their suppliers as a traditional core of the industrial structure were largely lost; in addition, the region was affected by outsourcing processes in the food industry and, more recently, with the slump in the production of wind turbines. In response to these developments, strong efforts have been made since the 1990s to further develop the regional economic structure through an accelerated expansion of the regional knowledge- and research-infrastructure (Fortmann & Nischwitz, 2018; Kropp, 2009; Mossig et al., 2010; Wauschkuhn, 1998). Up to the present promotion and strengthening of clusters and fields of competence mainly focus on the remaining industrial or industry-related production sectors such as automobile manufacturing, aerospace industry, energy technology and systems as well as maritime economy and logistics (SWAE, 2020). The strategic goal to establish high-quality R&D capacities and intensive efforts to link strong economic areas with the newly created research institutes and scientific facilities was initially the creation of modern and efficient competence clusters.

The region of Groningen in the northern Netherlands has experienced similar losses in the industrial economic structure as the Federal State of Bremen and is similarly pursuing a strategy of renewal and innovation that heavily relies on the inclusion and valorisation of the existing scientific potential of the region. Above all, the strengths of the regional economic structure in the areas of food production and processing, chemicals and energy, shipbuilding, metal industry, paper goods and cardboard boxes, business services and information and communication technology are to be further developed. In contrast to Bremen, the focus is set less on the settlement and establishment of new high-quality R&D capacities, but on the increased promotion of broad cooperation between commercial enterprises and a large number of existing scientific institutions, as well as to establish more permanent – not project-based – collaborations at the level of organizations. This does not only apply to the link between science and business; all actors involved are addressed to develop the regional innovation ecosystem with the participation of politics and regional government as a strongly networked, institutionalized “triple helix” (Foorthuis et al. 2020).

For various reasons, the two regions of West Flanders in Belgium and Pirkanmaa in West Finland were less affected than Bremen and Groningen by the major upheavals in the economic structure. With a small-scale and diversified economic structure that includes food production and processing, ports, logistics and transport companies as well as medium to small-sized industrial structures, the Belgian region West Flanders as an economically successful region ranks at the top of Europe regarding the innovation-oriented cooperation of small and medium-sized enterprises (see below, European Innovation Scoreboard). Although high-quality scientific capacities are also available, the current, knowledge-based regional

economic structure is considered here as rather inadequate and therefore as a future risk. The regional innovation strategy primarily aims to counter the so-called “West Flemish paradox” by investing in networking and institutionalized cooperation between business and science. This region-specific paradox means that a strong economic and innovation performance stands opposite to low foreign investment and relatively poor human capital, high energy costs and a lack of R&D capacities and infrastructures. With the “West Deal” program, a RIS3 strategy tailored to West Flanders (POM West-Vlaanderen, 2019a) was launched in 2013, which is supported by the Province of West Flanders as the legislature and the Provincial Development Company (POM) West Flanders as the executive body (POM West-Vlaanderen, 2019c). Sectors of the economy identified as “internationally outstanding sectors” with “excellent growth potential” are to be supported by an explicit cluster policy (POM West-Vlaanderen, 2019a).

While West Flanders has remained relatively unscathed by the structural upheavals of the past decades – possibly due to the absence of dominant large industrial companies, and due a regional innovation strategy more likely to adjust to anticipated future risks – the region Pirkanmaa in western Finland with the city of Tampere as center has already to a large part mastered the drastic structural change of the 1980s and 1990s. In the course of closings, outsourcing and tertiarization movements, a large part of the former shoe, leather, textile and paper industries disappeared from the region. With the collapse of Nokia's mobile phone division, a modern segment of the economic structure was also lost at the beginning of the 21st century. This lead to challenges and temporarily high impacts on the regional economic structure, e.g. regarding the rate of unemployment. However, due to a knowledge-oriented innovation and funding policy, it was possible to keep the majority of qualified employees in the region and to win them to work for start-ups as well as the modernization and digitization of the still strong mechanical engineering, electrical and ICT Industry. In this respect, Tampere/Pirkanmaa currently presents itself as dynamic start-up ecosystem and as region with world market leaders in mechanical engineering. With three universities and their technical specializations, an enormous density of universities also contributes to the fact that intensive cooperation between science and business has been able to produce, in particular, highly developed specialist knowledge at the intersection of IT, industry and mechanical engineering.

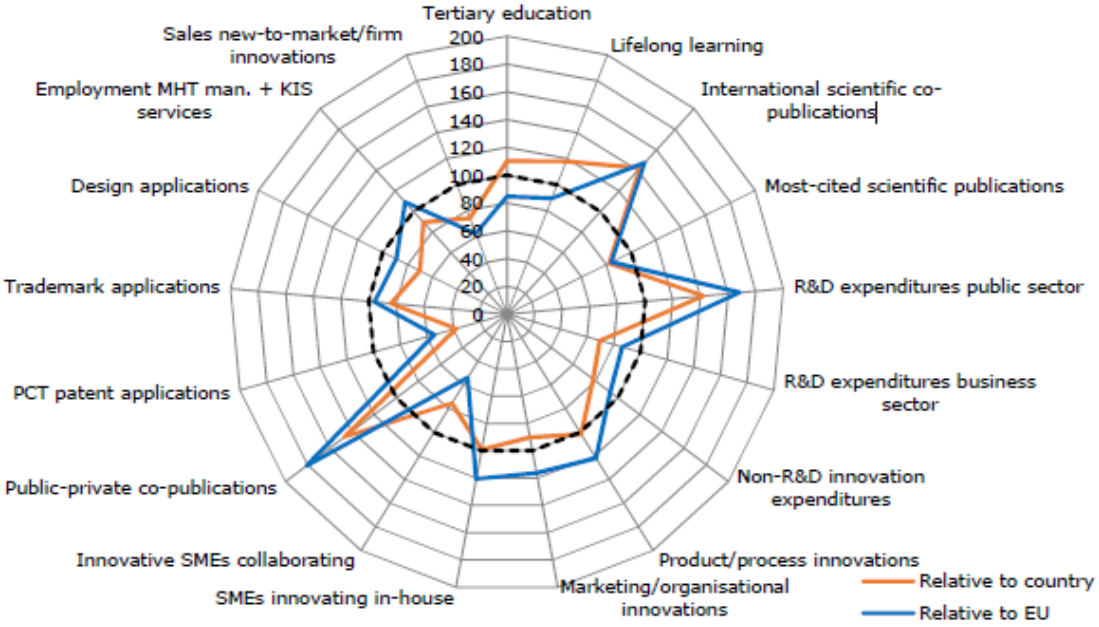
Finally, the case studies revealed that innovation support was primarily focused on two basic strategic orientations: Despite some non-simultaneities, R&D capacities and knowledge resources as well as corresponding institutions and infrastructures played a major role in the regional innovation and funding policies that (1.) had a focus on further strengthening the economically strong potentials within the region. In this respect, it is remarkable that *economic clusters* are no longer the unique focus of attention, but strong efforts to connect them to scientific capacities resulted in *innovation clusters or clusters of competence*. The promotion of well-working, hybrid and collaborative structures in the triple helix of business, science and politics thus becomes (2.) a special focus of *public and regional economic and innovation policies*.

Nonetheless, the role of public governance in the triple helix differs and – at least for the period under consideration – went hand in hand with various degrees of innovation performance. While the regions of West Flanders and Pirkanmaa/Tampere achieve at least the European average in almost all measurement categories of the European Innovation Scoreboard, but only show significantly higher values in few dimensions, greater amplitudes can

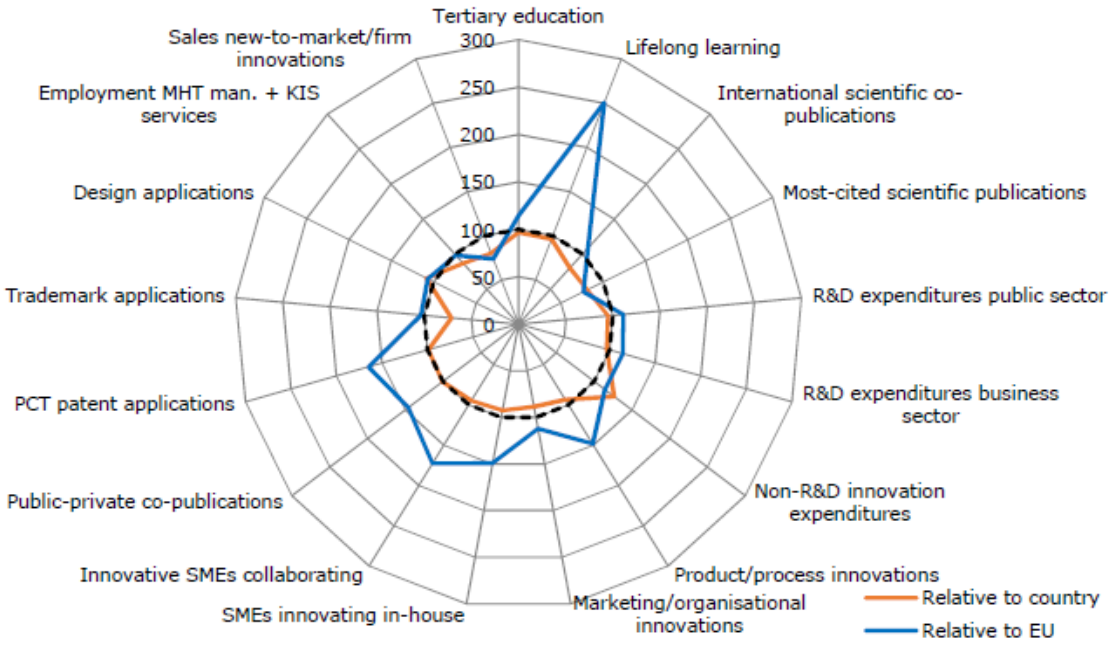
be stated across the entire spectrum of indicators for Bremen and Groningen. The Innovation Scoreboard for Groningen and Bremen shows, on the one hand, relatively high public R&D expenditures and well above-average scientific and co-productive publications. In both cases, on the other hand, the R&D expenditures of the private sector are below average and overall the output of patent applications, trademark applications, created jobs in promising industries or actually new marketable products is at best average (see below, fig. 2).

Fig. 2: Regional Innovation Scoreboards 2019

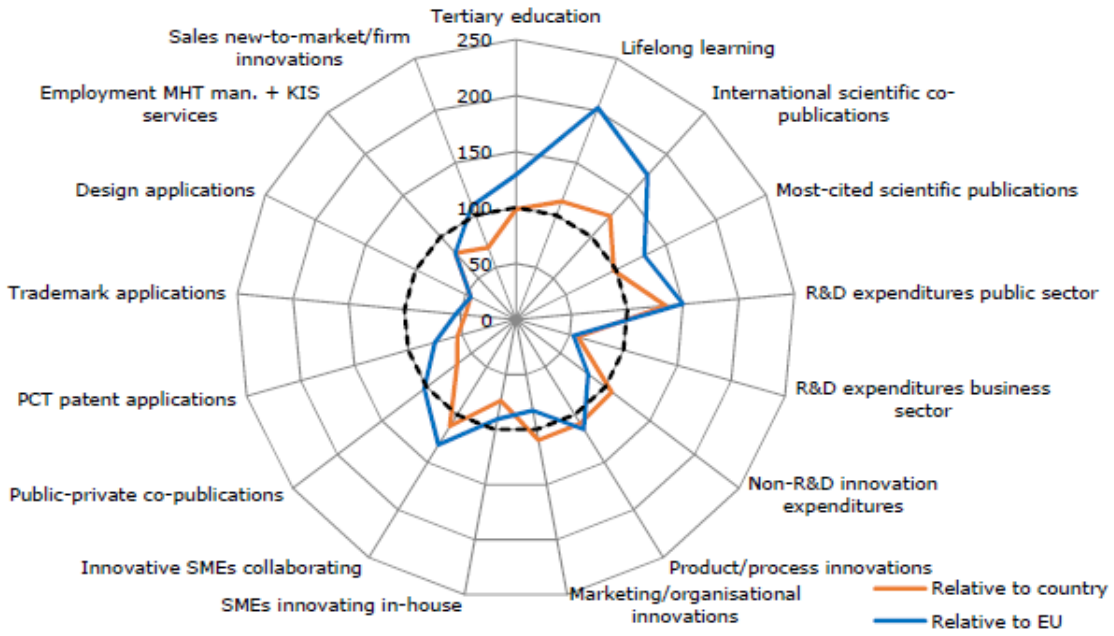
Regional Innovation Scoreboard Bremen 2019



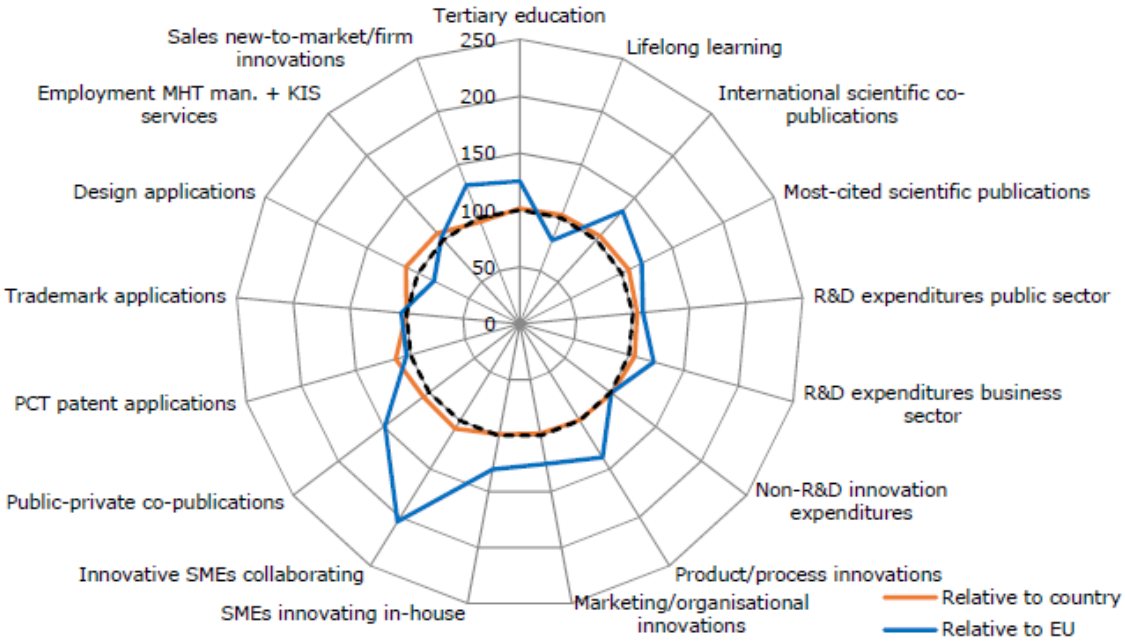
Regional Innovation Scoreboard Tampere / West-Finland 2019



Regional Innovation Scoreboard Groningen / Noord Holland 2019



Regional Innovation Scoreboard Vlaams Gewest (West-Flanders) 2019



Source: European Innovation Scoreboard; https://ec.europa.eu/growth/sites/default/files/ris2019.pdf

In contrast, the Western Finland region has high scores in the “lifelong learning” category and the innovative performance of small and medium-sized enterprises is well above average. The latter also applies to the West Flanders region, whose traditionally small and medi-

um-sized economic structure is clearly capable of above-average innovation activities. However, the outcomes of innovation efforts in both regions are hardly different than in Bremen or Groningen. Compared to the European average, Western Finland has a higher rate of patent applications and the West Flanders Region has an above-average number of innovative products that are launched to the market, too.

Although the design and development of regional innovation systems is based to a large part on identical basic assumptions, the real interactions within the triple helix between public innovation policies, scientific infrastructures and regional economic structures provide a differentiated picture. For example, the lack of large company headquarters in the two regions of Bremen and Groningen implies that innovative achievements of strong, publicly funded research and science capacities in cooperation with regional companies are often not visible because patent applications and all other effects are localized outside the regions in the respective headquarters of the companies. Large, high-quality and internationally positioned research institutions are primarily geared towards these collaborations; innovation activities in cooperation with small and medium-sized companies in the region, on the other hand, are less of a focus here. Not least because of this, the structural and innovation policy in these regions is increasingly shifting towards the promotion of start-ups and small-scale networks.

What turns out to be a recognizable disadvantage in Bremen and Groningen, however, seems to represent a particular strength of the regional innovation system in West Flanders: Since larger companies have never been represented here, less of an economic monostructure could arise here, and the smaller and medium-sized companies in the traditional economic sectors in the region have always been important carriers of innovation activities – though these have not yet lead to ground-breaking or disruptive innovations leading to a modernization of the economic and production structures. Not only Westflanders' key sectors agriculture and agro-industry do therefore have problems with reputation, attractiveness, and with the acquisition of young and qualified workers. Political innovation strategies are therefore oriented towards the continuous modernization and upgrading of the regional economic structure – for example through digitization – and the associated increase in attractiveness for young and highly qualified workers.

4.2 Westflanders and Bremen: Sectoral clusters of competence

Both in the Federal State of Bremen and in the region of West Flanders smart specialization is interpreted as an innovation strategy in which the state and quasi-state funding institutions primarily strengthen and expand the linkage and cooperation between scientific institutions and commercial enterprises. In West Flanders, the Provincial Development Company POM West Flanders takes on an important role as a regional intermediary and facilitator, bringing together competencies and actors from different sectors and different geographical levels. POM West Flanders advances the strategic (further) development of innovation infrastructures in the region with the help of EU funds, state and regional funding and thus provides the actors involved with new access to knowledge and know-how. All actors of the Triple Helix are involved. Partnerships are intended to give companies access to test facilities, research laboratories and incubators and to contribute to the acquisition of further funding and investments. In this way, the West Flanders region is to be installed and strengthened as a common brand (GreenBridge 2020, POM West-Vlaanderen 2019c, 2020c).

A similar funding strategy can be found in Bremen, where the state institutions for economic development also act as central actors in the creation of new innovation infrastructures. Here, too, a mix of EU and state funds is deployed to create infrastructures that are supposed to establish, accompany and promote the innovation-promoting transfer of knowledge between science and industry. In Bremen, not only the material infrastructures and the financial support conditions for innovation projects are focused, but also the specific needs in network support and consulting, which are considered essential for successful innovation, especially in the area of small and medium-sized business sectors and for start-ups. For this reason, appropriate facilities such as the creativity center *Alte Schnapsfabrik* and the one-stop agency for entrepreneurs, *Starthaus,* have been installed in Bremen over the past few years. In the logistics-focused project *BreLogIK*, young scientists are trained to become innovation ambassadors for the logistics industry at the university in cooperation with other scientific partners and can use the material infrastructure as well as the corresponding digital platform for research and development projects. Here, as in almost all other fields of application, digitization technology as a key technology plays a central role, and its innovative use is particularly encouraged. Beyond digital transformation, the *Bremen Center for Eco-efficient Materials and Technologies EcoMat* focuses on lightweight construction as a key technology and forms an important, innovation-oriented interface between research institutes and the Bremen-based automotive and aerospace industries. Various partners work together in research and development in this research center which was set up specifically for this purpose. A focus lies on new materials for vehicle construction, the research into their possible uses, and the integration of technological findings in manufacturing processes (EcoMat; https://ecomat-bremen.de/ueber-uns/).

Similarly tailored to the regional economic structure, differentiated nodal points are also being developed in West Flanders to strengthen the regional knowledge base. This includes the “Factories of the Future”, the “Academies of the Future” and the “Business Parks of the Future” as systematically deployed, specific cooperation networks to promote innovation and transformation of the West Flemish competence and innovation clusters. The strong emphasis on nodal points and cooperation incentives by the Provincial Development Company (POM) is expressed, for example, in the fact that the knowledge platform "Technical University Alliance West" (TUA West) was set up as part of the "Academies of the Future", in which various research and knowledge institutions in the region joint their endeavors to facilitate the access to knowledge and expertise for companies (POM West-Vlaanderen 2019c) and to extend the regional pool of qualified workers through further education and training measures. Beneath the particular context of the “Factories of the Future”, the state actors of the Triple Helix are supplemented by the expertise and technological competence of the national business association “Sirris”, which is active throughout Belgium, and also in West Flanders, and which supports companies in their innovation processes through advice and the provision of demonstration laboratories, testing, and development facilities (Sirris 2020 b, c, d). In the course of the past few years, it has been possible to establish numerous new cooperation relationships between companies, develop new SME-focused test facilities, and involve over 3,000 companies in funding projects (POM West-Vlaanderen 2019c). As in Bremen, digitization and various applications of ICT technology as a cross-sectional technology are of particular importance, but the activities of the “Factories of the Future” and the “Academies of the Future” are also developing new focal points and topics for innovation. This applies, for example, to the "Blue Accelerator" project, which is part of the regional inno-

vation cluster "Blue Energy". Due to the coastal location and numerous associated economic activities, blue energy is considered a growth sector in West Flanders and a field of competence and innovation of regional companies and research (POM West-Vlaanderen 2019b, 2020a). The project addresses the needs of companies and scientific institutions in the field of blue energy, especially in the field of offshore wind energy as well as wave and tidal energy (Renewable Energy Base Oostende 2019). The central element is a maritime innovation and development platform approximately 500 m off the coast of Ostend, which allows tests and demonstrations in a real marine environment (POM West-Vlaanderen 2019b, 2020a, VITO NV 2020). In Bremen, as well as in West Flanders, smart specialization implements the matrix structure of new cross-sectional technologies and existing economic clusters in such a way that, in addition to the targeted promotion of corresponding R&D projects, places and facilities are created that facilitate networking between regional economic and scientific actors and support and encourage their collaboration.

Making regional economic structures more efficient and competitive in this way is also a central goal in the other two case study regions. However, the ambitions in the regions of Groningen and Pirkanmaa go beyond that, in a way that the interactions regarding smart specialization not only focus on the economy through innovation strategies, but also take into account their social, urban and regional environment.

4.3 Tampere: „Smart but not Specialized“

In the Tampere/Pirkanmaa region, smart specialization is interpreted in a self-confident and idiosyncratic manner: Here the desired “specialization” is explicitely rejected because an “intelligent” innovation strategy should encompass all areas of life and regional conditions. The “Smart Tampere” program thus combines urban and public interests and objectives with those of business and cooperation partners and with the requirements and demands of citizens and stakeholders who are intensively involved in the urban, social and economic development processes leading to a Smart City.

The concepts for innovative and collaborative development are based on broad and open access to data and information as well as transparent development and allocation processes and on a participatory approach. As part of a “co-creation” concept, companies use agile experiments in flexible processes to develop ideas and solutions for problems that the city brings to them as problems (Business Tampere/City of Tampere 2020b). Hack-a-thons are carried out, of which some are directly linked to public procurement. Open specifications and definitions are used in the procurement processes and transparency and open access to information are guaranteed (Business Tampere/City of Tampere 2020e). For example, the development of smart city solutions for the city of Tampere is supported by the provision of open data including geodata and statistics (Business Tampere/City of Tampere 2020d). The program is financed by public funds, EU programs and investments by the companies involved (Business Tampere/City of Tampere 2019b), including the interreg-financed Area 21 program (https://smarttampere.fi/en/about-smart -tampere / sustainable-tampere-2030 / area21 /), the 6Aika Energy Wise Cities (EKAT) project (https://smarttampere.fi/en/about-smart-tampere/sustainable-tampere-2030/ekat/) and the Horizon 2020 project STARDUST (https://smarttampere.fi/en/about-smart-tampere/sustainable-tampere-2030/stardust/).

In addition to the pronounced focus on the use of ICT technologies in all areas of societal requirements, the regional innovation strategy defines the development of biomedical systems and their application in “health facilities of the future” as a further regional innovation focus. In this area, too, current funding policies and innovation strategies are based on a development that had already made the transition from traditional cluster funding to cross-sectoral, knowledge-based approaches in the 1990s. This process was and still is supported by the strong potential that has developed in the regional industrial structure through early specialization in ICT developments for advanced production processes, automation and internet of things (IoT) applications. Digital technologies are developed and used here for a wide range of cross-sectional functions from artificial intelligence and analytics to connectivity to security and protection functions.

4.4 Groningen: Living Laboratory and Cross-sectoral Technologies

While the Finnish case shows a well-developed real laboratory approach as a regional innovation strategy, the Dutch region of Groningen is pursuing an innovation strategy with the vision of the “Living Laboratory Region”, which valorises regional strengths by developing intersectoral and interregional cooperation networks. Beyond this, cross-sectoral technologies are promoted and new connections and cross-over-relations are created between clusters and economic sectors (SNN Northern Netherland Provinces 2013: 13-16).

The established innovation ecosystems in the Groningen region, for example, the Drachten innovation cluster or the Roden Health Hub, involve spatially concentrated research and development facilities that are shared, used, and operated by commercial enterprises, scientific institutions and the public sector (Foorthuis et al., 2020). The thereby intended transition from rather unsystematic and diffuse networks to collaborative innovation ecosystems does not least require a new culture of cooperation. Regarding the organizational form of these innovation infrastructures, special attention is therefore paid to the degree of cooperation and openness, for example the granting of low-threshold access to internal development processes between the actors involved – which could be realized despite the fact that some of them are market competitors.

Within the Drachten innovation cluster, which was launched in 2013, a total of 20 high-tech companies and knowledge institutions with around 4,000 employees cooperate. Diverse joint research and development activities are facilitated by the fact that the partners involved within the cluster can make use of shared infrastructures and/or provide their own facilities for mutual use. The technology fields and technological challenges addressed are 3D printing, remote sensing and big data, intelligent image processing, robotics and sustainable drive technologies. More than 100 million euros in annual R&D expenditures result in more than 50 new product launches per year. At the same time, the success of the concept conveys a positive image of the region as a high-tech location, promotes the securing and recruitment of qualified young professionals and supports further company settlements as well as spin-offs and start-ups. The special emphasis on intensive cooperation and shared infrastructures is underlined not least by extensive self-administration and bottom-up governance of the entire innovation cluster as well as joint public relations activities from the regional to the international level (Innovationscluster Drachten 2018; 2020a, 2020b).

A similar innovation approach is pursued in the Roden Health Hub, which is operated as a public-private partnership under the direction of the Hanzehogeschool Groningen. Cooperation, knowledge exchange and joint development between companies, knowledge institutions and government agencies are specifically aimed at innovative solutions in the areas of medical technology and healthy aging (Health Hub Roden 2018). The Health Hub Roden was created after a large medical company left the region, whose remaining employees and their know-how were integrated into the Health Hub Roden (Health Hub Roden 2020a). The spatial concentration of research and development infrastructures, including laboratories and fab labs, technical equipment as well as seminar, conference and office rooms enables formal and informal networking and provides the partners involved with support and contacts, for example with regard to financing and patenting (Health Hub Roden 2018, 2020a). Services and offers that are provided or mediated in the Health Hub include research activities between, for and in cooperation with partner companies, promotion of start-ups, innovation advice and support, open innovation, seminars, workshops and network meetings, company-related and professional training and further education, support with internationalization, joint market analysis, joint trade fair appearances or partner search. Specialized in the technological field of health and medicine, material infrastructures are combined in a variety of ways with support and networking offers for companies and research institutions and, in the course of projects located there, a variety of possibilities for direct involvement of students are created. Practical innovation projects that are carried out on site by participating companies, students and researchers include, for example, an R&D partnership to improve ambulance care in Groningen through technical innovations within the ambulance, or an international research project on the effects of plant dyes (Health Hub Roden 2018, 2020a).

The central characteristic of the innovation strategy in the Groningen region is the expansion or intensification of traditional cluster approaches through extensive cooperation and networking between the partners in the Triple Helix. From granting low-threshold access to external organization, to internal development processes, self-managed use of shared infrastructures, to the involvement of students in research and development, the practices developed here are aimed to replace competition and unsystematic network formation by coordinated cooperation. The networking and broadcasting effects of spatial focal points such as the Health Hub Roden or the Drachten innovation cluster are intended to contribute to realizing the vision of the “Living Laboratory Region”.

5. Mission-oriented Strategies and their Realization

In all four case study regions, over the past decades innovation strategies have therefore been established which clearly differ from previous cluster strategies primarily in two characteristics: The regional innovation performance is to be achieved through intensive involvement of economic, scientific and political actors in the 'Triple Helix', supported through tailored, closely interlinked, cooperative structures and infrastructures. Thereby, a major concern is to promote cross-sectional technologies, the use of which can be expected to significantly increase the performance and competitiveness of the existing economic clusters. This two-dimensional matrix structure is most clearly expressed in the fact that various applica-

tions of ICT technologies in all regions are an important focus of funding strategies. In Bremen and the Tampere/Pirkanmaa region, strong capacities for the development of this cross-sectional technology have been developed. In addition, there are clear efforts in Groningen, West Flanders and Bremen to promote future-oriented developments in energy generation and supply (hydrogen use; Blue Energy). In Bremen, there is another strong focus of public and private R&D funding on materials research – a research field which also holds high innovative potential for many areas of production.

However, the development of a complex, multi-dimensional innovation policy often remains tied to a functional logic of increasing the performance and competitiveness of the existing regional economic structures. The innovation strategies and policies based on this are increasingly being confronted with social debates on the social returns and societal benefits, especially of public investments promoting innovation. As a result, in addition to the regional economic potential and the catalyzing function of key enabling technologies, the third dimension of societal challenges is becoming increasingly important in regional innovation processes. The respective topics and contents, as well as process design, though, differ significantly.

Major and current social challenges are explicitly taken into account in the innovation program of the Groningen region. Here, smart specialization includes innovation strategies that address solutions in four explicitly defined social fields of action: Increased efforts are made in the field of health research and development to respond to the problems of demographic change and the growing demands on health care for an ageing population. Thus, a focus is laid on technical as well as social innovations, such as promoted in the Health Hub Roden, but also in other places. Another focus of the regional innovation strategy lies in the development of more efficient and sustainable methods of energy generation and supply as well as securing productivity in agriculture and in food supply. Likewise, with a view on potential supply problems, the goal of a safe and clean water supply is pursued (SNN Northern Netherland Provinces 2013). With these programmatic specifications, the innovation strategy of the Groningen region is oriented towards a region-specific selection of sustainability goals.

Less pronounced and rather implicit, the innovation strategies in West Flanders and Bremen aim to overcome major societal challenges. As in the Groningen region, special innovation efforts are being undertaken in these two case study regions to develop efficient and sustainable energy generation and supply, with the coastal location and its specific geographical and climatic conditions playing an important role. Last but not least, climate change and sustainability goals are also important motives for the focus of innovation that is set in West Flanders in the development of agricultural and food technologies, and in Bremen in the research and development of new materials. The latter primarily concerns the alignment of innovation processes with lightweight construction materials, which can make important contributions to saving raw materials and energy in many economic sectors. Similar motives can also be found in both regions in the areas of innovation in the logistics sector. Nonetheless, the topics and contents of the Regional Smart Specialization Strategies in those two regions seemed not to be explicitly aware of what is called ‘mission oriented’ yet. But, for the case of Bremen there has been a change in a new regional innovation strategy which has been developed in 2020/21 and which addresses societal challenges with each of the innovation areas and goals defined for the funding period until 2030 (SWAE 2021: 4).

Both the definition of the fields of action as well as the governance of the innovation infrastructures underline the special importance that is attached to the cooperation of partners within the framework of the "Triple Helix" in the Groningen region. This also applies to the West Flanders region, which also places a strong emphasis on promoting and strengthening cooperation between those actors who are professionally involved in the production and use of economically relevant knowledge. In contrast, low-threshold access to innovation processes for other social groups and actors is less pronounced. The R&D activities in hubs, innovation clusters or factories and academies of the future are primarily focused on promoting creative and trusting cooperation between the partners involved, between whom open data access and open innovation processes are organized. Here, young people from universities, research institutes, and others, are intentionally involved, but these processes are hardly accessible to other stakeholders and the general public. For example, experimental practices in real laboratories and in participation of diverse population groups are usually not part of the repertoire of regional innovation strategies.

As highlighted above (see section 4.3), the Finnish case study differs significantly from the other regions. Also, here the mission-orientation appears to be more pronounced and more integrated. The content of the regional innovation strategy explicitly aims at the general development goals of the region and implements them in a “Smart Tampere” development program. The strong focus on all types of ICT developments and applications runs like a red thread through the defined innovation priorities. For the most part, these focal points are explicitly oriented towards socially defined goals and challenges, with social, health and sustainability goals being addressed in particular: In the “Smart City Solutions” field of action, inclusive digital solutions are to be developed that enable improved access to education as well as more environmentally friendly mobility or personal security. Similar to Groningen, health services and medical technology developments represent a second focus of innovation, in which, on the one hand, direct health and treatment methodologies and, on the other hand, sensor technology, prosthetics and other digital applications are promoted. The challenges of sustainable development are to be met at the city and regional level with innovations in the field of circular economy. The R&D activities range from the sharing economy and efficient energy use to the recycling of materials, in which efficiency-increasing innovations are also expected primarily through the use of ICT technologies. Last but not least, a clearly business-oriented field of activity includes the development of advanced production techniques through ICT technology.

Urban space and urban infrastructures are used in Tampere as a living laboratory for smart city innovations, the development and implementation of which is based on intensive cooperation between companies, research institutions, other regional organizations and residents (Business Tampere/City of Tampere 2019b, 2020a). So far, 26 joint experiments have already been carried out, eleven of which were an integral part of city operations (Business Tampere/City of Tampere 2020a); for example, a pilot project to optimize the efficiency of the street lighting network (Business Tampere/City of Tampere 2019b, 2020c). The new district of Hiedanranta, e.g., works as a development platform for experiments and projects regarding the use of intelligent technologies for sustainability and circular economy (Business Tampere/City of Tampere 2020f). At the same time, the district serves as a test site for drone technology (Business Tampere/City of Tampere 2019b). In addition, a 5G test network (in cooperation between the City of Tampere and Nokia Oyj) and a LoRaWan network are offered for free to industry and research in the district and campus of Hervanta in order to de-

velop smart products and services, including automated vehicles and Test robot technology (Business Tampere/City of Tampere 2019b, 2020g, h). Another pilot project is developing solutions for an intelligent lighting concept for the city of Tampere (Business Tampere/City of Tampere 2019b, 2020d). A utility company was given the opportunity to test a newly developed intelligent remote pump monitoring system within the municipal water pumping stations (Business Tampere/City of Tampere (2019a). Further test platforms are provided for the wireless collection of data on mobility, parking, waste management and other services (Business Tampere/City of Tampere (2019b).

The presented case examples clearly show that Tampere is actually pursuing a multidimensional innovation strategy that not only integrates the institutional actors of the 'Triple Helix' but, depending on the specific topic, also many other social and interest groups, in short: the public. In this respect, this practice can be characterized as the implementation of the 'Quadruple Helix' (Roman et al. 2020; Höglund & Linton, 2018). This involvement of civil society or the public in innovation processes can support the development of better, every day and more practical solutions to problems, as well as it can increase the acceptance of far-reaching changes in people's living conditions. This is even more important as innovation practices in Tampere not only aim at technical or economic innovations that become relevant in distant markets – in many cases, they actually affect the living environment and everyday routines of the residents in the city or district. To the extent that such real-life laboratory situations are spreading successfully, learning effects in the broader population become more likely. This, on the one hand, can change the relationship of society to technology and innovation. On the other hand, through these processes public participation within such innovation processes may become a matter of course.

6. Towards a Multi-dimensional Innovation Strategy?

In two of the regions considered – West Flanders and the Federal State of Bremen – up to now two-dimensional innovation strategies have prevailed, which are primarily based on regional smart specialization and the promotion of key technologies. The regions of Groningen and Tampere, on the other hand, already programmatically apply all three of the described approaches multi-dimensionally. Hereby, the Tampere region can be considered a pioneer within Europe regarding the level of implementation.

In many European regions – besides the Federal State of Bremen also in the regions Tampere and Groningen – regional innovation strategies are being reformulated and regional innovation policy is being realigned. In order to address global societal goals and challenges – in particular climate change and its consequences as well as demographic change – a multidimensional innovation policy spanning sectors and technologies, a close interlinking of technological and societal innovation objectives and strategies, seems inevitable. All regions receiving European funding for innovation strategies are currently in the process of updating their regional funding programmes and adapting them to the newly formulated innovation agenda of the EU for more complex regional innovation strategies. However, the forthcoming years will show whether the innovation approaches of the European regions also meet the existing demands of society. Interregional learning as it is envisaged within the Interreg programme, as well as supra-regional comparisons of the respective approaches and the im-

plementation of regional innovation strategies in the European regions, could offer meaningful support for measures towards multi-dimensional innovation policies.

7. References

Asheim, B. T., Isaksen, A., & Trippl, M. (2019). *Advanced introduction to regional innovation systems*. Edward Elgar: Cheltenham.

Balland, P.-A., & Boschma, R. (2021). Complementary interregional linkages and smart specialisation: An empirical study on European regions. *Regional Studies*, 1-12. doi:10.1080/00343404.2020.1861240.

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

Business Tampere/City of Tampere (2019a): Agile Experiments deliver Results in Tampere. https://smarttampere.fi/en/agile-experiments-deliver-results-in-tampere/ (last access 07.05.2020).

Business Tampere/City of Tampere (2019b): Business Tampere and Smart Tampere. Präsentation im Rahmen des TraCS3-Projektpartnertreffens am 01.10.2019, Tampere, Finnland.

Business Tampere/City of Tampere (2020a): About Smart Tampere. https://smarttampere.fi/en/about-smart-tampere/ (last access 07.05.2020).

Business Tampere/City of Tampere (2020b): Co Creation: Agile Experiments. https://smarttampere.fi/en/develop/agile-experiments/ (last access 07.05.2020).

Business Tampere/City of Tampere (2020c): Co-creation: Hackathons. https://smarttampere.fi/en/develop/hackathons/ (last access 07.05.2020).

Business Tampere/City of Tampere (2020d): Develop: New Business and improved Services. https://smarttampere.fi/en/develop/ (last access 07.05.2020).

Business Tampere/City of Tampere (2020e): Develop: Open Definition. https://smarttampere.fi/en/develop/open-definition/ (last access 07.05.2020).

Business Tampere/City of Tampere (2020f): Platforms: Future City District. https://smarttampere.fi/en/develop/future-city-district/ (last access 07.05.2020).

Business Tampere/City of Tampere (2020g): Platforms: LoRaWAN. https://smarttampere.fi/en/develop/lorawan/ (last access 07.05.2020).

Business Tampere/City of Tampere (2020h): Platforms: Towards 5G network. https://smarttampere.fi/en/develop/towards-5g/ (last access 07.05.2020).

European Commission. (2012). A European strategy for Key Enabling Technologies—A bridge to growth and jobs. *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. COM; 341, 341*.

European Commission. (2014). *National/regional innovation strategies for smart specialisation. Cohesion Policy fact sheet*. Retrieved from Brussels:

http://ec.europa.eu/regional_policy/sources/docgener/informat/2014/smart_specialisation_en.pdf.

European Commission. (2015a). *Analysis of Smart Specialisation Strategies in Nanotechnologies, Advanced Manufacturing and Process Technologies. Final report*. Retrieved from Luxembourg: http://ec.europa.eu/research/evaluations/pdf/archive/other_reports_studies_and_documents/analysis_of_smart_specialisation_strategies_in_nanotechnologies_advanced_manufacturing_and_process_technologies.pdf.

European Commission. (2015b). *KETs: Time to act. High-Level Expert Group on Key Enabling Technologies.* . Retrieved from https://ec.europa.eu/docsroom/documents/11082/attachments/1/translations/en/renditions/native.

European Commission. (2021). Missions in Horizon Europe.What missions are, the areas they will focus on, studies and reports that led to this approach, how to get involved and relevant events. Retrieved from https://ec.europa.eu/info/horizon-europe/missions-horizon-europe_en.

Evangelista, R., Meliciani, V., & Vezzani, A. (2018). Specialisation in key enabling technologies and regional growth in Europe. *Economics of Innovation and New Technology, 27*(3), 273-289. doi:10.1080/10438599.2017.1338392.

Foorthuis, W., Manickam, A., van Berkel, K. & Lutz, S. (2020). Engaged. Naar een krachtige regio. Groningen.

Foray, D. (2015). *mart Specialisation. Opportunities and Challenges for Regional Innovation Policy*. Abingdon (UK): Routldege.

Foray, D. (2016). On the policy space of smart specialization strategies. *European Planning Studies, 24*(8), 1428-1437. doi:10.1080/09654313.2016.1176126.

Foray, D. (2017a). The concept of the ‘entrepreneurial discovery process’. In D. Kyriakou, M. P. Martínez, I. Periáñez-Forte, & A. Rainoldi (Eds.), *Governing Smart Specialisation* (pp. 29-43). New York: Routledge.

Foray, D. (2017b). The economic fundamentals of smart specialization strategies. In S. Radosevic, A. Curaj, R. Gheorghiu, L. Andreescu, & I. Wade (Eds.), *Advances in the theory and practice of smart specialization* (pp. 37-50): Elsevier.

Foray, D. (2018). Smart specialization strategies as a case of mission-oriented policy—a case study on the emergence of new policy practices. *Industrial and Corporate Change, 27*(5), 817-832. doi:10.1093/icc/dty030.

Foray, D. (2019). In response to ‘Six critical questions about smart spezialisation’. *European Planning Studies, 27*(10), 2066-2078. doi:10.1080/09654313.2019.1664037.

Fortmann, F., & Nischwitz, G. (2018). Wissensintensive Dienstleistungen in Bremen. Herausforderung und Chance für die Stadt- und Strukturentwicklung. Reihe Arbeit und Wirtschaft in Bremen H. 26, Bremen.

Georghiou, L., Tataj, D., Celis, J., Giannini, S., Pavalkis, D., Verganti, R., & Renda, A. (2018). Mission-oriented research and innovation policy: a RISE perspective. In: European Commission.

GreenBridge (2020): Factories for the Future (FVT). http://www.greenbridge.be/en/factories-future-fvt (last access 06.05.2020).

Health Hub Roden (2020a): Get to know Health Hub Roden. https://healthhub-roden.nl/about-us (last access 04.05.2020).

Health Hub Roden (2018): Met deze projecten creëren we een gezonde toekomst. https://healthhub-roden.nl/projecten (last access 04.05.2020).

Höglund, L., & Linton, G. (2018). Smart specialization in regional innovation systems: a quadruple helix perspective. *R&D Management, 48*(1), 60-72. doi:10.1111/radm.12306

Innovationcluster Drachten (2018): Hidden High Tech Diamonds. Presentation at TraCS3-Kick-Off-Meeting on 13.09.2018, Groningen, Niederlande.

Innovationcluster Drachten (2020a): Innovationcluster Drachten High Tech Systems. https://en.icdrachten.nl/ (last access 04.05.2020).

Innovationcluster Drachten (2020b): Innovation Cluster Drachten: Our Cluster. https://en.icdrachten.nl/ (last access 04.05.2020).

Innovationsplattform ECOMAT e.V. (2021) Das ECOMAT - Hier beginnt die Zukunft. https://ecomat-bremen.de/ueber-uns/ (last access 14.02.2022).

Kroll, H. (2015). Efforts to Implement Smart Specialization in Practice—Leading Unlike Horses to the Water. *European Planning Studies, 23*(10), 2079-2098. doi:10.1080/09654313.2014.1003036.

Kropp, P. (2009): Die Abgrenzung der Arbeitsmarktregion Bremen. IAB-Regional. Berichte und Analysen aus dem Regionalen Forschungsnetz. IAB Niedersachsen-Bremen, 03/2009), Nürnberg.

Mazzucato, M. (2016). From market fixing to market-creating: a new framework for innovation policy. *Industry and Innovation, 23*(2), 140-156. doi:10.1080/13662716.2016.1146124.

Mazzucato, M. (2018). Mission-oriented innovation policies: challenges and opportunities. *Industrial and Corporate Change, 27*(5), 803-815. doi:10.1093/icc/dty034

Mazzucato, M. (2021). *The Mission-Driven Economy*. Cambridge, MA: MIT Press.

McCann, P., & Ortega-Argilés, R. (2015). Smart Specialization, Regional Growth and Applications to European Union Cohesion Policy. *Regional Studies, 49*(8), 1291-1302. doi:10.1080/00343404.2013.799769.

Montresor, S., & Quatraro, F. (2017). Regional Branching and Key Enabling Technologies: Evidence from European Patent Data. *Economic Geography, 93*(4), 367-396. doi:10.1080/00130095.2017.1326810.

Mossig, I., Fornahl, D. & Schröder, H. (2010): Heureka oder Phoenix aus der Asche: Der Entwicklungspfad der Offshore-Windenergie-Industrie in Nordwestdeutschland. In: Zeitschrift für Wirtschaftsgeographie 54 (3/4): 222-237.

Normann, R., Strickert, S., & Knudsen, J. P. (2020). The Agder region: an innovation policy case study. In *Regions and Innovation Policies in Europe* (pp. 252–270): Edward Elgar Publishing.

POM West-Vlaanderen (2019a): Background Program West Deal: RIS3 for West Flanders. https://s3platform.jrc.ec.europa.eu/documents/20182/267084/Background_Programme+West+Deal+%E2%80%93+RIS3+for+West-Flanders.pdf/45650fa7-851d-42fb-ae1a-da9a196e05b2 (last access 23.11.2019).

POM West-Vlaanderen (2019b): Blue Energy Cluster. Präsentation at TraCS3-Partnermeeting on 13.02.2019, Brügge, Belgien.

POM West-Vlaanderen (2019c): West Deal: The Economic Transformation of West Flanders. Presentation at TraCS3-Partnermeeting on 01.10.2019, Tampere, Finnland.

POM West-Vlaanderen (2020a): Blue Accelerator. http://pomwvl.be/blue-accelerator (last access 06.05.2020.

POM West-Vlaanderen (2020b): Logistics Hub: Gateway to Europe. https://www.investinwestflanders.org/logistics-hub (last access 04.05.2020).

POM West-Vlaanderen (2020c): Over de Fabrieken. http://www.fabriekenvoordetoekomst.be/over-de-fabrieken (last access 06.05.2020).

Renewable Energy Base Oostende (2019): Blue Accelerator Testplatform has been installed. https://www.reboostende.be/news/blue-accelerator-testplatform-has-been-installed (last access 06.05.2020).

Roman, M., Varga, H., Cvijanovic, V., & Reid, A. (2020). Quadruple helix models for sustainable regional innovation: Engaging and facilitating civil society participation. *Economies, 8*(2), 48. Retrieved from https://www.mdpi.com/2227-7099/8/2/48.

Ruhrmann, H., Fritsch, M., & Leydesdorff, L. (2021). Synergy and policy-making in German innovation systems: Smart Specialisation Strategies at national, regional, local levels? *Regional Studies*, 1-12. doi:10.1080/00343404.2021.1872780.

Sarkar, S., Bilau, J. J., & Basílio, M. (2021). Do anchor infrastructures matter for regional Smart Specialisation Strategy? The case of Alentejo. *Regional Studies, 55*(3), 453-464. doi:10.1080/00343404.2020.1722804.

Sirris (2020a): Factory 4.0. https://www.sirris.be/factory-40 (last access 07.05.2020).

Sirris (2020b): Our Expertise. https://www.sirris.be/expertise (last access 07.05.2020).

Sirris (2020c): Our Services. https://www.sirris.be/services (last access 07.05.2020).

Sirris (2020d): Who are we? https://www.sirris.be/about (last access 07.05.2020).

SNN Northern Netherland Provinces (2013): Research and Innovation Strategy for Smart Specialization (RIS3): Northern Netherlands. https://www.snn.nl/sites/default/files/2018-11/Northern%20Netherlands%27%20RIS3.pdf (last access 29.04.2020).

Sörvik, J., & Rakhmatullin, R. (2013). *Preliminary report on KETs priorities declared by regions in the context of their work on Research and Innovation Strategies for Smart Specialisation (RIS3)* (9279330292). Retrieved from Luxembourg: http://publications.jrc.ec.europa.eu/repository/bitstream/JRC84659/preliminary%20report%20on%20kets_js.pdf.

SWAE (Die Senatorin für Wirtschaft, Arbeit und Europa, Bremen) (2020). Wirtschaftsstandort Bremen. Bremen und Bremerhaven – Home of Innovation. https://www.bremen-innovativ.de/industrie/ (last access 14.02.2022).

SWAE (Die Senatorin für Wirtschaft, Arbeit und Europa, Bremen) (2021). Schlüssel zu Innovationen - Innovationsstrategie Land Bremen 2030. https://www.bremen-innovativ.de/innovationsstrategie-2030/ (last access 14.02.2022).

Terstriep, J., Rehfeld, D., & Kleverbeck, M. (2020). Favourable social innovation ecosystem(s)? – An explorative approach. *European Planning Studies, 28*(5), 881-905. doi:10.1080/09654313.2019.1708868.

Tödtling, F., & Trippl, M. (2005). One size fits all? Towards a differentiated regional innovation policy approach. *Research Policy, 34*(8), 1203-1219. doi:10.1016/j.respol.2005.01.018.

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

Verhoef, P., Broekhuizen,T., Bart, Y., Bhattacharya, A., Qi Dong, J., Fabian, N., & Haenlein, M. (2021). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research* 122:889-901.

VITO NV (2020). Blue Accelerator. https://vito.be/en/blue-accelerator (last access 06.05.2020).

Wanzenböck, I., Neuländtner, M., & Scherngell, T. (2020). Impacts of EU funded R&D networks on the generation of key enabling technologies: Empirical evidence from a regional perspective. *Papers in Regional Science, 99*(1), 3-24. doi:10.1111/pirs.12473.

Wauschkuhn, M. (1998) Strukturwandel und standortpolitischer Handlungsbedarf im Land Bremen. Bremen.

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