Appendix

Detailed Description

Academy for Smart Specialisation, 2016–2020

Contents

Introduction

The partnership between Karlstad University and Region Värmland started with a 2006 OECD project.[1] Since then, the partnership has taken the form of declarations of intent about research cooperation, first for 2008–2010, and then for 2010–2014. The primarily result has been the establishment of ten new professorships at Karlstad University. External and internationally renowned experts have recommended a continuation of the partnership and given advice on how it should be developed.[2]

Värmland's Research and innovation Strategy for Smart Specialisation (VRIS3),[3] approved in April 2015, was developed in close collaboration between Karlstad University and the public and private sectors. The aim of developing a RIS3 is for a region to reach its realisable innovation potential by supporting the areas prioritised based on identified strengths and the international competiveness. The next phase of partnership will be based on VRIS3, which in turn builds on the earlier programme resulting in 10 professorships and Karlstad University's prioritised research areas. The partnership has been a success and as a token of its ongoing development, the parties have decided to establish the joint Academy for Smart Specialisation.

The Academy for Smart Specialisation invests in the six areas identified in Värmland's Research and innovation Strategy for Smart Specialisation (VRIS3).

The first specialisation that cuts across all areas is:

- Value-creating services

In order of priority, the five following specialisations are:

- Forest-based bioeconomy
- Digitalisation of welfare services
- Advanced manufacturing and complex systems
- Nature, culture and place-based digitalised experiences
- Systems solutions with photovoltaics

These six prioritised areas of specialisation are presented in more detail in the last part of this document.

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[1] Frans van Vught et al., *Supporting the Contribution of Higher Education Institutions to Regional Development, Peer Review Report: Värmland Region, Sweden.* OECD, 2006

[2] John Goddard et al., *Evaluation of the Cooperation between Region Värmland and Karlstad University,* CURDS Newcastle University and CIRCLE Lund University. 2013. Reference John Goddard: http://www.eua.be/activities-services/projects/past-projects/research-and-innovation/euima/EUIMA-Steering-Committee-and-Project-Team/Prof-John-Goddard.aspx

[3] VRIS3: Värmland Research and Innovation Strategy for Smart Specialisation.

Strategical objectives of the Academy for Smart Specialisation

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 EU. The Academic for Smart Specialisation has been designed to be well integrated into the university's research and education strategy, and thereby reinforces the university's goal to actively collaborate with society. This investment further develops the ten professorships programme from the previous declaration of intent between Karlstad University and Region Värmland.

Like VRIS3, the Academy for Smart Specialisation is a step in implementing the Värmland Strategy and the aims is that it will lead to more research and innovation[4] and more knowledge in Värmland's smart specialisations that will contribute to more and stronger companies[5] in Värmland. This would in turn create more and better employment opportunities and finance good living conditions in Värmland. The Academy for Smart specialisation therefore contributes to the highly prioritised area Quality of Life for All in the Värmland Strategy, which in turn is directly connected to the *Better Life in Värmland!* vision.

The Academy for Smart Specialisation brand will be developed to create awareness and facilitate communication about this investment and the partnership. The idea is to present the partnership and its results more clearly, but also to consciously shape associations with the Academy for Smart Specialisation brand. The aim is to create an internationally known brand that can help to strengthen the region, the university and Region Värmland by streamlining recruitment, investment, research funding and partnerships. Investing in branding will also facilitate communication about the six specialisations.

The Academy for Smart Specialisation should facilitate collaboration and joint action, for example by providing meeting places promoting regional sustainable development that takes advantage of the collective expertise of Karlstad University. The Academy for Smart Specialisation should also become a national and international actor in these areas.

After five years, at the end of 2020, the Academy for Smart Specialisation should be well known and respected in smart specialisation circles in Sweden and Europe.[6] The research groups included in the Academy should be reinforced academically and as partners. There

[4] Refers to the measure "More research and innovation" in the Värmland Strategy.
[5] Refers to the one of four main prioritised areas in the Värmland Strategy, "More and stronger companies".
[6] For example by the Government Offices, at the Ministry of Education and Research and the Ministry of Enterprise and Innovation, by the European Commission and DG Research, DG Regio, DG Education and DG Growth, and by European regions and higher education institutions.

should be established meeting places with the public and private sectors and the forms the partnership takes should be well established. The research groups should be involved in development that brings about renewal and the conversion of the public and private sectors in Värmland. Good results should be produced in the form of innovations and the development of the public and private sector. The Academy for Smart Specialisation should have made a significant contribution to procuring extensive external research funding for the participating research groups. There should be a strong agenda for further development of the partnership between the academy and the public and private sectors in the 2020s.

Budget, funding objectives and conditions

The funding from Region Värmland, a maximum of SEK 50 million over the agreement period, obligates Karlstad University to contribute at least as much funding. Further, the goal is that the Academy for Smart Specialisation as a whole should secure external co-funding of SEK 50 million. Connecting other funders to the initiative ensures a broad, sustainable and growing funding base. A goal should therefore be to obtain additional funding from national public and private sources, as well as from EU programmes.

In addition to the projects and budgets in the different specialisations, funding is allocated for the running costs of the Academy, and for its marketing and development.

Region Värmland may use its autonomy differently from year to year.

The basic budget is as follows:

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**

Strategic and operations management

An overall management structure is put into place to ensure and facilitate the implementation of the different projects and investments of the Academy for Smart Specialisation. The management comprises a steering group and a working group.

Steering group

The steering group approves the declaration of intent, monitors the projects, investments and overall budget, and makes decisions on strategic matters.

The steering group meets three to four times per year.

The steering group (SG) comprises:
From Region Värmland

- Two regional council members
- Director

From Karlstad University

- Vice-Chancellor
- Pro-Vice-Chancellor
- Assistant Vice-Chancellor tasked with external relations
- University Director

The Academy Coordinators, Region Värmland's Research and Innovation Strategist and the head of Karlstad University's Grants and Innovation Office, are co-opted members of the steering group and act as rapporteurs.

Working group

The task of the working group is to review grant applications, to continually monitor the Academy's projects and activities, to ensure that opportunities for co-funding are used and to develop the plan and budget.

The working group reports to the steering group and also have to ensure that the different indicators in the partnership are monitored and that the internal structures of Region Värmland and Karlstad University facilitate rather than hinder the implementation of the different projects and activities. The working group meets once a month.

The working group (WG) comprises:
From Region Värmland

- Research and Innovation Strategist (Academy Coordinator and main contact for Region Värmland)
- Preparation officials

From Karlstad University:

- Head of the Grants and Innovation Office (Academy Coordinator and main contact for Karlstad University)
- Research Advisors from the Grants and Innovation Office
- Financial Officer/Controller specialised in external funding

Advisory Board

In addition to the management, an Advisory Board is established with the task of supporting the long-term strategic development of the partnership as well as of the involved parties' strategies, and to contribute to the implementation of the current investment. The Advisory Board should specifically focus on contributing to development after 2020 by linking the Academy with European, national and regional levels.

It is suggested that the Advisory Board meets twice yearly and comprises people from or with close ties to the European Commission, the Government Offices (the Ministry of Education and Research and the Ministry of Enterprise and Innovation), the private sector (national and regional), the public sector (national and regional), as well as higher education institutions.

Support functions

Platform for the Academy for Smart Specialisation

Operating the Academy for Smart Specialisation as a whole will require resources for, for instance, the Advisory Board, meeting places, minor reports and evaluations, branding and profiling.

Support functions for partnerships and external funding

Support functions, comprising representatives of actors in Värmland that can provide support in the implementation of smart specialisation, are established in the Academy for Smart Specialisation. The aim is that business and public sector actors can be involved in research and innovation projects through exchanging information and ideas about ongoing work. The support function aims to initiate and develop opportunities for partnerships and funding, both within and between areas of specialisation, as well as between potential partners (particularly business and research groups) for specific projects.

The support function will comprise representatives of:

- Karlstad University, resources from the Grants and Innovation Office
- Region Värmland, strategists connected to the specialisations and staff of Region Värmland's office in Brussels
- Cluster organisations in Värmland

The following organisations are invited to participate:

- Almi
- European Enterprise Network
- County Council
- County Administrative Board
- Innovation Park
- Business Värmland

The support functions meet regularly (every six weeks) to coordinate ongoing initiatives, possible partnerships and particularly potential external funding that may be relevant for the further development of the six areas of specialisation.

Support functions for skills supply development

As part of the mandate of the researchers and research groups participating in the Academy for Smart Specialisation, knowledge generated in the areas of specialisation is incorporated into undergraduate education at Karlstad University if possible and relevant. In order to better supply the knowledge needed in the areas of specialisation, a support function is established with the task of continually reviewing which additional development-oriented initiatives may be undertaken. This may include identified skills supply needs in a specific branch, new recruitments, or improving the professional development of existing staff. Measures may include specialised new components in undergraduate education, such as entrepreneurship training, or developing commissioned courses connected to the identified need.

A specific support function is connected to the Academy for Smart Specialisation to work with these issues and to design solutions for continuous skills supply development in the Academy's areas of specialisation. This support function comprises representatives of:

- Uppdrags AB, Karlstad University's subsidiary that provides commissioned education
- Education coordinators at Karlstad University (one per faculty)
- The skills supply strategist at Region Värmland
- Representatives of cluster organisations
- Persons familiar with the Academy's research and new knowledge that can be incorporated into undergraduate education

Exchanges of experience, dissemination and EDP

Earlier partnerships between Region Värmland and Karlstad University have clearly shown the need for and value of exchanging experiences between different environments and organisations to develop collaboration and working methods. To highlight the value of the Academy for Smart Specialisation, i.e. collaboration across different boundaries, this will be formalised and structured. The exchange of experiences will be known as ERFA and different aspects will be in focus, including:

- Research partnerships
  ERFA focusing on lessons from good examples of research cooperation within the university as well as between the university, the clusters and the participating businesses and public organisations.
- Connection between research and undergraduate education
  ERFA focusing on the connection between research partnerships/projects and undergraduate education.

In addition to these ERFA groups, different types of events will be organised both at Academy and specialisation level. The aim of such events is to communicate and discuss the collaboration between the different partners involved (the university, Region Värmland, clusters, business, municipalities), but also to exchange the experiences of the Academy for Smart Specialisation nationally and internationally.

Meeting places

To facilitate and stimulate collaboration, the Academy for Smart Specialisation arranges for researchers, businesspeople and public sector actors to meet. The aim should be to arrange a few larger and a few smaller meetings annually.

Communication

The heads of communication at the university and Region Värmland are tasked with designing a joint branding platform and marketing the Academy for Smart Specialisation brand so that it becomes well known in relevant circles in Sweden and Europe.

Expected inputs and results in all specialisations

Expected inputs (i) in all specialisations

- Participating in the activities of the Academy for Smart Specialisation, including:
  - Networking and exchanging experiences of the partnership with other researchers, particularly those involved in the Academy (i).
  - Events bringing business and researchers together (i).
  - The ERFA group (i).
  - Investing in the brand development of the Academy for Smart Specialisation (i).
- Participating in other meetings and arenas with involved actors from the public and private sectors or with other community actors, with the aim of communicating and collaborating, as well as coproducing or transferring knowledge in the areas of specialisation (i).
- Supporting new ideas, student businesses and new companies connected to the specialisations (i).
- Participating in the innovation work done by businesses (i).
- Actively participating in working groups for the implementation of VRIS3 (i).

- Submitting applications for national[7] or EU[8] funding for research and innovation projects with public or private actors as partners or target groups (i).
- Collaborating with other research groups at the university, when relevant (i).
- Participating in lobbying activities aiming to ensure the development of the areas of specialisation (i).
- Taking advantage of researchers' knowledge in undergraduate education and the development of undergraduate courses and programmes (i).
- Actively contributing to establishing and developing student collaboration with business and the community (i).
- Reporting inputs, results and success indicators to the Academy for Smart Specialisation (i).

Expected results (r) in all specialisations

- National or EU funding granted for research and innovation projects with public or private sector actors (r).
- Development of each research group towards a strong or excellent research group, or an improved position for the research groups already designated excellent (r).
- Successfully implemented student collaboration (receiving organisations and students are satisfied) (r).
- Research results that may be applied by businesses, municipalities and the county council in Värmland (r).
- Verified ideas (r) and innovations (r).

Success indicators for the Academy for Smart Specialisation

In addition to the inputs and results, we expect the Academy for Smart Specialisation to contribute to further development. Success differs, is sometimes unexpected, and usually depends on current trends. The points below should therefore be seen as examples; this investment may lead to completely different, unexpected results.

Below some desirable effects of the activities of the Academy for Smart Specialisation are listed:

- 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.

[7] E.g. from the Swedish Governmental Agency for Innovation Systems, the Swedish Agency for Economic and Regional Growth, the Swedish Energy Agency, or the Knowledge Foundation.
[8] E.g. from the European Regional Development Fund (ERDF), Interreg programmes, Cosme, and Horizon 2020.

- Successfully influencing policy to support the development of the areas of specialisation.
- Larger testbed and demonstration environments and national or international assignments, for example as skills platforms/nodes, and national (e.g. Knowledge Foundation profiles) or European assignments in the form of establishing innovation or research environments 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 in taking Horizon 2020 to Värmland.
- 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.

Monitoring and evaluation

The working group (WG) coordinates the different aspects in order to implement the Academy's areas successfully. In each area, the project managers act as contacts, and they are responsible for reporting implemented activities and projects.

Based on the documentation received by the project managers on ongoing projects, the working group (WG) creates a short annual report about the results of the partnerships in the Academy for Smart Specialisation. Significant indications of success and results are reported (see examples below). The state of the indicators below are also reported:

- External co-funding of the co-funded projects (A)
- Number of strategic recruitments in the areas of specialisation (A)
- Number of participating business in project partnerships (S)
- Number of participating public sector actors in project partnerships (S)
- Number of verified ideas (innovations) at Karlstad University (K)
- Number of activities for stimulating EDP (Entrepreneurial Discovery Processes), i.e. organising activities and meetings aiming to facilitate the exchange of experiences and to generate new contacts and ideas for further development (A)

In addition to the annual reports there will be a halfway evaluation, as well as a final evaluation at the end of the period covered by the declaration of intent.

Application process for projects in the framework of the declaration of intent

In order for the different projects in the Academy for Smart Specialisation to be as effective as possible and to have joint strategic significance, all applications have to follow the procedure below.

- The proposed project manager consults the working group (WG) on whether the

investment is prioritised in the partnership framework, consults the head of department and dean, and designs the project, ideally in a workshop or through a different process in collaboration with external partners (businesses, clusters, municipalities, etc.).

- The project manager then writes the application according to Region Värmland's template and Karlstad University's checklist for external grant applications. The application is processed and quality assured through the university's internal process and by the working group (WG) before it is approved by the vice-chancellor and submitted to Region Värmland. During this process, Karlstad University, Region Värmland and the external partner/s (e.g. a cluster) jointly determine whether the specific application is also to be submitted for ERDF funding (northern mid-Sweden partnership), Interreg Sweden–Norway, or other external funding. Such projects have to take into account the requirements and regulations of different funders, for example regarding indirect costs.
  If the project is included as part of another actor's application at Region Värmland or for co-funding from another source, the process may be different.

Renegotiation and termination of agreement

The agreement is valid until 31 December 2020. Both parties can terminate the agreement and notice of termination is one year. If granted projects have to be cancelled, the process follows current regulations, laws and ordinances.

The financial and content frames may be renegotiated during the period and new priorities may be determined.

The priorities and directions of this declaration of intent may only be changed after consultation and agreement between the parties.

Delimitations of the partnership

The partnership is limited to development of the indicated areas for smart specialisation as well as to developing the Academy for Smart Specialisation as a whole. The steering group may decide to grant funding to research and other projects outside of the Academy for Smart Specialisation.

The following is not included in this agreement: orders from Region Värmland, for example reports and evaluations; educational investments and collaborations for example taking the form of joint profiling of the university and the region (in addition to profiling the Academy) and information and lobby activities (except for such activities that form part of the Academy).

Areas of specialisation

The Academy for Smart Specialisation invests in six identified areas of specialisation in Värmland's research and innovation strategy for smart specialisation (VRIS3): Value-creating services; Forest-based bioeconomy; Digitalisation of welfare services; Advanced

manufacturing and complex systems; Nature, culture and place-based digital experiences; and Systems solutions with photovoltaics. In addition, a specific gender-mainstreaming initiative may be undertaken in collaboration with the Centre for Gender Studies.

Value-creating services

Vision (from VRIS3): *We begin with the customer experience and work our way back toward the technology – not the other way around.*[9] *For Värmland, this entails placing the focus on value-creation processes for users, which serves as a compass for technological developments. This way, we become even smarter in devising and carrying out our specialisations.*

The specialisations are based on a view of service centred on the value-creation processes of the individual, business and the community. Investments are based on private sector needs and on cutting-edge research.
The aim of this investment is twofold.
First, by accessing the latest advances in marketing, organisation and management, the Service Research Center (CTF) offers and exchanges knowledge and experiences that enable businesses in the Värmland to increase their competitiveness.

Second, CTF can retain its position as one of the leading centres on service research in Europe by sharing knowledge while collecting and analysing processes of change in Värmland's business sector.
The specialisation comprises two main areas. The first centres on processes of change and is based on the tradition and (industrial) mentality that still reign large parts of Värmland's industrial sector. It therefore aims to create insight into and understanding for the notion that processes of change are necessary to advance and develop the sector. The second part depends on the first and involves preparing and developing business in Värmland through providing existing knowledge about new business models, servitisation, and the logic of value creation that is at the core of service research, while at the same time collecting data and analysing the ongoing processes of change.
Investments in gender-mainstreaming run horizontally through the Academy for Smart Specialisation. The focus will be on research and initiatives addressing the challenges of the gender-segregated labour market.

Resources needed

The specialised research and skills support is distributed to a team led by a few senior researchers.

[9] Steve Jobs

Expected inputs and results

The expectations formulated below should be seen as indicators and examples of the directions and types of initiatives and results that are expected. The formulations will be finalised when Region Värmland approves co-funding of the specialisation.

Also see “Expected inputs and results in all specialisations” above. Specific investments for this specialisation:

- Meetings and workshops on service innovation and servitisation with Värmland businesses connected to the five other areas of specialisation (i).
- Businesses have increased their capacity to participate in research and development projects (r).
- Businesses have started their own servitisation processes (r).
- Increased knowledge about service innovation and servitisation among the researchers in the other specialisations (r).
- CTF researchers have greater knowledge about the research done in the other specialisations (r).
- Organising initiatives with the other specialisations aiming to provide the best value creation for participating businesses, municipalities and the county council (i).
- Collaborating with the SP group, focused on service innovation in Karlstad (i).

Success indicators

Success differs, is sometimes unexpected, and usually depends on current trends. The points below should therefore be seen as examples; this specialisation may lead to completely different, unexpected results.
Also see the “Success indicators for the Academy for Smart Specialisation” above.

Examples of success:

- A number of businesses have developed new business models, innovation, servitisation, etc. connected to the initiatives.
- A number of businesses in the areas of specialisation have created a new business logic.
- National and European investments in service research and service innovation are made in Karlstad; RISE, for example, chooses to establish a national node for the institute in the region.

Forest-based bioeconomy

Vision (from VRIS3): *With a more than 150-year-long history within paper manufacturing, we conceive creative meetings between tradition and renewal and show the way using bio-based innovations originating from the forest to foster a fossil-free and sustainable society.*

The specialisation should contribute to knowledge to:

- Increase the efficiency of existing production systems.
- Develop effective production systems for new products replacing products that for

example are based on non-renewable resources.

- Facilitate conversion to a sustainable fossil-free society with forest-based innovations.

Karlstad University aims to establish a competitive research group in bioeconomy that will be an attractive partner for the Swedish forestry sector, including suppliers and consultants.

Collaboration with the private sector and community, and utilisation of research

The private sector aims to establish a long-term partnership characterised by mutual trust by developing process engineering research at Karlstad University. This leads to the optimisation of production units, combining experimental or process data with mathematical models for heat and mass transportation, fluid mechanics, and material and energy balances for the design and optimisation of production facilities for current and future products. An example of future products are microfibrillated cellulose (MFC), hyper-stretchable paper, or sustainable packaging that places new demands on dewatering, pressing and drying. Karlstad University therefore becomes a natural part of the regional business ecosystem. Target groups for partnerships: paper and pulp mills; workshop businesses with products relevant for a forest-based bioeconomy.
The role of society in converting to a sustainable forest-based bioeconomy needs to be investigated. This should be seen as a long-term process that requires structural changes in society and also increased collaboration between different actors. This includes taking advantage of different knowledge and perspectives in the framework of a quadruple helix system that also includes civil society, which plays an important role in environmental matters and in the development of, for example, ecosystem services. It is important to include civil society from a democratic standpoint, as well as to change habits and behaviour and create new innovations which in their turn can contribute to the conversion to a sustainable society, and which may also lead to new private sector innovations.
Businesses that develop services have the opportunity to receive input from the Service Research Center; see the “Value-creating services” specialisation above.

Resources needed

The forest-based bioeconomy research group at Karlstad University is called Processes and Products for a Sustainable BioEconomy (Pro^{2}BE) and to implement the proposed initiatives, it is reinforced with an additional doctoral student and a few postdoctoral researchers.

The Centre for Regional Studies is also involved in the specialisation and it is suggested that a postdoctoral researcher be appointed as associate senior lecturer, and that research time is allocated to a professor.

Expected inputs and results

See “Expected inputs and results in all specialisations” above.

Success indicators

Success differs, is sometimes unexpected, and usually depends on current trends. The points below should therefore be seen as examples of the specialisation's contributions, but it may lead to completely different, unexpected results.
Also see the "Success indicators for the Academy for Smart Specialisation" above.

Examples of success:

- Pro^{2}BE is established as a competitive research group in bioeconomy, and is an attractive partner for the Swedish forestry sector and their suppliers and consultants as well as for national and international research funders.
- Decisions for pilot facilities and full-scale investments.
- Attained MKET status (Multi Key Enabling Technology, http://mkpl.eu/home/) or equivalent.

Digitalisation of welfare services

Vision (from VRIS3): *A welfare sector for co-creating citizens with a well-developed and safe IT environment as a base where the focus is on the human aspect, and the individual's benefit from new value-creating processes*.

The specialisation aims to achieve the following:
Developing and testing future smart and value-creating digital welfare services in schools and healthcare through cross-disciplinary studies and user-driven innovation processes.

Strengthening and complementing skills in the specialisation to create better conditions for networking and joint research projects between the academy and public and private sectors.

Establishing, as a specific investment, a skills development partnership platform in the shape of a regional research school focused on the digitalisation of education. Using its own resources, the university recruits and appoints a professor in the area of digitalisation of schools tasked with heading the research school.

The overall aim is to contribute to increased patient safety and more efficient healthcare for users and providers in the region, to contribute to the digitalisation of schools, to increase the quality of pedagogical aids used in schools, to create new opportunities for regional businesses as well as to further develop Karlstad University's research in the area of specialisation.
To take full advantage of the opportunities and to attain the goals of this investment in the area of the digitalisation of welfare services effectively, close cooperation and extensive networking of several complementary skills and actors are needed. These includes disciplines at Karlstad University, such as Computer Science, the Service Research Center, Nursing, Teacher Education, Mathematics, as well as Compare ICT, Nordic MedTest, the Värmland county council and the municipalities in Värmland. The municipalities will collaborate in, for example, the areas of healthcare, education and IT resources.

Resources needed

The environments surrounding the earlier professorship investments are strengthened with additional postdoctoral researchers and doctoral students. They are further supplemented with investments in mathematics education and nursing through allocating time to senior researchers for developing these environments.
A co-owned and co-directed regional research school is established through which a group of teachers from some municipalities in Värmland are given the opportunity to do research and development work in the area of digitalisation of schools.

Expected inputs and results

The expectations formulated below should be seen as indicators and examples of the directions and types of initiatives and results that are expected. The formulations will be finalised when Region Värmland approves co-funding of the specialisation.
See also “Expected inputs and results in all specialisations” above.

- Prototypes of smart, value-creating digital welfare services in schools and healthcare have been developed (r).
- The research school has been established (r).
- Collaboration between the research school and municipal schools in Värmland (i).
- Collaboration between participating environments at Karlstad University (r).

Success indicators

See the “Success indicators for the Academy for Smart Specialisation” above.

Advanced manufacturing and complex systems

Vision (from VRIS3): *Värmland is an established partner in the movement for the industrial renaissance in Europe where we contribute with cutting-edge knowhow in advanced steel, advanced manufacturing, complex systems and servitisation*.

The specialisation includes support to businesses introducing advanced manufacturing methods and other key enabling technologies that are relevant to their existing production. Businesses should have access to an open development environment that includes the Karlstad Lean Lab at Karlstad University as meeting place.
The Karlstad Lean Lab should be module-based for training in “Lean Production”. This laboratory is specifically aimed at industry employees, but also at healthcare staff. The requirements are therefore completely different than for students.
There are a number of relevant research questions when a laboratory is developed for training professionals, for example:

- Which differences are there between university students and employees in the industrial and healthcare sectors? Which requirements should environments for game-based Lean training fulfil?
- Which gaming methods are appropriate for different professional groups and different learning outcomes?
- Which adaptions are needed if healthcare staff are also to be trained?

- Which are the effects of different fidelity levels on learning?
- Which long-term effects does game-based Lean training have on businesses' competitiveness and innovation capacity?

An investment in laser additive manufacturing (3D printing using metallic materials) will contribute in the following main areas:
– Developing resource-efficient production technologies
– Developing new basic knowledge about the connection between manufacturing, structure and characteristics.
– Developing new materials with the help of laser additive manufacturing technology.

Research activities are connected to the strategy of the Characterizing and Modeling of Materials (CMM) research group and aim to improve the academic quality of the group so that it can be designated one of Karlstad University's excellent research groups.
Industry gains the opportunity to collaborate in research projects and analysis using optical and scanning electron microscopes. This will lead to opportunities to participate in new joint project applications. The university has the opportunity to highlight the excellence of the engineering and physics research group globally.
Businesses get access to a development environment for 3D printing of metallic materials.
Businesses that develop services have the opportunity of receiving input from the Service Research Center; see the "Value-creating services" specialisation above.

Resources needed

The environments around the two earlier professorship investments are developed with a postdoctoral researcher and a doctoral student as well as equipment.

Expected inputs and results

The expectations formulated below should be seen as indicators and examples of the directions and types of initiatives and results that are expected. The formulations will be finalised when Region Värmland approves co-funding of the specialisation.

- Karlstad Lean Lab is established and delivers services to businesses and also to the healthcare sector (r).
- Businesses in Värmland regard research and equipment for 3D printing of metallic materials as a valued resources (r).

See also "Expected inputs and results in all specialisations" above.

Success indicators

Success differs, is sometimes unexpected, and usually depends on current trends. The points below should therefore be seen as examples of the specialisation's contributions, but it may lead to completely different, unexpected results.
Also see the "Success indicators for the Academy for Smart Specialisation" above.

Examples of success:

- Businesses have introduced and developed lean production, advanced manufacturing methods or other key enabling technologies aided by Karlstad University.
- Businesses have introduced laser additive manufacturing.
- The CMM research group has been successful in the global research arena connected to laser additive manufacturing.
- The CMM research group, a designated strong research group at Karlstad University, has made progress towards increased excellence and collaboration.

Nature, culture and place-based digitalised experiences

Vision (from VRIS3): *Enhanced nature and cultural experiences for people visiting Värmland using digital technology and media*.

Central to this initiative is the way in which digitalisation changes the conditions for the tourism and cultural sectors and identifying and developing co-creation models using digital media to create new, exciting and stronger tourist experiences. An important goal is increasing the integration of business and tourism as well as of IT and new tourism research, mobility and place by actively involving tourism actors and visitors in the study.

Resources needed

At the outset, 50% of fulltime for a researcher holding a PhD, who is later to be replaced by a doctoral student or a postdoctoral researcher in the area of tourism and mobility.

Expected inputs and results

The expectations formulated below should be seen as indicators and examples of the directions and types of initiatives and results that are expected. The formulations will be finalised when Region Värmland approves co-funding of the specialisation.
See also “Expected inputs and results in all specialisations” above.

- A completed pilot study (i).
- A number of development projects with actors who possess local knowledge, those interested in developing locations, technology suppliers and innovators as well as researchers (i).
- A number of prototypes with several in use (r).
- A model has been developed for co-creation between research, IT actors, the tourism sector and visitors where one of the driving forces is socially sustainable development (r).
- The tourism sector is more inclined to develop/use digital technologies (r).
- Innovative research in the interface between media and geographical locations. This is a new research area in which the Geomedia research group has a prominent position (r).

- The existing research environments at Karlstad University in the areas of tourism, mobility, places and regional development have been reinforced through collecting skills and through directed research (r).
- Scientifically based knowledge about the significance of digitalisation for humans and society, focusing on tourism (r).

Success indicators

Success differs, is sometimes unexpected, and usually depends on current trends. The points below should therefore be seen as examples of the specialisation's contributions, but it may lead to completely different, unexpected results.
Also see the "Success indicators for the Academy for Smart Specialisation" above.

Examples of success:

- A number of IT-based applications are used in the tourism sector and in other contexts.
- Innovations connected to digital experiences of places.
- Digitalisation has brought about a change and development in how places are represented.
- Increased qualitative development of tourism sector and increased use of digital technology.
- Digitalisation has brought increased attention to Värmland through innovative solutions, including dissemination in social media.
- The initiative has increased value-creation for the tourism sector, the IT industry and content providers.
- The European Commission regards the initiative as relevant for smart specialisation, despite initial scepticism about involving the tourism sector.
- The initiative led to development of the Geomedia research group both regarding research excellence and collaboration.

Systems solutions with photovoltaics

Vision (from VRIS3): *Värmland is a strong part of a leading European trans-regional, Norwegian-Swedish innovation system for solar power*.

The solar cell industry is rapidly developing internationally and in Sweden. Nationally, the branch expects a turnover of SEK 6–7 billion during 2015. It is a young branch with great innovation opportunities and a large need of professional development at all stages of the value chain. Karlstad University is therefore establishing a Bachelor's programme in engineering adapted to, for example, installers of solar power facilities.
The research on photovoltaic led by professors Markus Rinio and Ellen Moons is of a high international standard. Karlstad University boasts the only research environment in Sweden focusing on the commercially prominent silicon technology. Research about photovoltaics are not deemed directly relevant for businesses in Värmland. Instead, we expect business to take advantage of the knowledge on photovoltaic applications the professors possess, of applied research and innovation projects, of the global research network our researchers

participate in, as well as that the professors will contribute to specialisation through their renown.
There should be space for a number of service businesses in the branch as well as for businesses providing systems solutions with photovoltaics. Cutting-edge knowledge about photovoltaic technology, service development and production technology are all valuable areas of investment for development in Värmland. The initiative at Karlstad University includes all three aspects.
The specialisation includes initiatives to increase external research funding and to facilitate further expansion and also investment in laboratory equipment with the aim of securing long-term research on photovoltaics at the university.
Businesses who manufacture and assemble solar cell systems should be included in the Karlstad Lean Lab to optimise production (see “Advanced manufacturing and complex systems” above).
Businesses that develop different services connected to photovoltaics have the opportunity to receive input from the Service Research Center (see “Value-creating services” above).

Resources needed

One postdoctoral researcher (and a doctoral student).

Expected inputs and results

The expectations formulated below should be seen as indicators and examples of the directions and types of initiatives and results that are expected. The formulations will be finalised when Region Värmland approves co-funding of the specialisation.
See also “Expected inputs and results in all specialisations” above.

- Applied research and innovation projects (i).
- Project results that benefit businesses (r).
- Networking, organising or participating in workshops etc. to disseminate information about photovoltaics to businesses and other relevant actors (i).
- Participating in the procurement of solar power, particularly in innovation-promoting procurements (i).

Success indicators

Success differs, is sometimes unexpected, and usually depends on current trends. The points below should therefore be seen as examples of the specialisation’s contributions, but it may lead to completely different, unexpected results.
Also see the “Success indicators for the Academy for Smart Specialisation” above.

Examples of success:

- Glava Energy Centre has developed and has an even more prominent, decisive position in the development of the photovoltaics branch in Värmland, but also nationally and internationally.
- The research environment on photovoltaics at Karlstad University is nationally and internationally recognised as leading and closely collaborates with other research groups at the university.