Mapping of EU Member States' / regions' Research and Innovation plans & Strategies for Smart Specialisation (RIS3) on Bioeconomy

Task 3

Case Study Report, the region of North Denmark

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1. Short Regional Bioeconomy Profile

Name of the case region/country	North Denmark (Nordjylland)
Member State	Denmark
GDP – Euro per capita (2014)*	39 600 EUR
Total ESIF Research & Innovation per capita per year*	4.51
Total H2020 per capita per year*	19.95
Value Chain Approach to the Bioeconomy**	Marine-based primary production; Foods and beverages
Thematic Focus of the Bioeconomy Approach**	Agro-Food; Agricultural residues and bio-energy crops; Fisheries and aquaculture; Food Processing
Research and Innovation Fields highlighted for the Bioeconomy**	Primary Production with quality; Agronomy and crop sciences, oenology, etc.; Life-cycle Processing and efficiency, eco-design, recycling
Bioeconomy Activity Level**	Middle
CASE STUDY SUMMARY	
Bioeconomy Approach	Networks for aquaculture and fisheries development bring together public and private actors.
Bioeconomy Ecosystem	The entire value chain is represented in the region, including strong R&D environments.
Bioeconomy Policy Support	The Green Development and Demonstration Programme and Innovation Fund Denmark are key national programmes. The Danish Bioeconomy Panel gives recommendations for innovation and research.
Successful initiatives and Good Practices	Trash2Cash market maturation project for the fisheries industry. Mussels as a tool – new knowledge on the use of mussels for compensation production.
Main Needs, Gaps and Bottlenecks	Lack of synergies between H2020 and ESIF. Lack of industry participation in H2020.

* Source of the data: S3 – Regional Viewer: http://s3platform.jrc.ec.europa.eu/synergies-tool

** Data collected by this Study project in Task 1.

2. Regional Bioeconomy Ecosystem

This chapter describes the general characteristics of the regional bioeconomy ecosystem, its origins, main stakeholders and driving forces. It gives an overview on the recent evolution and trends on bioeconomy-related issues in the area and some of the main activities and initiatives.

2.1 Origin of Interest of the region in the Bioeconomy

The food industry is strong in the region of North Denmark with more than 9000 jobs and an annual turnover of approx. DKK 19 billion (Region North Denmark, 2016). Historically and still today the fishing industry comprises a position of strength for the region, and aquaculture is a related growth area. The entire value chain is represented in the region, including specialised R&D environments.

In Denmark, the Regional Growth Forums are responsible for the implementation of regional development policy, including the allocation of ESF and ERDF funds. In order to ensure coherence between national and regional policy, Growth Partnership Agreements are signed between the Government and the Regional Growth Forums. The most recent Growth Partnership Agreements were signed at the end of the year 2014. For North Denmark, building on previous Agreements, one of three prioritised areas for business development involves fisheries and aquaculture. The Agreement states that the North Denmark Region will establish two national networks, one for fisheries and one for aquaculture (vp-Nordjylland, 2014). At the same time a Collaboration Agreement on Food in West Denmark, which includes collaboration on fisheries and aquaculture development, was signed between the North and Central Denmark Regions. The North Denmark Region in collaboration with the Central Denmark Region brought together stakeholders for a series of meetings during 2014-2015 to facilitate network collaboration in the fields of fisheries and aquaculture. This process built on a cluster initiative for the fisheries industry which was already initiated in North Denmark, co-financed by regional development funds.

2.2 Bioeconomy Stakeholders

The regional development department at the North Denmark Region, which is secretariat for the **Regional Growth Forum**, has taken a leading role in facilitating **cluster development** for the fisheries and aquaculture industries. In collaboration with the Central Denmark Region regional development funds have been granted to a consortium led by Nordsøen forskerpark (in Eng: North Sea Science Park), based in North Denmark, to provide an operational function for the fisheries and aquaculture networks. Nordsøen forskerpark actively participates in a variety of projects, all of

which are intended to promote development and growth in the fisheries and aquaculture industries. The consortium provides the operational function also comprises the business association Nordjysk FødevareErhverv (in Eng: North Denmark Food Industry), FFI - Future Food Innovation and VIFU (knowledge centre for food development) based in the region of Central Denmark. An important task for this consortium will involve fundraising for project proposals that have been developed by stakeholders in the network development process.

Two strong research institutes in the field of aquaculture and fisheries are based in the North Denmark Region, DTU Aqua – the National Institute of Aquatic Resources of the Technical University of Denmark based at Nordsøen Forskerpark in Hirtshals, Danish Shellfish Centre in Nykøbing Mors, which is also part of DTU Aqua. Also Aalborg University in Aalborg/Hirtshals has a minor research group.

In the network development process the national business associations Danish Sea Food Association, Danish Aquaculture, and Danish Fishermen participated as representatives for the industry. Further a number of driven individuals representing individual businesses, including restaurants, participated in network meetings. The entire value chain from the fishing fleet, fish processing companies, and through to wholesalers and consumption is represented in the region. In 2011 approximately 40 fish farms, 4 eel farms, and 55 licenses to line mussel farming were in place in the region of North Denmark. Further, a number of firms have niche production and offer initiatives related to the experience economy. Several key construction and equipment suppliers for the fisheries and aquaculture industries are also based in the region (Plesner and Pedersen, 2011).

2.3 Bioeconomy – strategies, plans and projects

The **Danish Bioeconomy Panel** was established in 2013 in order to help turn Denmark into a growth hub in the field of knowledge, technology and production and to effectively promote the development of a sustainable Danish bioeconomy. The panel consists of leading firms and researchers, NGOs, key organisations and authorities, and its main task is to provide input for concrete action to promote bioeconomy in Denmark (Rönnlund et al., 2014). In June 2016 the Bioeconomy Panel published recommendations for **value chains based on blue biomass** with a particular focus on potentials from mussels and seaweed. The recommendations include, amongst others, research and development initiatives, development of market and product potential as well as technology export (Danish Bioeconomy Panel, 2016). The recommendations by the Danish Bioeconomy Panel are well in line with ongoing initiatives in the region of North Denmark to promote fisheries and aquaculture development.

As described in section 2.1 the Growth Partnership Agreement between the Government and the Growth Forum of North Denmark supports the development of

national networks for fisheries and aquaculture in collaboration with the Central Denmark Region. Based on dialogues between the triple helix actors during 2014-2015, lists of more than 100 project initiatives and action plans have been developed for the fisheries and aquaculture industries (Region North Denmark, 2016). As part of the EMFF, the Danish AgriFish Agency was responsible for developing the **national aquaculture strategy**, which was also done in parallel with the participation of representatives from the AgriFish Agency in both the aquaculture and fisheries network.

As described in section 2.2 the operational function managed by Nordsøen forskerpark will be instrumental in supporting the development and implementation of some of the proposed initiatives. The networks referred to as respectively **Forum for Aquaculture Growth** and **Forum for Fisheries sector Growth** will continue to have meetings minimum two times per year. The North Denmark Region will have a facilitating function in organising the meetings, also supported by the Central Denmark Region. Further, the development of national networks for fisheries and aquaculture are in line with the national cluster development initiative Danish FoodNetwork, which in 2014 achieved the Silver Label through the European Cluster Excellence Initiative (ECEI).

3. Bioeconomy Policy Support

This chapter gives a brief account of the existing policy instruments and action lines to support the bioeconomy in the area. It highlights the most important value chain approaches to promote the bioeconomy, the thematic focus of the Bioeconomy-related research and innovation, as well as some of the research fields that are relevant for further deployment of the bioeconomy.

3.1 General support framework

As described in the RIS3 expert assessment for the North Denmark Region, the Regional Growth Forums are together with the relevant ministries, especially the Ministry for Science, Innovation and Higher Education and the Ministry for Business and Growth the main responsible agencies for the implementation of a RIS3 strategy. The design and implementation of Danish R&I policies take place through a broad, network-based involvement of all relevant stakeholders, typically representing a triple helix constellation, both on the national and the regional level. Strong coordination secures that the policy initiatives at the various spatial levels and between different agencies pull in the same direction relevant for designing and implementing a RIS3 strategy (Asheim, 2014). Food and food technology is highlighted as one of the region's positions of strength in the Regional Growth and Development Strategy.

The Danish Business Authority, under the auspices of the Ministry of Business and Growth, is the Managing Authority for the ERDF and ESF. The funds are channelled through the Regional Growth Forums which are responsible for guiding and monitoring the implementation of regional development policy. The Danish AgriFish Agency, under the auspices of the Ministry of Environment and Food, is the Managing Authority for the EMFF and EAFRD. The AgriFish Agency also manages the **GUDP – The Green Development and Demonstration Programme**.

The Danish Agency for Science, Technology and Innovation under the auspices of the Ministry of Higher Education and Science provides guidance on national and international funding and collaboration opportunities, including Horizon2020. **Innovation Fund Denmark** was set up by the Agency as an independent body. It is the main national body supporting RTDI activity.

3.2 Bioeconomy Policy Support

GUDP – The Green Development and Demonstration Programme is a national programme managed by the Danish AgriFish Agency. The purpose of the programme is to ensure green and economic sustainability in the Danish food sector while solving some of the climate and environmental problems facing

society, and that the food industry will continue to create growth and secure jobs in Denmark. The target group for the GUDP programme include research institutes, food producers, entrepreneurs, industry associations, etc. in the food industry. The programme provides grants for applied research, development, demonstration and network projects. Development and demonstration projects can be granted a total of DKK 0.25-15 million for a period of up to four years. Network projects can be granted up to 50% of the eligible costs with a total grant of DKK 0.25-2 million in a period of 1-2 years.

Innovation Fund Denmark does not have a separate programme to support the bioeconomy, but the board of directors that decides investments is aware of opportunities from the bioeconomy and supports projects that promote circular economy, food and alternative use of biomass. In 2016, the total budget for Innovation Fund Denmark is DKK 1.25bn to be invested in new initiatives to create growth and employment in Denmark.

The Danish Bioeconomy Panel, as introduced in section 2.3, was established in 2013 in order to help turn Denmark into a growth hub in the field of knowledge, technology and production and to effectively promote the development of a sustainable bioeconomy. Recommendations from the Danish Bioeconomy Panel are developed for the government, authorities, the business community and they also **feed into national RTDI programmes** and can thus help guide how funds are spent.

3.3 ESIF and H2020 resources for the Bioeconomy

The Bio-Based Industries (BBI) Joint Undertaking is a EUR 3.7 billion Public-Private Partnership between the EU and the Bio-based Industries Consortium. Operating under Horizon 2020, it is driven by the Vision and Strategic Innovation and Research Agenda (SIRA) developed by the industry. A representative from the Danish Agency for Science, Technology and Innovation is represented in the states representatives group, and two companies – Novozymes and Dong Energy – participate in BBI. There is no participation from the region of North Denmark in the initiative. In general, according to the representative of the Danish Agency for Science, Technology and Innovation interest in the BBI initiative has been low from the side of industry in Denmark.

FACCE SURPLUS (Sustainable and Resilient agriculture for food and non-food systems) is an ERA-NET Cofund, formed in collaboration between the European Commission and a partnership of 15 countries in the frame of the **Joint Programming Initiative on Agriculture, Food Security and Climate Change (FACCE-JPI)**. Denmark is represented by the Danish Agency for Science, Technology and Innovation. One of the main objectives of the H2020-supported ERA-Net Cofund, FACCE SURPLUS, is to improve the collaboration across the European Research Area

in the range of diverse, but integrated, food and non-food biomass production and transformation systems, including biorefining.

According to the representative from the Danish Agency for Science, Technology and Innovation the **awareness from the regional development authorities in Denmark of BBI, FACCE SURPLUS and other opportunities from Horizon2020 is low**. This includes the opportunity of Regions to participate in the initiatives and to co-finance initiatives with regional development funds and ESIF. The engagement of Regions could be expected to also generate more interest and awareness among Danish-based companies to participate in Horizon2020 initiatives.

Funding from the ERDF 2014-2020 (TO1) has as yet not been granted to projects focused on the bioeconomy in the region of North Denmark. **EMFF is a funding source** which is being used for development projects in the aquaculture and fisheries sectors. Notably, the good practice initiatives highlighted in the following chapter were financed by regional development funds and national funds. The representative from the North Denmark Region did not have examples of EU co-funded research and innovation projects in the fisheries and aquaculture sectors.

4. Successful Initiatives and Good Practices

This chapter highlights successful initiatives and good practices to promote research and innovation in bioeconomy-related fields.

4.1 Trash2Cash

The project Trash2Cash was developed in collaboration between the Technological Institute, Nordsøen Forskerpark and a network of fisheries Municipalities. The project was granted DKK 3.2 million from the Growth Forum of North Denmark (regional development funds) and DKK 9.5 million from the Market Development Fund (managed by the Danish Business Authority) for the period 2012-2015. Enterprises and other participating actors contributed with own funding of DKK 8.5 million.

The project proposal was developed partly by taking as a point of departure previous work that had been carried out to develop a sector plan for the fisheries industry, which was co-financed by the EMFF (IFM et al., 2011), and partly based on ideas that developed in the ongoing meetings of the network of fisheries Municipalities and dialogues with the industry at network meetings. The overall purpose of the project was to uncover the potentials for better utilisation of products and by-products from the fishing industry. Six sub-projects were implemented including enterprises in all of the involved municipalities. These projects and their main results are briefly introduced below.

1) Utilisation of waste from whitefish: The purpose of the sub-project was to create added value in the whitefish industry in the marketing of fish off-cuts for consumption in new geographical areas and development of high-value products of fish off-cuts and side streams. The project has identified market potential in China, and prototypes for fish gelatine have been produced. Three-five new jobs have been created at the fish processing plant that participated in the project, and plans to construct a fish gelatine plant within five years are underway.

2) High Quality Fish from Thorupstrand: The project's objective has been to ensure fishermen better prices for the catch by saving costs from catch to consumer, and marketing the fish as a unique product of fresh fish from sustainable inshore fisheries. The project has assisted in the establishment of a cutting plant in Thorupstrand, where the fish are packed, cut or filleted, so the product is ready for retail sale. A fish shop on-board a ship has been set up in Copenhagen, and a fish shop has opened in Thorupstrand. Five-seven persons are employed at the newly established cutting plant.

3) Utilisation of viscera: The aim has been to further refine and utilise the production of ensilage from fish guts. Alternative silage procedures have been reviewed with the project partners to optimize the quality. The conclusion is that there is an economic advantage in adding enzymes to very fresh fish waste, so that a quick degradation of tissue and the release of the oil fraction which is separated are obtained through this pre-process. It was estimated that an economic incentive to collect the potential quantity of viscera will only exist with the introduction of the discard ban, so that the total volume of fish for processing increases.

4) Business incubators for the fisheries industry: As part of the sub-project efforts were made to engage new businesses or entrepreneurs, which was challenging. As a result it was recommended that further work on building actual business incubators designed for the purpose, ready for approval and with all the necessary facilities.

5) Extraction of high-value sources from seafood: This sub-project centred on the company A/S Læsø Fiskeindustri, which is one of the world's largest exporters of lobster. The company wanted to increase the added value of products and develop new, user friendly products with better profit and at better prices than for frozen lobster. In the development of "ready to cook" products, only one, the split lobster has as yet been introduced on the market. Sales are developing satisfactorily for this product. 1-2 new jobs have been created.

6) Re-processing of pelagic residual feedstock: Individual off-cut fractions (heads, tails, hull, and skins) from the manufacturing process are reviewed to perform commodity characteristics of the individual steps. Subsequently, there has been an assessment and characterization of products in selected markets in order to collate raw materials and products and to select new product opportunities. Possible products from off-cut fractions have been identified and evaluated in selected markets. These include market research on herring roe in Romania in addition to a larger market study in China. This sub-project helped pave the way for the innovation network "Marine Lipids" which has received support from the GUDP. The network includes companies and knowledge institutions with an interest in developments in the field.

The regional representative highlights the Trash2Cash project as a good example of how collaboration between public and private actors can promote innovation in the fisheries industry and job creation in rural areas.

4.2 Mussels as a tool - the use of mussels as compensation

In 2011, the Danish Shellfish Centre in collaboration with the private company Vilsund Blue a/s completed a study on the possibility of using compensation farmed mussels, smaller than the minimum size for fished mussels, for human consumption production. It was a sub-project of the more comprehensive project

"Mussels – Mitigation and Feed for Husbandry" (MuMiHus) funded by the Strategic Research Council and led by Danish Shellfish Centre. The purpose of the larger MuMiHus project was to develop cost-effective compensation farming, identify its ecological effects and to develop management tools related to compensation farming. The sub-project was co-financed with regional development funds (DKK 500,000) by the Growth Forum of North Denmark, six participating Municipalities and their common local Council (In Danish: Limfjordsrådet). The role of the Municipalities in the project was to disseminate the results to relevant political and technical forums and to promote alternative use of compensation farmed mussels.

Mussels as a tool means that mussels are used for removing nutrients – mainly nitrogen – from estuaries and other coastal waters. The purpose of the study was to identify whether compensation farmed mussels can be used for industrial processing through boiling for use as canning or loose-frozen mussels. A major obstacle to the use of farmed mussels has been that the existing industry is not geared to handle small and thin-shelled mussels from compensation rearing. As part of the project new machines and workflows were tested.

The study demonstrated that mussels grown on lines or similar can reach a size that makes them interesting for further industrial processing, and with relatively simple equipment it is possible to exploit this resource industrially. Vilsund Blue a/s estimates that they can use in order of 5-6,000 t net per year, representing gross production up to 9,000 tonnes gross per year. According to calculations of the average content of nitrogen (N) in mussels this corresponds to a removal of 90 t N. Such an amount can be grown on approximately 9 standard facilities (250 x 750 m, 90 lines).

A production of this magnitude is expected to result in 8-10 full-time jobs in the farming industry and converted 2-5 full-time jobs in the processing industry and related industries, and an expected turnover of around DKK 30 million. A prerequisite for such production is partly that the cultivation of mussels can be used as an instrument to meet the targets of the water framework plan, and that there is a model for compensation for farmers for the removal of nitrogen (Petersen and Mattesen, 2011).

The regional representative highlights this R&D project due to the new knowledge that has been developed in the field of using mussels as compensation, knowledge that can be utilised elsewhere in Europe.

5. Needs, Gaps and Bottlenecks to Deploy the Bioeconomy

This chapter describes the main needs of the area to further deploy the bioeconomy in the near future, as perceived by the regional stakeholders and in the revised documents. In particular, the gaps and bottlenecks that hamper the development of research and innovation for specific bioeconomy-related business areas are described.

Networks such as the forums for development of the aquaculture and fisheries industries are also highlighted as being important for future research and innovation in bioeconomy, i.e. ensuring that public and private actors are moving in the same direction. In Denmark, however, this type of public-private collaboration on bioeconomy development is not strongly linked with the national authority responsible for higher education and science or to Horizon2020 initiatives. According to the representative from the Danish Agency for Science, Technology and Innovation the concept of smart specialisation has not sufficiently been implemented in Denmark. A similar conclusion is presented in the RIS3 assessment for the North Denmark Region which states that an innovation system approach is not applied in Denmark, i.e. Danish policy has been quite strongly biased towards a supply side policy and promoting a R&D based innovation strategy. Tools as clusters and networks are established as partnerships and consortiums between universities, industry and often the public sector, generally of a duration between 3-5 years. In contrast most centres of expertise programmes in VINNOVA – the Swedish Governmental Agency for Innovation System – have ten years duration and is better funded (Aasheim, 2014).

A key problem for research and innovation in bioeconomy, according to the representative of the Danish Agency for Science, Technology and Innovation is the lack of awareness and interest among SMEs in Denmark to take part in the BBI initiative. Related to this, synergies between Horizon2020 and ESIF are not being achieved in Denmark. There is not a holistic approach to investments in RTDI initiatives. The interviewee stresses that it is relevant to activate regional development authorities to utilise opportunities from Horizon2020, including their own participation in initiatives. The Regions may in turn reach the private companies and generate their interest, also through co-investing in Horizon2020 initiatives with regional development funds and the ESIF. The Danish Agency for Science, Technology and Innovation has organised information meetings about BBI, but an issue in this regard is that only representatives from research environments are present, while the industry does not participate.

6. Information Sources

Literature and Documents:

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Relevant websites:

Danish Bioeconomy Panel: http://agrifish.dk/about-us/the-danish-bioeconomy-panel/

GUDP – The Green Development and Demonstration Programme: http://naturerhverv.dk/tvaergaaende/gudp/

Innovation Fund Denmark: http://innovationsfonden.dk/en

Mussels as a tool: http://www.skaldyrcenter.aqua.dtu.dk/Forskning/Afsluttede-projekter/Blaamuslinger/Muslinger-som-virkemiddel

Trash2Cash: http://fiskeviden.dk/?page_id=11

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