Smart Specialization as an innovation-driven strategy for economic diversification: Examples from Scandinavian regions

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Keywords: Smart specialisation; policy; innovation; economic diversification; entrepreneurial discovery; knowledge bases; new path development; competitive advantage; regions

JEL: O18; O30; O38; P48; R10; R58

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Abstract

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1 Introduction: Smart Specialization – presentation and clarification

Smart Specialization is probably the single largest attempt ever of an orchestrated, supranational innovation strategy to boost economic growth through economic diversification. It has been launched by the European Commission and is a strategic approach to an industrial policy for national and regional economic development, pursuing a high road strategy of innovation-based competition as the sustainable alternative to a downward spiral of cost competition (i.e. the low road strategy), which dominates in the majority of regions in Southern and Eastern Europe (Milberg and Houston, 2005). As such, smart specialization represents a new industrial policy that aims to promote new path development and economic diversification, going beyond 'just' a regional innovation strategy more narrowly defined (Radosevic, forthcoming). Furthermore, for the first time in the EU, smart specialization provides a policy framework or platform for promoting and implementing a broad-based innovation policy. This is of critical and strategic importance given the failure of the linear, research and development (R&D)-based innovation policy in the EU following the 2000 Lisbon declaration that set a goal of allocating 3% of GDP to R&D. The rationale was that this should transform the EU into the most competitive region in the world, but the outcome was very different. Thus, it is of great importance that smart specialization is fully and correctly understood, not the least because the choice of key words (i.e., 'specialization' and 'entrepreneurial discovery') may lead policy makers and practitioners to make false interpretations and draw wrong conclusions (Asheim, 2014).

Smart specialization is not about 'specialization' as known from previous regional development strategies, i.e., a Porter-like cluster strategy, but about *diversified* specialization. What this means is that countries should identify areas - or 'domains' as the smart specialization literature prefers to call it - of existing and/or potential competitive advantage, where they can specialize in a different way compared to other countries and regions. A smart specialization strategy implies maximising the knowledge-based development potential of any country or region, with a strong or weak R&I system or with a high-tech or low-tech industrial structure. Countries and regions should diversify their economies primarily based on existing strengths and capabilities by moving into related or unrelated sectors.

'Smart' in the smart specialization approach refers to the way these domains of competitive advantage should be identified, which is through what is called 'entrepreneurial discovery'. However, the emphasis here is not on the role of traditional entrepreneurs, resulting in a policy focus only on firm formation as an individual entrepreneurial project. As underlined in the writings on smart specialization, 'entrepreneurial' should be understood broadly to encompass all actors (including individual entrepreneurs), organizations (including firms and universities through intrapreneurship, knowledge-based entrepreneurship and spin-offs) and agencies (technology transfer offices and public development agencies) that have the capacity to discover domains for securing existing and future competitiveness. Perhaps Van der Ven's (1999) description of 'the entrepreneur' as one type of leadership along the 'innovation journey' comes close to what is meant by entrepreneurial discovery in the smart specialization approach. He talks about the entrepreneur as a role likely to be played by a core network of interacting actors from the national innovation system, comprising a limited number of firms, universities, public research organizations and government institutions (Van der Ven, 1999), which should also include, especially in small countries, non-local actors in cooperating transnationally and inter-regionally. Such a broad interpretation of 'entrepreneurial discovery' avoids the pitfall of ignoring the systemic nature of innovation. The systems approach to innovation policies also highlights the role of government in driving innovation, as well as the balance between exploration and exploitation (Asheim and Gertler, 2005; Asheim et al., 2011a; Asheim et al., forthcoming).

In the following section, the theoretical framework of the smart specialization approach for economic diversification is laid out, emphasizing how new path development can be pursued within the framework of a broad-based innovation policy. This builds on the *knowledge base* approach, which was key to the Constructing Regional Advantage (CRA) strategy (Asheim et al., 2006; Asheim et al., 2011b). The knowledge based approach argues that economic diversification and innovation-based competition can be achieved in all industries or sectors yet in different ways, depending on industry-specific modes of innovation and knowledge bases. In section three, we illustrate how smart specialization strategies have been designed and implemented in three Scandinavian regions, using the theoretical framework to inform the analysis. Section four offers some comparative conclusions discussing whether the strategies will result in diversified specialization, and whether one can corroborate the

relevance of the theoretical framework to guiding the design and implementation of a smart specialization strategy for economic diversification.

2 New path development for economic diversification

There is strong agreement that innovation is the key factor promoting economic diversification and increased competitiveness in a globalizing knowledge economy. Competition based on innovation implies choosing the high road strategy, which is the only sustainable alternative for developed, high-cost regional and national economies, as well as for the future of developing economies (Milberg and Houston, 2005). For a long time, such a strategy was considered the same as promoting high-tech, R&D-intensive industries in accordance with the linear view of innovation. Increasingly, researchers and policy makers have realized that a broader and more comprehensive view on innovation as interactive learning has to be applied to retain and develop competitiveness in the context of heterogeneous countries and regions of Europe at very different stages of economic development. Thus, it is fundamentally important to avoid 'one size fits all' policies, given the diversity of regional economies and innovation systems (Tödtling and Trippl, 2005). All drivers of innovation – both supply- and demand-side (user, market, demand (social innovation)), as well as employee-driven innovation – have to be integrated into an overall approach to innovation policy, as R&D intensity is not the same as innovation capacity. Knowledge is a far broader concept than R&D. This requires a differentiated knowledge base approach, distinguishing between analytical, synthetic, and symbolic knowledge (Asheim and Gertler, 2005; Asheim, 2007); as well as a broad view on innovation including both R&D (Science, Technology, Innovation or STI) based and experience-based (Doing, Using, Interacting or DUI) innovation (Lorenz and Lundvall, 2006).

Knowledge processes have become increasingly complex in the globalizing knowledge economy. The binary view of knowledge as either codified (i.e., knowledge that has been stored in certain media and can be readily transmitted to others) or tacit (i.e., knowledge that is difficult to transfer to another person by means of writing down or verbalising it) becomes too simplistic to accommodate this increased complexity and to provide an adequate understanding of knowledge creation, learning, and innovation. Thus, there is a

need to go beyond this simple dichotomy. One way of doing this is to distinguish between 'synthetic', 'analytical', and 'symbolic' types of knowledge bases, which partly transcends the tacit-codified dichotomy by arguing that the two forms of knowledge always co-exist, but in different combinations; and by emphasizing that, while all types of economic activity can be innovative, the modes of innovation differ, transcending the high tech-low tech dichotomy (Asheim, 2007). As this threefold distinction refers to ideal-types, most activities are in practice comprised of more than one knowledge base. However, one knowledge base will represent the critical knowledge input which the knowledge creation and innovation processes cannot do without. New combinations of knowledge bases seem to become increasingly important as sources of new path development.

An analytical knowledge base refers to economic activities where scientific knowledge relying on formal models and codification is highly important. Examples are biotechnology and nanotechnology. University-industry links and the respective networks are, in this case, more important than in the other types of knowledge bases. Knowledge inputs and outputs are more often codified than in the other types of knowledge bases. Consequently, the workforce more often needs some research experience or university training. Knowledge creation in the form of scientific discoveries and (generic) technological inventions is more important than in the other knowledge types, and, thus, innovations are science-driven. Often, inventions lead to patents and licensing activities. Knowledge is applied in the form of new products or processes, and there are more radical innovations than in the other knowledge types. An important route of knowledge application is new firms and spin-off companies which are formed on the basis of radically new inventions or products.

A synthetic knowledge base refers to economic activities where innovation takes place mainly through the application or novel combinations of existing knowledge. Often, this occurs in response to the need to solve specific problems when customers and suppliers interact. Thus, innovations are user, market, and demand driven. Industry examples include plant engineering, specialized advanced industrial machinery, and shipbuilding. University-industry links are also important for this knowledge base, but more in the field of applied R&D than in basic research. Tacit knowledge is more important than in the analytical type, in particular because knowledge often results from experience gained at the workplace, and through learning by doing, using, and interacting. Compared to the analytical knowledge

base, more concrete know-how, craft, and practical skills are required. They are provided by technical universities, polytechnics, or by on-the-job training. Overall, this leads to a rather incremental way of innovation, dominated by the modification of existing products and processes.

Symbolic knowledge is related to the creation of meaning and desire as well as aesthetic attributes of products, such as designs, images, and symbols, and to their economic use. The increasing significance of this intangible type of knowledge has been noted by OECD (2013), which mentions, for example, design as a new source of growth that is part of firms' knowledge-based capital. Other examples include the dynamic development of cultural production such as media (film making, publishing, and music), advertising, design, brands and fashion. In cultural production, the input is aesthetic rather than cognitive. This demands rather specialized capabilities in symbol interpretation and creativity. This type of knowledge is often narrowly tied to a deep understanding of the habits and norms and the 'everyday culture' of specific social groupings. Due to the cultural embeddedness of interpretations, this type of knowledge base is characterized by a distinctive tacit component and is usually highly context-specific. The acquisition of essential creative, imaginative and interpretive skills is less tied to formal qualifications and university degrees than to practice in various stages of the creative process. However, this knowledge base has also become increasingly knowledge intensive.

When designing and implementing a 'smart specialization-informed innovation strategy' for industrial and economic diversification, it is necessary to go beyond considering how to secure 'path extension', which has been the main goal of traditional innovation policies. Path extension mainly results in incremental product and process innovations in existing industries and technological trajectories. While this can secure competitiveness and growth in the short and medium term, in the long-term these industries run the risk of path exhaustion i.e. depleting the capacity for renewal. Path renewal takes place when existing local firms move into different but related industries through regional branching or unrelated knowledge base combinations (Asheim et al., 2011b). New path creation represents the most wide-ranging change in a regional economy. It includes the establishment of new firms in novel sectors, or firms that introduce new products, processes and/or business models in the regional economy. Path creation is most often R&D driven

and can either be the result of knowledge-based entrepreneurial discovery (university spin-offs through commercialization of research results) or proactive national innovation policy aimed at promoting new path development, as is the goal of VINNOVA's (Swedish Governmental Agency for Innovation Systems) Center of Expertise Programmes (Coenen et al., forthcoming).

The main problem of traditional industries with respect to promoting new path development (path renewal) and making them more innovative and competitive is a low level of education and competence and a lack of investment in R&D. This implies that these firms and industries have a low absorptive capacity, which limits their capability of accessing, acquiring, and applying new and often external knowledge, of making use of new production equipment and penetrating new markets, especially international ones. It also handicaps them in approaching universities to make their knowledge more research based and/or informed, which would extend their mode of innovation to the STI type. What is needed is to build the absorptive capacity of DUI-based firms by increasing their research-based competence (Isaksen and Nilsson, 2013). This is an important strategy to upgrade traditional industries, as research has demonstrated that combining DUI and STI makes firms perform better by utilizing both analytical and synthetic knowledge bases (Lorenz and Lundvall, 2006).

Such upgrading can take place through unrelated knowledge base combinations leading to new related industries. We maintain that this has been overlooked and represents an unexplored potential for new path development. Empirical illustrations of unrelated knowledge base combinations resulting in new path development would be traditional textile and shoe industries moving into technical textiles by adding nanotechnology (analytical knowledge base) to the traditional (synthetic) knowledge base of the industry; the food industry (synthetic knowledge) producing functional food using biotechnology (analytical knowledge); or the development of new media industry by combining unrelated symbolic knowledge with the analytical/synthetic knowledge bases of the existing ICT industry.

Another strategy to upgrade traditional industries is to move into high value-added niches. This strategy can be realized most efficiently by mobilising the symbolic knowledge base,

often in combination with synthetic knowledge, and applying a platform approach i.e. one transcending traditional sectors, in the concrete design and implementation. This would normally imply that the firms continue to rely on the DUI mode of innovation, but are able to climb the value-added ladder by introducing new products that have a strong element of symbolic knowledge so as to achieve product differentiation. The end-result would be unique products at the high-end of the global market in sectors such as food and tourism.

One example of the power of exploiting the symbolic knowledge base to create a unique product as a distinct luxury good in the high-quality market of smoked salmon is the Swiss Balik salmon. It achieves 2-3 times higher prices and value-added than comparable Norwegian smoked salmon, even if the basic raw material (farmed Norwegian salmon) is the same. The difference is the marketing of the product: Balik salmon is sold in Caviar House outlets - not Fine Food stores - at airports to achieve exclusivity, and the accompanying story that it is made with a recipe from a Russian tsar and washed in water from Swiss mountain rivers. This example of a market-related innovation using symbolic knowledge demonstrates the value-creating potential of such innovations.

Examples of upgrading strategies in tourism are the Ice Hotel in Northern Sweden with 30,000 guests every season (November-April) and The Santa Claus Village in Rovaniemi, in Northern Finland, which attracts visitors by advertising the possibility of crossing the 'magical' Arctic Circle in reindeer-drawn sledges

Some of the ideas of the smart specialization approach are – as already mentioned – derived from the Constructed Regional Advantage (CRA) approach coming out of work by an Expert Group appointed by the EU Commission's DG Research (Asheim et al., 2006; Asheim et al., 2011b). The main message of the CRA approach is to promote competitive advantage for diversified specialization through an innovation-based product differentiation creating unique products, building on the view that this can be achieved in all types of industries, yet based on the industry-specific modes of innovation and knowledge bases. Thus, the CRA approach represented a broad-based innovation policy. This makes the approach instrumental in designing and implementing an innovation-based policy for promoting diversified specialization. Moreover, as the aim of CRA was to inform the development of *regional* innovation strategies, it constituted an explicit spatial, *place-based* approach. Thus,

we are inclined to maintain that the smart specialization approach has something to gain from the CRA approach (Asheim et al., 2011b; Boschma 2014), which may help it become a more powerful policy tool for promoting new path development in regions.

The CRA approach implies that competitive advantage has to be constructed on the basis of the uniqueness of firms' and regions' capabilities (Asheim et al., 2006). As an important initial strategy for new path development, regions and countries should base their competitive strategy on industries in which they have traditionally been doing well. The existing industrial structure will, in most regions, represent the main source of new path development to secure future competitiveness (Boschma, 2015). In the following three cases, we look at the main differences in the regions, the key driving factors, and the policy options with respect to diversified specialization, as well as the resulting new path development.

3 The cases – Scandinavian regions

This paper draws on three empirical studies of Scandinavian regions: the North Denmark Region (NDR), Scania in Southern Sweden, and Møre og Romsdal in North Western Norway. The two latter instances are case studies developed as part of a FP7 research project on 'Smart Specialization for Regional Innovation'; the first is an expert assessment of NDR's work on smart specialization undertaken by one of the authors on behalf of DG Regio. While to outsiders Scandinavia may look very homogenous, the regions are quite different with respect to innovation capacity and industrial structure. Møre og Romsdal is a moderate innovator, relying heavily on an experience-based or DUI mode of innovation, while both NDR and Scania are innovation leaders, according to the European Scoreboard. Scania in particular has a strong R&D performance, and has formed, together with some other advanced, leading regions in Europe, what they call 'the Vanguard Initiative for new growth by Smart Specialization'. In each of the cases, we look at 'innovation and diversification potential' as well as 'strategies and policies for new path development'. Taken together, the comparative analyses of these regions will hopefully give insights into how a smart specialization strategy can be designed and implemented in three highly developed regions in coordinated market economies characterized by close cooperation between the private

and public sectors, good governance, and strong institutions nationally and regionally. At the same time, the regions also represent contrasting cases with respect to innovation capacity and innovation policy.

3.1 North Denmark Region (NDR)[1]

NDR is a region with a rich resource endowment. Among the European regions, it has positioned itself as an innovation leader. The region is organizationally thick with good governance, strong institutions, and a population of 580.000. Denmark has a well-developed and coordinated national research and innovation policy, with good connectedness between the national and regional levels. Thus, it has fulfilled the ex-ante conditionalities for designing and implementing a smart specialization strategy.

Denmark is one of the best performing economies in the EU and ranks highly on various international innovation and competitiveness rankings. It is also one of the top performers in Europe with respect to the share of GDP allocated to R&D, only behind Finland and Sweden. Denmark is one of the few countries that managed to fulfil the EU's 3% target for R&D as a percentage of GDP.

Innovation and diversification potential

NDR is a well performing region that has improved its competitive advantage rapidly recently. According to the European Regional Innovation Scoreboard, since 2014 NDR has belonged to the group of European regional innovation leaders, a position it also held in 2010. The region performs well with respect to R&D expenditures in the business sector, SME in-house innovation activities, as well as in product and process innovations introduced by SMEs. Poor performance is found in non-R&D innovation expenditures and European Patent Office (EPO) applications, while the performance on other indicators is average. Quite logically, the most innovative regions, which are characterized as innovation leaders, are typically found in the most innovative countries (in addition to Denmark, Sweden, Finland,

[1] This section builds on the following report: Bjørn T. Asheim (2014): 'North Denmark Region RIS3.' An expert assessment on behalf of DG Regional and Urban Policy. May 2014.

Germany, and Switzerland). In the benchmarking tool, which is available on the smart specialization platform website, the regions which NDR could use for benchmarking purposes are Southern Sweden (the region of Scania, which is another case in this chapter) and the Central Denmark region, with which NDR already cooperates closely.

The region's industrial structure represents in many ways a dual structure. On the one hand, one finds the traditionally dominating industries, which are either large, process-based firms (such as those in the production of cement) or smaller firms (often SMEs) that depend on an experience-based mode of innovation. In the NDR context, such firms can be found in the food, construction, maritime, and tourism sectors. On the other hand, there are the research and knowledge intensive, mostly emergent, sectors, which are based on commercializing research results from Aalborg University and are described as 'regional front technologies' in the regional innovation and development plan.

A key to making traditional industries more innovative and competitive is to strengthen the absorptive capacity of firms relying on an experience-based mode of innovation (synthetic knowledge base) by increasing their R&D competences (analytical knowledge base). Examples of this would be for the food industry to start producing functional food directed at the growing market of obesity and other life style diseases in collaboration with medical and biotechnology research at Aalborg University; or for the maritime sector to link up with the research on intelligent transport systems, logistics, and ICT at the university, a collaboration already underway.

Another path to upgrading traditional industries is to move into high value-added niches. This is a strategy that can be most efficiently realized by mobilizing symbolic, intangible knowledge (branding, design, fashion), combined with a platform approach to achieve product differentiation. In NDR there is, for example, a potential of combining food (gastronomy) with nature and culture to produce a tourist product that can be customized to the preferences of demanding international customers and thus create a high level of value added.

However, the general low educational and competence level in the region's traditional SMEs, and a lack of investment in R&D, represent the greatest threats to such upgrading paths due to the firms' low absorptive capacity. A low absorptive capacity will have a

negative impact on firms' potential to become more innovative and to link up with national and international collaborators, e.g. in global value chains and innovation and production networks. Together with the problems of attracting and retaining highly qualified people, especially graduates of Aalborg University, this challenge must be overcome as part of a successful smart specialization strategy.

The other part of the dual industrial structure of the NDR is the research and knowledge intensive, mostly emergent, sectors, which are based on the regional front technologies within energy, health and life science, and transportation (including logistics and the maritime sector). These areas all represent strong research milieus at Aalborg University. In addition, ICT should be added to these regional front technologies as it has been and remains both a research stronghold and an important industrial sector (although not as important as before). ICT is also a general purpose technology that can increase productivity in other sectors. These technologies are found in firms which are part of regional clusters and networks. In some of these areas, such as medical technology, energy efficiency and embedded software, wireless communication, and sustainable energy (especially connected to windmills), the university's research is world leading.

Applying an R&D-based strategy is a very costly development and differentiating strategy, with a high failure rate yet yielding positive results in new firm growth and job generation in the long-term. However, given the strong research base in key technologies which can address future societal challenges regionally, nationally and globally, this research capacity and access to the best knowledge internationally should, of course, be exploited in an optimal way. In addition, the front technologies represent a combination of analytical/scientific and synthetic/engineering R&D-based knowledge (e.g. medical technology), which brings them closer to being exploited (commercialized) than 'pure' analytical knowledge such as biotechnology. The traditional focus on an R&D-based strategy, manifested in a strong national science and technology policy in Denmark, represents an important asset in implementing such a strategy, especially as the regional front technologies are also part of national prioritized technologies. If the available national funding for developing these technologies is mobilized together with accessible EU funding through Horizon 2020 and other relevant programs in a smart way, a considerable amount of funding should be available for commercializing these technologies, leading to new firm

formation, generation of highly qualified jobs, and the attraction of Foreign Direct Investment, especially R&D units from international corporations. The latter can take advantage of connecting up to the university's leading research milieus and of the accessibility to the highly qualified labor force graduating from Aalborg university. In many ways, these resources are so far only marginally exploited in the region.

Strategies and policies for new path development

NDR has selected the following 'growth areas' to be prioritized as a basis for diversified specialization through its smart specialization strategy (Figure 1).

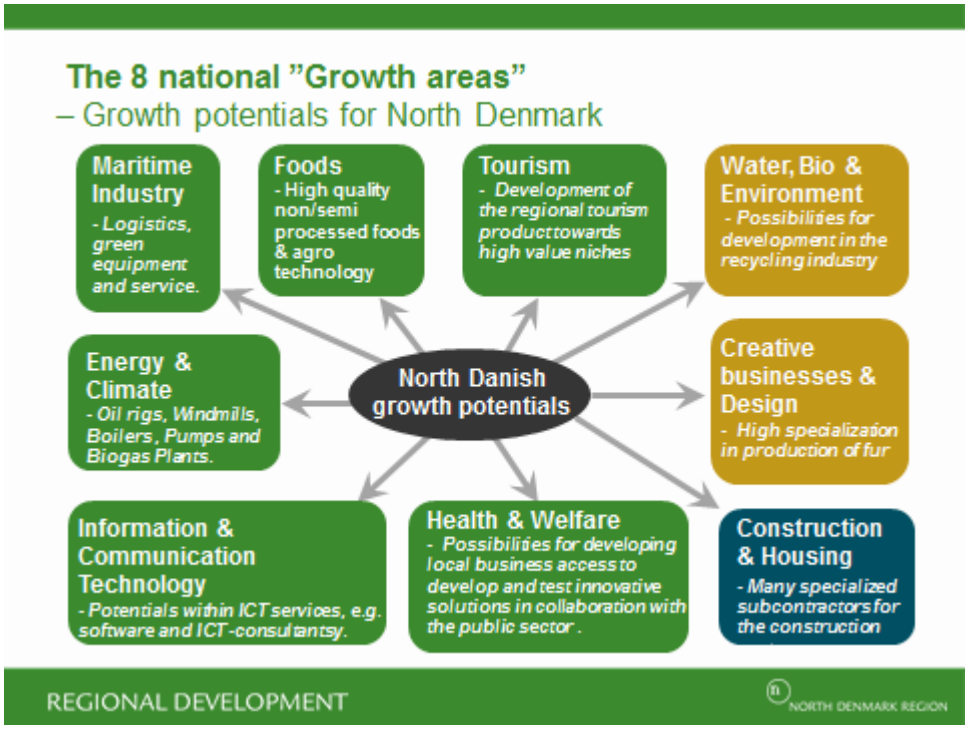

Figure 1: Selected growth areas of the NDR's smart specialization strategy. Maritime industry, energy & climate, ITC, health and welfare, foods, and tourism represent growth areas with considerable regional potential (and therefore implemented in the strategy as supported clusters). Water, bio & environment, and creative businesses & design are national growth areas with limited growth potential. Construction & housing is a regional strength position which we chose to include in the analysis and subsequently in the strategy (Smart City).

An optimal situation for regions is when regional strongholds, either traditionally or based on research strengths at the regional universities, are found within the same areas which are prioritized nationally. NDR seems to be in such an optimal situation, as the strong areas selected by the Growth Forum North Denmark Region correspond to the nationally

prioritized sectors. This puts NDR in a very favorable position for designing an efficient smart specialization strategy.

In the existing regional innovation and development strategy, the North Denmark Region has classified sectors in focus areas of clusters (ICT, food, construction industry, health and life science, and the maritime sector) and networks (tourism and energy). Moreover - as referred to above -, the so-called regional front technologies are also identified in energy (sustainable energy such as wind, hydrogen, wave, and biofuel), health and life science (medical technology, social innovation) and transport (intelligent transport systems including logistics). The regional innovation and development plan also proposes, with reference to food and tourism, the application of a platform approach based on combining knowledge, including intangible knowledge. .

Both in national plans and in the regional innovation and development plan, we find strategies for dealing with the problems connected to the low educational and competence level and the lack of R&D investment in many Danish firms, especially in SMEs in traditional industries. Nationally, we see mobility plans, i.e., subsidising the hiring of academic work force in firms not previously employing this category of workers, as well as financial support for SMEs to acquire research-based knowledge through collaboration with universities. Regionally, we find a focus on firm-oriented competence development and continued education as well as the matchmaking institution where Aalborg University plays a key role.

One way to increase the development and exploitation rate of the front technologies is to make public procurement for innovation (PPI) a central instrument. The areas of health and welfare are confronted with huge societal challenges generally due to societal aging, which requires these sectors to operate in a smarter way. More specifically, the building of the new university hospital in the region close to the university offers a big opportunity for using PPI to support the development of these technologies. In fact, all the front technologies (energy, health and life science, transport/logistics, and ICT) could be stimulated by effective use of PPI. As the public sector is the large, critical and demanding customer in this area, and the region has the main responsibility for health, the region has a unique opportunity to influence the development and exploitation of these front technologies.

However, successfully promoting new path development, either in the form of path renewal (regional branching based on related variety or unrelated combinations of knowledge bases) or new path creation based on commercialization of research-based knowledge, will require concrete and specific action lines. Regionally, what seems to be lacking is a higher capacity of formulating specific and concrete action lines, due to difficulties in the decision making 'Growth Forum'. All municipalities in the region are represented there and have found it hard to agree on the kind of tough choices leading to prioritizations, which are needed to successfully implement a smart specialization strategy. This is a major challenge in the process of designing and implementing a productive smart specialization strategy for regional development in NDR.

3.2 Scania (Skåne), Southern Sweden[2]

Scania is a wealthy and highly innovative region with approximately 1.2 million inhabitants situated in the southern-most part of Sweden. Compared to other European regions, Scania performs well in terms of unemployment, GDP per capita, competitiveness, and quality of government.

Innovation and diversification potential

The wider Southern Sweden region has been classified as an 'innovation leader' in the Regional Innovation Scoreboard 2014. A study by the OECD (2012) found that Scania is one of the most innovation-intensive regions within the OECD, performing the role of a 'knowledge and technology hub'. Key strengths include high R&D expenditures in the business sector (reflecting the presence of research-intensive firms in the region), a large share of population with tertiary education, and a strong endowment of human resources in science and technology. This points to a highly developed analytical knowledge base and the prevalence of the STI mode of innovation. The DUI innovation mode seems to be less important (when measured by 'non-R&D innovation expenditures'). This score, however,

[2] This section builds on the following report: Trippl, M., J. Miörner and E. Zukauskaite (2015): 'Smart Specialisation for Regional Innovation – Final Report, Scania, Sweden.' CIRCLE, Lund University, September 2015.

follows a general pattern of other Swedish regions. Moreover, the region's SMEs have strong in-house innovation capabilities, collaborate intensively with external partners, and perform well when it comes to introducing product and process innovations. A weakness of Southern Sweden seems to be the exploitation and commercialization of its strong R&D assets and the knowledge generated regionally. The capacity to generate radical innovation (measured by sales of new-to-market and new-to-firm innovations) appears to be rather low.

Scania hosts an organizationally thick and diversified regional innovation system and thus exhibits excellent potential for economic diversification through new path development. Since the 2008 financial crisis, the region has undergone some structural change. Manufacturing industries have somewhat declined and employment has shifted towards the service sector and knowledge-intensive activities. The region's industrial structure is characterized by a high degree of heterogeneity with many sectors contributing to total employment. Among the most important are the food, packaging, life science, ICT, moving media, and clean tech industries, reflecting the presence of all three types of knowledge bases (analytical, synthetic and symbolic) and offering potential for new path development based on combinations of knowledge bases.

Scania is also well endowed with knowledge-generating organizations, further enhancing opportunities for path renewal and new path creation. Both Lund University (one of the most prestigious and largest universities in Scandinavia with strengths in science, technology, and medicine) and Malmö University College (particularly strong in design, media, and culture) play an active role in shaping regional innovation and diversification dynamics. Lund University has been involved in the establishment of facilities such as Ideon science park, Medicon Village, MAX IV and ESS (European Spallation Source). New path creation in sectors such as ICT and biotechnology in Scania would not have been possible without the competences provided by Lund University. It has also played an important role in path renewal and upgrading of traditional sectors, contributing to the rise of functional food activities (which reflect a combination of analytical and synthetic knowledge bases) in Scania. In general, Lund University contributes to regional development through the establishment of spin-off companies, by performing joint research with firms, by participating in intermediary organizations and networks, and by providing consultancy support and advice in different technological areas. Malmö University College has played a

major role in the transformation of the city of Malmö. It has contributed to the emergence of a new media cluster (reflecting path renewal based on a combination of analytic/synthetic and symbolic knowledge bases) by providing skilled labor and collaborating in joint projects with firms.

A striking feature of the regional innovation system is the large number (around 100) of public, quasi-public, and private business and innovation support organizations. Firms (and other stakeholders) located in the region thus benefit from a plentiful offer in terms of networking opportunities, counselling activities, and so on. There is, however, also a negative side. Many support organizations present in the region have overlapping functions and compete for funds and attention from entrepreneurs as well as other actors (Zukauskaite and Moodysson 2014). There is a lack of cooperation and coordination among the support organizations, resulting in a fragmented innovation support system. Actions have only recently been taken to improve the situation with the establishment of a coordination body.

Strategies and policy priorities for new path development

Innovation policy ranks high on the policy agenda in Scania. Over the past 10 years or so, regional authorities have adopted an innovation-driven regional development approach. In 2011, a new strategy ('International Innovation Strategy for Skåne 2012-2020', henceforth IISS) was launched, largely building on the rationale of smart specialization. Based on a thorough analysis of strengths and weaknesses of Scania's regional innovation system, the strategy was developed primarily by the 'Research and Innovation Council in Skåne' (FIRS), a body founded in 2010 consisting of representatives from Region Skåne, the universities, municipalities, and key industrial sectors. Thus, the strategy is evidence-based and the result of a collective, participatory process where a wide variety of stakeholders have been included. The selection of policy priorities in the IISS can be seen as the outcome of a highly inclusive process, based on intensive discussions and collaboration among key regional stakeholders.

Three main focus areas (prioritized areas) are identified in the IISS: Smart Sustainable Cities, Smart Materials, and Personal Health. These are all broad areas targeting global challenges, with a clear focus on combining regional strengths. For each focus area, a platform has been

created. Platform coordinators employed by Region Skåne are in charge of encouraging collaboration between various actors in their respective platforms.

The chosen priorities reflect Scania's heterogeneous regional industrial structure and research strengths. They are broad enough to encompass many important sectors present in the region. Smart sustainable cities, smart materials and personal health are platforms where different sectors can intersect to create new solutions and identify activities leading to new path development. Most likely, this broad way of selecting priority areas would not have been possible in a region with more specialized economic structures, reflecting the consideration of place-specific factors in the case of Scania.

The IISS also explicitly aims to increase the region's international connectedness and, consequently, a key feature of the IISS is its strong international dimension. The new innovation strategy aims to foster international cooperation and strengthen the region's position in knowledge networks by developing bridging organizations and global strategic alliances. It covers a stronger emphasis on collaboration within the Öresund cross-border region and expresses the intention of opening up the selected innovation arenas to non-local actors on a global scale. Thus, the IISS represents a move beyond inward-looking policies, towards greater outward orientation, focusing on external linkages, international collaboration, and wider reaching knowledge networks.

The IISS covers several other novel elements. It reflects the adoption of a broad approach to innovation, including service innovation as well as public sector innovation. It thus goes beyond previous policies, which mainly focused on promoting research-based innovation, exploiting the strengths in the knowledge generation subsystem. The IISS indeed shows an evolution from research commercialization as the main policy target towards a more systemic approach to innovation. Furthermore, a shift has taken place from a traditional view of clusters based on a sector logic towards an approach focusing on inter-industry crossovers, combining knowledge bases and bringing actors with different backgrounds together in innovation activities through 'open innovation arenas'. In turn, these arenas are organized in platforms with two or more arenas, which are broadening the variety of actors who can collaborate (Figure 2).

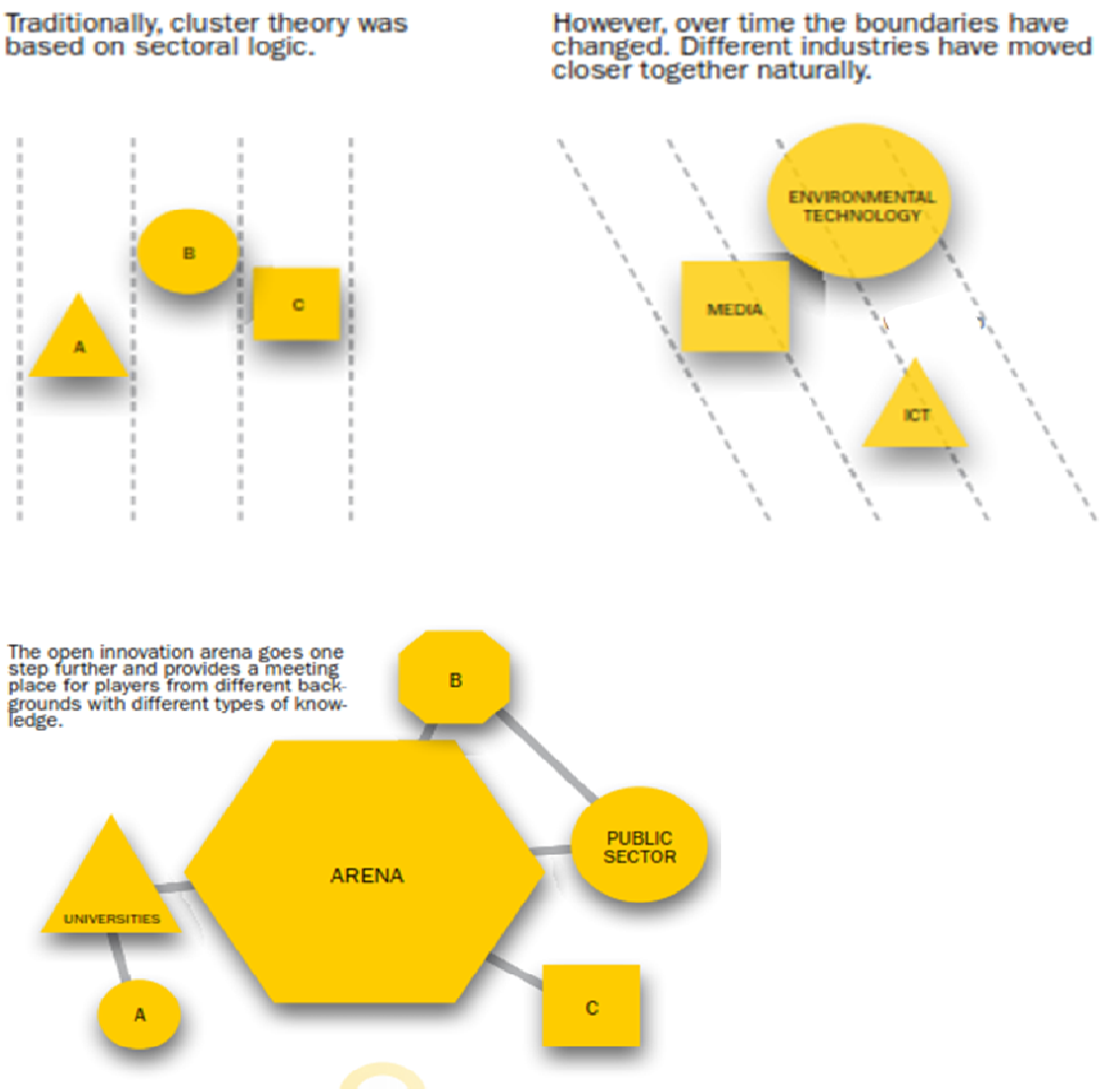

Figure 2: Logic of open innovation arenas in the context of Skåne's international innovation strategy. It moves beyond the sectoral logic of the cluster theory towards an open space where actors from different backgrounds and with various types of knowledge can meet (Source: Söderström et al., 2012).

The IISS is seen as an overarching strategy to which policies in the whole region should be aligned and related. On a practical level, Region Skåne is doing this by relating its 'Regional Development plan for 2030' to the innovation strategy, acknowledging the IISS as a 'central tool in the work [for strengthening the innovative capacity in Scania]' (Region Skåne, 2014, 24). In addition, there are units working very closely on the innovation strategy within the regional administration. One example is the Entrepreneurship Unit working with the Sounding Board for Innovation (SIS) in Scania, where a wide variety of innovation relevant actors are brought together.

The governance structure has been an important determinant of how the region has engaged in developing the IISS. The highest elected regional governance body, Region Skåne, carries formal responsibility for regional development issues. The political mandate for dealing with these issues was added to Region Skåne's primary responsibilities (mainly health care and public transport) in the late 1990s. However, at the same time, Region Skåne lacks resources for large-scale budgetary commitments.

This has led to Region Skåne approaching regional development and questions regarding regional innovation capacity as a coordinator in the regional innovation system, rather than taking on large funding commitments and acting as a big investor. To aid this, Region Skåne has conducted several studies on the regional economic structure in general and innovation activities in particular, for example through functional analyses of the regional innovation system. These identified issues with a fragmented system containing many supporting organizations, and a lack of service innovation support and support to companies in later phases of development. Thus, coordination and systemic leadership has been a key task for Region Skåne during the last five years. The establishment of two public-private coordination bodies, namely the research an innovation council (responsible for the development of the region's smart specialization strategy) and the sounding board of innovation (in charge of increasing the level of coordination between the large number of supporting organizations) has played an important role in this regard.

The IISS is without any doubts a 'new generation policy strategy', containing many elements of the emerging smart specialization paradigm. It is an evidence-based and place-based policy, building on a thorough analysis of Scania's innovation capacity and aiming to promote innovation and industrial renewal by exploiting unique assets and responding to global challenges. Policy priorities have been selected in a participatory, inclusive way, involving a large variety of key stakeholders in Scania. The IISS has a strong international orientation and reflects a move from a narrow, R&D-based view towards a much broader understanding of innovation. The smart specialization practices in Scania have been a source of inspiration for the development of the national innovation strategy and the policy development processes regionally. The design of the IISS also has the potential to become a role model for other European regions.

3.3 Møre og Romsdal, North Western Norway[3]

This section builds on a case study of the Møre og Romsdal region in North Western Norway with a population of 265.000. It is an illustration of a specialized and relatively peripheral region with a competitive manufacturing industry building largely on a synthetic knowledge base and a DUI mode of innovation. However, the landscape is changing, meaning that firms must make continuous efforts to remain competitive in existing fields and to venture into new fields.

The case is highly interesting due to the region's outstanding economic and export performance, despite its low ranking on common innovation indicators. On the one hand, it represents a perfect case for advocating a broad perspective on innovation and knowledge bases as the foundation of firms' and regions' competitiveness. On the other hand, this case allows us to unveil the potential for renewal in regions that are not blessed with a high degree of related and unrelated variety or with strong universities conducting basic research.

<u>Innovation and diversification potential</u>

Møre og Romsdal is one of the global hubs in the maritime industry where leading firms such as Ulstein and Rolls Royce are located. Regional ship owners control 40% of the world's most advanced offshore fleet. The maritime cluster is one of only a few worldwide in which all actors of the value chain are represented. Input-output analyses have shown that the cluster exhibits high regional connectedness as well as national and international linkages (Møreforsking, 2014). In terms of employment and value creation, the maritime industry is most important in Møre og Romsdal. Besides a high degree of vertical and horizontal integration, the maritime industry therefore also benefits from a thick labor market.

[3] This section is based on the following book chapter: Asheim, B. and Grillitsch, M. (2015): 'Smart specialisation: Sources for new path development in a peripheral manufacturing region.' Fjordantologien (also published as Working Paper: Papers in Innovation Studies No 2015/11, CIRCLE, Lund University).

The maritime industry can be described as a traditional manufacturing industry that relies largely on a synthetic knowledge base. In other words, the workforce has a high level of experience-based, tacit knowledge in the field of engineering. Learning and innovation is supported by a high level of trust regionally, which allows for informal and quick communication between the various actors in the regional cluster. Furthermore, interaction and learning also occurs to a high degree between the management and employees thanks to flat hierarchies and the Scandinavian model of learning work organizations (Lorenz and Lundvall, 2006). The maritime industry benefits from university colleges and applied research institutes, which have adapted their educational programs as well as R&D activities to the needs of the industry. R&D consists mainly of applied and support in testing and application development. The maritime industry is organized in a cluster, the Global Centre of Expertise 'Blue Maritime', a category in Innovation Norway's industrial cluster program reserved for the internationally most competitive clusters.

The combination of strong experience-based engineering knowledge, an institutional environment that fosters knowledge exchange and learning between and within organizations of the cluster, as well as tight collaboration between the industry and higher educational institutes explains the high speed of incremental innovation that has substantially contributed to the cluster's leading position.

However, the maritime industry is currently facing tremendous challenges due to the dramatic fall in oil prices since the second half of 2014. The fall in oil prices has strained profits for the more demanding, technologically complex and costly offshore exploration and exploitation activities. This represents a big challenge for the Norwegian economy overall, and the maritime industry in particular, which delivers specialized equipment and provides services to offshore installations off the coast of Western and Northern Norway. Furthermore, due to the previously high profit margins and restricted supply of labor, the wages are very high in the traditional industries thereby reducing the incentives to explore new economic opportunities.

Besides the maritime and oil and gas industries, Møre og Romsdal has a specialization in the marine and furniture industries. The marine industry has substantial future potential. Møre og Romsdal has a long tradition in fishery, which contributes to the strong regional export

performance equally as much as the sales of manufacturing goods. However, the marine industry has changed. Due to high labor costs, firms have invested significantly in process innovations that reduce the required labor input through automation and robotization. In that regard, synergies between the maritime and marine industries have resulted. In fact, the rough fishing conditions have put high requirements on ships and fishing equipment, creating the sophisticated demand that spurs innovation and competitiveness (Porter, 1998).

Due to the increasing cost pressures in traditional fishery, firms have begun to venture into biomarine. Biomarine describes the inflow of biotechnology into traditional marine activities that leads to new functional foods (e.g., healthy oils), health and pharmaceutical products, or flavors. Besides, traditional fishery is complemented by aquaculture i.e. the farming of salmon, cod, and halibut. Due to these new developments, the marine industry has expanded steadily since 2000 and the market is expected to grow significantly in future.

The renewal of the marine industry challenges the regional knowledge infrastructure specialized on experience-based engineering knowledge. The further development of the biomarine sector, in contrast, requires strong analytical, science-based competencies. However, until this year, when the Norwegian University of Science and Technology in Trondheim merged with Aalesund University College, the region had no university; only the university college in Molde had university status for logistics. Furthermore, R&D expenditures per capita are far below national average and only a small minority of researchers in Møre og Romsdal have a doctoral degree. This weakness is problematic not only for biomarine, but also for increasing the knowledge intensity of maritime and other industries.

The strong linkages of actors in the regional innovation system are further promoted through several cluster initiatives financed by Innovation Norway and the Research Council of Norway. The Norwegian cluster programme operates on three levels: i) the Arena program targets emerging clusters; ii) well-established, economically strong and export-oriented clusters can apply to the Norwegian Centre of Expertise Program; and iii) the Global Centres of Expertise (GCE) program stimulates strongly developed clusters with a leading position in global value chains. The GCE Blue Maritime cluster in Møre og Romsdal was one of the first two GCEs in Norway. In addition, three Arena clusters support the marine

industry (Legasea), the furniture industry (Norwegian Rooms), as well as activities in logistics, material and production technologies (iKuben). Regional entrepreneurs show strong ownership of and lead these cluster initiatives.

Strategies and policy priorities for new path development

The significant drop in oil prices has shaken the industrial basis of Møre og Romsdal and put economic diversification at the top of the regional policy agenda. In light of being a highly specialized and rather peripheral region, the region focuses on three main strategic priorities relating to: (i) broadening the vision to capture potential new development paths; (ii) upgrading and adapting the knowledge base of the existing industry through a combination of regional investments and strategies to access complementary extra-regional sources; and (iii) seeking opportunities for cross-fertilization between regional industries and clusters.

Regional stakeholders agree that their core assets are access to the ocean, high competencies in dealing with difficult maritime operations, and strong environmental standards. Building on these assets, their vision is for their region to be a global leader in the environmentally sustainable exploitation of the ocean space. The vision thus captures current specializations but opens the way for a large variety of related activities concerning, for instance, sub-sea operations, renewable energies, advanced maritime operations, marine, and transport. The vision underlines the importance of developing generic competencies in material technologies, robotization and automatization, visualization, bioeconomy, biotechnology, logistics, and design (Figure 3). In Møre og Romsdal, the vision is shared by firms, higher educational institutes, and regional policy makers.

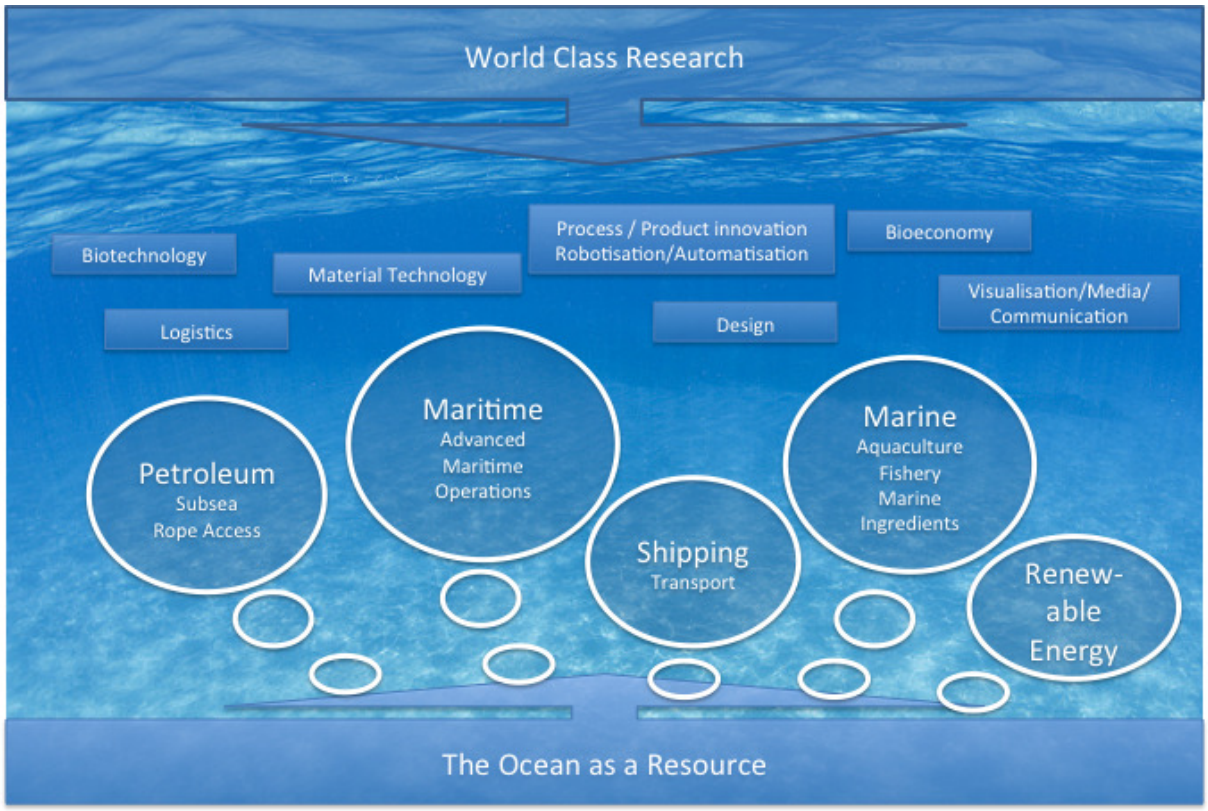

Figure 3: Selected growth areas in the regional development strategy of Møre og Romsdal; the ocean as resource provides the basis for the key sectors (petroleum, maritime, shipping, marine, renewable energy) to be developed. Upgrading of R&D capacities as well as firm competencies in generic technologies (biotechnology, logistic, material technology, robotization and automatization, design, bioeconomy, visualisation/media/communication) are key elements to achieve competitive advantage in the core sectors.

Semi-peripheral and specialized regions potentially find it easier to develop a broadly accepted vision compared to major agglomerations because fewer stakeholder groups and agendas need to be coordinated. Nevertheless, even a small region like Møre og Romsdal has a variety of actor groups, which are associated with different institutional contexts and potentially conflicting interests. This includes a fragmented municipal structure, potential tensions between home-grown firms and multinational co-operations with headquarters abroad, as well as diverging needs and development stages of the industries present in the region. Hence, institutional variety exists even in small regions and requires processes of coordination and negotiation of interests. In Møre og Romsdal, these processes are supported by a strong local identity and trust amongst people who grew up in the region. Furthermore, we find that locals are represented in managing positions of the multinational firms, thereby acting as translators of cultures and regional ambassadors. In addition, several cross-cutting institutional arrangements such as the Aalesund Knowledge Park ensures

coordination between industries. It is this 'institutional connectedness' that strongly supports the aligning of interests, development of a shared vision, and coordinated action (Grillitsch, 2016; Grillitsch and Asheim, forthcoming).

The second key strategic element is upgrading and adapting the regional knowledge base: strong efforts have been undertaken here to enhance research capabilities in the private and public sectors. This has translated into a higher share of staff with a PhD, industry-sponsored professorships, and a successful application of the Aalesund University College to the 'Centre for Research driven Innovation' program. The latter promotes research collaboration with industry, in this case mainly the maritime industry, focusing on strategic and targeted basic research as well as advanced applied research. This application was done in partnership with the Norwegian University of Science and Technology. This will potentially increase the access to basic (analytical knowledge) and applied (synthetic knowledge) research for firms regionally.

However, given the narrow knowledge base and peripheral location of Møre og Romsdal, new path development also relies heavily on accessing extra-regional resources and knowledge. This regional limitation and hence the need to search beyond regional boundaries is widely appreciated in the region: The GCE Blue Maritime defines scouting for knowledge globally as a core activity. The higher education and research institutes aim to establish national and international linkages. Leading firms in the region collaborate with non-local partners to bring in complementary knowledge (mainly analytical and symbolic knowledge).

Besides seeking to upgrade and adapt the regional knowledge base, one priority also lies in creating synergies between existing regional clusters. In particular, cross-fertilization is promoted by an organization called Aalesund Knowledge Park, which coordinates the GCE Blue Maritime and the Legasea Arena cluster as well as an offshore wind project and a program to support start-ups. As already mentioned, synergies exist between the maritime and marine industries. Furthermore, the furniture cluster initiative Norwegian Rooms focuses on branding (i.e. using symbolic knowledge), which can potentially also contribute to enhancing value creation in the other industries. Good potential is also seen in the

promotion of generic competencies related to, for instance, material and production technology or logistics (promoted by the iKuben cluster).

However, a closer investigation of the potential synergies has also shown that the clusters are in different growth stages and face varying challenges. For this reason, the main strategy of the maritime industry is to diversify into related sectors such as renewable energy, where the technological competencies can be re-used. In contrast, the marine industry emphasizes national and international linkages to renowned research organizations and firms. The focus lies on identifying niches in which Møre og Romsdal has a competitive edge in global markets, rather than diversifying from an existing position of global leadership. The challenges of the furniture industry are different and pivot around building competitive advantage through design, the creation of symbolic value, and innovation in production processes.

4 Conclusion: Comparative perspectives on smart specialization strategies in Scandinavian Regions

There are similarities and differences between the three cases, making them interesting to compare when discussing smart specialization as a strategy for economic diversification. All three regions are Scandinavian, which makes them good representatives of highly developed economies with good governance and strong institutions. On the other hand, only two of the regions, NDR and Scania, are part of the EU, where the implementation of a smart specialization strategy is compulsory. In contrast, Norway is not a member of the EU so does not have this requirement. However, Møre og Romsdal as well as other regions in Norway have chosen to use smart specialization to guide and inform their work on counties' R&D and development plans. Moreover, the regions differ in their innovation capacity and industrial structure. Møre og Romsdal is only a moderate innovator, relying heavily on an experience-based or DUI mode of innovation, while both NDR and Scania are innovation leaders according to the European Scoreboard.

Besides, when it comes to innovation policies at national and regional levels, there are interesting contrasts between the three countries. Sweden has always ranked as one of the

countries with the highest level of R&D expenditures, Denmark is becoming one of the leaders, while Norway has relatively modest spending on R&D. This reflects partly the different industrial structures in the three countries, but partly also a lower prioritization of R&D and innovation in Norwegian industrial policy. Sweden has a long tradition of publicly funded, ten-year programs for building competence considered to be of strategic importance for the future competitiveness of Swedish industry (e.g. generic technologies such as ICT, electronics, and biotech). As the Centre of Expertise (CoE) programs aim to create new path development, they have a strong focus on exploration i.e. new research-based knowledge, and are consequently university owned, even while the close link between exploration and exploitation is always underlined (thus the reference to the CoEs as 'strong research and innovation milieus'). This is why OECD has described Sweden as the most resilient economy in Europe (OECD 2013).

The innovation systems approach has traditionally held a strong position in Sweden's innovation policy. The 'strong research and innovation milieus' mentioned above are an example of a regional innovation systems strategy. In Norway, one finds strong sectoral, national innovation systems around the dominating industries (oil and gas, maritime, marine and process industry), while the absence of research-based regional universities – in contrast to Sweden – has resulted in a void of regional innovation systems. This has partly been substituted by strong clusters, which use the Norwegian University of Science and Technology as the main exploration hub. The region of Møre og Romsdal may represent a change in this situation towards an emerging regional innovation system through the merger of the regional university-level college and the national technical university. Denmark, on the other hand, has not used an innovation systems approach but has relied more on a linear model, putting strong efforts into supporting basic research at the expense of exploitation. This has resulted in a lower level of innovation than what could be expected from the relatively high R&D spending. NDR's rank as an innovation leader reflects the level of R&D spending, which does not necessarily translate into comparable strong innovation performance. Thus, one finds neither regional innovation systems in Danish regions, nor strong clusters as in Norway. The result may be a less efficient implementation of smart specialization strategies due to the absence of strong intermediaries.

All three regions were well prepared for taking on board the smart specialization perspective. The three regions applied a similar logic about how to promote innovation and economic growth in their previous R&D and development plans. Nevertheless, NDR (in part) and Møre og Romsdal, especially, placed greater emphasis on path extension, and thus less on new path development, which is the core of smart specialization. The introduction of a smart specialization strategy seems to have strengthened the focus on new path development.

The regions' strategies build on a thorough analysis of their innovation capacity and aim to promote innovation and new path development by exploiting unique assets and responding to global challenges. The regions have opted for rather broad visions as guidance for achieving diversified specialization. Scania has chosen Smart Sustainable Cities, Smart Materials, and Personal Health as their priority areas. Møre og Romsdal focuses on the ocean space, combining strengths in the maritime and marine sectors. The region of NDR has a more sectoral prioritization in which 'front technologies' play an important role. The differences in industrial structure and innovation capacity are reflected in the ways they aim to reach their goals. Scania in particular, and partly also NDR, can rely more on the R&D capacity of their regional universities, while Møre og Romsdal still has to depend on and develop its experience-based mode of innovation. Thus, the cases also provide a good illustration and confirmation of the need to apply a broad-based innovation policy, which smart specialization encourages by emphasizing that countries and regions should diversify their economies starting with existing strengths. The cases illustrated here also confirm the relevance of a knowledge-based approach in designing and implementing smart specialization strategies. This approach is an important instrument in demonstrating how innovation-based diversification can be achieved in various sectors with different knowledge bases and modes of innovation. Thus, it also shows how a policy that goes beyond old 'one size fits all' models can be applied to accommodate the needs and potential of heterogeneous European regions.

Academic highlights:

- Smart specialization means:
    - Diversified specialization into areas of existing or potential competitive advantage, which differentiates a region/nation from others
    - Smart identification of these areas through a process of entrepreneurial discovery, in which all actors are mobilized to be able to discover domains for securing existing and future competitiveness (individual entrepreneurs, firms, universities, technology transfer offices, public development agencies, etc.)
- Competitive advantage through smart specialization can be promoted in all types of industries but based on the industry specific modes of innovation and knowledge bases:
    - Firms innovate based on research (STI – science technology innovation) and experience (DUI – doing using interacting)
    - Analytical, synthetic, and symbolic knowledge drive innovation activities of firms
- This allows for varied strategies of smart specialization, including:
    - Building the absorptive capacity of DUI based firms by increasing their research based competence (introducing analytical knowledge)
    - Combining unrelated knowledge bases to move into new related and unrelated industries
    - Combining related knowledge bases to move into unrelated industries
    - Moving into high-value added niches by introducing symbolic knowledge in traditional sectors

Policy highlights:

- Scandinavian cases represent regions with highly developed economies, good governance, and strong institutions yet exhibit important differences in their:
    - Knowledge infrastructure
    - Industrial structure
    - Innovation policy
- All three regions have developed their smart specialization strategies based on a thorough analysis of their innovation capacity and with an increasing focus on new path development by exploiting unique assets and responding to global challenges
- The different preconditions are reflected in the smart specialization strategies and ways in which the three regions aim to achieve their objectives:
    - Taking into account industry specific modes of innovation and knowledge bases (although sometimes only implicitly)
    - Adapting strategies to regional and industrial specificities
- This corroborates the importance of applying a broad perspective on innovation policy and the relevance of the knowledge-based approach

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