The Geography of Higher Education

Evaluation of the Academy for Smart Specialisation

Final report June 2020

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This paper was authorised for publication by Lamia Kamal-Chaoui, Director, Centre for Entrepreneurship, SMEs, Regions and Cities, OECD.

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Preface OECD

Higher education institutions (HEIs), such as universities and colleges, have become important actors in our knowledge-intensive economies. Their teaching and research activities are increasingly defined and shaped in cooperation with new stakeholders, including from the private sector and civil society. By establishing and cultivating these relationships, HEIs increase their capacity to generate economic and societal value. Most of these interactions have a spatial dimension, which encompasses both the concepts of "proximity" and that of "community". It is, therefore, important to understand these spatial interactions in order to help higher education policy – which is generally "space-blind" – develop place-responsiveness and an understanding of the role HEIs play within innovation and entrepreneurial ecosystems: i.e. the "geography of higher education".

Taking into account space, however, does not mean that HEIs should merely serve their surrounding communities. Place-responsiveness is needed because of four main factors. First, evidence shows that proximity matters for research and innovation activities. Second, a large number of HEIs are important landmarks of their cities/regions generating identities, and narratives, of places and communities. Third, by developing the capacity to connect with their ecosystems (embeddedness), HEIs can improve their teaching and learning activities empowering communities with the skills that help them vis-à-vis the future of work and society. Connections with communities can positively affect research outcomes by providing ideas or helping identify needs. In addition, the COVID-19 pandemic has shown the importance of these linkages with ecosystems also in terms of HEIs' resilience. Fourth, local and regional communities often face the challenge of generating complementarities and synergies among different sectoral policies percolating from the central level. The need to pursue sustainable and inclusive development has exacerbated this challenge. HEIs embedded in their ecosystems support bottom up innovation and help communities and businesses develop the skills and capabilities needed to handle complexity (grand societal challenges, recovery from the Covid-19 pandemic): an entrepreneurial mindset promoting sustainable innovation and entrepreneurship.

The Swedish case of the "Academy for Smart Specialisation" (the Academy) assessed in this report, reflects well all the characteristics mentioned above, and illustrates the kind of services and support a place-responsive HEI can provide to its own ecosystem. The Academy hosted by Karlstad University (KAU) and co-managed by the latter and the Region of Värmland, has been playing a transformative role vis-à-vis Värmland's Smart Specialisation Strategy since its creation, in 2015. The Academy has contributed to innovate such a strategy, by identifying comparative advantages in new sectors and emerging skills needs, and by connecting these with teaching and research activities carried out at the KAU. Going forward it will be important to keep the momentum going and make the Academy a visible landmark at the national and European level. This OECD report – prepared in close collaboration with Nordregio – provides some recommendations for Värmland regional and academic actors to preserve and develop the transformative power of the Academy, and aims to inspire similar practices in other OECD regional communities.

Lamia Kamal-Chaoui
Director, Centre for Entrepreneurship, SMEs, Regions and Cities, OECD

Preface Karlstad University and Region Värmland

Establishing smart specialisation strategies has become vital in making the best use of limited resources; but it has also become obvious that managing these innovative approaches and establishing the necessary linkages between actors with different competences is not an easy task. Smart specialisation strategies have been established throughout Europe, but there is often a lack of concrete action to link research and innovation with a user-driven need and with strong collaborations with industry, the public sector and civil society.

The Academy for Smart Specialisation is the research and innovation agreement between Region Värmland and KAU for the period 2016–2020. Through the agreement and the creation of an organisation implementing the agreement, an operational tool has been developed; a tool for the transformation and renewal of the private and public sectors in Värmland as well as for the development of research and education at KAU.

The concept of "smart specialisation" involves finding strong areas in a region with the capacity to transform into internationally competitive industries. KAU and Region Värmland jointly run the Academy, and through that partnership they have created a platform for researchers, companies, funders, and entrepreneurs. By linking research, innovation and education in thematic knowledge triangles, the Academy prepares KAU students for employment which will drive industrial transformation in Värmland's prioritised areas.

The Academy has been successful in filling the gap between strategy and concrete actions. It has driven the process of establishing more than 15 new, strategically important projects involving strong collaborations, ensuring the outputs benefit all actors involved. Within KAU, the Academy has helped connect different knowledge areas to common domains for research, innovation and transformation. It is obvious that by working with this model, unique combinations are created that can lead to innovative solutions for the future benefit of society and for advancements in research. Through the evaluation performed by OECD, in close collaboration with Nordregio, we now have the evidence, and also the courage, to develop this partnership and model even further in the future.

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Raffaele Trapasso (Economist and Project Co-ordinator, CFE), co-ordinated and co-drafted the assessment in collaboration with Jukka Teräs, Senior Research Fellow at Nordregio, Linnea Löfving, Research Fellow at Nordregio, and Diana N. Huynh, Junior Research Fellow, Nordregio. Sandra Hannig (Policy Analyst, CFE), provided drafting support and important insights concerning the Smart Specialisation Strategy. The report was prepared under the supervision of Lucia Cusmano, Acting Head of CFE's SME and Entrepreneurship Division.

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Executive Summary

The Academy for Smart Specialisation has originated from a long lasting partnership between the regional government of Värmland and the University of Karlstad. Its aim is twofold: first, generate academic research and skills in areas that are relevant for regional competitiveness, as identified by Värmland's Smart Specialisation Strategy; and second, generate advanced services that help enhance the region's capacity in identifying emerging industries and key local assets.

Smart specialisation has been transformational in Värmland by promoting new specialisations and skills in a variety of sectors, such as the forest-based bioeconomy, ICT and care, smart industry and tourism, among others. The region managed to capitalise on existing strengths and generate new knowledge networks. Bringing clear priorities into the regional agenda has facilitated the allocation of available resources.

Recognising the need to enhance their collaboration to promote the regional innovation system through connected policy tools, Region Värmland and Karlstad University created the Academy for Smart Specialisation (the Academy, hereafter), in 2015. Based on the priorities set out in the Smart Specialisation Strategy, the Academy has promoted and funded a range of innovative and entrepreneurial activities with a strong connection to local businesses, including: value-creating services; forest-based bioeconomy; digitalisation of welfare services; advanced manufacturing and complex systems; nature, culture and place-based digitalised experiences; and systems solutions with photovoltaics. The Academy is also working to mainstream gender issues in the regional smart specialisation strategy.

Most of the programmes and projects implemented by the Academy have generated value for both the regional smart specialisation strategy as well as for Karlstad University. At the level of selected individual projects, however, the overall alignment between stated objectives and expected results varies significantly. Some projects have been exceeding the expectations regarding quality of research and/or cooperation with industry. Some others have not fully met the high expectations concerning the positive development of businesses through the joint engagement in innovation diffusion activities. As in many other regions across the OECD, businesses, and particularly SMEs, may still be unprepared for close university-industry collaboration. In addition, the Academy has not yet reached its full potential in terms of funding from the private sector. This may depend on the relative lack of visibility of the "brand" and the "narrative" of the Academy vis-à-vis the regional productive sector. Generating funding from the interaction with the private sector should become a priority going forward.

The overall management, coordination, and implementation of the Academy for the first years of operation has been quite successful. To this end, the role of both Region Värmland and Karlstad University has proven central in the coordination of the Academy. Importantly, there is a fair amount of accumulated trust among the regional stakeholders contributing to the successful implementation of the Academy's work. There is a need, however, for a further formalisation of management practices in order to open the core management group to outsiders.

Going forward it will be important to ensure that the Academy increases its transformational potential. The current COVID-19 pandemic, with its economic and social consequences, represents a stress test for the Academy, which has to provide information and intelligence to its regional community, and in particular, to firms of different sizes and ages on how to weather the crisis and bounce back once the pandemic is over or under control.

Abbreviations and Acronyms

AS3	The Academy for Smart Specialisation
CTF	Service Research Centre
EFSI	The European Funds for Strategic Investments
EUR	Euro (June 15, 2020: 1 EUR = 10,5 SEK)
HEI	Higher Education Institutions
IPR	Intellectual property rights
KAU	Karlstad University
KK	The Knowledge Foundation (KK-stiftelsen)
OECD	Organisation for Economic Co-operation and Development
RIS3	Research and Innovation Strategies for Smart Specialisation
RV	Region Värmland
SEK	Swedish Krona (June 15, 2020: 1 EUR = 10,5 SEK)
S3	Smart Specialisation Strategy
Vinnova	Swedish Governmental Agency for Innovation Systems
VRIS3	Värmland Regional and Innovation Strategy for Smart Specialisation

Policy Brief

The Academy for Smart Specialisation in Värmland, Sweden, represents the unique effort to generate a sustainable relationship between a higher education institution and its regional ecosystem. The Academy for Smart Specialisation (hereafter 'the Academy') is part of Värmland's Research and Innovation Strategy for Smart Specialisation 2015-2020 (VRIS3), a strategy document implemented by Region Värmland, Sweden. The Academy represents a powerhouse of applied research that aims to diversify, internationalise, and increase the resilience of the regional economy. The Academy has created an interdisciplinary platform that provides tailored research activities to regional stakeholders, including specific training programmes. However, changes in the regional governance and the limited capacity to attract funding and engagement from the business community may challenge the possibility to scale up the Academy and give it a more central role within the regional development policy. Going forward, there is a need to invest additional resources to continuing the development of the Academy, mainstreaming it within Karlstad University, and increasing its national and international visibility and impact.

Figure 1. Detail of Region Värmland in relation to its location between Sweden and Norway
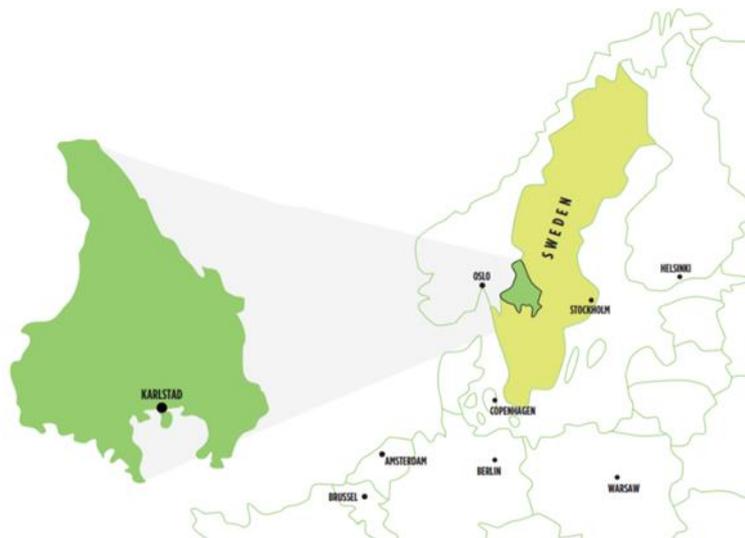
Source: Region Värmland

Värmland is located in North Middle Sweden (Norra Mellansverige), bordering Norway, and has a population of approximately 282 000 inhabitants. Karlstad is the main city of Värmland and together with bordering municipalities, the Karlstad regionis home to a population of approximately 143 000 inhabitants. Värmland's main economic activities are based on its abundant natural resources, which have supported the development of a flourishing forestry sector and related process industries. The historical accumulation

of capital and know-how in resource-based industries has generated a technological, productive, and scientific infrastructure.

The regional government has actively leveraged national and European policies to build on the existing industrial infrastructure and to better prepare for the emerging economic and societal challenges related to international competition, changing demographic profiles, and outmigration (ruralisation). The regional government, which originally functioned mostly as a regional development agency, has generated an ambitious smart specialisation strategy to strengthen R&D capacity and support the diversification of the economy in new sectors, to create new skills, valuable jobs and, more generally, a new attractive narrative for Värmland.

Smart specialisation has been transformational in Värmland by promoting new specialisations and skills in the forest-based bioeconomy, ICT and care, smart industry and tourism for example. The smart specialisation concept is firmly rooted in Värmland's approach to sustainable and inclusive growth and well-being, as reflected by its regional development strategy. The region managed to capitalise on existing strengths and generate new knowledge networks. Bringing clear priorities into the regional agenda has facilitated the allocation of available resources. The success of smart specialisation in Värmland owes to the institutional "mobilisation" of regional actors, political agencies and place-based leadership combined with high levels of trust and social capital in the region.

> Going forward it will be important to ensure that the Academy increases its transformational potential.

Recognising the need to enhance the regional innovation system, Region Värmland and Karlstad University decided to capitalise on their longstanding collaboration and in 2008 established a partnership. Strengthening the collaboration between the regional government and the university was also the main recommendation of an international evaluation project about regional development and collaboration in a triple helix context, implemented by the regional government in cooperation with the OECD in 2006. The initial aim of the partnership between the regional government and the local university was to generate academic research in areas that were relevant for the regional needs in terms of research and development. The regional government provided financial resources to Karlstad University to create the so-called "10-professor" programme. This first phase was important to generate a common ground between the regional and the academic instances. However, there was a need for a clearer governance arrangement in order to enhance the linkage between research activities and the areas identified by the smart specialisation strategy of the region.

Based on this requirement, and after the positive experience of the 10-professor programme, Region Värmland and Karlstad University created the Academy for Smart Specialisation in 2015. The Academy has funded a range of activities in areas of smart specialisation priorities with a strong connection to local businesses. Since its creation, the Academy has been operating in the six industrial areas identified by Värmland's smart specialisation strategy: value-creating services; forest-based bioeconomy; digitalisation of welfare services; advanced manufacturing and complex systems; nature, culture and place-based digitalised experiences; and systems solutions with photovoltaics. Moreover, the Academy is working to mainstream gender issues in the VRIS3.

The Academy is one of the institutions contributing to the success of the regional smart specialisation strategy. Another example is the Sting Bioeconomy Incubator, supported by the Paper Province Cluster, which is also contributing to the creation of innovative start-ups and spinoffs from large firms operating in Värmland's forest-based bioeconomy in the region. In addition, regional clusters have become important players to link local industry with academia and additional players outside their local ecosystem to support tailored interactions and skills exchange between academia and industry. In the same vein, the Karlstad

Innovation Park, established by Karlstad University, Karlstad Municipality, Region Värmland and Värmland County, supports interactions between research activities and entrepreneurship and helps to develop shared networks.

The OECD, with the support of the Nordic research organisation Nordregio, made an agreement in 2019 with Karlstad University and Region Värmland to evaluate the design and the implementation of the Academy for Smart Specialisation initiative. The review process took place in the period between December 2019 and June 2020, including a review visit in Värmland in January 2020, followed by an additional visit in February 2020.

The OECD & Nordregio team assessed the first years (2016-2019) of implementation of the Academy for Smart Specialisation. This evaluation does not represent a bureaucratic exercise and accordingly it does not discuss the efficiency or the effectiveness of specific actions put in place by the Academy, nor their formal legitimacy. Rather, the aim of the evaluation was twofold. First, it discusses ways in which the action of the Academy can be strengthened to increase its impact on the regional ecosystem. Second, it analyses the way in which regional stakeholders have been able to bridge the university and the regional smart specialisation strategy in Värmland. This experience could represent an international 'best practice' to be further discussed in the forthcoming HEInnovate review of Sweden 2020-2021, which will discuss how the Swedish higher education system and institutions promote the "entrepreneurial and innovation agenda".[1]

This assessment recognises that between 2016 and 2020, the Academy has generated value for both the regional smart specialisation strategy and for Karlstad University. The Academy is seen as an important matchmaking and partnership creation instrument within the Värmland innovation system. The Academy has implemented many value-added programmes, projects, and other initiatives all in line with the Värmland´s VRIS3. This represents a clear advancement of the 10-professor programme.

At the level of selected individual projects, the overall alignment between stated objectives and expected results varies significantly, with some projects even exceeding the expectations regarding quality of research and/or cooperation with industry. The Academy, however, has not fully met the high expectations of contributing to the positive development of businesses through the joint engagement in innovation diffusion activities. As in many other regions across OECD, businesses, and particularly SMEs, may still be unprepared for close university-industry collaborations. This shows the need to support entrepreneurial and innovative mind-sets in local businesses. Despite a clear boost in fund raising, the Academy has not yet reached its full potential in order to generate additional funding for the research and innovation activities in Värmland - especially regarding funding from private sector actors. The relatively weak connection with business may depend on the fact that the "brand" and the "narrative" of the Academy have not yet gained enough visibility outside the core group of regional stakeholders. Generating funding from the interaction with the private sector should become a priority for the next period.

The overall management, coordination, and implementation of the Academy for the first years of operation has been done with relative success, and the strategical and operations management (Steering Group, Working Group), as well as the support functions, are put in place. To this end, the role of both Region Värmland and Karlstad University is central in the coordination of the Academy. Importantly, there is a fair amount of accumulated trust among the regional stakeholders contributing to the successful implementation of the Academy work. There is a need to identify those management practices that can be further formalised to open the core management group to outsiders.

Going forward it will be important to ensure that the Academy increases its transformational potential. The current Covid-19 pandemic, with its economic and social consequences, represents a stress-test for the

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[1] The OECD and the European Commission will produce an HEInnovate review of Sweden in 2020-21. HEInnovate is an OECD/EC project that promotes the "entrepreneurial and innovation agenda" in higher education systems and institutions. The Swedish report will consider 10 case study universities, including Karlstad University. Additional information about HEInnovate: www.heinnovate.eu.

Academy. The Academy has to provide information and intelligence to its regional community, and in particular, to firms of different sizes and ages to help them understand the situation, the damages and the potential opportunities that will arise once the pandemic is over or under control. In this way, the Covid-19 crisis could actually contribute to the establishment of new forms of interaction (and trust) in the system. The Academy may play a pivotal role after the pandemic by providing granular information and intelligence to investment plans put in place to regenerate the economy and build social resilience.

In sum, the evaluation group of OECD & Nordregio highlights six key recommendations regarding the future development of the Academy for Smart Specialisation in Värmland, presented in the box below.

Box 1. Main recommendations

- **Mainstreaming the Academy for Smart Specialisation within Karlstad University:** The university is the stronghold of the Academy, and the Academy should focus on further unlocking the full potential of the intense and systematic cooperation within Karlstad University.

- **Enhancing & communicating a competitive profile:** The Academy for Smart Specialisation needs to pay attention to sharpening and communicating its profile and areas of strength. A better, clearer, narrative will facilitate fund raising.

- **Strengthening internationalisation:** The Academy, with its experts with broad international networks is a significant asset in the international matchmaking and cooperation of Värmland. The Academy can contribute to strengthening internationalisation as one of the main goals of the future smart specialisation strategy and implementation, in Värmland.

- **Prioritising fund-raising:** Specific attention should be given to the ability of the Academy to generate additional funding to the research and innovation activities in Värmland. Additional resources and professional skills should be allocated to fund-raising especially regarding private sector – both by providing relevant knowledge of funding opportunities and practical assistance in fund-raising attempts.

- **Streamlining entrepreneurial structure:** The management, coordination, and implementation of the Academy for smart specialisation deserves some re-thinking. A more streamlined structure of activities, funding and services provided, and organisation is suggested to be considered for the future.

- **Adapting regional resilience:** The Covid-19 situation, with all its challenges, provides the Academy with a new opportunity to contribute to regional resilience in Värmland. Research and innovation should be therefore also be cornerstones of Värmland in a post-pandemic world as well.

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1 Introduction

Background

The OECD, with the support of the Nordic research institution Nordregio in Stockholm, reached an agreement with Karlstad University and the Region of Värmland in 2019 to assess the design, implementation, and effectiveness of the Academy for Smart Specialisation. Region Värmland and Karlstad University are planning to conclude a new agreement on the future of the Academy for Smart Specialisation in 2021 (hereafter 'the Academy). The aim of this evaluation is to assess the role of the Academy within Värmland's Research and Innovation Strategy for Smart Specialisation (VRIS3), identify challenges and opportunities for improvement, and to make recommendations for the future design of the strategic partnership between Karlstad University and Region Värmland. In parallel with this evaluation, Region Värmland is in the process of updating its strategy for smart specialisation.

The findings of this report will also feed into the OECD HEInnovate review of Sweden, which will assess Karlstad University's entrepreneurial and innovation agenda.

Methodology and implementation

The evaluation report of the Academy focuses on the following aspects:

- The overall alignment between stated objectives, expected results (as listed in the letter of intent that inaugurated the Academy) and actual effects
- The alignment between stated objectives and expected results at the level of selected individual projects the regional, national and international partnerships created by the Academy
- The implementation practices and the collaboration among stakeholders
- Financing mechanisms, with a particular focus on the ERDF as a form of financing for research and innovation.

The OECD delegation evaluated the activities of the Academy between December 2019 and June 2020. The evaluation took place in the following steps:

- Desk study: review of the Academy for smart specialisation documents and relevant articles and analyses on innovation and smart specialisation in Värmland
- Visits of the OECD & Nordregio evaluation team to Värmland: evaluation week Jan 20-23, 2020, followed by a visit by the Nordregio experts on Feb 19, 2020
- Frequent exchanges with representatives of Region Värmland and Karlstad University, and the evaluation team throughout the evaluation process
- Analysis of the data and response to key research questions (see above) with recommendations for the future
- Presentation of Draft report to Karlstad University and Region Värmland, to collect feedback and final input (April 2020)

- Preparation of the final report (May 2020)
- Final report presented for Karlstad University and Region Värmland and made public (June 2020)

Furthermore, the results of the interviews of the Värmland competence analysis by Region Värmland in February-March 2020 were used as additional data source in the evaluation.

The analysis frame of the evaluation was based on three components (Figure 1). First, the evaluation team collected the data regarding the input: the financial and human resources allocated by Region Värmland, Karlstad University and their stakeholders to launch and operate the Academy. Second, the evaluation team collected and analysed data regarding the main activities: the preparation of the document "Academy for Smart Specialisation 2016-2020" and the agreements between the stakeholders, the "Entrepreneurial Discovery Processes" (EDPs) to set-up and implement the various activities 2016-2020 for the prioritised specifications, and the "Management, coordination and monitoring of the activities." Third, the evaluation team analysed the results the Academy had achieved by early 2020 together with foreseeable impact and compared these to the goals set by the strategic documents.

Table 1. Evaluation framework of the Academy for Smart Specialisation

1. Input	2. Main activities	3. Expected results & impact
Financial resources Budget for the period 2016-2020	**Operations and support functions** • EDP processes for prioritised specialisations • Priority-specific activities 2016-2020 in the Academy document • Coordination, guiding & monitoring	**Major Results** • Performance of the Academy for smart specialisation • Awareness and visibility of the Academy
Human resources • Steering Group • Commitment of the stakeholders		**Impact** • Upgrade of research & innovation in Värmland • Broadened network of research related S3 in Värmland • Contribution to economy, employment, and competence in Värmland • Contribution to the performance of the VRIS3

The structure of this report

This report is structured as follows. Chapter 1 states the background and framework for the evaluation of the Academy for Smart Specialisation. Chapter 2 sets the scene for the regional geographic and innovation context. Chapter 3 introduces the smart specialisation strategy in Värmland (VRIS3). Chapter 4 presents an overview of the Academy for Smart Specialisation. Chapter 5 focuses on presenting the evaluation of the Academy, including specific analyses on specialisations, major opportunities and bottlenecks, as well as summary of key findings. The report concludes with recommendations for the future in Chapter 6.

2 Regional & Innovation Context

Värmland: An introduction

Värmland is located in *Norra Mellansverige* (North Middle Sweden) and has a population of approximately 280 000 inhabitants. More than a third of the county's population live in the main city, Karlstad. Karlstad is about 300 km from the capital Stockholm in the east, with which most of its economic activities are connected, and 250 km from Gothenburg to the south. Today, Värmland holds close ties with Norway – the country's most important trading partner, and its capital region, Oslo, which is 250 km to the west. More than 5 400 people from Värmland commute to Norway to work on a weekly basis, and these figures keeps increasing, and this figure is much higher at a national level. According to the findings of Region Värmland reports from 2015, about SEK 11.5 billion (ca EUR 140 million) of Swedish residents' income are earned across the border, which underestimate the real figures of employment and income for Värmland. In turn, many people from Norway travel to Värmland to shop or to live while maintaining a regular cross-border commute, which has in the past few years generated approximately SEK 4 billion annually (ca EUR 360 million) for involved business industries and stakeholders.

Figure 2. Map of Region Värmland
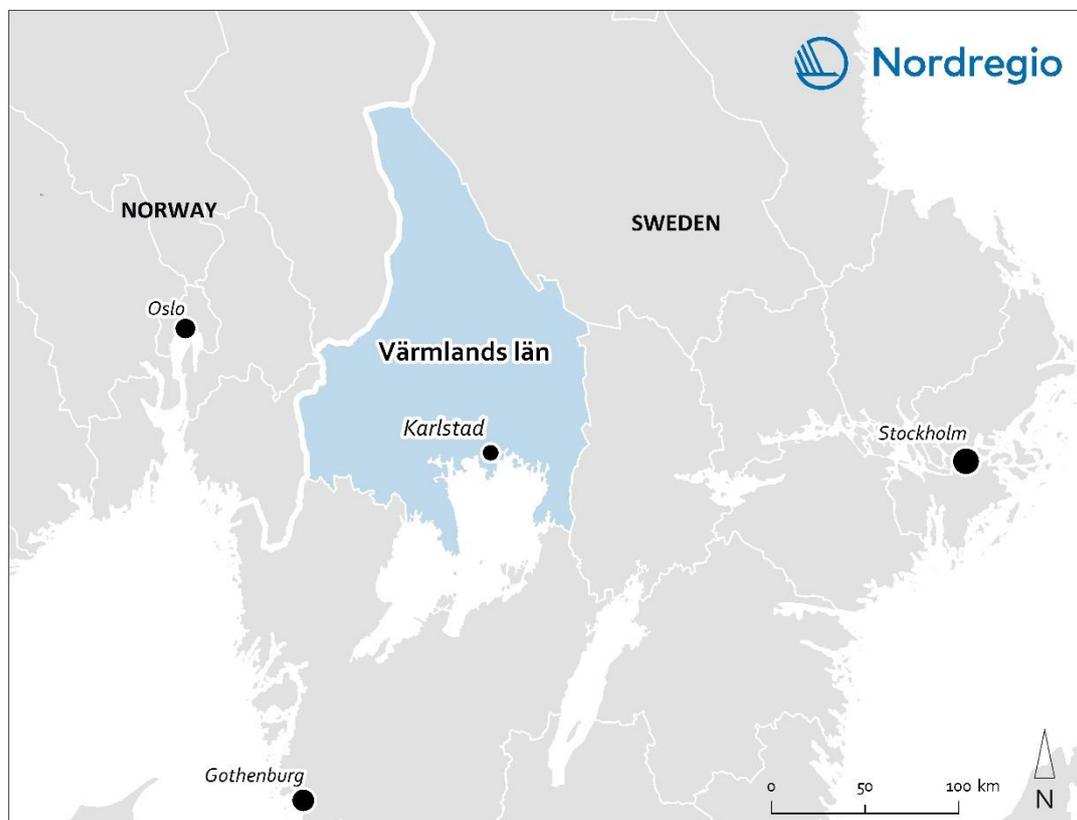
The region's connection with neighbouring Norway will remain pivotal in the years to come, especially with plans to expand the railway infrastructure in the two countries (Region Viken, 2020). However, Värmland's economic development has historically been built on its abundant natural resources, particularly forestry and steel industries, which is why it is also known as the 'Paper Region'.

Värmland displays specialisations also in the IT-sector, tourism, and cultural events, building on a long history with rich traditions of cultural activity in literature and music. The scenic landscape has also provided opportunities for recreational activities and tourism all-year round, which is why the region also has dedicated efforts in developing these areas as part of its strategy and vision for the coming decades (The Regional Strategy, *Värmlandsstrategin*, 2016-2020). Given that Värmland is largely built on its abundant natural resources and key industries around the forestry, forest-based bioeconomy and process industries, the regional economy has been able to steadily develop over a long period.

However, as employment in manufacturing and production has declined over the years due to industrial automation and outsourcing, Värmland has gone through periods of fluctuating development and change. Like many other non-metropolitan regions in Europe and Fennoscandia, Värmland continues to face a range of socio-economic challenges related to its peripheral location and was affected by the financial crisis in the 2010s. To counterbalance the projected negative trends seen in the business structure dominated by its traditional industries, demographic change and a relatively low participation in higher education, Värmland has nevertheless performed better than expected over the past decade according to national data and statistics. The Gross Regional Product of goods and services remain lower than the national rates, and while employment in general has steadily increased the past decades, at 65.2% it is below the national level of 68.5% (Swedish Agency for Economic and Regional Growth – *Tillväxtverket*, 2016, & Swedish Public Employment Service - *Arbetsförmedlingen*, 2019).

Considering this, one of the critical questions for Värmland in the coming years will be how the region can develop a resilient and innovation-oriented economy that is focused on local strengths while maintaining an outward-looking and competitive edge, reaping and sustaining the benefits of both.

Innovation support system in Värmland

Starting in the early 2000s, national and regional authorities have put considerable efforts to foster and promote regional innovation and the development of new economic activities and valuable jobs in creative industries, while recognising that more efforts are needed to reach the ambitions within potential key business and innovation areas and subsequently the region's development strategy more broadly. An emerging result was Värmland's Research and Innovation Strategy for Smart Specialisation (VRIS3), prepared in 2014-2015 and approved in 2015 (see Chapter 3).

The overall innovation support system in Värmland plays a central role for the development of smart specialisations, with the VRIS3 strategy as a roadmap emphasising the need unlock the innovation potential of Värmland by identifying and developing prioritised domain areas based on regional strengths and expected market potential. The innovation support system, as part of the broader regional innovation system, consists of actors with public financing who offer support to innovators, entrepreneurs and (new) businesses (see Table 2).

Karlstad University, together with the Grants and Innovation Office, plays a major role in this innovation support system (see Academic Innovation and Entrepreneurship in Table 2), as well as Region Värmland. In recent decades, the university has created operationalised paths toward sustaining the research and innovation of the region, alongside actors with public financing who offer support to innovators, entrepreneurs and (new) businesses. The establishment of Karlstad University goes back to 1843, when it was founded as a teacher training college. Karlstad gained university branch status in the late 1960s, and later a university college status. Karlstad University was formally established in 1999. Today, the university is characterised by a culture of cooperation, and considers itself an international institution with

strong connections to the region and with many research areas that are aligned with the business communities of Värmland.

The historically close cooperation between the university and the region has therefore always been a strength for the partnership on innovation and research. This cooperation was further enhanced and formalised in 2006 through the recommendations of the OECD report "Supporting the Contribution of Higher Education Institutions to Regional Development". Declarations of intent about research cooperation for the periods 2008-2010 and 2010-2014 were subsequently developed. A major outcome of this was the ten new professorships programme at the university, dedicated especially to strengthen the regional impact of its research.

The regional innovation support system was developed in stages from the turn of the millennium to the present day and consists of public organisations, clusters, businesses, the university and institutes, all working in close cooperation. According to the EU's Regional Innovation Scoreboard 2019, Värmland, as part of Norra Mellansverige, is considered a "Strong" innovation leader (RIS 2019, 80). When it comes to the category "Percentage population aged 25-64 participating in lifelong learning" (Ibid, 39) the region scores 13th place in a list of 40 selected regions. The RIS 2019 is a comparative assessment of regional innovation based on the European innovation scoreboard methodology, using 18 of the latter's 27 indicators. In provides a more detailed breakdown of performance groups with contextual data that can be used to analyse and compare structural economic, business and socio-demographic structure differences between regions (European Commission, Regional Innovation Scoreboard, 2019).

Table 2. Major actors in Värmland's business & innovation support system

Academic Innovation and Entrepreneurship

Karlstad University, Grants and Innovation Office
Academy for Smart Specialisation
Gammelkroppa Forestry University College, Drivhuset, Bergsskolan, RISE Service Labs, RISE Bioeconomy

Specialisations (with clusters and innovation platforms)

Forest-based bioeconomy
Digitalisation of welfare services
Advanced manufacturing and complex systems

Nature, culture and place-based digitalised experiences
Systems solutions with photovoltaics
Value-creating services

The following cluster organisations operate in the sectors listed above:

- Paper Province
- Compare
- IUC Steel & Engineering
- Visit Värmland
- Glava Energy Centre.

Innovation Park & Incubators

Innovation Park in Karlstad
Kickstart Network Värmland,
Digital Well Arena Innovation Support
Sting bioeconomy
Bioexpress

Stakeholder groups

Regional actors (General, Business Support)
Municipal Business Support organisations
Business & financial services
Niche actors

3 Smart Specialisation in Värmland

The birth of a Smart Specialisation Strategy

The task of developing a regional research and innovation strategy for smart specialisation for Värmland was assigned by Region Värmland's council when they approved the organisational plan for 2014. Smart specialisation is closely connected to funding from the European Regional Development Fund (ERDF) (Box 2). However, regional stakeholders were keen to specify in their strategic documents that Värmland's Research and Innovation Strategy for Smart Specialisation (VRIS3) should not only be used to implement ERDF programmes. Rather, the VRIS3 should also be used to influence regional and national policies, and to affect and facilitate participation in other European-driven programmes such as Interreg, European Social Fund (ESF), European agricultural fund for rural development (EAFRD), Cosme (Europe's programme for small and medium-sized enterprises), and Horizon 2020 as well as national programmes and funding opportunities (VRIS3, 6).

Box 2. Smart Specialisation Strategy to promote knowledge-driven growth

Smart Specialisation, a pillar of the current European Commission's Cohesion Policy, aims at finding strategic areas where regions or countries have a competitive advantage or have the "potential to generate knowledge-driven growth" (European Commission, 2019). Smart Specialisation strategies stimulate regional development by gathering key stakeholders (public sector, business, and Higher Education Institutions) to pursue opportunities to upgrade key sectors or to identify new areas. A Smart Specialisation Strategy (S3) consists in identifying the sectors that have potential for growth, based on local resources and comparative advantages, and prioritize the development of these sectors through innovative activities or technologies.

Source: European Commission, 2019; OECD, 2019.

The process of formulating the agenda and identifying the areas (or fields) for smart specialisation included a review of existing analysis, an updated statistical analysis of the strong industries in Värmland, and a review of the strong research environments, primarily at Karlstad University.

Other factors considered included: the need for growing markets, actors in the region who could be a driving force, the level of entrepreneurship in that given field, and whether it was possible to contribute to solutions for dealing with societal challenges within the field. Region Värmland defines smart specialisation as smart ways to organise and develop existing regional assets in order to create value for users and society. In short: Smart ways to create value!

The prioritised smart specialisations are based on the "traditional" strength areas of Värmland with solid anchoring in the history of the region (Figure 4). In identifying these areas, VRIS3 serves as a tool for sustainable and inclusive development and growth in Värmland. More specifically, the VRIS3 process restructured the strength areas and partly combined them with each other to create the prioritised

specialisations. The strategy concerns all key groups that work with innovation within Värmland's specified areas of specialisation, as well as actors elsewhere in Sweden, in Europe and globally. The aim is also to realise the set goals for the region and to increase national and international visibility (VRIS3, 7-8). The strategy allows for innovation in the future and can be updated if new specialisations emerge in the regional ecosystem.

Figure 3. Correlation between areas of strength in business and smart specialisations
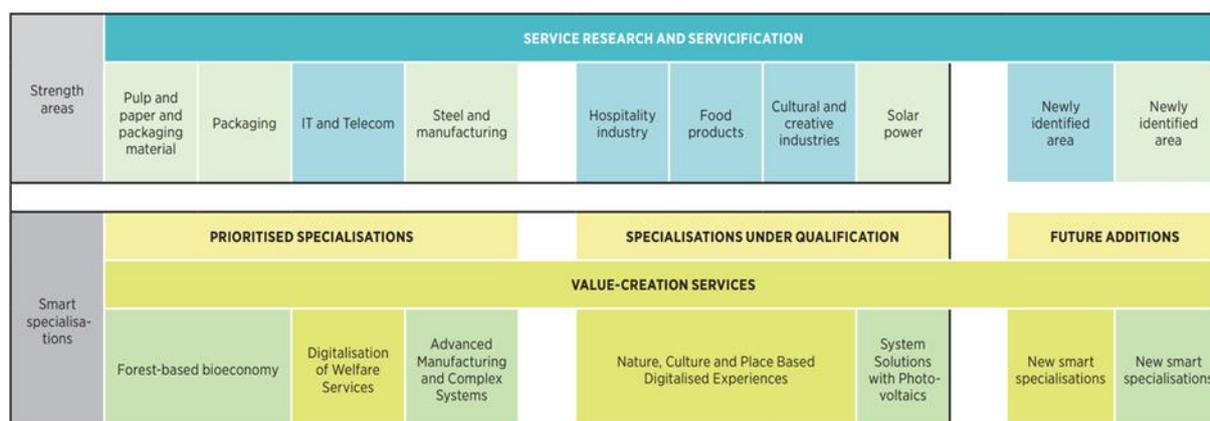
Smart specialisation priority areas

Subsequently, the strategy's priority areas were selected based on the following criteria: the potential for earning international recognition within both business and research; critical mass of companies; innovation capacity; clustering and networking; and entrepreneurial dynamics. In addition, the strategy considered the potential contribution of the actions to societal challenges and the integration of gender perspectives. As the strategy states: "the specialisations involve what we are good at, and also what we are good for" (VRIS3, 7).

The analysis and prioritisation work in 2014-2015 produced six areas for smart specialisation for the period 2016-2020 with different levels of priority (Figure 4). Forest-based Bioeconomy, Digitalisation of Welfare Services and Advanced Manufacturing and Complex Systems are the prioritised specialisations. Nature, Culture and Place-Based Digitalised Experiences and System Solution with Photovoltaics are specialisations under qualification. In addition, the specialisation in value-creating services crosses throughout the other sectors with the aim of promoting interdisciplinary collaborations. To create a gender-integrated innovation strategy, "gender" has been mainstreamed in all productive specialisations.

In sum, the VRIS3 strategy has been developed with an overarching vision of improving the well-being in Värmland, with "a green, open border region, we create companies and jobs by providing good education for everyone from pre-school to university. The future and well-being of our children is always in focus. Relying on our ingenuity and the forest business as an industrial base, we develop new products and new industries of a world class calibre" (Region Värmland, Värmlandsstrategin 2014-2020).[2]

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[2] Authors' translation from Swedish

Figure 4. Värmland S3 specialisations with clusters and innovation platforms
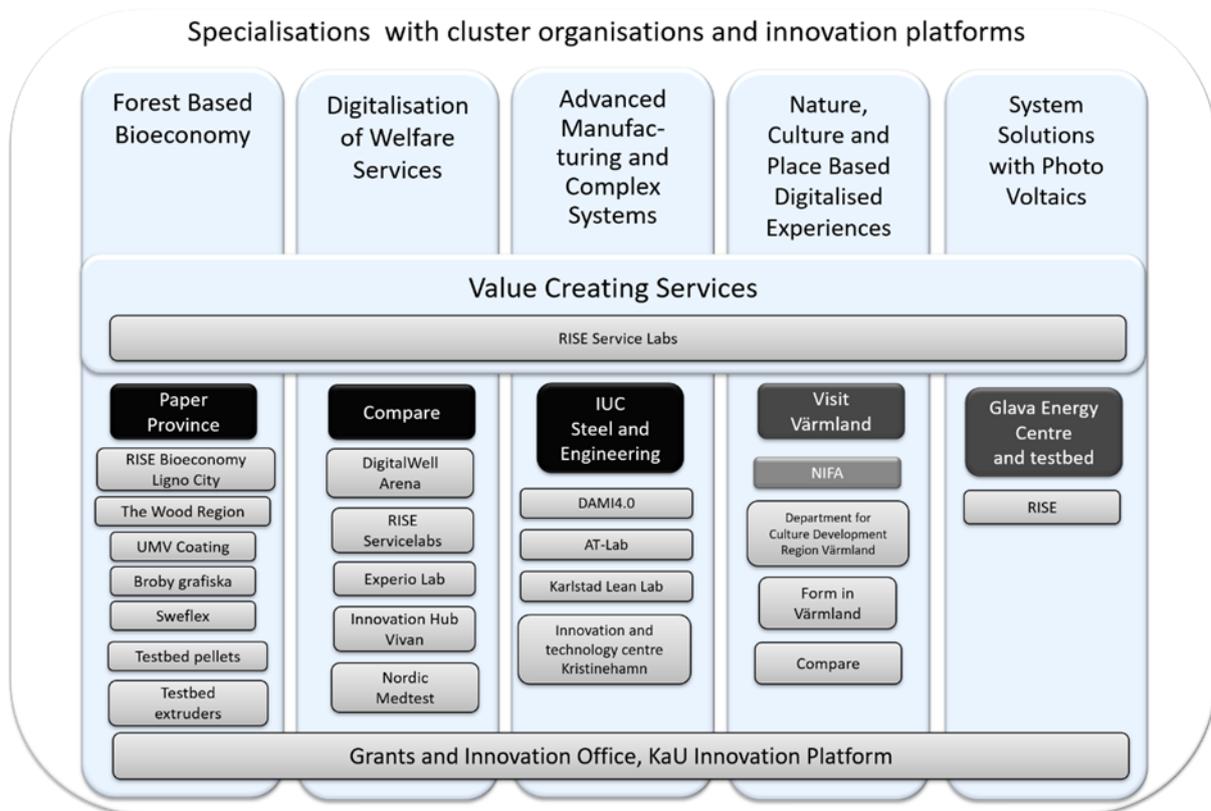
4 The Academy for Smart Specialisation

The Academy as a piece of a broader regional puzzle

The Academy for Smart Specialisation plays a pivotal role vis-à-vis Värmland´s Research and Innovation Strategy for Smart Specialisation 2015-2020. According to the regional strategy, the Academy represents a research powerhouse that will tailor innovation towards positively affecting the competitiveness of firms located in Värmland (Region Värmland, 2014).

More generally, the Academy for Smart Specialisation is a complementary element of the broader regional innovation system of Värmland and its smart specialisation. The Academy is therefore part of a long-term process and the fostering of an ecosystem around smart specialisation in Värmland. The Academy is nevertheless a highly ambitious step in terms of increased collaboration between Region Värmland and Karlstad University to further strengthen the research-related innovation and job creation in Värmland. The collaboration with the cluster organisations is highly relevant in this structure.

Finally, the Academy does not represent the only collaboration activity between the University and the region. Karlstad University has a broad base of activities in education and research that also go beyond the scope of the Academy and is not limited to its networks.

The Academy's establishment and function

The Academy for Smart Specialisation is a strategic partnership between Region Värmland and Karlstad University to strengthen the research environment and regional competitiveness in Värmland. The Academy started its operations in 2016, capitalising on other forms of cooperation that already existed. Karlstad University and Region Värmland have a long history of cooperation that precedes the Academy for Smart Specialisation and the VRIS3. The partnership between these actors was strengthened in 2005, when Värmland participated in an OECD initiative looking at the contribution of universities to regional development. Värmland was one of the 14 international case studies involved in the OECD project "Supporting the Contribution of Higher Education Institutions to Regional Development".

The report drew on a self-evaluation process initiated and led by Karlstad University and conducted by a steering committee representing the main regional and national actors. Recommendations from the review included the need to strengthen ties between key regional clusters and national innovation policy, and that the university should focus its activities on those in which it has clear strengths and on which Värmland's economy can give competitive advantage (OECD, 2006). The OECD study ignited a process that eventually led regional counterparts to establish the Academy for Smart Specialisation. Based on the result of the 2005 study, regional and university stakeholders started a formal collaboration in 2008. The collaboration evolved between 2010 and 2015. In this phase, the Region of Värmland provided funds to

finance ten professorships at Karlstad University. Regional authorities participated actively, along with academics and representatives from the regional private sector, in the selection of the ten professors.

The aim of the programme was to link the University's research and competences with the strategic priorities of the cluster organisations, reflecting the industrial specialisation of the region. Eight professors were doing their research in areas directly linked to the needs of the cluster organizations. The remaining two professors were working in crosscutting research areas generating economic and societal value for all actors in the region. All together, these professors had the task of generating and/or evolving research environments within the University in connection with the regional ecosystem.

The creation of the Academy for Smart Specialisation represented the next step of collaboration in the region (Figure 6). The Academy capitalised on the previous experience, the 10-professorship programme, and tried to go beyond the "silo-thinking" attitude that had represented one of the shortcomings of that experience. The idea behind the Academy was to scale up the previous initiative and transform it into an interdisciplinary platform favouring the interactions among the university, public authorities, and the private sector in different areas of specialisation.

Figure 5. The evolution of higher education, research, and smart specialisation in Värmland
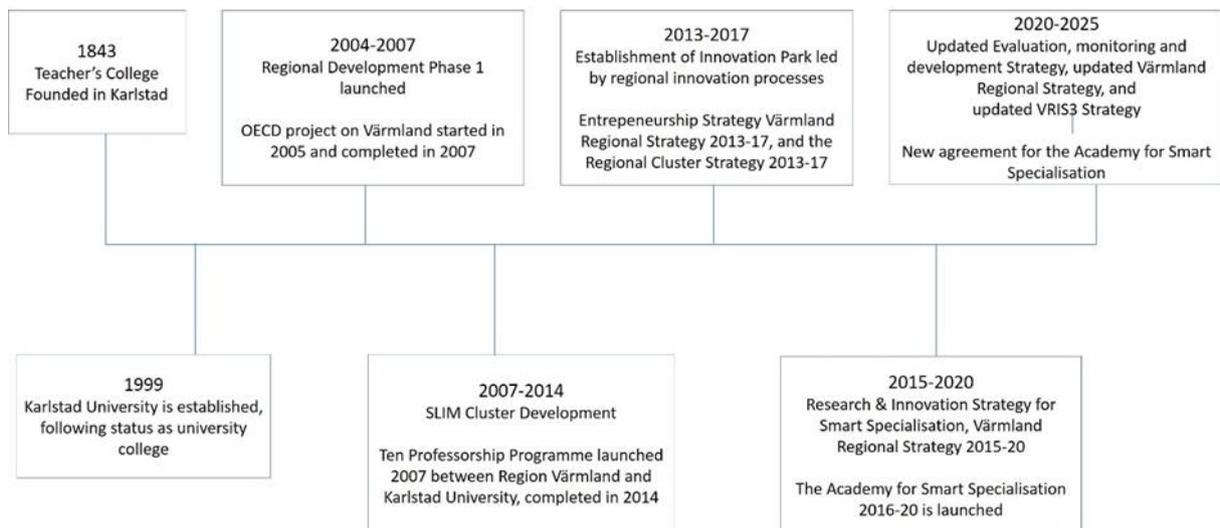
Objective, structure and financing of the Academy

The Academy for Smart Specialisation is jointly run by Karlstad University and Region Värmland. According to the document *Appendix Academy for Smart Specialisation 2016-2020* (2016) the purpose of the Academy is to serve as a meeting-place and cooperation platform for researchers, companies, financiers, public sector and entrepreneurs. Based on this document, the main strategic objective of the Academy is the following:

"The Academy for Smart Specialisation should promote the conversion and renewal of the public and private sectors in Värmland as well as research at Karlstad University. The Academy for Smart Specialisation has been established to contribute to innovation by promoting long-term partnerships and identifying priorities, increasing the involvement of the public and private sectors, increasing the capacity to participate in international research and innovation projects and creating awareness about the partnership nationally and in the European Union," (Appendix Academy for Smart Specialisation 2016, 4)".

By linking research, innovation and teaching, the Academy is also preparing students at Karlstad University to meet the requirements of the regional labour market, to support the industrial development in the six priority areas identified by the smart specialisation strategy, in Värmland.

The management structure of the Academy is organised into two institutional bodies: a steering group and a working, or management, group. These two bodies encompass representatives from both Region Värmland and Karlstad University. The Steering group is in charge of strategic decisions. The representatives from the university that sit in the Steering group are the Vice-chancellor, the two pro-vice-chancellors and the university director. The representatives from the regional government that are part of the Steering group are two elected officials and a civil servant - the director responsible for regional development and growth. The Steering group meets four or five times per year.

The working (or management) group handles operational and day-to-day activities, and manages the budget. Among others, the working group reviews grant applications, monitors the Academy's projects, ensures that the Academy is involved in all opportunities for co-funding. The working group is based on representatives from the university and from the region. On the university's side, the members of the working group are: the Head of External Relations (who is also in charge of the Grants and Innovation Office) along with a research advisor, a financial advisor, and a research administrator from the Grants and Innovation Office. On the Region's side, there are the regional manager of the smart specialization strategy and a project administrator.[3]

Region Värmland and Karlstad University provide funds to the Academy for Smart Specialisation. The Region has agreed to allocate a maximum of SEK 50 million (EUR 4.53 million[4]) during the first five years of activity. Karlstad University provides additional resources. The Academy for Smart Specialisation should also generate external co-funding of SEK 50 million from the national research system, the private sector, and EU programmes. Table 3 below illustrates the divisions of the internal funding in percentages among the different specialisations, and university departments. The Health, Science and Technology department receives the most funding, 44,1%. This is mainly because the specialisation "Digitalisation of welfare services" has a high capacity for co-funding.

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[3] The founding agreement of the Academy mentioned the possibility to create a third body: an Advisory Board. This third group should have developed the long-term strategy of the partnership and contribute to the institutional strategies of the other parties. In addition, the Advisory Board should have specifically focussed on the development of the Academy after 2020, with the aim of coordinating the activities of the Academy with European, national and regional levels. However, the Region and the university decided to drop the idea of an Advisory board and to use the allocated funding instead to support an evaluation process of the first four years of activity of the Academy.

[4] Currency rate as of 2020-03-26

Table 3. Budget allocation (in percentages) for the S3 Academy 2016-2020

Smart specialisation	Arts & Social Sciences	Health, Science & Technology	Board for Teacher Education	Other	Total	Per party
Value-creating services	10.8				10.8	5.4
Forest-based bioeconomy	5.4	8.6			14.0	7.0
Digitalisation of welfare services		16.5			16.5	8.25
— Digitalisation in schools			14.0		14.0	7.0
Advanced manufacturing and complex systems		10.0			10.0	5.0
Nature, culture and place-based digitalised experiences	5.0				5.0	2.5
Systems solutions with photovoltaics		9.0			9.0	4.5
Gender mainstreaming	5.6				5.6	2.8
Running costs for the Academy				2.7	2.7	1.35
Unallocated funding (to be decided by the SG)				12.4	12.4	6.2
TOTAL	26.8	44.1	14.0	15.1	100.0	50.0

Source: Academy for Smart Specialisation 2016-2020

The research groups, projects and transversal activities

The Academy for Smart Specialisation hosts different research groups and projects. Most of these groups and projects mirror the sectorial priorities as identified by the Värmland smart specialisation strategy. There are, however, other projects, linked or interconnected to the specialisations of the Academy that are not covered by the agreement between the region and the university.

Beside the sectoral specialisations (Box 3, below) the Academy promotes a holistic approach to research activities. The VRIS3 Academy Platform facilitates and funds strategic partnership and cooperation among different research groups and other stakeholders. The Platform is also a strategic tool promoting a long-term perspective and seeking new linkages among actors and projects. Interdisciplinary and inter-sectorial activities coordinated by the Platform represent a core business of the Academy. For example, the model for knowledge exchange (ERFA) where projects and research groups share their work and create new collaborations and project applications is a central part of the structure of the Academy. The joint responsibility and shared leadership in this platform are essential for the strategic partnership of the Academy.

Another important function of the Academy Platform is external communication. The platform has developed a communication plan with tools such as roll-ups, flyers, webpage, power point templates and films. The Academy aims at spreading knowledge and information about the cooperation model adopted in the Region, in order to attract the interest of an international audience. Institutional communication is considered important and is actively pursued. For example, the project Inside Out EU has identified the Academy as a good practice. Based on this, the Academy was presented on the Interreg Europe website. Between 2016 and 2019, the Academy took part in more than 100 different activities such as conferences, workshops and seminars to present Värmland advanced approach to the smart specialisation model. Within the platform a half time position was also employed in 2017 to facilitate the coordination of the platform activities.

Box 3. The projects and research groups within the Academy for Smart Specialisation

FOREST-BASED BIOECONOMY

    1. Forests as resources and opportunities in regional development

The project aims to contribute to the strengthening of regional innovation systems in Värmland and the transition to a forest-based sustainable bioeconomy. The project explores what it means for a region to transit towards a bioeconomy, and the processes through which regional actors build and implement such transition.

Involved research group: The Centre for Regional Studies (CRS)

    2. The Research Environment for a Circular Forest-Based Bioeconomy (FoSBE)

The project aims to contribute research-based knowledge, in order to prepare public and private sectors in Värmland for future needs for new biomaterial and renewable bioenergy.

Involved research groups: Processes and Products for a circular BioEconomy (Pro2BE), Service Research Center (CTF)

    3. Shaping the Bioeconomy future (Pro2Be)

The project aims to develop and consolidate the research environment Pro2Be by recruiting a research leader to work with organisation and external relations. The project strives develop research excellence to support the regional forestry actors both in terms of research and front edge competence. The project will start in autumn 2020.

Involved research group: Processes and Products for a circular BioEconomy (Pro2BE)

DIGITALISATION OF WELFARE SERVICES

    1. Graduate School for Digitalisation in Education (FUNDIG)

This project aims is to contribute to research on the digitalisation of education, as well as to developing the knowledge and skills of primary and pre-primary schoolteachers in Värmland.

Involved research groups: Centre for Social Science Education (CSD), Centre for Language and Literature in Education (CSL), Science, Mathematics and Engineering Education Research (SMEER), Research on Subject-Specific Education (ROSE)

    2. DigitalWell Research

This project aims to strengthen research, technological development and innovation in small and medium-sized businesses of digital welfare services. The project will increase the capacity of businesses to develop new services while meeting the needs of the public sector in a secure manner.

Involved research groups: Computer Science (CS), Service Research Center (CTF), Nursing Science

    3. Demand-Responsive Transport to ensure accessibility, availability and reliability of rural public transport (RESPONSE)

The project will contribute to the development of call-controlled public transport through analyses of user's experiences of traveling.

Involved research group: Service Research Center (CTF)

ADVANCED MANUFACTURING AND COMPLEX SYSTEMS

1. Karlstad Lean Factory

Karlstad Lean Factory is a newly established development and meeting environment for industry at Karlstad University. The aim is to optimise processes and production in the manufacturing industry and to promote innovation capacity.

Involved research group: Characterizing and Modelling of Materials (CMM)

2. Regional additive manufacturing laboratory at Karlstad University (AT-LAB)

The aim of the project is to install a laboratory for Additive Manufacturing at Karlstad University and to use it as a place where academia and regional companies can meet and transfer knowledge.

Involved research group: Characterizing and Modelling of Materials (CMM)

NATURE, CULTURE AND PLACE BASED DIGITALISED EXPERIENCIES

1. Digitalisation and the Tourism Industry

The project will initiate a development and innovation process, partnering companies in the tourist industry with IT companies to increase their competitiveness.

Involved research groups: The Centre for Regional Studies (CRS) and Geomedia

2. Music Ecosystems Inner Scandinavia (MECO)

The project aims to work through cross-border collaboration between research, education, and industry for a sustainable, innovative and inclusive music life in Värmland and Hedmark.

Involved research groups: Geomedia and Service Research Center (CTF)

SYSTEMS SOLUTIONS WITH PHOTOVOLTAICS

1. Solar Värmland

The aim of the project is to cooperate with regional industries to create new products and services in the area of solar cell-generated electricity and strengthen cooperation between regional companies and international groups.

Involved research group: Characterizing and Modelling of Materials (CMM)

GENDER STUDIES

1. Gender Academy for SME

The project aims to prepare and develop companies in Värmland by applying knowledge about gender, organizational change processes, gender-mainstreaming and norm-conscious innovation to increase innovation capacity as well as the growth of SMEs.

Involved research group: Centre for Gender Studies (CGF)

VALUE-CREATING SERVICES

This specialisation is included in projects under Forest based bioeconomy, Digitalisation of welfare services and Nature, culture and place based digital experiences.

Evaluation and monitoring activities of the Academy

The evaluation approach of the progress and performance of the Academy for Smart Specialisation, takes into account "expected inputs" (i), and expected results (r). These are set up by the Academy and described in the document Academy for Smart Specialisation 2016-2020.

Inputs include:

- Participation in the activities of the Academy and its stakeholders
- Provide support to new ideas, student businesses, and new company development, as well as participation in innovation work done by businesses.
- Actively submit applications to national and EU funding calls, and seek collaboration with other research groups
- Commit to attendance and comprehensive reporting of S3 activities
- Expected results of each specialization include:
  o National or EU funding granted for research and innovation projects with public or private sector actors
  o Development of each research group towards a strong or excellent research group, or an improved position for the research groups already designated excellent
  o Successfully implemented student collaboration (receiving organisations and students are satisfied)
  o Research results that may be applied by businesses, municipalities and the county council in Värmland
  o Verified ideas and innovations

Success indicators include examples of possible success for the different specialisations, for example:

- Large demands for the researchers' skills and networks from businesses, the municipalities and county council in Värmland.
- Supply of specialised skills.
- Breakthroughs in research and innovation, innovations, export success, growth of the businesses involved
- Successfully influencing policy to support the development of the areas of specialisation.
- Larger test bed and demonstration environments and national or international assignments for areas of specialisation in Värmland.
- National and international prominence.
- Strategic regional, national and international partnerships.
- Larger, prestigious, relevant research and innovation projects, for example Horizon 2020
- Investments in the existing business sector in Värmland.
- Larger businesses choose to locate, develop or retain their research and innovation resources in the region.
- Establishing new businesses, particularly large/strategic ones.
- Valuable jobs are created

The Academy actively monitors its activities. Project managers from all specialisations, generate short annual reports illustrating the activities based on a series of synthetic indicators. Significant indications of success and results are reported, as well as the state of the following indicators: external co-funding of the co-funded projects, strategic recruitments in the areas of specialisation, participating business in project

partnerships, participating public sector actors in project partnerships, verified ideas (innovations) at Karlstad University, and activities for stimulating EDP (Entrepreneurial Discovery Processes). The Grants & Innovation Office (GIO) has an established process regarding innovation-support including idea development and verification. A research handbook was published by Karlstad University in 2020, with information about the development of ideas and verification process.[5]

In 2019, Region Värmland started a parallel process with the leaders across the six areas of specialisations to jointly evaluate the progress, performance, and next steps of the respective specialisation. Each area applied individual monitoring indicators to self-evaluate how the processes within the different specialisations are proceeding. The documentation from the joint evaluation events add to the evaluation and monitoring process of the Academy.

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[5] See the Karlstad University Research Handbook, available at https://www.kau.se/en/research-handbook, where Step 6 focuses on 'Innovation and Utilization of Research' https://www.kau.se/en/research-support-handbook/step-6-share-your-research/step-6-innovation-and-utilization-research

5 Analysis of the Academy for Smart Specialisation

The evaluation of the Academy for Smart Specialisation benchmarks the activities and performance achieved by the beginning of 2020 to the goals the Academy had set in 2016. The evaluation team collected the data regarding the financial and human resources allocated by Region Värmland, Karlstad University and their stakeholders to establish and implement the Academy. The main documents that informed the evaluation include:

- The "Academy for Smart Specialisation 2016-2020" (2016) which is the strategic planning of the Academy.
- The "Värmland's Research and Innovation strategy for smart specialisation 2014–2020" (VRIS3)
- The "Annual Reporting of the Academy for Smart Specialisation 2017-2019"
- Additional documents related to the self-evaluation and monitoring process of the specialisations within the VRIS3 carried out in 2019-2020

The desk analysis has been complemented by field visits. An OECD delegation encompassing experts from Nordregio and from the Polytechnique of Montreal, Canada, interviewed regional stakeholders in January 2020. In addition, experts from Nordregio performed follow-up interviews in Värmland in February 2020. Additional data from the interviews of Region Värmland Competence study in March 2020, with focus on smart specialisation themes, has been used where relevant to complement the interview data.

This section is structured as follows. The first part assesses the governance framework in which the Academy for Smart Specialisation operates. The following part evaluates the way in which the Academy operates vis-à-vis the "regional specialisations" in which its activities are organised. The chapter ends with a summary of the main findings.

Governance of the Academy for Smart Specialisation

Overall, the evaluation of the management, coordination, and implementation of the Academy for Smart Specialisation is positive. The strategic and operational management (Steering Group, Working Group), as well as the support functions are in place and follow the guidelines set by the "Academy for Smart Specialisation 2016-2020" document. The Academy benefits from the capacity of the region and the university to work together. The role of Region Värmland and its research and innovation strategy has become central in the coordination of the Academy, as well as the role of the Grants and Innovation Office at Karlstad University. The symbiosis between these two regional bodies represents one of the key assets of the Academy and, at the same time, illustrates the challenge of replicating a similar experience in a different regional context.

The Academy for Smart Specialisation is not managed following a traditional approach based on a director, middle management, and research group leaders. Rather, the Academy has adopted a shared leadership

structure. This is understandable considering the need to profile the Academy as a joint effort of different regional stakeholders. Collaboration among the chief stakeholders of the Academy is functioning without major difficulties, and there is a fair amount of accumulated trust among the regional stakeholders contributing to the successful implementation of the Academy work. This governance arrangement, however, may be difficult to explain to partners from outside of Sweden, or even outside the region.

The concept of "Academy" is not straightforward. The interpretation of the word "Academy" is often associated with training activities rather than with research projects bearing innovation elements. Therefore, it is important that the Academy for Smart Specialisation finds a way to avoid this potential misunderstanding in communication with external stakeholders and potential partners.

Priority specific analysis

This section presents the development, and the performance of the specialisations within the Academy, which represent the key foci of the evaluation process. In particular, the following dimensions (or issues) were considered in this evaluation:

- The overall alignment between stated objectives, expected results and actual effects
- The alignment between objectives and results at the level of individual projects
- The regional, national and international partnerships created by the Academy
- The implementation practices and the collaboration among stakeholders
- Financing mechanisms.

The evaluation of the six "specialisations" and gender integration is based on three major sets of information6. The first one, which is called "Part A. results based on annual reports" discusses the results presented in the annual reports referring to the different projects in 2017, 2018 and 2019. The second set of information "Part B. Feedback from interviews 2020", presents information from the interviews conducted by OECD team in Karlstad, in January and February 2020. The third part, "Part C. results based on self-evaluation of the VRIS3" illustrates results from a self-evaluation and monitoring process performed in all six specialisations related to the ongoing process of developing a new VRIS3 in Värmland.

The evaluation focuses on the following key specialisation defined in the VRIS3: Forest-based bioeconomy, Digitalisation of welfare services, Advanced manufacturing and complex systems, Nature, culture, and place based digitalised experiences, Systems solutions with solar power, Value-creating services. Moreover, the evaluation includes analysis and recommendations related to a special initiative for gender integration.

Forest-based Bioeconomy

Within the Academy, the forest-based bioeconomy specialisation operates to provide regional products and innovations for a global market to foster a transition to a fossil-free and sustainable society. This area of specialisation is rooted in the industrial tradition of the region. Värmland is home to a world-leading cluster within pulp and paper technology: the "Paper Province" (Box 4). Forest-based bioeconomy is the second largest area of specialisation based on funding; it absorbs up to 14% of the total resources of the Academy.

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[6] Note: the list of major expected results and key indicators see Ch 4.5.

A. Results based on annual reports

The forest-based bioeconomy specialisation has two major projects within the current agreement: "Research Environment for a Circular Forest-Based Bioeconomy" (FosBE) and "Forests as resources and opportunities in regional development".

During 2017, FosBE allocated resources to the creation of external contacts and capacities by financing a PhD programme, and having PhD candidates collaborating with industry. During 2017-2019 FosBE generated several national research applications and was able to receive a research grant from the Swedish Energy Agency (SVINPELS) and from Vinnova (Närskog 2). Research results from FosBE have also generated several new research applications and projects (Lignocity 2.0, Multi-BARR) and the project has collaborated with testbeds such as LignoCity and the biomass factory and several companies. In 2018, FosBE received grants – Transbio II – for the continuation of the project "Transition to a responsible forest-based bioeconomy".

The project "Forests as resources and opportunities in regional development" was presented at several international conferences and for the Swedish Ministry of Enterprise and Innovation during 2019. Within the current agreement a new project "Shaping the Bioeconomy future (Pro2Be) will start in autumn 2020. The project, which has a new professorship, and aims to develop and consolidate the research environment of this specialisation.

The projects within this specialisation have significant external cooperation with both public and private actors as well as academic institutions. The collaboration with industry is essential for the projects in this specialisation and the cluster organisation Paper Province is an important player in the region. The projects collaborate with bigger companies and, to some extent, with the SMEs. The bigger companies include, for example: Stora Enso, Astra Zeneca, Attana AB, BillerudKorsnäs, Cellcomb, Iggesund Paperboard, OMYA. There is also collaboration with the Swedish University of Agricultural Science SLU.

Box 4. Additional information on the Paper Province

The Paper Province is a unique business cluster of forest-industry companies as it connects all parts of the forest value chain with university, public organisations and civil society in the search for new bio-based solutions, thereby creating a platform for gathering stakeholders. Among its members are various world leaders in packaging material and packaging solutions, specialty paper, cardboard, paper and pulp and tissue machines, coating machines, and barriers (e.g. Stora Enso, Valmet Paper, SOMAS, and BTG). There are also a large number of SMEs, which provide the sector's largest share of employment and turnover, and provide key competencies.

Värmland has effectively moved from traditional 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 Academy and the Paper Province have developed as parallel organisations and been complementary assets to each other.

Learn more: www.paperprovince.com, www.nordregio.org/publications/green-growth-in-nordic-regions-50-ways-to-make-it-happen/

B. Feedback from interviews

Based on the interviews made by the OECD delegation in 2020, the Academy for Smart Specialisation's research activities are in line with the needs of the forest-based bioeconomy, in Värmland. According to

local stakeholders, the Academy for Smart Specialisation has contributed in the cultivation of connections and collaborations between Karlstad University and the regional industry.

The Academy was able to establish a functional relation with the Paper Province, which is an important intermediate organisation, for forest-based bioeconomy projects. However, while the collaboration with industry is essential, it also presents some challenges for the Academy. For many projects, there are requirements for co-funding from private sector. If there are no large companies participating, the co-funding from small and medium-sized companies may become a challenge.

Representatives from the research projects in this specialisation are expecting to increase their cooperation with the private sector to generate additional funding for the research activities carried out by the Academy. The research capacity of the Academy also has an indirect impact on local activities. The Academy helps local stakeholders identify and select research leaders for important projects within the forest-based bioeconomy.

Based on interviews, there is the opportunity to create a service lab to help companies develop new business models and new ideas on how to benefit the smart specialisation economy. The Academy could promote entrepreneurship (education) and have an applied approach to allow individuals to experiment with their ideas. A closer link between the Academy and the Innovation Park in Karlstad would facilitate these activities.

C. Results based on the Self-evaluation of the VRIS3

The self-evaluation and monitoring process of specialisations in the VRIS3 in 2019-2020 provides additional information on projects related to the forest-based bioeconomy.

In particular, the Academy contributed to three external projects on forest-based bioeconomy: "BioWiseTrans", "InGO-skog" and "Cross border ecosystem services – the forest as a nature and cultural heritage resource". These projects have the aim to develop knowledge about inclusion and utilisation in a quadruple helix spectrum[7].

Based on the self-evaluation, actors within paper and pulp mass technology have experienced growth since the Academy was created and contacts have increased with other areas of smart specialisation in Värmland. The Paper Province cluster is perceived as a strong unifying actor in the region and a strong engine in the bioeconomy sector. In addition, the business incubator Sting Bioeconomy contributes to developing companies in the sector. Sting Bioeconomy started in 2018 and the Academy was instrumental in the establishment.

In the self-evaluation, actors working within the specialisation emphasise the need to further work on developing the front edge competence regarding pulp fibre-based packaging material through testbeds and collaboration between Karlstad University and industry. The need for generating additional skills that can support the industry is therefore acknowledged. The planned graduate programme at Karlstad University, which aims at improving value creation through Service Innovation (ISE), is mentioned as a possible way to provide this requested skill to the industry in the future. In addition, the attempts should further tie the undergraduate programmes to the BEST initiative (Bioeconomy students), where students are connected to companies in the Paper Province cluster as well as to other programmes such as Industrial Economy, Environment and Chemical engineering.

The projects within this specialisation have provided innovative collaborations with industry, which has resulted in Successful R&D activities including, for example, collaboration with H&M on recycled garments

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[7] The quadruple helix concept adds to the triple helix concept by identifying civil society as a fourth important actor, together with public sector, private sector and Academia, in the regional innovation system (Karlstad University, 2020).

(Renewcell), compost friendly food packaging, industrial wood construction and paper batteries. Even so, one conclusion from the self-evaluation is the need to improve the linkages between research and industry, and further develop the cooperation between the Forest-based bioeconomy and the Service Research Centre (CTF).

Concluding remarks

Forest-based bioeconomy is one of the strongholds of the Värmland's Research and Innovation strategy, as well as of the Academy for Smart Specialisation. The Academy with its projects has contributed to strengthening the competitiveness of the forest-based bioeconomy sector. However, more can be done in the future, in particular in relation to the collaboration between Karlstad University and the private sector, including both by the leading companies and towards SMEs. Forest based bioeconomy is of significant importance in Värmland to guarantee the future development. The role of Paper Province as an intermediary organisation between research and industry is highly relevant for the Academy. Another remark was that the Academy has the potential to complement the Paper Province in accomplishing demanding missions and tasks in the forest bioeconomy supply-chain. In addition, the Academy has contributed to the continuity of fundraising for research, reflecting the needs of regional actors in the field. The initiative to strengthen the Pro2be research group with an additional professorship in 2020 is a promising next step.

Digitalisation of welfare services

The "digitalisation of welfare services" specialisation develops and tests digital welfare services in care facility environments and in close collaboration with the users. The public sector is an important user and procurer of these processes. Resulting in better and more effective care, education and other social services, which leads to healthier citizens. The specialisation thereby supports the digital transition in the region and adopts an innovative approach to mainstream digitalisation in areas where it is not yet common. This specialisation is the biggest in terms of funding and absorbs 16.5% of the total funding for the Academy.

A. Results based on annual reports

The specialisation Digitalisation of Welfare services has generated three major projects in the current agreement: "DigitalWell Research", "FUNDIG" and "Response". Digital Well Research is a sister project to "DigitalWell", which is a project run by the IT cluster Compare. The projects within this specialisation have been successful in raising external funding. The most significant of the funding programmes is the 10-year funding from Vinnova, a national innovation agency, which was allocated in 2018 for the project DigitalWell arena8. DigitalWell Arena is a platform for cooperation on digital solutions to societal problems in collaboration with several actors from the public sector, the IT cluster Compare, private actors, academic institutions, and research groups at Karlstad University (Nursing, Centre for Gender Studies, Service Research Centre, Computer Science and Mathematics, Grants and Innovation office). In addition, the research group within this specialisation prepared two EU Horizon 2020 applications in 2018: 5G-ALICE and 5G-PRIME. Several other projects have been granted research funding as a result of the Academy projects. During the ongoing Covid-19 crisis, a number of initiatives have been triggered via DigitalWell Arena. The initiatives are mainly linked to solving the financial problems of SMEs and start ups. However, it is too early to evaluate any effects.

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[8] More information about DigitalWell Arena is accessible at https://digitalwellarena.se/about-digitalwell-arena/

Researchers working on the "DigitalWell" project teach at undergraduate level as a way to transfer results from the project to students and to ensure front edge competence in the future. The department of computer science is also currently developing new courses related to personal integrity and computer communication (financed through the KK foundation and NU programme), with the aim of strengthening student collaboration within the field. DigitalWell has generated an environment of innovation in which different disciplines such as nursing science, computer science, service research and gender studies participate in workshops and meetings to explore possible cooperation options, in particular among undergraduate students and PhD candidates.

In the "FUNDIG" project, the Academy collaborates with municipalities in Värmland to enhance the link between education and research activities. Seven primary and secondary school teachers are attending a PhD programme at Karlstad University while still working 50 % as teachers, in their respective municipalities

The project Demand-Responsive Transport to ensure accessibility, availability, and reliability of rural public transport (RESPONSE) is run by the Service Research Centre (CTF). The project includes public and private actors in Sweden, Norway, Denmark and Lithuania. During 2019 the project developed a digital handbook about vulnerable travellers.[9]

B. Feedback from Interviews 2020

Based on the interviews made by the OECD delegation in 2020, the Academy for smart specialisation has played a pivotal role in the development of the project structure and regional networks in the field of digital welfare services. From the perspective of Karlstad University, the cooperation between two large research groups, the computer science research group and the Service Research Centre (CTF), has spurred several additional projects. According to regional stakeholders, the Academy has acted as a catalyst in promoting the specialisation of the regional system in this area. The IT cluster Compare is mentioned as an important element in the collaboration structure. Stakeholders consider the Compare cluster as an important broker of innovation between businesses and students, companies and IT companies, public sector and the Academy and digital businesses.

The Academy is seen as an important tool in the regional strategy for smart specialisation in Värmland, and has generated additional funding and collaboration opportunities. In general, there is a shared opinion that the business sector has driven forward the development of digital welfare services in the region. The Academy therefore, is expected both to fulfil the needs and perspectives of public sector and to contribute to the efforts of private sector.

Stakeholders consider that the project "FUNDIG" created a stronger connection between education, teaching and research activities, which will promote innovative thinking related to digital technology and education. For instance, by exposing students in teacher training schools to entrepreneurship, it is possible to mainstream entrepreneurship education much faster, as entrepreneurial teachers transmit their mind-set to students in lower levels of education (OECD 2019[10]). In general, strengthening the connection between research and teaching at Karlstad University has promoted several innovation projects.

Local stakeholders also identified key challenges facing this specialisation, particularly the fact that the private and the public sector – i.e. business and university – have a different system of incentives and different time perspectives.

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[9] Karlstad University, Service Research Center (2020), Experiences of Demand Responsive Transport Among Vulnerable Travellers, available at https://www.kau.se/files/2020-04/Handbok_DRT_RESPONSE.pdf.

[10] See the OECD/European Union (2019) HEInnovate country review for Austria, "Supporting Entrepreneurship and Innovation in Higher Education in Austria," available at, https://doi.org/10.1787/1c45127b-en.

There are also challenges relating to the role of the researcher at the university. So far, researchers involved in the development of the Digitalisation of welfare services have devoted much of their energy to creating relationships with regional actors as well as in building the project infrastructure (platform). Researchers consider these activities as time consuming because they leave only limited time for "traditional" research (publishing scientific articles). Some of the researchers state that this may cause problems in their professional development and their academic career perspectives. However, the current effort could generate a very innovative tool for collecting data and information about health systems in a digitalised way, which would represent a great asset for research in the long-term.

"There is no incentive for the researchers to build the infrastructure that is needed since researchers are rewarded for publishing. This is a problem since the infrastructure is really important and can generate a lot of data and articles when it is created. But it can take several years."[11]

C. Results based on self-evaluation of the VRIS3

Based on the self-evaluation of digitalisation of welfare services, this specialisation has developed an excellent R&D environment, connected with entrepreneurship and developed innovative ideas and projects. According to the self-evaluation process, there has been a positive feedback between entrepreneurs and the research activities of the Academy. In addition, regional firms value the contribution of the IT Compare cluster. However, the self-evaluation also identifies the limited number of companies with significant R&D potential to develop their own products – which is seen as a structural problem for the activities of the Academy in Värmland.

The collaboration between research groups within computer science and the Service Research Centre (CTF) has improved due to better understanding of each other's language and motivations. Even though this has resulted in more interdisciplinary projects, additional external funding and international recognition, the self-evaluation highlighted the need to further develop the cooperation between the different research groups within the specialisation. The self-evaluation also addresses the need to access care facilities where projects and ideas can be tested.

Concluding remarks

The Digitalisation of Welfare services is a good example of interdisciplinary collaboration and with success in fund raising too. The collaborative platform involves many different sectors and governmental levels within regional development in Värmland. The interdisciplinary approach also helps to overcome a common problem mentioned in other higher education systems in OECD countries, namely that business and university have different incentives and time perspectives. The 10-year funding that Digital Well Arena received from Vinnova has contributed to the creation of a long-term project structure. The cooperation with the IT cluster Compare has proven to be fruitful in 2016-2019. Digitalisation in schools and health care sector is expected to receive an additional boost from actions triggered by the Covid-19 pandemic, which represents a great research and cooperation opportunity for the Digitalisation of welfare services.

Advanced manufacturing and complex systems

The specialisation "Advanced manufacturing and complex systems" develops and offers energy and resource-efficient systems solutions and components for: heavy vehicles, the forest industry and renewable energy (energy efficiency and hydrodynamics).

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[11] Author's translation from Swedish

A. Results based on annual reports

In the current agreement this specialisation has developed two major projects: "Regional Additive Manufacturing Lab (AT-LAB)" and "Karlstad Lean Factory". In 2018, AT-LAB participated in two research project applications to Vinnova, out of which one proposal was approved (ADROAM). Two additional applications to Vinnova and State KK Foundation were prepared in 2018 together with the Örebro University. Karlstad Lean factory was developed from an ex-student's work and the application was created by Karlstad University, IUC Steel and Engineering cluster and Lean Nätvärk Wermland, and approved by the Swedish Agency for Economic and Regional Growth (*Tillväxtverket*) in 2018.

In the project AT-LAB, the Academy is collaborating with the large steel manufacturing company Uddeholm AB. The Academy and Uddeholm AB and other regional and national companies co-developed DAMI4.0 (Digital Adaptive Manufacturing for Industry 4.0), which is a research centre under construction with activities aimed at developing strategic collaboration with Uddeholm and other companies in an area of smart manufacturing within the Industry 4.0 concept. This project is interdisciplinary since there are collaborations with research groups at the Service Research Centre (CTF), Computer Science, and with Electrical Engineering

Even though this specialisation connects to applied research fields in the Academy, the research group has become a strong research actor. As part of the collaboration with Uddeholm, the research activities of AT-LAB has, for example, resulted in five peer reviewed articles and the scientific results have been presented at three international conferences. AT-LAB is also involved in networks with the regional coordinator Triple Steelex, the steel cluster IUC, Alfred Nobel Science Park, and the 3DTC project. AT-LAB has direct contacts to industry and Academic institutions such as the Örebro University, Luleå University and the Research institute of Sweden (RISE). AT-LAB has also started printing prototypes for SOMAS Ventiler AB and Nords International AB and they are collaborate with the health sector in Värmland.

B. Feedback from interviews 2020

In the interviews made in 2020, the current transformation of the manufacturing industry is highlighted as a focal point within the sector. The need for flexibility, experimentation, fast production lines, and the availability of a labour force with a universal knowledge about manufacturing are the main areas in which the specialisation is generating activities.

Stakeholders mentioned the lack of research and development capacity in the region as a challenge especially regarding SME's without their own R&D departments. Another issue, according to some stakeholders, is that many companies in the region are doing well and therefore have limited incentives to invest in the development of innovations. In addition, it is mentioned that the industry stakeholders do not always know which kind of assistance they need. Some stakeholders mentioned that there can be difficulties for researchers and industry experts to understand each other. Since the Lean Factory is the most applied of all projects in the Academy, it can therefore play a vital role bridging between university and industry.

The two projects within the agreement for this specialisation have not been running for a long time but have already managed to create substantial collaborations.

"The Academy has provided assistance in printing from additive manufacturing and helped collaborations with industry. Some researchers would already have left the university without the Academy. It is difficult to put numbers on what we have gained but the Academy has put additive manufacturing and lean factoring together in one specialisation."[12]

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[12] Author's translation from Swedish

C. Results based on self-evaluation of the VRIS3

In the self-evaluation of Advanced manufacturing and complex systems, several companies and collaboration partners are mentioned in various sectors and fields, showing the interdisciplinary dimension of this specialisation. The recruitment of engineers and PhDs from the university to industry is mentioned as a common and valuable link for continued cooperation. Even though the connection between research and industry is central for the manufacturing sector, there are currently insufficient links to graduate programmes - an industry graduate programme is however under development together with Service Research Centre.

For the specialisation to grow stronger, it is mentioned that cooperation with clusters and networks needs to be intensified. In detail, the specialisation needs to focus on new branches and together with industry develop packages that derive from the needs of the client and that builds on the ability to create complex systems with attached services.

Concluding remarks

Advanced manufacturing and complex systems is one of the most applied specialisations of Värmland VRIS3 with strong industry collaborations. Even so, the importance of networks for this specialisation still suggests strengthening the collaboration with the cluster organisations and industry even more. It is especially important to find smaller companies without their own R&D departments and provide them with incentives to join projects. DAMI4.0 is a good example of collaboration between the different research groups within the Academy and the private sector and highlights the important role of the Academy as "translator" and catalyst between the different ways of working in the academic world vs the business environment.

Nature, culture and place based digitalised experiences

The specialisation "Nature culture and place based digitalised experiences" uses digital technology and media to visualise knowledge, stories and natural values of places for people that visit Värmland and for people living in Värmland. The specialisation capitalises on Värmland's natural and cultural amenities.

A. Results based on annual reports

Two projects are part of the agreement for this specialisation, "Digitalisation and the Tourism Industry" and "Music Ecosystems Inner Scandinavia (MECO)". The projects within this specialisation have prepared applications for national and EU funding and started discussions with other research teams and universities for Horizon 2020 applications. Even though the projects have not yet generated additional funding, the projects are connected to the research groups Geomedia and the Service Research Centre, which have established several national and international projects during the period 2015-2020.

The development of Geomedia into a strong research group has worked well. There is good communication and close ties to other research groups and projects within the Academy (Service Research Centre, Digital well Research and Center for Regional Studies). The project has increased knowledge about Geomedia, tourism innovation and place-based innovation. The two research groups have for example collaborated on a new study about the effects of Covid-19 on the music industry. Two recruitments have been made to the Research group.

Collaboration between the projects and the private and public sectors is growing, especially with the tourism cluster Visit Värmland and the IT cluster Compare, but also with a lot of municipalities inside and outside of Värmland. External ICT companies such as communication agencies and tourism companies in Värmland are involved in the projects. The group has enriching collaborations with Swedish universities,

as well as with universities, music organisations and companies inside and outside of Europe. Regarding student collaboration, the research team is developing a new course within the tourism programme that builds on results from the projects within the specialisation. They are comprised of bachelor level students and have workshops and guest lectures. There is a "cooperative agreement" between the tourism programme and businesses, organisations and municipalities within the tourism sector. Within the music sector, two graduate programmes and one master programme have started. The Academy is connecting Värmland with the buoyant Norwegian music sector, generating new networks in innovative, international, and business sectors.

B. Feedback from interviews 2020

Based on the interviews made by the OECD delegation in 2020, involved researchers and actors are happy with the outcome and results of the projects within this specialisation. Since the specialisation is broad, it has the possibility to reach several sectors and new communication partners beyond tourism, which can be seen as an interdisciplinary asset for the Academy.

The specialisation is not connected to the traditional industries in the region that, according to some sources, may create difficulties when trying to collaborate with new businesses. Interviewees also expressed certain challenges in relation to the Värmland VRIS3 framework. Tourism does not fit as well to the cluster approach as other specialisations, according to some stakeholders.

"My wish would be to stop working with too much focus on clusters, to stop comparing branches, and to start seeing Värmland as a platform where we can work together."[13]

The research group has the possibility of working even more transversally and to involve more actors, especially if cooperation with Service Research Centre should be increased. Cross-border collaboration is accentuated in reference to the cooperation with Hedmark in Norway within MECO.

C. Results based on self-evaluation of the VRIS3

The self-evaluation of Nature, culture and place based digitalised experiences describes how results from the projects within the specialisation are used in individual tourism places in Värmland. Collaboration with Mid Sweden University, Dalarna University, Luleå University of Technology are also mentioned as part of the specialisation's reference group, which has resulted in several research applications.

Efforts to increase the understanding between the dominant clusters in Värmland, the IT companies and the tourism sector are highlighted as important in the self-evaluation. In reference to this, it is mentioned that there is a need to modify the image of the Academy to be more approachable for new companies. A suggestion expressed at the self-evaluation was to work more with intersectoral methods involving researchers, business and visitors at the same time.

Concluding remarks

The specialisation could further increase collaboration with the other research groups of the Academy. It is important to strengthen the link with the private sector and in particular with smaller companies and increase the incentives for them to participate. Collaboration with companies in rural areas of Värmland, where the projects may have significant regional impact, would be beneficial. The specialisation is broad, and the cluster approach has not yet found its place.

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[13] Author's translation from Swedish

Systems solutions with solar power

The research under Systems solutions with solar power focuses on strengthening the role and importance of Värmland as a part of a leading Norwegian-Swedish innovation system for solar power. The specialisation is expected to start relevant research projects, attract external funding, and contribute to new solar power businesses, especially in the service business sector.

A. Results based on annual reports

One project is part of the agreement for this specialisation, Solar Värmland. In 2017, the Silicon solar cell research group attended several networking events with international and national companies. The networking inside Sweden led to collaborations with the private sector, Karlstad municipality and Dalarna University, and to the creation of three new project ideas that were submitted to the Swedish Energy Agency in 2018 out of which a project about energy storage in apartment buildings was granted funding.

The number of staff increased from one to seven in 2017-2018, which contributed significantly to the development of the research group. The research group collaborates with several companies in Germany, UK, and research institutions in Germany (Fraunhofer ISE), Norway (NTNU), France (University Marseille), and USA (Massachusetts Institute of Technology). Results and resources from the research group have been used within the teaching of student courses at Karlstad University, additionally 1 PhD student and 2 master students' thesis were based on solar cell simulations. This is of importance since in 2019 the regional solar cell companies pointed to the challenges of recruiting skilled personnel. In 2019, the national and international networks and cooperation increased substantially for the research group.

The project has strong collaboration ties with the business network and testbed Glava Energy Centre. Together with the Värmland company Sunfuria AB, the Solar Värmland project has developed "the Solar cooker". The project derives from a previous collaboration project with Karlstad University, from where the solar cooker idea originally came. This idea for the need of cheap and efficient energy was developed and produced by Sunfuria AB, and the project currently collaborates with Kenya. Social and environmental sustainability are big elements of the Kenya project.

B. Feedback from interviews 2020

The Academy for Smart Specialisation has been of crucial importance in developing the research-based expertise of solar power in Värmland. Moreover, the Glava Energy Centre has managed to increase the interest of the companies in the field. The owner of solar company states that the networks and contribution of Karlstad University and Glava Energy Centre have been highly important for the development of the sector.

"It has been an amazing value for us that they (Karlstad University) have worked with this […] I definitely want to continue the cooperation with Karlstad University […] the cooperation is now part of my system."[14]

The solar power sector in Värmland is small, and project representatives point to the importance of international contacts and collaborations. The Academy has been able to contribute with international contacts and networks to build up or connect to significant solar cell hubs in the region.

In order to develop solar power research in Värmland, there is a need to include more ideas by local companies into research applications. An industry stakeholder says that the industry would benefit from additional funding to entrepreneurs and companies that want to try new ideas and business structures. As an example of future research areas for the Academy, new measurement techniques regarding the defects in solar cells were discussed.

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[14] Author's translation from Swedish

C. Results based on self-evaluation of the VRIS3

The self-evaluation of the solar power specialisation in the context of the VRIS3 in 2019-2020 focused on the cooperation between the Academy and the cluster organisation Glava Energy Center (GEC). During the last few years the Glava Energy Centre has grown stronger, and become more established in the Swedish and Norwegian markets. The focus of the organisation has broadened to include more forms of renewable energy, energy storage, electric vehicles, smart cities and homes, apps for rural areas in cold climates, and more sophisticated electricity grids. The specialisation has therefore become much broader and more interesting for the development in Värmland.

According to some interviewees, the interdisciplinary perspective that Karlstad University is delivering is a considerable advantage to solar solutions. It is the interaction between technology, economy and behaviour science that can be leveraged, together with cooperation with public and private sectors.

The self-evaluation provides detailed examples of cooperation with companies and networks, including cooperation with newer companies and start-ups. Even so, it is emphasised that there is a challenge to attract more entrepreneurs and companies within the region and that existing companies experience difficulties in recruiting the right people to expand their operations.

The specialisation has been involved in several research projects, for example two Horizon 2020 projects (HighCast, HeSiTSC), but there is the aim to further develop the ability and preconditions for externally funded projects on a national and international level. The projects within the specialisation have developed several product and process innovations, and since the market for solar solutions is growing, there is space for further development of verified ideas and innovations.

Concluding remarks

Solar power, or systems solutions of photovoltaics, is a fairly new specialisation in the region. The Academy has contributed to sharing the risks of developing the innovation system for solar power in Värmland, which has resulted in product innovations. The Academy for Smart Specialisation, with the Solar research group, has been able to run interesting projects in the field. The Solar Värmland project has acted as a link to the Värmland community and increased the awareness of, for example, service business possibilities. The Norwegian cooperation with concrete cross-border activities has not yet been realised in a larger scale.

Solar power in Värmland is currently at a crossroads, which also affects the Academy. The questions regarding the critical mass and identifying profitable niche areas for Värmland and its research and industry in solar power are of high importance. The main challenge of changing an energy system, relevant to solar power research, will be the integration of renewable energy sources in smart grids, and with mobility and production. The interdisciplinary perspective provided by Karlstad University is a valuable asset in developing new solar solutions.

Value-creating services

Value-creating services is about enhancing the abilities of private and public actors in the contribution to value creation for customers, users and society as a whole. Value-creating services is cross-cutting through the other specialisations and therefore, there are no individual projects in the current Academy agreement under Value-creating services alone. Instead, the main actor of this specialisation, Service Research Centre (CTF), is involved in several different projects within the Academy and is the foundation for the advancement of the interdisciplinary and intersectoral structures of the Academy. The research of CTF takes the needs of the user as a starting point by involving the user and focusing on service innovation and service and system transformation.

A. Results based on annual reports

There are no annual reports for this specialisation since the specialisation has no individual projects in the current agreement. The description and analysis of value-creating services is therefore largely based on the interviews carried out by the OECD team in Värmland in 2020[15].

B. Feedback from Interviews

CTF is the biggest research department at KAU with 74 researchers and is one of the biggest research environments for service research internationally. The CTF has existed since 1986 and does a lot work outside the scope of the Academy and the specialisations.

As a result of the Academy the two major research groups, Computer Science and Service Research Centre, have increased their collaboration and created common projects, such "DigitalWell Research" and the continuation of "DigitalWell Arena" that have received a 10 year co-funding from Vinnova. The project is a broad-based collaboration, that also includes several other research groups, and both private and public actors (other research groups: Social Care, Centre for Gender Studies and Grants and Innovation Office, the IT cluster Compare, Region Värmland, Karlstad University, County Administrative Board, Karlstad municipality, Karlstad El & Stadsnät, RISE Service Labs, MSB, Tieto, CGI, Nordic Medtest, Effect Management, Xmentor Management).

Researchers within the specialisation emphasise the benefits of the transversal position of the specialisation within the VRIS3 but say that there are more opportunities for interdisciplinary collaboration that are not being taken advantage of. By this, they mean that the specialisation of value creating services could have been better and more systematically integrated in the other specialisations.

"We shouldn't have our own track but all different specialisations should be called something about "increased value creation"[16], so it really finds its way into all specialisations" (from Värmland competence interviews 2020)

Several other research groups within the Academy refer to CTF as one of their main collaboration partners. Most connections exist between CTF and the digital project "Digital Well research", and the forest bioeconomy project "Research Environment for a Circular Forest-Based Bioeconomy" (FoSBE). The Service Research Centre also runs the project "RESPONSE", within the specialisation Digital Welfare Services. One of the assets of this specialisation is the flexibility to cooperate with different research groups and sectors. It has also been noted that Värmland, as a region, has a special advantage since actors are closer to each other, and collaboration is necessary and prioritised. CTF works a lot with both private companies and public institutions.

"We have an ecosystem and can work with Swedish Civil Contingencies Agency, Agency for consumers, Research Institute of Sweden as well as care facilities. Our specialities are that we can create small teams and collaborations really fast"

The interdisciplinary collaboration has created innovative projects that the researchers involved, believe are unique in Sweden. For example in the project Digitalwell Research, computer sciences are collaborating with CTF, a researcher from nursing science and a private company trying to understand how they can use digital technology to help people change their behaviour when it comes to health.

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[15] The analysis is also based on a Värmland S3 competence analysis, (Nordregio 2020).

[16] Author's translation from Swedish

Results from the specialisation will be the foundation of a new master's programme at Karlstad University. The programme will probably be in the field of business administration with a focus on service design, customer experience and servitization.

C. Results based on self-evaluation

In the self-evaluation of the specialisations in the VRIS3 during in 2019-2020, the Service research Centre (CTF) is mentioned as one of the main actors within the specialisation value creating services. They are one of the leading research groups in the world within the field of service research and are said to be one of Värmland's strong assets within the services field. Other important actors are the RISE service group (located in Karlstad) who develops servitization as an operation, and Experio Lab Sweden, a collaboration between regions that want to develop their skills in user-driven development using service design, coordinated by Region Värmland.

The evaluation highlights the importance to both increase and clarify the cooperation between CTF and Experio Lab Sweden, and between CTF and the RISE service group. It is highlighted that the cross-disciplinary cooperation between Value creating services and the other specialisations should be increased and that more methods should be developed in relation to the public and private sectors. To continue this development, the specialisations need to create contacts outside of the region and aim to win Vinnova grants for strategic innovation areas within service innovation.

Concluding remarks

A key strength of this specialisation is represented by its capacity to work at an interdisciplinary level and provide solutions and innovations to other specialities. Going forward, the specialisation has the possibility to generate more crosscutting collaborations, and to involve students in entrepreneurship who can create innovative projects. The Värmland case of Value-creating services is an inspiration to many other regions in the taking advantage of local universities with their interdisciplinary approach and connecting to the R&D power they represent.

Gender Academy for SME

Värmland is a pioneer region in Europe in having conducted a gender analysis study and thereby undertaken a conscious gender-mainstreaming of its strategy for smart specialisation. The Gender Academy is therefore not a specialisation by itself but should be integrated and mainstreamed to all other specialisations.

A. Results based on annual reports

The Gender Academy for SME is a project within the current agreement for the Academy for Smart Specialisation

The project aims to prepare and improve Värmland and its enterprises by developing and applying knowledge about gender, organisational change processes, gender-mainstreaming and norm-conscious innovation to increase innovation capacity and research and development activity as well as the growth of SMEs.

In 2018-2019 the Gender Academy worked with seven companies (Löfbergs, Sticky Beat, IUC cluster, Ventisol; Industrisupport: LBC Frakt och Aspervall) in the food sector, digital sector, steel manufacturing, solar power and construction, and applied a gender perspective on recruitment, organisation structure, organisation culture, competitiveness and effectiveness. They have organised different workshops about norms, gender, ethnicity, age and disability. The Academy works with one company at the time and the

results from the research are directly applied in the development of the company. During 2019 the Gender Academy has developed equality plans for the companies LBC Frakt and Aspervall Mekaniska based on the work performed within the Gender Academy.

The Centre for Gender studies is also part of the new Digitalwell Arena project together with Computer science, Service Research Centre and Social Care. The research group has grown and now has 2 people working at 40 %, but the project still has limited resources and is one of the smaller research groups.

B. Feedback from interviews

The Gender Academy works mainly with qualitative theories of the changing of norms and culture. According to a company representative, the Academy has helped her to identify an "improper working culture that doesn't reflect the company's customers or our society". One argument for changing inappropriate work cultures is to attract more women to the sector but also to get them to thrive and want to remain working there. By this, the interviewee means that it is about securing competences and increasing the pool from which employees can be selected. The collaboration with the Academy has resulted in a change for the company:

"I have already started recruiting in a different way; I needed new (different) people to bring new innovations and ideas"

Researchers within the gender Academy say that the Academy for Smart Specialisation has provided an important platform for collaboration. The focus on gender has also brought gender analysis into spheres where it may not have otherwise been, for example the cooperation with Forest-based bioeconomy or with the Innovation Park.

Like with the other crosscutting specialisation Value Creating Services, there is a discussion on how well the interdisciplinary aspect has worked in practice and how mainstreamed gender actually is within the other specialisations. Even though more could beF done with more resources, time and long-term commitment, the project leaders are positive and explain that the implementation of a gender perspective always is difficult.

C. Results based on self-evaluation

Since the Gender Academy is not a specialisation, it is not part of the self-evaluation in the VRIS3 context.

Concluding remarks:

To apply a gender-integration approach to smart specialisation is highly innovative. The use of a gender perspective is relevant and it envisages new aspects of efficiency and regional development. It is also a good way to stand out and brand the VRIS3 strategy. The collaboration with other specialisations has worked well, but could be increased going forward. Even though there have been collaborations with companies it has not been scaled up because of limited resources.

Table 4. Summary of priority-specific specialisations analysis

Specialisation	Key findings and observations
Forest-based bioeconomy	- The Academy projects have contributed to the development of the forest-based bioeconomy sector - Additional efforts are needed to strengthen the links to industry for both the major companies and SMEs - Paper Province has played a key role as a broker between research and industry, which will be highly relevant for the Academy in the future. The establishment of the incubator Sting Bioeconomy was a result of the Academy and an important step for this specialisation in the region.
Digitalisation of welfare services	- Successful interdisciplinary collaborations and has received funding amongst research groups at KAU and public and private actors - From 2016-2019, cooperation with the Compare cluster has proven to be fruitful. - Digitalisation in schools and the health care sector has been boosted by Covid-19, though the effects are not yet discernible. Need expressed for a more coherent way of measuring the long-term effects of the Academy work related to the specialisation.
Advanced manufacturing and complex systems	- One of the most applied specialisations of VRIS3. - Strong industry collaborations; where the initiative DAMIA4.0 will further increase the development. - The importance of networks in this specialisation suggests strengthening the collaboration with the cluster organisation and other companies even more Role for the Academy to engage additional SMEs without their own R&D departments to join the Academy projects
Digitalised experience of nature, culture and place	- Some innovative and interdisciplinary projects - but potential for more - Important to strengthen the link with the private sector and in particularly with smaller companies Cluster approach that works well with some other specialisations has not found its place in the specialisation.
Systems solutions with photovoltaics	- Specialisation without long traditions in the region - The Academy has shared the risks of developing solar power projects in Värmland and been a link to further business service possibilities, which has resulted in product innovation. - The Norwegian cooperation has not been realised at a large scale. Solar power in Värmland is currently at crossroads, which affects the Academy. Is there critical mass and profitable niche area for Värmland and its solar research & industry?
Value-creating services	Interdisciplinary is a key strength. The specialisation has the possibility for much more cross-cutting collaborations
Gender	The Gender Academy has already brought gender analysis to new environments Additional channel to stand out and brand the VRIS3 strategy.

Summary of the analysis

Based on the analysis of Academy for Smart Specialisation, the evaluation group presents the following conclusion of the findings.

Smart specialisation has been transformational in Värmland

The region of Värmland has selected its smart specialisation priorities based on existing industrial strengths with a strong potential to diversify. Traditionally, Värmland has been dominated by pulp and paper, steel, and engineering, but in the recent years, other industries such as ICT, tourism, service, food, and packaging, have developed in the region. By designing the S3 strategy and priorities, the region has managed to create clear and obvious prioritisations based on existing strengths and knowledge networks. The smart specialisation concept is firmly rooted in Värmland's approach to sustainable and inclusive growth and well-being and has, as such been successfully integrated into its regional development strategy. Bringing clear priorities into the regional agenda has facilitated the allocation of available regional resources. The success of smart specialisation in Värmland rests on:

- High acceptance and implementation levels of smart specialisation in Värmland. Commitment to the implementation and subsequent performance of the strategy is evident across a large range of regional innovation actors, including the regional authorities, Karlstad University and the cluster organisations in Värmland, showing that the strategy carries high substantive importance for the regional innovation stakeholders, confirming its transformative potential.

- Strong political ownership and place-based leadership: Devising a smart specialisation strategy requires a combination of harmonised actions and actors. Region Värmland and Karlstad University has shown a competent co-leadership of key stakeholders with the right set of capabilities for bringing about the strategy in a sound manner.

- High levels of trust and social capital in the region. In exploring smart specialisation and the relative policy and regional context in the Värmland Region, there are evident signs of high levels of social capital and trust between stakeholders.

- A strong regional innovation system. The traditionally strong connection between regional and national public actors, businesses, and universities has clearly helped the successful implementation of smart specialisation in Värmland. Key actors include regional authorities, Karlstad University, and the key clusters. Success in raising funds from Vinnväxt programmes by the national Vinnova organisation serves as an example of the cooperation ability of the Värmland innovation system. It is also important to recognize that Karlstad University has broad based activities in education and research outside the scope of the Academy for Smart Specialisation as well.

- Innovative approach to higher education based on value creation. The Academy illustrates the possibility to connect a HEI to regional development strategies respecting the autonomy of the institution as well as the priorities of faculty, staff and students. This requires generating a shared narrative about the role of the HEI, additional resources, trust, and a long-term strategy that allow for experimenting with innovative solutions and – importantly – selecting good practices. All these conditions have proved to be important for the implementation of an entrepreneurial and innovation agenda in Karlstad University and in the Academy for smart specialisation.

The establishment of the Academy for Smart Specialisation underpins the Research and Innovation strategy for smart specialisation

The Academy as a collaboration between Karlstad University and Region Värmland has actively supported the development of new industrial paths. The Academy has been designed to be integrated into the university's research and education strategy and thereby to reinforce the university's goal to collaborate

with businesses and society in the region. The Academy has funded a range of activities in areas of the smart specialisation priorities with a strong connection to local businesses, including, for example, advanced manufacturing, digitalisation of welfare services, and forest-based bioeconomy. The research undertaken in these areas builds on existing strengths and aims to diversify those into new promising industrial paths. Importantly, the smart specialisation strategy and the Academy has not only supported individual company clusters centred around large firms, but has contributed to establishing an entrepreneurial ecosystem within the region. There is however room to improve the ecosystem, to strengthen entrepreneurial mind-sets and to further diffuse innovation towards the SMEs.

The role of the university is of specific interest in the Academy for Smart Specialisation in Värmland. The Värmland case is unique regarding the formal role that the university has within the VRIS3 of the region. It is also important to clarify that the university does not play the role of a development agency, it does "something else". It is very important that this "something else" is clarified and agreed on. Moreover, local universities play an important role vis-à-vis the regional S3 in other regions. Professors may act like experts and help the region identify the comparative advantages of the industrial framework, but they do it on an individual, sectoral and sporadic basis. The Academy offers the possibility to develop an interdisciplinary and systematic approach to industrial "de-specialisation" and to allocate sufficient resources (professors and researchers), on a systematic basis in connection with the regional strategy. In this way, there should be a convergence between the different incentives. The challenge of setting incentives for researchers participating in Academy initiatives is an important task to be undertaken: a faculty that engages with the Academy may face a reduction in scientific publishing.

The Academy has met most of the objectives set for the period 2016-2020

Based on the evaluation, the Academy for Smart Specialisation has been able to meet a large majority of the strategical objectives set for the 2016-2020period. It has taken the desired step in implementing the Research and Innovation strategy for smart specialisation towards more innovation, knowledge and research. The Academy for smart specialisation brand has been developed to create additional awareness about Värmland, and its attempts to strengthen research and innovation. The Academy has also been able to facilitate additional collaborations and joint actions in Värmland. It is, however, unlikely that the strategical objective expressed in the Academy for Smart Specialisation 2016-2020 plan to become "well known and respected in smart specialisation circles in Sweden and Europe" will be fully met. Even though the Värmland smart specialisation approach is nationally and internationally well-known and respected, the concept of the Academy for Smart Specialisation has not received the same level of awareness and visibility.

Concerning selected individual projects, the overall alignment between the stated objectives and expected results varies significantly. Some projects have met, even exceeded the quantitative and qualitative expectations, whereas some others are not likely to meet all the expectations by the end of 2020. A performance comparison between individual projects is, however, a challenging task especially across the selected specialisations. This is partly due to the challenge of setting proper follow-up indicators for the projects compared to the Academy goals.

The evaluation indicates that the Academy for Smart Specialisation has significantly contributed to establishing and strengthening regional partnerships. The Academy is seen as an important matchmaking and partnership creation instrument within the Värmland innovation system. Moreover, the awareness and visibility of the Academy is comparatively high among the relevant actors inside Värmland. Nationally, the Academy and its programmes face increasing competition especially when it comes to the larger cities in Sweden with well-known universities and high levels of research and innovation. There are promising individual partnerships and collaborations created by the Academy, but there is additional work to be done to link the Academy even closer to the national research and innovation system in Sweden. Internationally, the Academy for Smart Specialisation is somewhat known among the smart specialisation community, but

the overall international visibility has remained low. Again, however, the Academy has been able to create some individual partnerships internationally.

Regarding the financing mechanisms and the ability of the Academy to generate additional funding to the research and innovation activities in Värmland, it can be stated that there are a considerable amount of research and innovation projects in the specialisation field of VärmlandS3 that have raised regional, national, and international funding. However, there are indications, confirmed by several stakeholders, that the additional private funding from the key related industries has not met all the expectations.

The management, coordination, and implementation of the Academy for Smart Specialisation has been relatively successful. The strategical and operations management (Steering Group, Working Group) as well as the support functions are in place, largely following the guidelines set by the Academy for S3 2016-2020 document. The role of Region Värmland and its research and innovation strategist has become central in the coordination of the Academy, as well as the role of the Head of the Grants and Innovation Office at Karlstad University. The collaboration among the major stakeholders of the Academy is functioning without major difficulties, and there is a fair amount of accumulated trust among the regional stakeholders contributing to the successful implementation of the Academy work. It is also important to note that the Academy is actively developing its evaluation and monitoring mechanisms and practices to further improve activities.

Several other innovation facilities have also contributed to the success of the strategy

An important additional vector of university-business linkages in the region is Karlstad Innovation Park, which has been established by Karlstad University, Karlstad Municipality, Region Värmland (previously Region Värmland and Värmland County Council). The Innovation Park supports interactions between research activities and entrepreneurship in the region and helps to develop shared networks. The Sting Bioeconomy Incubator, supported by Karlstad University, Region Värmland, Karlstad municipality, Kristinehamn municipality and the Paper Province Cluster, is contributing equally to the creation of innovative start-ups and to spinoffs from existing large firms operating in forest-based bioeconomy globally. However, in contrast to the strong partnership in the Värmland region between business, academia, and the regional government, the link remains rather weak with civil society and ordinary citizens, whose knowledge about smart specialisation and the Academy for Smart Specialisation remains rather limited. Increased communication efforts around the Academy, its purpose and vision might be needed to overcome this.

Industry 4.0 is an opportunity into concrete outcomes

The industrial revolution currently unfolding blurs the boundaries between the physical, digital and biological worlds. It combines technological advancements in artificial intelligence (AI), robotics, the Internet of Things (IoT), 3D printing, genetic engineering, quantum computing and other technologies. These enabling technologies are changing how people live and how business is conducted in nearly every sector, disrupting existing industries across OECD countries and providing important opportunities to advance the transition to a climate-neutral and circular economy.

For the region of Värmland, Industry 4.0 can provide an important opportunity to build regional resilience and increase competitiveness in line with smart specialisation. For example, in the forest, paper and packaging sector, industry 4.0 applications mean that companies can digitise essential functions within their internal vertical value chain, as well as with their horizontal partners along the supply chain. They can also enhance their product portfolio with digital functionalities and introduce innovative services. Making use of the opportunities of Industry 4.0 requires constant innovation and strong collaboration within the business and academic worlds. Värmland has presented important elements for this collaboration: Funding from the Academy for Smart Specialisation has enabled the university to position themselves together with the region in the domain of Industry 4.0. Researchers working on additive manufacturing, electrical engineering, computer science and service research/innovation are increasingly collaborating at Karlstad

University. As a result of the co-operation between Karlstad University and Region Värmland, the new research centre Digitalised Advanced Manufacturing Industry 4.0 (DAMI4.0) is started.

There is however, a need to focus more on increasing co-operation with new companies and further foster important cross-fertilisation of companies. For example, clusters that operate traditionally in one domain (such as the Paper Province cluster) could broaden, to a higher degree, their membership to firms from other industries that can offer important services to firms within the paper and mill sector, notably with regard to ICT. Interestingly, the ICT cluster Compare is also experiencing a digitalisation development that most businesses are currently undergoing, not only ICT companies. Moreover, the information and knowledge acquired from researchers through co-operation with businesses can feed into revised curricula at Karlstad University in areas of industry applicability, for example through the design of inter-disciplinary Master programmes. This also helps build stronger links between research and education at Karlstad University and boosts the role of the Academy as an intermediary for talent.

The success of smart specialisation in Värmland goes hand in hand with a mature cluster ecosystem in Värmland

Since the establishment of the cluster strategy "Värmland model 2.0" in 2012, clusters have played an important role in the success of the Research and Innovation strategy for Smart Specialisation and of the Academy by facilitating and providing a bridge between local industry and academia. Värmland is home to several strong clusters, including the Paper Province Cluster, the Compare Cluster, the Glava Energy Centre, the Steel & Engineering Cluster and Visit Värmland (cluster linked to tourism in Värmland). All these clusters have a dedicated cluster manager, a team of cluster advisers and strong membership of local companies. The Paper Province cluster emerged out of the need to strengthen the pulp and paper industry after it faced international competition in the 1990s and early 2000s. Equally, the Compare cluster emerged out of the problem of a lack of ICT-competences. Clusters in Värmland fulfil several important cluster functions:

- **Intelligence function**: the Värmland clusters help gather information from a wide range of stakeholders, and help develop a diagnostic of key regional challenges;
- **Connecting function:** the clusters help in fostering networks that enhance knowledge spillovers between actors within the cluster and outside. They also play an important role in channelling business engagement and function therefore as important engines in the entrepreneurial discovery process;
- **Marketing function:** the clusters represent their members in national and international markets;
- **Support function:** the clusters support the development of local human resources and provide access to the existing research and innovation capacity, including through their local cluster advisors and the Academy for Smart Specialisation.
- **Innovation function:** the clusters contribute to addressing societal challenges and boost digitalisation and industry 4.0 in Värmland by identifying future skills and investment needs, active participation in skills needs assessments, and support in cross-fertilisation of research and business activities.

The industry development from pulp and paper towards bioeconomy is a case in point

Bioeconomy is a key contributor to the regional economy in Värmland. Traditionally, the region has been dominated by pulp and paper, steel, and engineering. Despite increased international competition, the Värmland region has remained as a strong international player in the pulp and paper industry, especially with its focus on packaging materials. Since the start of the Vinnväxt programme in 2012, Värmland has emphasized innovation, application of new products in other branches and diversification. Through a cluster approach, the region has expanded from the traditional pulp and paper industry into a broader bioeconomy.

The Paper Province became instrumental in bringing together the forest value chain as well as public authorities and Karlstad University for developing a vision for the regional industry. by During the evaluation of the Academy for Smart Specialisation, representatives from the Paper Province stressed that developing a strong vision on where to go with the bioeconomy in the next fifteen years, and collaborating actively in the region towards that goal has been instrumental in accessing funds for the region and driving industrial diversification. The cluster has also been instrumental in developing pragmatic and innovative solutions to drive the industry, for example through close collaboration and shared leadership with the managers of the pulp and paper mills, and study visits and exchanges with other clusters in Finland and Norway and Canada.

It is important to strengthen innovation capabilities and entrepreneurial mind-sets in Värmland

Smart specialisation activities in Värmland have supported entrepreneurial ventures through the Innovation Park and the STING bioeconomy incubator. Karlstad University supports entrepreneurial initiatives through the Grants and Innovation Office whose purpose it is to turn academic research into businesses.

Looking beyond start-ups and scale-ups, the region of Värmland is characterised by a mix of some very innovative and some very traditional companies. Industry involvement in the Academy for Smart Specialisation is partially hampered by a lack of absorptive capacity, especially in SMEs. Interviews confirmed that "there is sometimes a gap between professors and SMEs, which is too large and where we see a translational problem". Building absorptive capacity and strengthening entrepreneurial mind-sets is not easy and requires more attention going forward. While the region has successfully built research capacities in the important fields of regional strengths, strengthening of business capabilities, in particular in SMEs, and finding ways to stimulate innovation is one of the challenges that remain.

There is a need to ensure that both the Research and Innovation Strategy for Smart Specialisation and the Academy keep their transformational potential.

Doing so requires that businesses and academics have constant access to new knowledge and markets, inspiration and long-term partnerships in research and innovation. It also requires further reducing disparities in innovation between those businesses that experience challenges relating to modernisation – especially in the after-COVID19 situation – and those who have been innovation drivers. In addition, it means that the Academy for Smart Specialisation needs to better foster links between businesses and university.

6 Future Recommendations

The evaluation group of OECD & Nordregio highlights the following recommendations regarding the future development of the Academy for Smart Specialisation in Värmland.

- **Mainstreaming the Academy for Smart Specialisation within Karlstad University:** The University is the stronghold of the Academy, and the Academy should focus on further unlocking the full potential of the systematic cooperation with Karlstad University. The Academy faces a challenge, which characterises most higher education systems in Europe: connecting the "knowledge exchange and collaboration" activities with teaching and research activities.

- **Enhancing & communicating a competitive profile**: The Academy needs to pay attention to improving and communicating its profile and areas of strength. The Academy faces tough competition for external funding with other actors in the national research and innovation system in Sweden. The Academy in Värmland needs to focus on competitive niches and leverage the cooperation with Värmland-based industries.

- **Strengthening internationalisation:** The Academy, with its experts and broad international networks, is a significant asset in the global matchmaking and cooperation of Värmland. The Academy can include strengthening internationalisation as one of the main goals of the future smart specialisation strategy and implementation in Värmland. Especially in light of the Covid-19 pandemic, the Academy could help other research and innovation ecosystems in the European Union and elsewhere, to strengthen the connection between academia and a productive R&I ecosystem.

- **Prioritising fund-raising:** Specific attention should be given to the ability of the Academy to generate additional funding to the research & innovation activities in Värmland. Resources and professional skills should be allocated to fund-raising especially regarding the private sector – both by providing relevant knowledge of funding opportunities and practical assistance in fund-raising attempts.

- **Streamlining entrepreneurial structure:** The management, coordination, and implementation of the Academy for Smart Specialisation deserves some re-thinking. It has been suggested that a more streamlined structure of activities, funding, organisation, and services provided should be considered for the future. For example, by developing entrepreneurial mind-sets, the Academy could provide tailored services to local SMEs, positively affecting their innovation capacity and productivity.

- **Adapting regional resilience:** the Covid-19 situation, with all its challenges, provides the Academy with new opportunities to contribute to regional resilience through research and innovation in Värmland.

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Annex A. Funding per May 2020

Smart specialisation	Arts & Social Sciences	Health, Science & Technology	Board for Teacher Education	Other	Total	Karlstad University	Region Värmland	Other external funding	Currency
Value-creating services	13,890,627				13,890,627	6,107,079	4,848,772	2,934,777	SEK
Forest-based bioeconomy	10,043,734	21,611,559			31,655,293	13,942,863	8,961,982	8,750,448	SEK
Digitalisation of welfare services		33,362,511			33,362,511	14,281,256	13,081,256	6,000,000	SEK
Digitalisation in schools			13,458,066		13,458,066	6,379,034	6,379,032	700,000	SEK
Advanced manufacturing and complex systems		22,814,325			22,814,325	8,459,533	4,892,071	9,462,722	SEK
Nature, culture and place-based digitalised experiences	16,448,480				16,448,480	6,061,661	2,752,273	7,634,546	SEK
Systems solutions with photovoltaics		13,555,449			13,555,449	5,563,582	2,663,955	5,327,912	SEK
Gender mainstreaming	14,463,701				14,463,701	5,968,214	2,793,829	5,701,658	SEK
Running costs for the Academy				2,700,000	2,700,000	1,350,000	1,350,000	0	SEK
Total funding decided (2016 - May 2020)	54,846,542	91,343,845	13,458,066	2,700,000	**162,348,453**	**68,113,221**	**47,723,169**	**46,512,063**	SEK
Unallocated funding (to be decided by the SG)				4,553,662	4,553,662	2,276,831	2,276,831	0	SEK

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