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Smart specialisation: Sources for new path development in a peripheral manufacturing region

Bjørn Asheim (bjorn.asheim@circle.lu.se)
UiS Business School/Centre for Innovation Research, University of Stavanger & CIRCLE, Lund University

Markus Grillitsch (markus.grillitsch@circle.lu.se)
CIRCLE, Lund University

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Centre for Innovation, Research and Competence in the Learning Economy (CIRCLE)
Lund University
P.O. Box 117, Sölvegatan 16, S-221 00 Lund, SWEDEN
http://www.circle.lu.se/publications

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JEL codes: P48, R10, R11, R58

Keywords: Smart specialisation, new path development, periphery, innovation, regional development

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Björn Asheim[1][2] and Markus Grillitsch[2]

[1] UiS Business School/Centre for Innovation Research, University of Stavanger

[2] CIRCLE, Lund University

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Smart specialisation as a strategic approach for an innovation-driven regional development policy is extremely important in the European policy context and a precondition for accessing significant amounts of funding. In this paper, we pursue two aims: First, we clarify what smart specialisation means and introduce theoretical perspectives strengthening this policy approach. We will discuss the role of different modes of innovation and knowledge bases for different types of new path development. Second, we aim at identifying the sources for new path development within the smart specialisation framework for a peripheral manufacturing region. We present the key findings from a case study of Møre and Romsdal, in the western parts of Norway, which has been successful economically despite low scores on the typical innovation indicators. The case study was conducted in autumn 2014 and combines an in-depth analysis of relevant policy documents and 17 semi-structured interviews. Thereby, we illustrate to what extent a smart specialisation policy can add value in Norway. As Norway is not part of the EU, it is not compulsory for Norwegian counties to design smart specialisation strategies.

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1 Introduction

EU member states and regions are required to develop Research and Innovation Strategies for Smart Specialisation (RIS3) in order to access the European Regional Development Fund (ERDF) for innovation activities (EC, 2012; Landabaso, 2014)[1]. Hence, it is of great relevance for policy makers to correctly understand and apply the core concepts underlying this strategic approach for an innovation-based regional development policy. However, as admitted by some of the architects of smart specialisation, Dominique Foray, Paul A. David, and Bronwyn H. Hall (2011) the breakthrough on the policy agenda of this concept is a perfect example of "policy running ahead of theory". This paper, therefore, sets out to do two things.

First, our aim is to clarify what RIS3 is and what theories are underlying this approach. We will clarify important terms that easily lead to misunderstandings, most importantly the notions of "smart specialisation" and "entrepreneurial discovery". We show that smart specialisation refers to diversification into areas related to current regional strengths and that entrepreneurs are thought of broadly as encompassing all actors that can potentially contribute to discover current and future areas of competitiveness. Also, we wish to suggest that RIS3 has something to gain from the constructing regional advantage approach, which emphasises a pro-active role of public-private partnerships in promoting innovation through a "no size fits all" approach to regional development, duly appreciating the industry specific modes of innovation and knowledge bases on which these innovation modes build. Considering these theoretical perspectives, RIS3 becomes a more powerful policy tool for promoting new path development in regions.

Second, we investigate empirically how RIS3 can potentially contribute to new path development in peripheral manufacturing regions. We present a case study of the Møre and Romsdal region in western Norway, which is highly interesting due to its outstanding economic performance while ranking low on common innovation indicators. On one hand, it is therefore a perfect case advocating a broad perspective on innovation and knowledge bases, which are the foundation for firms' and regions' competitiveness. On the other hand, this case allows us to unveil the potentials for renewal in regions that are not blessed with a high degree of related and unrelated variety or strong universities conducting basic research.

[1] This country case study is part of the EU FP7 project on "Smart specialisation for regional innovation". As Norway is not part of the EU, it is not compulsory for European counties to develop smart specialisation strategies.

The paper will proceed in section 2 with the literature review and theoretical discussion. Section 3 will present the empirical case emphasising in particular the sources for renewal and section 4 concludes the paper.

Literature Review

What is Smart Specialisation – a short presentation and discussion

Smart Specialisation is a strategic approach to an innovation-based policy for regional development. It will be the basis for European Structural and Investment Fund interventions in research and innovation (R&I) as part of the future Regional and Cohesion Policy's ambition to the European 2020 jobs and growth agenda. RIS3 is being promoted by DG Regio as the basis for the next generation of Structural Fund programs post-2014. The presence of a RIS3 strategy is a requirement as part of the next conditionality framework for a member state wishing to use the European Regional Development Fund (ERDF) for innovation activities. This is why all EU member states have to design and implement this strategy in order to receive structural funds in the coming years towards 2020. Thus, it is of great importance that this strategy is fully and correctly understood, not the least because the choice of key words (i.e. 'specialisation' and 'entrepreneurial discovery') may lead policy makers and practitioners to make false interpretations and draw wrong conclusions.

RIS3 is basically not about 'specialisation' as is known from previous regional development strategies, i.e. Porter based cluster strategies, but about diversification, or diversified specialisation/specialised diversification. Thus, 'smart diversification' would have been a better description of the strategy. What it means is that regions should identify areas - or 'domains' as the RIS3 strategy prefers to call it - of existing and/or potential competitive advantage, where they can specialise in a diversified way compared to other regions. A RIS3 strategy implies maximising the knowledge-based development potential of any region, with a strong or weak R&I system or with a high-tech or low-tech industrial structure. Moreover, regions should diversify their activities based on existing strengths and expertise by moving into related areas through regional branching (Boschma and Frenken, 2011). As an example regions (e.g. in Southern Europe) where tourism is a dominating sector could be used as an illustration. Such regions should not all just go for a plain SSS (sea, sand and sun) strategy, which would end up in a downward spiral of price competition (i.e. the low road strategy), but should combine the quality of the natural endowment with other attractions such as art, culture, gastronomy etc., and/or combine natural, historical and cultural attractions with

medical treatment by offering health tourism, in a platform based policy which would allow the local tourist product to travel up-market through a knowledge based process of product differentiation (i.e. a high road strategy).

The 'smart' in the RIS3 strategy refers to the way these domains of competitive advantage should be identified, which is through what is called 'entrepreneurial discovery', to secure specialised diversification across related technologies. Here lies another source of potential misunderstanding, as it easily will be thought of as identical with the traditional entrepreneur resulting in a policy focus on firm formation. However, it is underlined in the writings on RIS3 that 'entrepreneurial' should be understood broadly to encompass all actors (including individual entrepreneurs), organisations (including firms and universities through intrapreneurship, knowledge based entrepreneurship and spin-offs) and agencies (technology transfer offices and regional development agencies) that have the capacity to discover domains for securing existing and future competitiveness. Perhaps Van der Ven's description of 'the entrepreneur' as one type of leadership of the 'innovation journey' comes close to what is meant with entrepreneurial discovery in the RIS3 strategy. He talks about the entrepreneur as a role likely to be played by a core of interacting actors from the regional innovation system (RIS), comprising a limited number of firms, universities, public research organisations and government institutions (Van der Ven et al., 1999). Given such a broad interpretation it might perhaps have been preferable if the process of identification of growth areas was called 'innovation discovery' in order to avoid that the systemic nature of innovations and, thus, the importance of a system approach to regional innovation policies is ignored as well as failing to understand the role of government in driving innovation, which is central to a system approach (Asheim and Gertler, 2005; Asheim et al., 2011a).

Some of the stronger regions in Europe with respect to R&D, innovativeness and competitiveness have formed what is called 'the Vanguard Initiative for new growth by Smart Specialisation'. In the presentation of the RIS3 strategies of these regions a system approach is clearly present, e.g. in the cases of the Basque Region, Scania, and Zuidoost-Nederland, which talks about innovation system, innovative clusters, and triple helix cooperation, all examples of a system approach to innovation and regional development.

Some of the ideas in the RIS3 strategy are derived from the Constructed Regional Advantage (CRA) approach which stems from work that started in Brussels in an Expert Group appointed by DG Research of the EU commission. In 2006 DG Research launched the final report on 'Constructing Regional Advantage' as the new way of taking on and combating

challenges and problems of globalisation for European regions (Asheim et al., 2006). Examples of such diffusion of ideas are the recognition that knowledge and innovation are the driving forces of economic development, that history matters which underlines the importance of path dependency, that the process of specialised diversification should build on related variety, that a combined top-down/bottom-up approach should be applied in the implementation of the strategy giving a key role to local and regional stakeholders, that both approaches have a stronger focus on demand than supply for driving innovation, an appreciation of a 'no one-size fits all' policy, and, finally, being in favour of public-private collaboration (Boschma, 2014a). As there is more to gain by drawing from this work, especially the knowledge-base approach, which represent a theoretical cornerstone in the CRA approach (Asheim et al., 2011b), we now turn to a short presentation of this approach in the next section to provide a more theoretical informed perspectives on how to design a RIS3 strategy.

Theoretical perspectives on Smart Specialisation – an overview of key concepts

Constructing regional advantage means promoting competitive advantage through product differentiation creating unique products. While building on the lessons from the dynamic principle of the theory of competitive advantage (Porter, 1998) as well as of the innovation systems approach (Lundvall, 2008) emphasising that competitiveness can be influenced by innovation policies and supporting regulatory and institutional frameworks, the constructed advantage approach especially recognises the role of a proactive public-private partnership and impact of the public sector and public policy support by acknowledging to a greater extent the importance of institutional complementarities in knowledge economies. This approach represents an improved understanding of and response to the problems of system failures caused by a lack of connectivity in regional innovation systems.

Increasingly there is a strong agreement that innovation is the key factor in promoting competitiveness in a globalising 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. For a long time such a strategy was thought of as being identical with promoting high-tech, R&D intensive industries in accordance with the linear view of innovation. More and more the recognition has evolved that a broader and more comprehensive view on innovation has to be applied to retain and develop competitiveness in the heterogeneity of European regions, i.e. that 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. This broad, comprehensive view requires a differentiated perspective on the types of knowledge relevant in innovation processes (Asheim and Gertler, 2005; Asheim, 2007). Such a broad based innovation policy is in line with the innovation system approach of defining innovation as interactive learning combining an STI (Science, Technology, Innovation) and a DUI (Doing, Using, Interacting) mode of innovation (Lorenz and Lundvall, 2006). This allows also appreciating the heterogeneity of European regions and thereby promotes a 'no size fits all' approach (Tödtling and Trippl, 2005).

Thus, a Porter perspective was adopted arguing that all industries can be innovative and that the high-tech – low-tech distinction is not relevant at a sectoral level as a point of departure for innovation policies as R&D intensity is not the same as innovation capacity; knowledge is a far broader concept than R&D. This implies that regional advantage has to be constructed on the basis of the uniqueness of the capabilities of firms and regions, which, however, in a globalising economy becomes more and more knowledge intensive (Asheim et al., 2006). Secondly, it implies that regions and countries should base their competitive strategy on industries they traditionally have been doing well in; i.e. building on their technological path dependency to achieve positive lock-in effects or path extension. The existing industrial structure of regions will also in most cases represent the main source of path renewal in the form of regional branching based on related variety to secure future competitiveness and to make regions resilient (Boschma, 2014b).

Knowledge processes have become increasingly complex in the globalising knowledge economy. The binary argument of whether knowledge is codified (i.e. knowledge that has been stored in certain media and can readily be transmitted to others) or tacit (i.e. knowledge that is difficult to transfer to another person by means of writing it down or verbalising it) becomes too simplistic to accommodate this increased complexity and provide an adequate understanding of knowledge creation, learning and innovation. Thus, a need to go beyond this simple dichotomy can be identified. One way of doing this is to make a distinction between 'synthetic', 'analytical', and 'symbolic' types of knowledge bases, which partly transcends the tacit-codified dichotomy arguing that the two forms of knowledge always co-exist but in different combinations, and partly emphasises that all types of economic activity can be innovative but that the modes of innovation differ, thus, transcending the high tech-low tech dichotomy (Martin and Moodysson, 2013). As this threefold distinction refers to ideal-types,

most activities are in practice comprised of more than one knowledge base. New combinations of knowledge bases, especially when symbolic knowledge is involved, seem to become increasingly important as a source of new path development (i.e. path renewal and path creation).

An analytical knowledge base refers to economic activities where scientific knowledge based on formal models and codification is highly important. Examples are biotechnology and nanotechnology. University-industry links and respective networks are more important than in the other types of knowledge bases. Knowledge inputs and outputs are in this type of knowledge base more often codified than in the other types. The workforce, as a consequence, needs more often 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, consequently, innovations are science-driven. Partly these inventions lead to patents and licensing activities. Knowledge application is 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 coming up in the interaction with customers and suppliers, and, thus, innovations are user, market, and demand driven. Industry examples include plant engineering, specialised advanced industrial machinery, and shipbuilding. University-industry links are also for this knowledge base important, but more in the field of applied research and development than in basic research. Tacit knowledge is more important than in the analytical type, in particular due to the fact that knowledge often results from experience gained at the workplace, and through learning by doing, using and interacting. Compared to the analytical knowledge base, there is more concrete know-how, craft and practical skills required, which is 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 its economic use. The increasing significance of this intangible type of knowledge is observed by OECD (2013) mentioning e.g. design as a new source of growth as part of firms' knowledge-based capital as

well as through 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 in quality. This demands rather specialised abilities in symbol interpretation and creativity. This type of knowledge is often narrowly tied to a deep understanding of the habits and norms and '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, also this knowledge base has become increasingly more knowledge intensive.

The knowledge base approach implies that no type of knowledge should a priori be classified as more advanced, complex, and sophisticated than other knowledge (Laestadius, 2007), or that analytical knowledge be considered more important for innovation and competitiveness of firms, industries and regions than synthetic or symbolic knowledge. The knowledge base approach, thus, offers a promising framework for informing the next generation of broad based regional innovation policy, i.e. being able to fine tune regional innovation policy according to the dominating knowledge bases in the region both with respect to strengthening existing industries and promoting new path development. This implies an active role of policy makers and agencies in stimulating novel combinations of differentiated knowledge bases, thereby boosting innovation and regional development (Asheim et al., 2011b). The OECD highlights knowledge-based capital (KBC), constituted precisely by combining knowledge bases, as new sources of growth (OECD 2013).

New path development

When designing and implementing a RIS3 inspired strategy for regional development, it is necessary not only to consider how to secure 'path extension', which has been the main goal in much of Norway's innovation policy, for example in Innovation Norway's cluster programme, including the new level of 'Global Centers of Expertise', but also to promote new path development ('path renewal' and 'path creation'). Path extension mainly results in incremental product and process innovations in existing industries and technological trajectories. While this can secure competitiveness and growth in a short and medium term perspective, in the longer run these industries run the risk of path exhaustion, referring to situations where the capacity for renewal is lacking. Path renewal takes place when existing local firms branch into different but related activities and sectors. Regions' industrial

specialisation and firms' knowledge bases shape the types of renewal that occur in the form of regional branching (Boschma and Frenken, 2011). Path creation represents the most wide-ranging changes in a regional economy. It includes the establishment of new firms in new 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 regional innovation policy aiming at constructing regional advantage as is the goal of VINNOVA's (Swedish Governmental Agency for Innovation Systems) Center of Expertise programmes (Asheim et al., 2013; Asheim et al., 2011b; Isaksen and Trippl, 2014).

The main problem of traditional industries with respect to promoting new path development (path renewal) and making them more innovative and competitive is the low educational and competence level and a lack of investment in R&D. This implies that these firms and industries have a low absorptive capacity, which limit their capacity of accessing and acquiring new and often external knowledge, make 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 absorptive capacity of DUI based firms by increasing their research based competence (Isaksen and Nilsson, 2013). This is an important strategy for the upgrading of traditional industries, as research has demonstrated that combining DUI and STI makes firms perform better by utilising both analytical and synthetic knowledge bases. Furthermore, as Grillitsch and Nilsson (2015) show, firms in the periphery with a high absorptive capacity can better compensate for a lack of knowledge available regionally through engaging in extra-regional collaborations.

Another strategy of upgrading of traditional industries is to move into high value-added niches. This is a strategy that most efficiently can be realised by mobilising the symbolic knowledge base, often in combination with synthetic knowledge, and to apply a platform approach, i.e. 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 has a high element of symbolic knowledge to achieve product differentiation and, thus, represent a unique product at the high-end of the global market. Recent studies, in this case from Italy, shows

that regions with a significant symbolic knowledge base (but not prevalent) which is balanced with other knowledge bases, in particular with the symbolic, are the most positively performing (Sedita et al., 2015).

One example of the power of exploiting the symbolic knowledge base in the marketing of high quality food products, is the Swiss Balik salmon. This achieves 2-3 times higher prices than similar Norwegian smoked salmon, even if the basic raw material is the same, farmed Norwegian salmon. The difference is partly that Balik salmon is sold at Caviar House outlets at airports to achieve exclusivity and partly the story accompanying it, that it is made by a recipe from a Russian tsar and washed in water from a Swiss mountain river. Given Norway's position as a big fishing nation with long traditions in value adding processing into high quality consumer product, this niche should also be exploited, especially by firms in Møre and Romsdal.

Empirical study

Methodology

This case study was conducted in the context of a collaborative European research project titled "smart specialisation for regional innovation". A joint research methodology was developed and applied for all cases. Møre and Romsdal is a special case as Norwegian regions, in contrast to EU countries, are not obliged to developed RIS3 strategies. Hence, the empirical study investigates the potentials for new path development by applying the theoretical perspective on smart specialisation developed above.

The case study combines in-depth studies of relevant policy documents and semi-structured interviews. It includes an analysis of studies prepared by local research institutes about the regional innovation system and the regional cluster initiatives, the regional policies related to R&D and innovation, regional statistics on demography, the economy and innovation performance, as well as relevant national policy documents. In total, 17 interviews were conducted in October 2014 with representatives from different stakeholder groups including firms, higher education institutes, research organisations, public administration and regional government, cluster organisations, as well as innovation and research support programmes. The interviews were all conducted with a representative of the top management of these organisations. An interview guide was used covering the background and experience of the interviewees, information on the organisations they represent, the strengths, weaknesses,

opportunities, threats, and major changes in the clusters and industries located in Møre and Romsdal, the regional innovation system, as well as regional innovation policy.[2]

Description of the case study

Møre and Romsdal is a county in the region of Vestlandet located in the western parts of Norway. The county has an area of approximately 15 thousand square kilometres and is home to 262 thousand inhabitants and 110 thousand households corresponding to 5% of Norway's population. The unemployment rate in Møre and Romsdal is extremely low with 2.4% in August 2014. However, due to the dramatic fall in oil prices during the second half of 2014 this figure is expected to rise, as the county is very dependent of the oil and gas industry. The mean GDP per inhabitant was 377,000 NOK in 2012. In the last 20 years, Møre and Romsdal has closed the income gap as compared to the national average from 92% in 1993 to 97% in 2012. (Møre and Romsdal fylkeskommune, 2014)

This strong economic performance is surprising against the backdrop of Møre and Romsdal's performance on typical R&D indicators. Although the total R&D expenditures have augmented significantly in the last two decades (with the exception of a drop from 2003 to 2005) the average expenditures per inhabitant remains low with 3,500 NOK as compared to the national average of 8,700 NOK per inhabitant. The leading regions Sør-Trøndelag (with the university city of Trondhem) and Oslo, with the two largest universities in Norway, even reach more than 20,000 NOK per capita. The private sector plays an important role in funding R&D in Møre and Romsdal. 75% of the total R&D of expenditures of 870 million NOK are funded by the private sector, which is significantly above the national average of 54%. However, only just above 10% of the researchers in Møre and Romsdal have a doctoral degree as compared to Tromsö where the share of researchers with doctoral degree is above 40%, and to Hordaland (with the second largest city and the third largest university), Sør-Trøndelag and Oslo with figures above 30% (Møre og Romsdal fylkeskommune, 2012; Bremnes, H., 2013; Forskningsrådet, 2014).

While Møre and Romsdal is characterised by a low level of R&D activities, it accounts for about 10% of Norway's exports (in comparison, it is home to only 5% of the country's population). One half of the exports consists of manufactured goods while the other half relates to fish. Møre and Romsdal is highly specialised in the maritime, marine, oil and gas,

[2]All interviews were recorded. Besides one phone interview, all were conducted in person. One interview was conducted in Norwegian, the remaining in English.

and furniture industries. Of the four mentioned industries, the maritime industry is the largest in size, exhibits the highest degree of vertical and horizontal integration and benefits from a thick labour market (Bremnes, 2013). The maritime industry is a typical manufacturing industry, relying on a synthetic knowledge base and generating mainly incremental innovations. According to a cluster analysis conducted by Møreforsking (2014), the maritime cluster features strong regional input-output relationships, thus confirming that the cluster firms are firmly embedded regionally. The maritime cluster in Møre and Romsdal is one of only few globally where all actors of the value chain are presented. The cluster firms are also well integrated in global value chains. 40% of the world's most advanced offshore fleet is controlled by the region's ship owners constituting the second largest fleet in the world after the USA.

The marine industry has experienced a continuous growth since 2000. Møre and Romsdal has a long tradition in the fishing industry. Firms have expanded from traditional fishery to biomarine activities, which include for instance healthy oils, pharmaceutical products, or marine ingredients and flavors. These activities relate to advancements in biotechnology and therefore rely to a relatively large extent on analytical knowledge. The market for biomarine products grew significantly in the last decade and is expected to expand rapidly in future. Furthermore, aquaculture and resulting food products take on a central part of the marine industry in Møre and Romsdal (especially farming of cod and halibut). As labor costs are high, a focus has been on process innovations and automatisation.

The oil and gas industry has grown rapidly in the last decade, and the county is very dependent on this industry as is the case for the Norwegian economy overall. Thus, the new realities that now confront Norwegian regions caused by the dramatic fall in oil prices represent big challenges for the industry in the county. The county is dependent on the oil and gas industry both directly, i.e. connected to the exploitation of the natural resources as such, and indirectly, through deliveries of equipment and supply of various services to the off-shore installations. The oil and gas exploitation is taking place off-shore outside the coast of Western and Northern Norway. It started in 1970 in the North Sea outside Stavanger, which is the 'oil capital' of Norway with the headquarter of the national oil company, Statoil, as well as of many of the international oil companies present in Norway, and the public control and regulatory agency, the Oil Directorate. When new oil and gas fields were discovered and exploited further north in the North Sea and the North Atlantic, the operational bases

supporting exploitation also moved north. In this process one such large on-shore facility was established outside Kristiansund in the northern part of the county.

Although the highest degree of specialisation is related to the production of furniture, this industry has witnessed a steady decline in employment from the peak year in 1998 with almost 4,500 employees. Until 2012, employment in the furniture industry has almost halved to approximately 2,300 employees (Møre og Romsdal fylkeskommune, 2014). The industry is driven by a few major furniture manufacturers and suppliers (less so designers), which have international brands and exhibit a high export rate.

As regards the local knowledge infrastructure, we find three university colleges in Ålesund, Molde and Volda conducting applied research in close collaboration with the industry. Ålesund University College has an academic profile focusing on the areas of maritime technology and operations, engineering and natural sciences, life sciences, international business and health sciences. Molde University College has university status in the field of logistics, in which international Master and PhD programmes are offered. In addition, the university college has a strong focus on event and sport management. Further research activities are undertaken in social science, management and health sciences. Volda University College provides courses in humanities and education, social sciences and history, art and physical education, and media and journalism. Furthermore, the university college focuses on welfare and cultural research.

The research environment is complemented by several applied research institutes: Moreforsking is a regional applied research institute with offices in Ålesund, Molde and Volda where it collaborates closely with the university colleges as well as industry partners. The main research areas comprise logistics; marine focusing on resources, processing, markets and biotechnology; industrial economics and policy; society including work life and labour mobility, public health and welfare, childhood and education and social change; as well as transport economics. SINTEF, connected to the Norwegian University of Science and Technology, is the largest independent Scandinavian research organisation. SINTEF has a regional office in Ålesund, which belongs to the organisation's fishery and aquaculture division. Furthermore, SINTEF pursues the following research fields: ICT, maritime technologies, materials and chemistry, energy research, petroleum research, technology and society and building and infrastructure. Bioforsk is a national R&D institute under the Norwegian Ministry of Agriculture and Food. The office in Møre and Romsdal is located in Tingvoll and focuses on organic food and farming. Runde Miljøsenter is an international

research station located at the most southerly bird cliff in Norway, which is located in Møre and Romsdal. It provides facilities for researchers working for instance in the fields of climate change, bird research and fishery.

Several innovation support and cluster organisations are located in Møre and Romsdal. In Norway, cluster organisations are financed by Innovation Norway, Research Council of Norway and SIVA. The programme has three levels: the Arena programme for emergent clusters, Norwegian Centre of Expertise for well-established, economic strong and export oriented clusters, and Global Centres of Expertise for mature clusters that are considered to be leading global knowledge hubs within their sectors. Møre and Romsdal was awarded one of only two Global Centers of Expertise and three Arena clusters.

The Global Centre of Expertise, Blue Maritime, supports equipment suppliers, shipyards, ship design companies, ship owners and ocean-going fishing vessels. The goals of the cluster organisation are among others to improve the speed of product innovations, to increase productivity, to strengthen global and national knowledge links, and to support SMEs and start-ups. It also strives to develop opportunities in new fields such as advanced subsea operations, blue ocean space innovations, or virtual prototyping. iKuben, located in Molde, is an Arena cluster for manufacturing firms supporting platform technologies, which are shared by all firms, namely logistics, material technology and production technology. Legasea, another Arena cluster, supports firms in the sustainable and profitable exploitation of marine biomass and raw materials. It includes companies operating fishing fleets, land-based processing industries, fish farms, omega 3 manufacturers, and companies that refine marine proteins. The Arena cluster Norwegian Rooms supports furniture firms in the fields of branding and internationalisation, design and material technologies, as well as supply chain management.

Last but not least, the Ålesund Knowledge Park (ÅKP) and the Norsk Maritimt Kompetansesenter (NMK) are important support organisations in the regional innovation system. ÅKP is a regional centre for business development, innovation and community building. ÅKP has a coordination role for the Blue Maritime Global Center of Expertise, the Legasea cluster, an offshore wind power project, and the start-up activity hoppid.no. Furthermore, it provides innovation and investment support to firms. NMK is part of the Ålesund University College Campus and hosts many of the aforementioned organisations and facilities, among others ÅKP, Moreforsking, the offshore simulator centre, and SINTEF as well as firms such as Rolls-Royce, Mitie Norge AS, Zacco Norway, Segel, or Elia consulting.

Current strengths and weaknesses of the Regional Innovation System

The regional innovation system in Møre and Romsdal is characterised by a tight network and collaboration between the industry and research organisations, including the three university colleges as well as applied research institutes. The university colleges put an equal wait on the three missions of higher educational institutes, namely education, research and collaboration with the local environment. The educational programmes are well aligned with the needs of the local industry. Firms are important for funding research activities including for instance contract research as well as sponsored professorships. University colleges and local research organisations conduct applied research with firms. Leading local firms and international groups have reported that they collaborate more with university colleges now than 10 years ago. Also, university colleges play an important role in providing advanced vocational education and training.

One example for the synergies between, in this case, Ålesund University College and firms is the development of a world leading training centre for advanced maritime operations using sophisticated simulators, which attracted global players such as Rolls-Royce to the region. The Offshore Simulator Centre located at NMK is partly owned by the Ålesund University College, Marintek, Farstad Shipping and Rolls Royce. At the university college, first simulators were developed, which quickly attracted the interest of maritime firms. At the NMK, we find that firms such as Marintek, Farstad Shipping and Rolls Royce are co-located with the Ålesund Knowledge Park, and the applied research organisation Moreforsking. Hence, we find co-location as well as active collaboration between these different actor groups. The collaboration between industry, university colleges and locally based research organisations provides excellent preconditions for enhancing knowledge along an existing development path, thus promoting path extension.

Another key strength of the regional innovation system is the presence of competitive firms with global knowledge and trade linkages in the maritime, oil and gas, marine and furniture industries. Due to the global competition, firms are constantly exposed to changing market and technological conditions. From a historical perspective, firms in the region have shown a strong ability to adapt to such changes and to innovate in order to meet these challenges. Strong input-output relationships among local firms (especially in the maritime industry), combined with flat hierarchies, high-levels of trust and informal interaction patterns, create a supportive environment for interactive learning and experience-based problem solving at the work floor.

Furthermore, an entrepreneurial culture is deeply rooted in the self-image of the local population and regional identity. Strong family businesses have been at the core of the development of the regional economy (although some of them have recently been bought by international groups). These family businesses tend to have a longer time horizon than stock-market companies and are more prepared to invest in projects that will only pay off in the medium- to long-term. However, international groups also play important roles as they are gateways to international knowledge sources and increase the attractiveness of the region as potential suppliers and for international customers.

The aforementioned factors have allowed regional firms to utilise and benefit from the access to abundant natural resources related to the ocean space. The firms in the region have managed not only to exploit the natural resources but to develop higher value products and services.

The biggest weakness of the regional research and innovation system relates to the low capabilities in basic research. Of the three university colleges, only the one in Molde has a university status in the field of logistics. The R&D expenditures are low and only a small share of the researchers has a PhD degree. Admittedly, much of the innovation activities of firms relate to applied research and application development, based on synthetic knowledge and the DUI mode of innovation, which usually is not counted as research and development. Nevertheless, this still points to the fact that the regional capacities to conduct basic research and to draw on analytical knowledge in promoting path renewal are relatively low. In the past, analytical knowledge only played a minor role for the competitiveness of firms in Møre and Romsdal. However, competition has changed. Firms compete increasingly in more knowledge intensive activities such as ship design, project management, or biotech, as opposed to building and assembling ships or selling raw materials. While the leading firms use extra-regional sources to access analytical knowledge, other firms lack the absorptive capacity to do so because of the low share of employees with higher education.

Although local stakeholders have identified this weakness, they have faced difficulties in addressing it. Due to the dominance of applied research and the low capacities to publish in renowned scientific journals, which is essential for career development in research, researchers have a strong tendency to work at universities with international reputation. Also, the main universities in Norway are better funded to provide a favourable research environment. This is problematic both as regards attracting and retaining talent. Furthermore, Møre and Romsdal is a semi-peripheral region with a relatively low attractiveness of its urban

living spaces. While this is an advantage for individuals who like outdoor experiences, many young professionals may prefer a livelier urban environment. This also relates to the variety of jobs available and to the fact that the dominant sectors are still male dominated. Young talent with interests in other areas, especially educated women, have a high tendency to out-migrate.

However, the region's accessibility is rather good with several daily flights to Oslo and other major Norwegian cities, as well as to Copenhagen (SAS), London (Norwegian) and Amsterdam (KLM). The daily flights to London and Amsterdam are primarily a result of pressure from the international actors of the Blue Maritime cluster, not the least large MNE such as Rolls-Royce. In addition, flights also operate to some destinations in the Baltic states due to the high number of workers in the clusters that originate in these countries.

The lack of variety is particularly problematic in terms of renewing existing growth paths or creating new ones. The region is highly reliant on the maritime and marine industries and access to oil and gas. Due to the high profit margins in these sectors, and the limited labour supply, the labour costs are extremely high and the incentives to venture out in new fields of economic activity are limited. This creates strong lock-in effects, which will be problematic if the existing industries are challenged by e.g. the exhaustion of natural resources, changes in prices for natural resources, as is actually happening with the dramatic fall in oil prices, or changes in the technological and market environments.

Sources for new path development in Møre and Romsdal

Shared development vision for Møre and Romsdal

The region has chosen the ocean space as their main focus area. The ocean space is clearly a broad topic under which many potential specialisations are feasible. The ocean is seen as a resource, related to which research and development should be undertaken and new business opportunities discovered. Within the ocean space, important development opportunities are expected in the following specialisation areas: oil and gas (and subsea operations), advanced maritime operations, shipping and transport, the marine industry including aquaculture, fishery and ingredients, as well as renewable energies. In order to progress in these specialisations, the objective is to develop generic technologies or build knowledge about generic technologies in fields such as biotechnology, logistics, material technologies, process (especially automatisation and robotisation) and product innovations, bioeconomy, visualisation, media and communication.

These priorities are well reflected by the cluster organisations, three of which are directly related to the above fields, namely the GCE Blue Maritime, and the Arena clusters Legasea and iKuben. Also, the regional research environment is specialised in the above topics. Seen in a broad context, namely the ocean space, opportunities open up for path renewal at the interfaces between these related fields.

Slightly different is the priority of supporting the furniture industry, which is stipulated in regional documents and evidenced by the existence of the Norwegian Rooms Arena cluster. This priority is based on a number of strong firms in this sector. In contrast to maritime and marine, this priority is narrower and consequently aims in particular at extending an existing development path.

Developing the regional knowledge bases

The global competitive landscape has changed significantly for the traditional industries. Global overcapacities in shipbuilding and the emergence of new competitors from for instance China and South Korea have led to increasing cost pressures. As a result, regional actors have clearly indicated the need to develop the regional knowledge base and offer more knowledge intensive products. Partly these efforts are directed towards increasing efficiency by focusing on process innovations, which is typical for path extension. Firms, however, also highlight the importance of branching into new higher value activities, e.g. moving from shipbuilding to ship design and the management of complex projects, moving from selling fish as raw material to the production of healthy oils, ingredients and flavours, or introducing business model innovations and service innovations. Such endeavours potentially lead to path renewal.

In order to better address these challenges expressed by firms, the university colleges have strengthened their research capacities and share of staff with PhD education, i.e. have been able to partially address the weakness pointed out above. The industry sponsored five professorships at the university college in Ålesund. As the regional research organisations augmented the capacities to address the needs of the industry in more knowledge intensive fields, leading firms, including global groups, have increased their collaboration activities with the regional research environment.

Aalesund University College, as the first ever university college, just received funding for a "Centre for Research driven Innovation" with among others the Norwegian University of Science and Technology as a partner. In contrast to the clusters mentioned earlier, which are

industry owned, Centres for Research driven Innovation are owned by higher educational institutes, but require a strong industry participation and co-funding. This distinguishes such centres from the pure basic research driven Centres of Excellence, where only higher educational institutes participate. The establishment of such a centre in the region will clearly increase the capacity of carrying out especially strategic or targeted basis research as well as more sophisticated applied research in close collaboration with industrial partners primarily in the Blue Maritime cluster, and thereby increase the potential for path renewal.

A similar strengthening of basic research capacity could be the result of the mergers among Norwegian higher educational institutes which is on its way, if Aalesund University College merges with the Norwegian University of Science and Technology, which the board of this university just has supported. The best case scenario would be that the university colleges become gateways to analytical knowledge and basic research while still maintaining their capacities to do applied research in close collaboration with the local industry. However, if the resources from the university colleges to conduct industry relevant research would be drawn to NTNU, this might diminish the accessibility of local firms to relevant knowledge.

Scouting for global knowledge

There is awareness among regional actors about the limitations and risks associated with relying only on local knowledge sources and learning opportunities. Accessing complementary knowledge from outside the region is therefore high on the agenda of firms and regional support organisations.

One example is a local, family owned firm, small in size, which has set-up an advisory board with international experts. In addition the owner of the firm is involved in regional cluster activities and shares knowledge with other firms in complementary fields. Another example is one of the leading local firms that explicitly searches for complementary, unrelated knowledge. The interview partners argued that knowledge, which is very dissimilar from what is known in the firm, offers the greatest potential for radical innovations. The collaboration with the Oslo School of Architecture and Design was mentioned as an example which led to a unique product. In other words, the combination of synthetic and symbolic knowledge was fundamental in this particular innovation process.

Also, the medium-sized and large firms with global operations, some of which have foreign owners, are important nodes in international knowledge networks. One international group, for instance, finances and maintains competence centres all over the world. Through strong

input-output relations as well as regional knowledge networks, this knowledge spills over regionally.

Furthermore, university colleges and locally based research institutes provide access to extra-regional knowledge. These organisations have strong linkages to other research environments nationally. In addition, however, university colleges and research institutes aim at establishing international collaborations. Clearly, the resources are limited to do so, however, it is another example for the interplay between regional and extra-regional knowledge sources. This knowledge, which is the result of collective and integrative efforts, is currently at the core of identifying new opportunities for path renewal.

In addition, however, the interviewees have suggested that the regional cluster organisations and in particular the Blue Maritime Global Center of Expertise should play a key role in identifying, assessing and circulating new knowledge in a more systematic manner. The idea is that these support organisations should attend fairs, talk to policy makers at the national and European level, identify trends and changes in the regulatory environment, establish contacts to leading players internationally, and extract the relevant knowledge for firms and policy makers. While this role is not new to the cluster organisations, several interview partners suggested that the knowledge-search activities of the cluster organisations should be intensified.

On the one hand, these knowledge scouting activities aim at extending development paths for instance by introducing technologies that allow more cost-efficient production. On the other hand, knowledge scouting also aims at identifying trends as well as new market and technological niches that may offer potential for generating new development paths, i.e. foster path renewal.

Broad understanding of entrepreneurial discovery

The smart specialisation policy approach emphasises entrepreneurial discovery processes. We find that entrepreneurs in Møre and Romsdal emerge due to their initiative, drive, ideas, knowledge and ability to mobilise resources. There are examples of entrepreneurs not only within industry but also within the regional research, education and training environments.

It is the entrepreneurs who drive things forward and take on leadership roles. The entrepreneurs seize opportunities in the institutional landscape such as the Arena, NCE or GCE programmes. These programmes often strengthen existing competencies and industries further. For instance, one of the main criteria for being awarded a GCE is the “maturity” of a

cluster, this is to say the co-location of competencies and actors covering the whole, or at least most of the value chain, global linkages and an understanding of international markets. Hence, these programmes rather support path extension rather than path renewal or new path creation.

However, entrepreneurs (in firms and other organisations) use these instruments in a rather creative manner, where activities are reported to fit the administrative purpose while the provided resources are combined and synergies created between e.g. the activities of the different cluster organisations. Hence, while not necessary foreseen in the design of these instruments, the "entrepreneurial" use also opens opportunities for path renewal and possibly even path creation.

Entrepreneurial activities are not limited to firms but extend to for instance the regional research environment and regional actors. An example of entrepreneurial activities in the regional research environment is the application for and granting of a Centre for Research driven Innovation grant initiated by Ålesund University College in collaboration with NTNU Trondheim. The project aims at studying and advancing technologies for the most demanding maritime operations, including subsea operations, installations of offshore wind, oil extraction and the extraction of minerals from the subsea. This is a typical entrepreneurial activity, which focuses on radical innovations that may open up completely new markets and opportunities. In this case, entrepreneurial professors take the initiative and use the opportunities in the national institutional landscape. In contrast to the Arena, NCE and GCE programmes, Centres for Research driven Innovation fosters basic strategic or targeted research and has a more transformative focus, i.e. path-breaking discoveries.

There are also examples where regional actors lead the entrepreneurial discovery process. The VRI programme provides support to SMEs for innovation activities. This programme co-finances pilot innovation projects with up to 200.000 NOK. Typical activities relate to e.g. biomarine and food value chains, including the development of new seafood products, or the search for new ingredients and flavours using biotechnology, or the automation of production technologies. While most projects relate to the dominating industries, i.e. maritime and marine, the programme is open for projects in other areas such as public health or furniture. Hence, entrepreneurial discoveries of SMEs are supported in a broad sense.

Conclusions

Smart specialisation understood as a strategic policy approach to innovation-based regional development emphasises the diversification of the regional economy into new fields building on the knowledge bases and capabilities developed in the past. Entrepreneurs in all sectors of society are mobilised and consulted in order to identify these new fields of economic activity. These efforts to promote the development of new growth paths in regions require an understanding of the place-based current and potential future competitive advantage. The constructing regional advantage approach underpins this search for competitive advantage theoretically and provides empirical evidence. It shows that industries and regions differ in the dominant modes of innovation and prevailing knowledge bases and that regions can be competitive in both high-tech and low-tech sectors, even in high-cost economies.

We illustrate this empirically in a case study on Møre and Romsdal, a region in western Norway. Møre and Romsdal has been very successful economically with low unemployment and high income while scoring low on the typical innovation indicators capturing mainly STI type innovation activities. A competitive manufacturing industry has developed building largely on a synthetic knowledge base and a DUI mode of innovation. However, the competitive landscape is changing, requiring from firms continuous efforts to maintain competitive in existing fields or to venture into new fields.

We find that also peripheral (or in the Norwegian context semi-peripheral) regions, like Møre and Romsdal have a range of opportunities for "smart diversification" into related fields of economic activities as advocated by RIS3. First, Møre and Romsdal exhibits outstanding collaboration between the industry, the local university colleges and applied research institutes. Building on a culture of trust, informal networks, and flat hierarchies, interactive learning between users and producers as well as industry and applied research leads to a high speed of incremental innovation, enhancing efficiency and productivity along an existing development path, i.e. promoting path extension.

Second, regional actors share a common vision to be a global leader in the environmentally sustainable exploitation of the ocean space. This vision is as narrow as necessary to focus regional efforts around a theme and as broad as possible to allow for branching into new fields of economic activities and the development of platform technologies, thus opening the horizon for path renewal.

Third, efforts are undertaken to develop the regional knowledge bases by firms and the regional education and research environment alike. This has become necessary as competitiveness lies increasingly in more knowledge intensive activities. The share of employees with PhD education is raising and the prevailing synthetic knowledge base becomes increasingly complemented with analytical knowledge, which also increases the absorptive capacity of regional actors to source knowledge from outside the region. Largely these efforts focus on maintaining and increasing competitiveness in current fields of economic activity.

Forth, due to the limited regional diversity, regional actors actively scout for knowledge outside the region. Interestingly, this comprises small local firms putting together international advisory boards, large international groups financing competence centres around the world, local leaders engaging lead designers and thus introducing symbolic knowledge as source of competitiveness, as well as university colleges and local research institutes engaging in national and international collaborations. Furthermore, the role of the regional cluster organisations to scout actively for knowledge globally is clearly emphasised. Combining the regional knowledge bases with complementary and rather dissimilar knowledge from extra-regional sources provide opportunities for path renewal and even new path creation.

Fifth, even in a specialised region, it becomes clear that entrepreneurial discovery processes need to be seen from a broad perspective. Entrepreneurs are found not only among firms and individuals engaging in start-up activities but also in the local research environment, educational facilities, cluster organisations, and public administration. Entrepreneurs are in fact those who identify and make use of opportunities that arise not only in markets and technologies but also in the funding environment supporting path extension as well as the development of the knowledge bases and critical mass for future areas of competitiveness.

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