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

Task 3

Case Study Report Värmland, Sweden

Contract: RTD/F1/PP-03681-2015

2016-12-05

Johannes Henriksson

1. Short Regional Bioeconomy Profile

Name of the case region/country	Värmlands län (SE311) (NUTS 3)
Member State	Sweden
GDP – Euro per capita (2014)*	20 726
Total ESIF Research & Innovation per capita per year*	16.18 (for SE31, where Värmland is one out of three regions)
Total H2020 per capita per year*	7. 28 (for SE31, where Värmland is one out of three regions)
Value Chain Approach to the Bioeconomy**	Pulp and paper, Bio-energy and fuel from biomass, Bio-based construction and furniture, Bio-based materials and plastics, Bio refinery
Thematic Focus of the Bioeconomy Approach**	Forestry and Wood, Wood-based biomass, Conversion to Fibres and Lignocellulosic biomass, Bio-based construction material, Bio refinery
Research and Innovation Fields highlighted for the Bioeconomy**	Logistics and Packaging, Processing, Biology, Biotechnology, Chemistry, Life Sciences, Nano Technologies
Bioeconomy Activity Level**	High
CASE STUDY SUMMARY	
Bioeconomy Approach	Linking together the whole value chain within the Forest-based Bioeconomy
Bioeconomy Ecosystem	Cluster organisations acts as drivers for the implementation of Bioeconomy related priorities in the Smart Specialisation strategy, Strong links with Academia and Regional Authorities in setting priorities for new initiatives and research
Bioeconomy Policy Support	Substantial and long-term public investments from national funds, strong triple-helix cooperation
Successful initiatives and Good Practices	Paper Province 2.0, Academy for smart Specialisation
Main Needs, Gaps and Bottlenecks	Low R&D Intensity in SMEs, Absence of policy creating market demand

* 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

2.1 Origin of Interest of the region in the Bioeconomy

Compared with a majority of regions within the EU, Värmland is home to large tracts of forestland, with more than 70 percent of Värmlands' land area being covered by forests. This enables the region to use the wood for different purposes with different added values. Global structural changes have, however, resulted in outsourcing, international mergers and acquisitions and increased competition within the forest sector. Coupled with trends such as an increased focus on recycling of biological raw materials, feedstocks, bio refining and, in particular, lignin development (a side product of paper production) together with behavioral changes – such as reduced demand for newspaper quality paper – has created a need to develop new business models making the Forest-based Bioeconomy the main priority in the Smart Specialisation strategy of Värmland.[1]

The Pulp and Paper Industry in Värmland counts 200 companies, with around 12.000 employees. Many of these are SMEs, but the region also hosts global giants that play an important role in the development of technologies used worldwide. Successful exploitation of the forest started early, creating a unique local knowledge and helped the region become a unique competence centre for the global pulp and paper industry.[2] The unique context, with businesses active in all parts of the value chain provides benefits through partnerships that boost both development and results. Värmland has effectively moved from orthodox pulp and paper operations into adopting a Bioeconomy approach, with the aim of becoming a global leader of the forest-based Bioeconomy and an example of best practice.

The priority of forest-based Bioeconomy as a top priority in the Smart Specialisation Strategy of Värmland builds on a number of perceived assets that can be summarised as major access to raw materials with long fibres, world-leading companies within paper technology, active cluster organisations with long-term funding, leading edge research expertise within cellulose fibre-based packaging materials and access to world-class service research through research institutes and its demonstrators.[3]

2.2 Bioeconomy Stakeholders

The region hosts major machinery and process system suppliers such as Metso, Andritz, GL&V, Voith and BTG, as well as technology and IT consultants such as ÅF,

[1] Värmland's Research and Innovation Strategy for Smart Specialisation 2015-2020
[2] Regional Innovation Monitor Plus 2016. Regional Innovation Report North Middle Sweden (Production Related Bioeconomy)
[3] Nordregio (2016). Green growth in Nordic regions – 50 ways to make it happen

Pöyry, Citec KPA, Sogeti and Tieto. There are also paper mills and packaging production units operated by Stora Enso, Billerud, Rottneros, Nordic Paper, Tetra Pak and Mondi, alongside with an extensive network of suppliers and contractors.

Värmland's businesses are concentrated around a few dominant industries which also has been organised into cluster initiatives and networks. The main actor promoting the regional activities in Bioeconomy is the cluster organisation **Paper Province** that gather bioenergy suppliers, packaging suppliers, all the large equipment suppliers of the paper industry, a quarter of Sweden's pulp and paper mills and a number of small and medium-sized suppliers of services and components. Despite the worldwide decline of paper production, companies involved in the cluster have had a growth rate three times higher and 6.8% higher profitability than the Swedish average over the last six years. The uniqueness of the Paper Province is partly due to the fact that it connects all parts of the forest value chain with university, public organisations and civil society in search for new bio-based solutions thereby creating a meeting and learning platform for all cluster stakeholders.

The **University of Karlstad** (Värmland) is an important knowledge source and innovation partner for regional industry, and is actively involved in regional innovation and cluster development, not at least through The Centre for Regional Studies (CRS), a cross-disciplinary research centre for research on societal and scientific challenges. For years, Karlstad University has undertaken cooperative research with industry in paper, pulp and printing technology, as well as on materials and chemical engineering. These research activities are being developed further, based on the – regionally supported – idea that these industrial sectors can form the crucial base for regional innovative clusters.

With the Research and Innovation Strategy for Smart Specialisation 2015-2020 **Region Värmland** has made forest-based Bioeconomy its top priority. This has resulted in a pooling of resources from academia, industry and research institutes such as Innventia towards this areas. On a national level, funding of different programs from the Swedish Innovation Agency VINNOVA has been pivotal for the development of the structures serving the base of the forest-based Bioeconomy sector and research in the region.

2.3 Bioeconomy – strategies, plans and projects

Värmland's Research and Innovation Strategy for Smart Specialisation 2015-2020 has made forest-based Bioeconomy its top priority. The long-term ambitions of the cluster organisation Paper Province and its member companies have been very influential in the outline of the strategy. The cluster organisations in the region are further viewed as taking a leading role in the implementation of the strategy. There is a clear vision for the region to lead the way using bio-based innovations

originating from the forest to foster a fossil-free and sustainable society. Clear action points to achieve this vision is, among other, a vision for Karlstad university to become a leader in Europe within one or two research areas central to Forest-based Bioeconomy and increasing participating in projects within Horizon 2020, also as a leading partner.

Major projects underway or planned relevant to Bioeconomy includes Ligno City, Academy for Smart Specialisation and Paper Province 2.0 (see below) with primarily national and regional funding. Also IMTRIS (Wood-based innovation in the Inner Scandinavian region) Co-financed by the Interreg V-A Sweden-Norway programme for 2015-2018 (budget €1,7M of which €811,000 comprises EU support and Norwegian funding) with the objective to undertake joint cross-border R&D efforts for sustainable regional growth relating to wood is underway. In 2014 together with the Norwegian forest cluster Tretorget AS, Innovation Network for Biomass/INBIOM (DK) and Tarvaala Bioeconomy Campus/JAMK University of Applied Sciences (FI), Paper Province started a BSR Stars Innovation Express project called 'Accelerating Bio-economy Innovation for SMEs' (ABEIS) to boost SMEs' innovations through cross-cluster and cross-sectorial networking at an international level.[4]

Värmland has been actively involved in Interreg Sweden-Norway for the completion of cross-border projects related to Bioeconomy. There is currently an project pending decision (The Bioeconomy Region, approx. €4M) aiming to create a common innovation system together with Region Dalarna (Sweden) and Norwegian partners including universities, research institutes and six Norwegian municipalities. The cluster organisation Paper Province has an application pending within ERDF TO4 and The Academy for Smart Specialisation has one application within ERDF TO1.

[4] Regional Innovation Monitor Plus 2016. Regional Innovation Report North Middle Sweden (Production Related Bioeconomy)

3. Bioeconomy Policy Support

3.1 General support framework

By European standards, Värmland is a small region. As a result, the number of actors in the innovation support system is limited. Since Värmland has established cluster organisations with clear connections to its specialisations, these actors are viewed as having the ability to take a leading role in the implementation stage and the channelling of funds to projects related to Bioeconomy. The sources for financing the innovation system in Värmland today are mainly:

- EU: ERDF (Interreg), Horizon2020
- National: Vinnova, (Swedish innovation Agency) Tillväxtverket (Swedish Agency for Economic and Regional Growth), Almi (Advisory Services, Loans and Venture Capital)
- Regional: Region Värmland
- Local: Municipalities and Associations of municipalities
- Academia: Karlstad University
- Research Institutes: Innventia, SP
- Private: Private co-financing of EU-project, research projects and financing of players within the system.

Programmes funded by VINNOVA have been vital in building the general eco-system supporting the forest-based Bioeconomy sector in the region combined with large scale demonstrator and test facilities owned by Research institutes such as Innvetia. Karlstad University is a relatively small university measured as research output or by participation in EU-programmes such as Horizon 2020 (e.g. participating in 8 projects up until 2016). In the ERDF Operational Programme for North Middle Sweden 2014-2020 it is however stated that there is a need for strengthening university participation within Horizon 2020.

3.2 Bioeconomy Policy Support

In a Swedish context there is currently no national strategy for the development of the bio-economy. The budget proposition for 2017 the Swedish government however states a need to take a comprehensive policy approach towards the Bioeconomy and a National Agenda for the Bioeconomy is expected to be made official in the beginning of 2017. One of five strategic working groups appointed by the Prime Minister for developing the Government's innovation policy focuses on the circular and biobased economy. A newly published study on the scenarios for the Bioeconomy in Sweden points clearly to the need of public support to realise the

vision of a transition towards a Bioeconomy until 2050. A key challenge is identified in the production of biomass.[5] In a legislative proposal of March 2016 to the parliament, the Swedish government are suggesting to set up a state-owned venture capital fund primarily oriented to build and maintain large scale demonstration facilities, for example in the bio-refinery area.

In Värmland the **Academy for smart Specialisation** (see chapter 4.2) covering in total about €15 million over five years based on funds from academia, Region Värmland and the private sector will be an important policy instrument serving as a meeting-place for researchers, companies, financiers and entrepreneurs related to, among other, the Forest-based Bioeconomy.[6]

As mentioned above the national innovation agency **VINNOVA** has been very important in channelling funds to Bioeconomy-related projects in the region over a longer period of time and have a long-term commitment in several large-scale projects relating to the forest-based Bioeconomy in the region.

The **research institutes** situated in the region are very active in developing physical infrastructures and demonstrators. One such example is the open innovation site Ligno city for the development of innovations on the further processing of lignin into new products such as carbon fiber, textile fibers, bio jet fuel, carrier of ferilizers for agriculture and forrestry, binding agents, etc.[7] The project is run by the research institute Innventia, Nordic Paper and Paper Province, with support from the municipality of Kristinehamn, Vinnova and 18 companies. Region Värmland is currently active in discussions with the research institutes of Sweden (RISE) to build a service innovation Lab focusing on the Bioeconomy.

The **Nordic Council of Ministers** runs several programmes and initiatives related to the Bioeconomy (e.g. BioLab, the Nordic Bioeconomy Panel) that Region Vämland actively participates in.

3.3 ESIF and H2020 resources for the Bioeconomy

Region Värmland has been active within the Vanguard Initiative's Bioeconomy Pilot together with the cluster organisation Paper Province. There is a decision pending on Region Värmland to become full members of Vanguard in a near future. Region Värmland is very active within the ERRIN Network and the working group on Bioeconomy. Within the S3-plattform Region Värmland is involved in setting up a

[5] Stockholm Environment Institute (2016). Den svenska bioekonomin: definitioner, nulägesanalys och möjliga framtider
[6] Karlstad University (2016). Academy for Smart Specialisation
[7] Region Värmland (2015). Region Värmland Position Paper in response to the European Commission Public Consultation on the Circular Economy.

working group on Forest-based Bioeconomy. The region also has several on-going projects related to Bioeconomy on behalf of the Nordic Council of Ministers.

In the RIS3 of Värmland it is stated that the strategy should not be regarded strictly as a strategy for implementing the regional fund programme (ERDF). It should also be used to influence regional and national policies and to affect and facilitate participation in other European-driven programmes such as Interreg, ESF, EJFLU, Cosme and Horizon 2020. In the agreement between industry, Region Värmland and University of Karlstad there is a demand for the university to apply for funding for Bioeconomy related projects under Horizon 2020.

In the Operational programme for Middle North Sweden, Bioeconomy is not explicitly stated. To strengthen competitiveness in trade and industry it is underlined as important to increase international involvement, exchange and presence. Strategically preparatory operations will therefore be implemented aimed at increasing the participation of enterprises in international programmes such as Horizon 2020 and COSME.

Actors situated in Värmland participated in 28 projects under FP7, whereof Karlstad University participated in 14 of these. Until 2016, Karlstad university had participated in 8 projects within Horizon 2020, whereof 1 as coordinator, totalling approx. €4,2M. Actors in Värmland participated in a total of 14 projects, totalling approx. €5M. None of the projects with industrial actors relates to Bioeconomy. Karlstad University today has a success rate of 39% in Horizon 2020 but there is great potential to expand the number of applications and involvement in EU-funded projects.

The regional ERDF programme covering Värmland (North Middle Sweden) has a three priority axis which have relevance of the development of the Bioeconomy:

- Smart growth and innovation, TO 1; €32 million, 22% of EU resources within ERDF OP Middle North Sweden
- Smart growth – small and medium size enterprises, TO 3; €43 million, 30% of EU resources within ERDF OP Middle North Sweden
- Sustainable growth – reduction of carbon dioxide emissions, TO 4; €22 million, 15% of EU resources within ERDF OP Middle North Sweden

The Swedish national ERDF programme is also entirely directed towards TO 1, 2, and 4, and the purpose of this programmes is to complement the regional programmes and enable synergies between regional, national and EU funding. The intervention under TO 3 (23 million euro) is focused on venture capital, especially in relation to energy efficiency, and TO 4 (78 million euro) is focused on energy efficiency and use of renewable energy and R&D concerning reduction of carbon dioxide emissions.

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 Paper Province 2.0 – an innovation system for a bio based economy

In 2013 Paper Province was named one of the winners in The Swedish Innovation Agency, VINNOVAS' cluster competition among regions, called "Vinnväxt". The price was approximately €13 million over ten years with the aim of transforming the pulp and paper industry in Värmland into a forestry-based Bioeconomy together with the other cluster organizations, public and private research and innovation environments. The initiative is co-funded by a triple helix partnership consisting of the Paper Province members, Karlstad University, Region Värmland, the County Administrative Board, Local authorities and the Swedish Forest Agency

The fact that Paper Province 2.0 was awarded Vinnväxt-funding had a profound effect on the smart specialization strategy of Värmland where the forest-based Bioeconomy has become the specialization of highest priority.[8] The Paper Province 2.0 project has been very influential in forming the smart specialisation strategy of Värmland.[9]

The vision of the initiative is for Paper Province to become a leading European competence node for a forestry based bio economy in ten years' time. The aim is to create a large scale demonstrator that from a service and systems perspective coordinates and demonstrate bio economy in practice. The objective is to set the stage for the 1000 new jobs and 25 new businesses during one decade. The vision is to generate large number of projects, both national and international, including in Horizon 2020.

The structure of the initiative is based partly on research projects in knowledge dynamics and innovation such as EURODITE (FP6) and REKENE (NICe). The collaboration with Academia within the initiative builds on forming networks between industry and research in areas such as environment, energy-systems and chemical engineering. The initiative however also highlights that a transition to a Bioeconomy needs broader knowledge and development including social sciences and the humanities. One such example is the research project "Transition to bioeconomy, smart specialisation and quadruple helix" that was co-financed by the project with the aim to widen the understandings and meanings of civil society in

[8] Grundel, I. & Dahlström, M. (2016). A Quadruple and Quintuple Helix Approach to Regional Innovation Systems in the Transformation to a Forestry-Based Bioeconomy. Journal of the Knowledge Economy, pp. 1-21

[9] VINNOVA (2016). Paper Province. Vinnova VINNVÄXT International Evaluation. 24th - 26th May 2016.

regional innovation systems and more specifically its role in the transition to a forestry based Bioeconomy.[10]

4.2 The Academy for Smart Specialisation

Between 2005 and 2007 Region Värmland and Karlstad University participated in an OECD initiative looking at the contribution of universities to regional development. The initiative identified the need to strengthen the link between clusters and research and develop a few internationally strong research areas. One outcome of the study was the decision to sign a formal agreement for collaboration between the university and the region. The original agreement covered the period 2008–10 with a yearly grant framework of approx. €400 000. In 2010 a new and more ambitious agreement was signed to run from 2010 to 2014 with total financing of approx. €15M made up of equal contributions from the region, the university and external sources involving the region's four strategic cluster organizations in the formulation of the agreement. One significant project initiated under the agreement was the '10 Professors' programme resulting in the installation of 10 new professorships in areas where the competency of the university and strategic priorities of the cluster organizations intersect.[11]

In 2016, a new initiative was formed following on the above agreements where Karlstad University and Region Värmland collaborates through the Academy of Smart Specialisation to renew the Värmland industry, public sector, and research at Karlstad University. The initiative will go on to the year 2020 and can be viewed as a tool for transformation and renewal of private and public sectors in Värmland and for research and education at Karlstad University.[12] Region Värmland contributes with approx. €5M during a five-year period and Karlstad University with the equivalent amount. Another €5 million was gathered from public research funding and private companies, resulting in a total of about €15 million over five years. High-quality research is expected to attract more external funding to the university. The Forest-based Bioeconomy is one of six areas that serves as the foundation of the Academy for Smart Specialisation. Karlstad University and Region Värmland will run the Academy jointly for the purpose of serving as a meeting-place for researchers, companies, financiers and entrepreneurs related to, among other, the Forest-based Bioeconomy.[13] The rationale behind the initiative is that a transition to a Bio-economy needs new way of thinking, new knowledge and networks and that this process takes time and will need to build on long term commitment. The

[10] Karlstad University (2016). Transition to Bioeconomy, smart specialization and quadruple helix.
[11] Kempton, L. (2015). Delivering smart specialization in peripheral regions: the role of Universities. Regional Studies, Regional Science, 2:1
[12] ERRIN (2016). Bioeconomy development: challenges, best practices, some ideas for the future. Presentation by Richard Tuffs, European Bioeconomy Congress October 6–7 2016 Lodz.
[13] Karlstad University (2016). Academy for Smart Specialisation

initiative is a good example on how the RIS3-strategy of the region facilitates the process of clarifying priorities for research and strengthening the modes of cooperation between academia, industry and the public sector both nationally and within the EU and thereby attracting more external funding.

5. Needs, Gaps and Bottlenecks to Deploy the Bioeconomy

Värmland is well endowed with national resources and has traditionally been dominated by capital-intensive export industries. The forest-based sector and the paper and pulp industry are however still in a process of structural transformation towards an industry with a higher capital service and knowledge content.

According to the Partnership Agreement for ESI-Funds a main challenge for the region is a low R&D intensity in SMEs, contributing to low adaptability and innovativeness.[14] Even though the forest industry has provided a solid platform for the transition to the forest-based Bioeconomy and moving up the value chain, these factors serves as bottlenecks for further development.[15] Furthermore, even though the region has a well-developed innovation system it suffers from a rather weak output due to the education level of the region, a unilateral business community and a low proportion of entrepreneurs. The low R&D intensity in SMEs in the region tends to be related to limited resources in terms of finance and skills available for the companies.

For industry, research and the public sector in Värmland to participate in collaborative projects within the ESI-funds related to the Forest-based Bioeconomy are viewed as a great possibility to strengthen the output from the resources put in the innovation system. Having identified Forest-based Bioeconomy as a top propriety in the regions' strategy for smart specialisation facilitates the participation in EU-programmes and the pooling of resources towards this specific sector. Clear action points to achieve this vision is, among other, a vision for Karlstad University to become a leader in Europe within one or two research areas central to Bioeconomy and increasing the participation in projects within Horizon 2020. Further participation in cross-border projects within Interreg and in programmes similar to the Vanguard Initiative and S3-plattform are viewed as very important by the region for input on how to develop the Forest-based Bioeconomy of the region.

Finally, another main bottleneck for the development of Bioeconomy in the region is perceived to be a lack of national and EU-legislation creating economic incentives for a transition to a Bioeconomy (e.g. relating to Biobased jet-fuel). The market forces are not perceived as sufficient for speeding up this process.

[14] Operational Programme North Middle Sweden, 2014-2020
[15] Regional Innovation Monitor Plus 2016. Regional Innovation Report North Middle Sweden (Production Related Bioeconomy)

6. Information Sources

Literature and Documents:

Värmland's Research and Innovation Strategy for Smart Specialisation 2015-2020

Regional Innovation Monitor Plus (2016). Regional Innovation Report North Middle Sweden (Production Related Bioeconomy)

Nordregio (2016). Green growth in Nordic regions – 50 ways to make it happen

Operational Programme North Middle Sweden 2014-2020

VINNOVA (2016). Paper Province. Vinnova VINNVÄXT International Evaluation. 24th – 26th May 2016.

Karlstad University (2016). Transition to Bioeconomy, smart specialization and quadruple helix.

Kempton, L. (2015). Delivering smart specialization in peripheral regions: the role of Universities. Regional Studies, Regional Science, 2:1

ERRIN (2016). Bioeconomy development: challenges, best practices, some ideas for the future. Presentation by Richard Tuffs, European Bioeconomy Congress October 6-7 2016 Lodz.

Grundel, I. & Dahlström, M. (2016). A Quadruple and Quintuple Helix Approach to Regional Innovation Systems in the Transformation to a Forestry-Based Bioeconomy. Journal of the Knowledge Economy, pp. 1-21

Region Värmland (2015). Region Värmland Position Paper in response to the European Commission Public Consultation on the Circular Economy.

Stockholm Environment Institute (2016). Den svenska bioekonomin: definitioner, nulägesanalys och möjliga framtider

Relevant websites:

http://paperprovince.com/en/news_type/lignocity-the-cradle-of-bioeconomy/

http://www.varmland.se/sv/artiklar/innovationer-ger-smarta-fossilfria-forpackningar

http://www.varmland.se/sv/artiklar/framtidens-flygbransle-vaxer-i-varmlands-skogar

http://www.vinnova.se/upload/EPiStorePDF/va_16_02T.pdf

http://bsrbioeconomy.net/seminars/berlinpresent/Dahlstroem.pdf

http://paperprovince.com/wp-content/uploads/2015/01/CRS_Policy-Brief_nr1_1509_ENG.pdf

http://www.varmland.se/sites/default/files/kcfinder/files/RV_Bioekonomi_miniinfo_till%20tryck6.pdf

Interviews and Contact details:

Name	Position	Institution/ Organisation	Phone	Email	Interview Date
Anders Olsson	Strategist	Department for regional growth and research and innovation, Region Värmland	+4654701 10 25	anders.olsson@regionvarmland.se	2016-12-02
Participation in workshop on Bioeconomy in Värmland arranged on October 4th in Karlstad (Sweden) during the national conference for smart specialisation.					