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Bioeconomy on the Nordic Agenda

In 2014, the Icelandic Presidency of the Nordic Council of Ministers has put bioeconomy at the top of the Nordic political agenda, stating that the Nordic countries have excellent potential for creating a sustainable bioeconomy, with positive effects on regional development. There are three arguments behind this statement. First, the Nordic countries are rich in biotic natural resources. Second, they have well-functioning institutions and well-developed cross-border co-operation. Finally, they have the requisite competence and research capacity. In this issue of Nordregio News, we look at the current situation regarding the bioeconomy in the Nordic countries.

The Nordic region contains a multitude of biotic natural resources, from the marine environments off the Icelandic and Norwegian coasts to the vast forests of Finland and Sweden and the fertile agricultural soils in Denmark. Hence, each Nordic country has special strengths and comparative advantages. There are also differences in the extent to which the bioeconomy is prioritized on the political agenda. So far, Iceland and Finland are the forerunners in this regard. Iceland's prioritization of the bioeconomy has already been mentioned. In Finland, with its strong forest sector, the phrase 'superpower in bioeconomy' is used. The Finnish Bioeconomy Strategy was launched in 2014, and is based on a broad-based national project set up by the Ministry of Employment and the Economy. In Denmark, the Ministry of Food,

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Agriculture and Fisheries has established a national bioeconomy panel with the task of promoting Denmark as a centre for science, technology and production in a sustainable bioeconomy. Moreover, Norway and Sweden offer several good practical examples of implementation of a bioeconomy, as described in the following articles.

Behind the term 'bioeconomy' lies a political ambition. It is not only the integration of traditional primary sectors such as agriculture, forestry and fisheries with the biotech industry, but something more. First, it is the ambition of replacing fossil fuel and other limited resources with *"the production of renewable biological resources and the conversion of these resources and waste streams in value added products"*, as stated by the European Commission in its strategy entitled **Innovation for sustainable growth: A bioeconomy for Europe**.

Second, the bioeconomy is expected to boost the productivity of agricultural and industrial processes, as stated in an OECD report entitled **The Bioeconomy to 2030: Designing a policy agenda**.

Finally, in the Arctic region, the bioeconomy plays a definite role in the development of sparsely populated areas where for a long time people have lived by utilizing biotic natural resources, as stated in a forthcoming report financed by the Nordic Council of Ministers, Future opportunities for bioeconomy in the West Nordic region.

In the first article of this issue, **Bioeconomy in the Nordic Regions**, Jukka Teräs takes us through the current situation regarding the Nordic bioeconomy, looking especially from the viewpoint of regional development. The article is based on an in-depth Nordic regional study on bioeconomy conducted in 2014.

Gunnar Lindberg and Jukka Teräs take us to Örnsköldsvik in the second article, **Bioeconomy and the Regional Economy: Örnsköldsvik Biorefinery Cluster**, which takes a closer look at one case from the in-depth study described in the first article.

In the third article, **Views on Finnish and Nordic Bioeconomy**, we interview Kaisu Annala from the Ministry of Employment and the Economy in Finland. We ask her about what new regional opportunities the bioeconomy can offer, to what extent the bioeconomy is prioritized in Finland and how the Nordic countries can learn from each other.

For Nordregio, the bioeconomy is currently a prioritized theme. This issue of Nordregio News is based on work conducted for the **Nordic Working Group on Green Growth - Innovation and Entrepreneurship** under The Nordic Council of Ministers' Committee of Senior Officials for Regional Policy.

It is also a main topic at the **Second Nordregio Forum** in Keflavik, Iceland, on 12-13 November, where mapping the bioeconomy and the ways in which new innovative use of local natural resources can contribute to regional economic growth and development are hot topics.

We hope you enjoy reading this issue, and we are looking forward to seeing you at the Nordregio Forum in Keflavik.

Kjell Nilsson
Director

and the Editorial Board of Nordregio News

Bioeconomy in the Nordic Regions

By Jukka Teräs

Bioeconomy has gained growing attention and importance on the Nordic research and industrial agenda. An increasing number of Nordic actors have attempted to develop the principal products of the bioeconomy: bio-based products and bioenergy. What then is the current state of the art of the Nordic bioeconomy - especially from the viewpoint of regional development? Are there good regional practices to learn from and transfer within the Nordic region?

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Nordic in-depth study of the regional bioeconomy

Nordregio has conducted an in-depth regional study of the Nordic bioeconomy in 2014. The study presents an overview of instruments and explores 'good practice' case studies of innovation and entrepreneurship in the field of bioeconomy. The study included five Nordic cases: the Forssa region of Finland, South Iceland, the Østfold region of Norway, the Örnsköldsvik region of Sweden, and the Lolland region of Denmark. The cases were selected to provide rich data on good practices in the field of bioeconomy in Nordic regions. The selected cases include regions with biorefinery initiatives in various stages, regions with a variety of approaches to regional clustering, and regions where key companies play different roles in the bioeconomy field.

Regional bioeconomy cases - a brief overview

Forssa, a region with 37,000 inhabitants in south-west Finland 100 km from Helsinki, has launched the bioeconomy concept as part of the **Forssa Brightgreen** concept. The activities usually connected to the bioeconomy originated in the early stages of the industrialization of Forssa, with an emphasis on the symbiosis of agriculture and industry as early as the 1840s. **MTT Agrifood Research Finland**, operating under the Ministry of Agriculture and Forestry, located its main operations in Jokioinen in the Forssa region in the 1970s. Currently, the private sector bioeconomy actors in Forssa include the food industry and clean-tech/environmental technology companies such as Envor Group Oy (recycling, processing of paper, treatment of biowaste), the LHJ Group (industrial waste treatment, soil remediation, municipal waste management) and Watrec Ltd. (clean-tech solutions in biogas technology and wastewater and process water treatment). Envor Group has recently published a plan to establish a biorefinery as a flagship project of the Forssa EnviGrowPark industrial region.

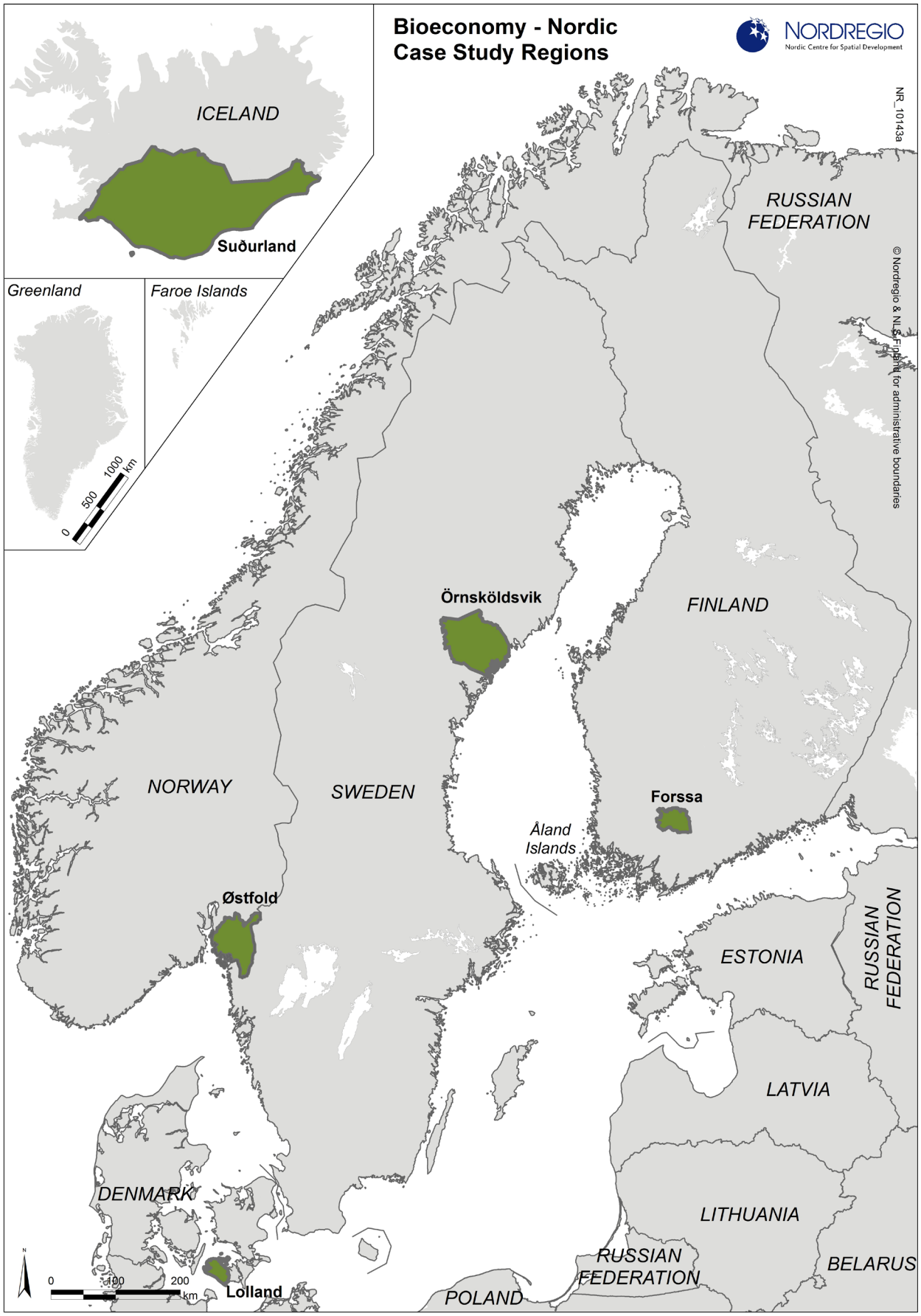

Figure 1: *Nordic case-study regions of the Nordregio regional bioeconomy study in 2014.*

According to the study, Forssa has the advantage of a long tradition and accumulated knowledge of bioeconomy-related know-how and expertise, especially in agriculture. The key public and private actors have succeeded in preparing a common vision. The Brightgreen Forssa programme is an instrument to focus on spearhead programmes and key priorities of the bioeconomy. The actors in the Forssa region emphasize long-term continuity, but short term 'victories' are also needed as well as rapid steps to develop the local bioeconomy.

The South Iceland region covers a large area of 30,966 km2 across the south and south-east coast of Iceland, has 26,000 inhabitants and is divided into 15 municipalities. Unlike in Iceland as a whole, agriculture is an important sector, with 40% of the agricultural production of Iceland coming from the region. Fisheries also play an important role in the regional economy. Tourism is expanding in the region, and food innovation there has been promoted by the state-owned Matís Ltd., Innovation Centre Iceland, and local and regional actors. The small-scale bioeconomy innovation activities include developing cod liver, dried fish products as souvenirs, raw goat sausages, and the development of hot smoked mackerel products. Moreover, the use of waste flows has been developed in connection with the fisheries.

The study shows that there is considerable potential in South Iceland to increase the added value of the biomass materials from agriculture and fisheries. Innovation is central to the development of the bioeconomy. Food innovation is particularly relevant to this rural and sparsely populated region, as it can build on local competences and knowledge of primary production and does not necessarily require high-technology competences and facilities. The innovative projects in South Iceland are mostly small-scale innovations for which local knowledge and the competences of the local people are central. Small companies require external encouragement to develop their innovative ideas further.

The Østfold region in Norway is situated in south-eastern Norway. The population of Østfold County is approximately 285,000, with Sarpsborg and Fredrikstad making up the fifth-largest urban area in Norway. Although agriculture comprises an important part of the economic activity in the region, 83% of the population lives in urban areas. Traditionally, wood processing has had a stronghold in Østfold County. Borregaard, the locomotive company of the bioeconomy in the Østfold region, is one of the world's most advanced and sustainable biorefineries. Borregaard is a relatively self-sufficient company, and has little collaboration with regional stakeholders such as the County Council. However, Borregaard contributes to the local environment through various development projects. The local forest owners who provide Borregaard with raw material for their production are also important regional actors.

The Norwegian bioeconomy case study in Østfold County illustrates an example of a strong locomotive company dominating the bioeconomy activities in the region - without significant regional cluster formation. Borregaard controls the entire value chain from extracting wood/forest residues to the end products (e.g. cellulose, lignin, fine and basic chemicals, food ingredients, ethanol). Borregaard is more a globally and nationally based company than a regionally based one.

Örnsköldsvik is located in Sweden, 550 km from Stockholm. There are approximately 55,000 inhabitants in the Municipality of Örnsköldsvik, which has a city centre as well as large forest areas and minor areas of agriculture in the countryside. The major industrial ventures include MoDo, a pulp, paper and logging enterprise that was established in 1903. A large proportion of the bioeconomic activities in the Örnsköldsvik region form a bioeconomic cluster built around the pulp mill in Domsjö, SP Processum being the cluster company.

According to the study, the Örnsköldsvik bioeconomy cluster is an essential part of the regional change story, based on accumulated knowledge and natural resources in the region. The industrial downturn of the 1990s paved the way for the biorefinery initiative. The SP Processum bioeconomy cluster organization has been able to deliver and communicate a systematic, long-term approach and vision in bioeconomic initiatives. Read more about the Örnsköldsvik case in the **next article of this issue**.

The Lolland region of Region Zealand, Denmark initiated green growth activities as early as the 1980s. These green growth activities have developed significantly in recent years, especially into the fields of bioeconomy and resource efficiency. Biofuel production in Lolland was established in collaboration with public–private partnerships. These biofuels include rapeseed oil, biodiesel from algae cultivation and bioethanol from agricultural production. **The Green Centre** was founded in 1988 in Lolland to help farmers innovate. The centre has modern laboratories that offer biological, plant technological and environmental analyses and development facilities.

The economic resurgence of Lolland has mainly been the result of local initiatives rather than interventions at a national level, although the overall national policy of a green economy has played a role. In addition to providing practical and innovative solutions for local and regional problems, the focus on the 'green economy' also represents additional export potential for Region Zealand.

Lessons learned from the Nordic cases

First, the adoption of the bioeconomy concept varies significantly - not only among but also within the Nordic regions. Some Nordic regions have largely adopted the term 'bioeconomy', whereas some other regions are only just becoming familiar with the term.

Second, the intensity of regional co-operation between actors varies significantly among the Nordic case-study regions. For example, regions may have developed an active regional cluster collaboration with intensive public–private co-operation and a cluster management organization, as the Örnsköldsvik case illustrates. Regions may have an actor structure with a locomotive company but without intensive regional co-operation, as Østfold does. Other regions may have a fragmented actor structure with numerous smaller bioeconomy organizations, such as in the South Iceland case. There is no typical Nordic bioeconomy regional structure or organizational model that can be identified; every region has its own specific characteristics.

The Nordic cases also illustrate the importance of the long-term commitment of key operational and financial actors in developing a regional bioeconomy. An example is the 10-year **VINNVÄXT programme** by VINNOVA in Örnsköldsvik, which makes it easier for several other actors to commit to regional bioeconomic initiatives. Moreover, public–private partnerships such as those in the Forssa case are frequently mentioned by the respondents of the study as favourable for developing the bioeconomy of the Nordic regions.

The study reveals a variety of national approaches to bioeconomic activities. Some Nordic countries have recently launched national bioeconomy strategies (Finland 2014) or important documents intended to have an impact on the national bioeconomy policy (Bioeconomy Panel, Denmark 2014). However, there is a common desire in the Nordic countries and regions to focus on true implementation and definite actions on the bioeconomy, including scaling up of demonstrator plants to larger-scale facilities and opening up new export markets to bioeconomic products and services. This study shows that there is a genuine interest among the bioeconomy actors in learning from other Nordic actors, and also in building co-operative Nordic relationships. The increased international visibility of the Nordic bioeconomy actors would also be welcomed. For larger-scale R&D efforts and bioeconomic investments, intensified Nordic co-operation may offer new opportunities for initiatives such as scaling up of the regionally/nationally developed pilot plants.

The general impression of the Nordic bioeconomy is that it can be a motor for creating jobs and economic activities, especially in rural regions, while also being beneficial for the environment. Although all cases show examples of successful entrepreneurship, cluster development, creation of clustering or intermediary firms and even what can be defined as successful regional innovation systems around the bioeconomy, it is difficult to assess the actual impact of regional development (in terms of jobs or economic activity). Certainly, many jobs have been created and this is obviously one extremely important factor

of (rural) regional development. It was not the explicit purpose of the project to identify these jobs, but the results of the case studies make it obvious that they are important from a local perspective.

What can be ascertained is that the Nordic cases illustrate the possibilities of the bioeconomy in terms of providing jobs and regional growth, not only in an urban context but also in a rural environment. However, the large-scale impacts of bioeconomic development still hinge on the scaling up, market development and systemic changes that would need to occur in society. From a long-term perspective, the 'glocal' nature of the bioeconomy - global and local at the same time - also opens up new business opportunities for Nordic entrepreneurs.

Bioeconomy and the Regional Economy: The Örnsköldsvik Biorefinery Cluster

By Gunnar Lindberg & Jukka Teräs

Bioeconomic development in Örnsköldsvik in Sweden has a specific feature of strong clustering activity around the 'Biorefinery of the Future' initiative, but how did the regional biorefinery cluster develop over time to become one of the most interesting Nordic regional bioeconomy initiatives? What is the future of the Örnsköldsvik biorefinery?

The Örnsköldsvik region faced a serious downturn during the 1990s, when many local businesses closed, downsized, or relocated to more central regions of Sweden. This resulted in the loss of around 5,000 jobs in the Örnsköldsvik region (Arbuthnott, 2011). However, the regional decline created a sense of urgency among the local actors to create new industries and jobs in the region. The idea of generating activities based on the novel biorefinery initiative, together with the increasing popularity and awareness of clustering initiatives, paved the way for a regional biorefinery cluster in the Örnsköldsvik region. The cluster company **SP Processum** was founded in 2003 to gather local and regional actors, including the municipality and the local power plant.

The cluster development received an additional boost in 2005 when Processum received its first **VINNVÄXT** funding for the development of the Biorefinery of the Future project. VINNVÄXT is the Swedish innovation agency's programme for 'regional growth through dynamic innovation systems', and it awards winning initiatives with 10-year funding to develop competitive research and innovation milieus. In 2013, the Swedish Industrial Research Institute (SP) bought 60% of Processum's shares, and the cluster is now part of the Swedish government's science partner initiative; today the cluster company itself employs 17 people.

Development of the bioeconomy initiative

SP Processum's Biorefinery of the Future VINNVÄXT project is the flagship project of the Örnsköldsvik bioeconomy. Its purpose is to accelerate development in the field of biorefining woody biomass. In other words, the project is intended to be a collaborative effort by its member companies, academic partners and the local community to create, promote and invent products and processes based on lignocellulosic feedstock in a triple-helix set-up.

The bioeconomy is a competitive and knowledge-intensive sector, and to be competitive the cluster uses 80% of its funds for research and innovation. All research is conducted in an open innovation net-

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work setting, and there are professors from Umeå University within the cluster organ. The remaining funds are devoted to building the innovation system and helping to develop the member firms. In the past three-year period, substantial resources have been devoted to scaling up promising projects. To facilitate this scaling up, a unique set of pilot equipment has been developed that can take technologies from the laboratory scale to a first-demonstration scale, and a regional test bed has been created. In this way, SP Processum has created an open test bed (a pilot park) that can be used by member companies and collaborators, as well as universities.

Today, the cluster has 21 member companies, and most of these are in one way or another connected with the forest industry, the chemical industry or the energy industry (Figure 1). Some of these are large forest and paper industries, while others are smaller research and technology firms. They base many of their new ideas on existing capital investments in pulp and paper mills. As an investment in an average-sized biorefinery could easily amount to 1.5 billion euros, a large number of endeavours within biorefining are dedicated to converting existing mills and infrastructure into biorefineries. The same reasoning applies to energy-sector utilities. The cluster's main strategy in biorefining is to improve existing mills, to create more value, new chemicals and new materials, and to turn residual streams into products and thereby increase both economic efficiency and the efficiency of feedstock usage. In other words, once woody biomass has been processed into the main product (e.g. pulp and paper), the numbers of complementary products and complementary streams in a biorefinery set-up are maximized. This thinking will also decrease the generation of waste from the production sites and improve the environmental footprint of the industry even more.

The average yearly turnover for SP Processum has been 23.5 million SEK. All their activities are devoted to biorefining R&D and cluster development. VINNOVA spends 6 million SEK every year through the Biorefinery of the Future project, and regional actors put up an equal amount to match this funding. An extra 12 million SEK per year has been supplied from EU structural funds, member companies and public and private research funds (regional and national), as well as funding from FP7 and similar EU sources.

Geographically, the focus of the cluster is along the coastal area of northern Sweden; the original cluster started in the Domsjö development area in Örnsköldsvik, but now extends from Piteå in the north to Iggesund in the south. Today, the core of the cluster in terms of the number of companies is located in the region of Örnsköldsvik - Umeå. Many of the member companies are multinational, which means that the core region sometimes extends as far as Brazil, India or Canada. Over the past two years, intense co-operation with the chemical industries on the west coast of Sweden has been initiated by the Processum cluster and the 'Hållbar kemi' cluster in Stenungsund.

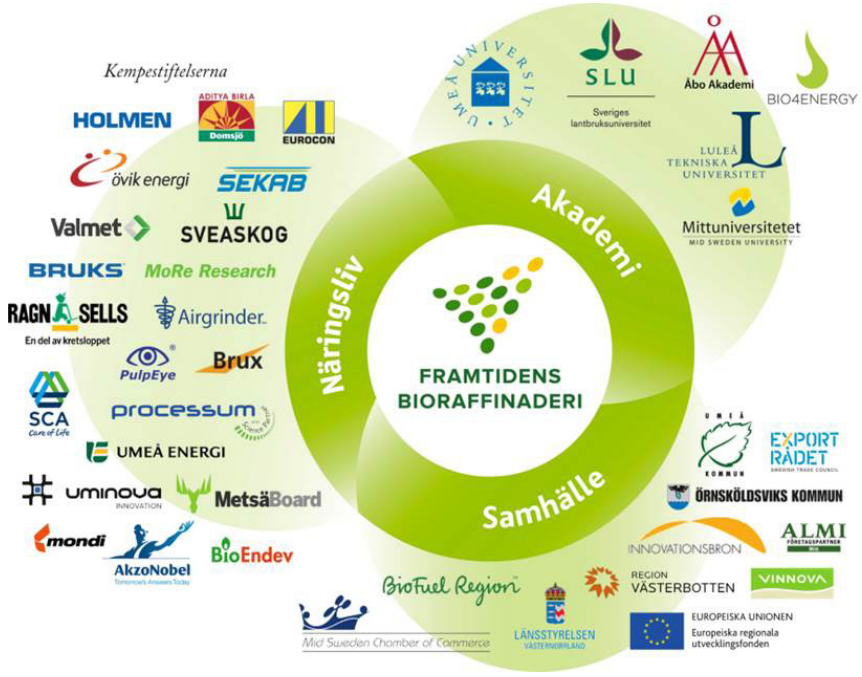

Figure 1. *The members of the Biorefinery of the Future cluster.*

The universities in the region are not officially included in the cluster, nor are the regional financing bodies and development authorities. However, the cluster co-operate intensively with these actors of the helix as well. They are represented on the board of Processum and take part in activities such as membership meetings and project meetings. Thus, the structure is open to all parties of the helix. Non-member companies can also be part of the structure at several levels. However, the only formal owners are SP and 'Processums Intresseförening' (the association).

Regional and national impact of the activities

It would seem evident that an important aspect of the bioeconomy cluster in Örnsköldsvik is the national influence that this activity has had on the development of the bioeconomy. When the Biorefinery of the Future project began, many of the big pulp and paper companies in Sweden were relatively uninterested in the biorefinery field. The example of Domsjö and the VINNÄXT cluster, combined with a decline in the demand for paper products, has inverted the situation. Today, almost all the big pulp and paper companies have entire units working on biorefining and new businesses, and the Swedish chemical industry has taken a bio-based route. In Sweden, SP Processum has been an early and successful example that has inspired others and accelerated this development.

The challenge now lies on the political side. According to SP Processum, the political will for change is often lacking in terms of tax

incentives, biofuel quotas or other measures. The technologies are ready for scale-up, but the demand for green solutions is insufficient. A couple of years ago, almost all the planned scale-ups to the industrial scale were aborted. One of these was the big gasification plant planned for the Domsjö mill. The failure to invest in Domsjö was a very clear example of the situation in Sweden today. Based on our case studies in the Nordic countries, we know that this situation is not unique. However, there are now bioeconomy panels developing (e.g. in Denmark) and fresh bioeconomic strategies being developed (e.g. in Finland). It will be interesting to see whether these ambitions can influence the playing field for substantial (and expensive) bioeconomic investments in the long term.

The actors in the cluster believe that a large part of value creation in the short run will take place within existing companies rather than within start-ups. This is mainly related to the huge investment costs and the economies of scale in the industry. However, recent trends in new technologies and the need for entrepreneurs to develop businesses around waste-stream conversion make it clear that new businesses also need to be developed. These new businesses have proven more important than previously believed in terms of bringing new processes and products to the market. Large global companies alone will be unable to handle this systemic change in the bioeconomy.

What is the future for the bioeconomy in the region?

Based on interviews with regional and local actors in Örnsköldsvik, the bioeconomy sectors are considered to be important. The actors perceive that the bioeconomy and the forest sector in general have a strong position in the regional development programme, and they see some positive impacts in developing this field. There are many municipalities, counties, firms and universities in the region that have the same ambition, and they are collaborating on branding the region, focusing on the social, technical and economic aspects of the regional bioeconomy. For the smaller region of Örnsköldsvik, the bioeconomy is an important sector today. For the larger region, including the city of Umeå, the bioeconomy has a less strong position because the economy is rather diversified and other sectors are more important. However, the universities in Umeå (a technical university as well as a branch of the agricultural and forestry university) are involved in bioeconomic development in Örnsköldsvik. One feature of this is that the region is becoming more integrated in terms of aspects such as the labour market, because high-tech employment is being created in Örnsköldsvik and people are commuting from Umeå for these opportunities. Interaction with Umeå, as well as national and global relationships in the field of bioeconomy, may contribute to the long-term development of new parts of the regional economy. The perception is that the regional interaction will spill over to other sectors as well, with increased interaction between the two cities.

The Örnsköldsvik bioeconomy, especially the build-up phase of the biorefinery initiative, is an essential part of regional change, based on accumulated knowledge and natural resources in the region. The industrial downturn of the 1990s paved the way for the biorefinery initiative; there was a 'sense of urgency'. The cluster organization acted as the key regional development tool in bringing the actors together, and it has delivered and communicated a systematic, long-term approach that is definitely needed in bioeconomic regional initiatives. In conjunction with this, the role of the national institute VINNOVA has been significant in guaranteeing the long-term approach to the Örnsköldsvik bioeconomy, which is probably necessary to continue this development and reach the next stage of bioeconomic development in the region.

From a bioeconomic perspective, the biorefinery cluster in Örnsköldsvik is unquestionably a success story. However, the questions are how great an impact on regional development this geographically confined and rather high-technology cluster has had on employment, societal systemic change and the development of other sectors, and to what extent it has had multiplier effects on the economy. It is a fact that firms have been created (and sustained), and they are finding new ways to make use of the region's forests, which may not be required for paper in the long run. However, there is a challenge in linking such a knowledge-intensive cluster to 'wider' aspects of rural and regional development. If markets and funding were available, there would be more job creation because plants would be built for other forms of refinement of forest products, and production scales would increase for those firms developing products such as ethanol, coal and proteins. Moreover, there is an obvious temporal dimension to the question of regional development - in the long run, economic activities, attractiveness and labour markets may evolve because of the narrower-sector growth taking place today. However, an integrated vision for the region would seem to be a necessary tool to enable this development to take place.

Views on Finnish and Nordic Bioeconomy

With Kaisu Annala

We asked Kaisu Annala, Strategic Director of Cleantech at the Ministry of Employment and the Economy in Finland, some questions on Finnish and Nordic bioeconomy. Kaisu chairs the Nordic Working Group for Green Growth - Innovation and Entrepreneurship. Finland has set ambitious goals to be in the forefront of bioeconomy in the Finnish Bioeconomy Strategy drafted in 2014, a project set up by the Ministry of Employment and the Economy.

Kaisu Annala drives Finnish Cleantech through the governmental Cleantech strategic programme in the Ministry of Employment and the Economy. Originally a wood chemist from the University of Technology (now Aalto University), Kaisu has worked in various positions and for all continents in the private sector at Pöyry, Metsä-Botnia, Kemira, Federation of the Technology Industries and Indufor.

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In your opinion, why has bioeconomy risen on the agenda in such a short time, both nationally and internationally?

- The bioeconomy is the global response to the continuously growing concern over the consequences of the climate change. In Finland, the bioeconomy and its enabler, cleantech, are seen as the answer to the question, how to renew the economy after the big holes created by the challenges in electronics and printing paper markets of the Finnish products.

What kind of new opportunities does the bioeconomy offer regionally? Can it offer concrete opportunities for job creation and regional growth for rural areas?

- The bioeconomy, like the 'circular economy', opens minds to see the potential of biomass whether it's virgin, recycled or waste. It is not experimentation though: we cannot just start to produce energy from biomass. Either the market already exists or it has to be grown from scratch.

In the first case the bioproducer faces the competition of the fossil producers, who are not going to give up the market easily. Well, most of the oil companies have started bio based research or at least they closely follow the progress. For example, some companies like Neste Oil have major biobased operations themselves. It's always cannibalization of the energy market, even individual companies have opposing forces working internally.

In the second case the market creation does not happen overnight, but co-research in the value chain has to be done, and this can take years to become profitable. The question is who can cover the costs during these years? Even if new technologies are close to the market the European research funding agencies have their hands bound. The large companies want to see results and payback fast so it's very important that we are able to use bio based intermediate products as biofuels during the time required for the market to generate higher added values.

But coming to your question, the bioeconomy does offer regional potential. For rural regions our Nordic forests will be the treasure world.

But one thing we can't disregard are the logistical and other secondary costs associated with a growing bioeconomy. This brings us back to the financial facts of life and will dictate how many jobs and how much business can be created.

How important is the role of the bioeconomy for industrial development in Finland? What does the Finnish Bioeconomy strategy from 2014 emphasise?

- The industrial Policy of Finland was renewed in 2014. The spearheads for growth are bcd, i.e bioeconomy, cleantech and digitalization. The target is to gain serious growth in bioeconomy, 40 billion euro more revenue by 2025. Another 25 billion is to be created in clean technologies by 2020. Like I said earlier, cleantech is the enabler of the bioeconomy.

What can the Nordic countries learn from each other concerning the bioeconomy? Can you mention some interesting regional bioeconomy projects in Finland and the other Nordic countries?

- The most important issue is probably to focus on collaboration rather than competition, at least as much as the customers and competition laws allow. That way we can learn together and have the critical mass to proceed. The Nordic countries are all quite small, and our large companies are not so large in comparison with their competitors around the globe.

A bold ongoing project is the biorefinery in Äänekoski, Finland. Their permitting is progressing and they will decide if the project will be implemented sometime in the spring. There is also an interesting process called KasvuOpen ("growth open") going on in the region to find the biorefinery partners. It's worth a google, I would say.

You are the Secretary of the Nordic Council of Ministers' working group for green growth – innovation and entrepreneurship. How do you think we could increase the Nordic cooperation within bioeconomy to achieve concrete results? For instance, how can we increase the visibility of Nordic bioeconomy actors internationally?

- Cooperation should be built especially based on innovation in the sector. New processes and services have to be developed and demonstrated. For instance, new opportunities for funding this cooperatively can be sought from the new Horizon 2020 programme.

We should also organize stands in exhibitions close to each other under the basis of 'Nordic clean technologies for biobased products'. One good example that already exists is the Cleantech Venture Day.