ARC13

Assessment of Research and Coproduction

Reports from the assessment of all research
at Halmstad University 2013

HALMSTAD
UNIVERSITY

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Foreword

Since the birth of formal research, the quality of research has been a crucial factor for the development of all societies. This is also one of the major issues for all universities. In order to strengthen Halmstad University for the future and to continue our positive development, we have been conducting the first comprehensive evaluation of research at our university – ARC13.

The acronym ARC corresponds to Assessment of Research and Coproduction, but it is also possible to associate to an *archive of knowledge* or *Noah's ark*. Just like Noah, we can build a better future by listening to good advice. The evaluation ARC13 provides advice on future directions for our research and for the development of our university as a whole. For all of us who work at Halmstad University, it is obvious that meeting the challenges that we face today and tomorrow requires knowledge, dissemination of knowledge and cooperation.

At Halmstad University, we do well to capitalise on what is unique and original in our education and research. To further strengthen our position, we can not only follow the development of society. We need to stay ahead. And we do this through excellence in our research. There is much to say about the tasks ahead of us but the most important one is to protect the quality and efficiency in all our operations. That's why we conducted ARC13. The results from the completed evaluation ARC13 will be dealt with and addressed at all levels within the university during 2014; from the University Board to each researcher and administrator. This work will lead to important choices for everyone in terms of focusing and prioritising within various areas and themes. This process is essential and we all need to engage in this.

I would like to thank everyone who took part in the evaluation ARC13. I am convinced that you will draw wise conclusions and make the best possible choices for the further development of Halmstad University.

Mikael Alexandersson
Vice-Chancellor, Halmstad University

Organisation: ARC13 Halmstad University

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Chapter 1
Introduction

Halmstad University is a young Swedish university, founded in 1983. During these first thirty years, our creative and ambitious faculty members have established several high quality research groups. For the last ten years, the university has strategically used evaluations by external experts as guides for improving the quality of research; two smaller evaluations of subareas have been carried out, one in 2008 and another in 2010. Both provided valuable feedback and advice to Halmstad researchers. A golden opportunity for evaluating all the research conducted at Halmstad University came when we were appointed a "KK Environment" by the Knowledge Foundation in late 2011 and the foundation offered financial support for such an evaluation. The university's Vice-Chancellor, Professor Mikael Alexandersson, took the decision on October 29, 2012, that all research and research collaboration at Halmstad University should be evaluated during 2013 in what we have chosen to call Assessment of Research and Coproduction 2013—for short, ARC13.

Like other young universities in Sweden, Halmstad University was established by the Swedish government with the ambition of doubling the number of Swedish people who complete higher education. It was originally intended to be a university college, teaching exclusively at the undergraduate level and conducting little or no research. However, it

very quickly became clear to both the regional industries and the university management that high-quality education and innovation, which really must be the national goals behind having universities, require research activities. An initial research base was therefore established, largely through the support of mostly regional bodies and local industries. After several years, the university also received some direct government research funds. Furthermore, in 1994 the Swedish government established the Knowledge Foundation with the specific purpose of supporting research at the new universities—research that should take place in collaboration with Swedish industry. This provided the opportunity to start building strong research and innovation groups to engage in coproduction with Swedish industrial players. Halmstad University has continued to develop tremendously over the last twenty years, and today we issue doctoral degrees in three areas: information technology, innovation sciences, and health and lifestyle.

Halmstad University is on the threshold of taking the next step in its development. The current ratio between time spent in education and time devoted to research is about 7:3; our ambition is to reach 6:4 within the next few years. This requires well-developed strategies. The issue of prioritizing research is more challenging at Halmstad University than at, for example, older Swedish universities since government research funds are more meagre in relation to the number of faculty who hold doctoral degrees. This reality represents a considerable challenge in terms of attracting faculty and engaging in world-class research and innovation. Nevertheless, this report shows that it is possible to build up strong research even under these circumstances, and coproduction with Swedish industry and the Swedish public sector has been a key factor for success.

When we undertook ARC13, we knew that collaboration and impact must be included in the assessment. Halmstad University is the *innovation-driving* university, and strong innovation and research in coproduction should be our hallmarks. We believe that universities of this kind—with profiles in education, research, and innovation, and that work in close cooperation with external partners—will become even more important in the future. Universities are important resources in a knowledge- and innovation-driven economy. Universities develop the talents in young individuals and train them to think creatively, critically, and constructively. It is important that a nation fosters close cooperation among the industry, the public sector, and the education sector. Students are a driving force for transforming a society. Exposing them early to the needs of society through education and cooperative research is the obvious thing to do.

Evaluations by external experts are central in a structured quality-improvement process, and some Swedish universities, mostly larger ones, have conducted quality assessments of their research during the last six or seven years. Peer-review assessments constitute part of the government quality-improvement strategy in some countries. The main reason for an external evaluation is guided self-improvement: we aim to shine a critical light on the research, coproduction and innovation at Halmstad University and ask for sound advice regarding our strengths, weaknesses and opportunities. Furthermore, being exposed to an external review improves the involved individual researchers' ability to present and promote their research, which is important to our plan of increasing the university's research volume by attracting more external research grants. Halmstad University currently receives about 10 percent more funds in external grants than in direct government support for research. Our ambition is to grow this considerably and to

increase the impact of the research. ARC13 is the tool guiding us to further improve the quality of and to develop certain foci in our research and coproduction—and ultimately, to achieve these goals.

Chapter 2
Executive Summary

During 2013, an evaluation of all the research conducted at Halmstad University was carried out. The purpose was to assess the quality of the research, coproduction, and collaboration in research, as well as the impact of the research. The evaluation was dubbed the Assessment of Research and Coproduction 2013, or ARC13.

The evaluation used a peer-review process; researchers from other universities and representatives of the industrial and public sectors were engaged to review Halmstad's research. The peer review was based on written summaries of research results, strategies, self-evaluation (including future strategies), a bibliometric analysis, and economy for each unit of assessment (UoA)—that is, for each of the eight research environments at Halmstad University. The written background material was produced during spring 2013 and provided to the external reviewers in June 2013. The external reviewers visited the university in late August 2013 for four days. During this time, UoA representatives presented their research, were interviewed, and discussed strategies and results with the reviewer panels. Many of the UoAs invited their external collaborators and coproduction partners to participate in these interviews. The reviewer panels delivered preliminary reports at the end of August and final reports in September 2013.

The expert panels were asked to assess seven aspects of each UoA's research: (1) quality

of research, (2) productivity, (3) research environment and infrastructure, (4) networks and collaborations, (5) coproduction and external cooperation, (6) impact, and (7) strategies and plans for the UoA's development. They were also asked to provide a general overall assessment of each UoA, along with recommendations for future development and activities. The expert panels used four categories for their assessment of the seven aspects: *excellent, very good, good,* and *insufficient*.

Two UoAs—representing about half the research at the university when measured in volume of research funding—were rated excellent or very good in quality of research. The two UoAs that received the highest ratings were Mechanical Engineering and Product Development (MTEK), which was rated excellent, and Halmstad Embedded and Intelligent Systems Research (EIS), which was rated very good. These two UoAs received positive ratings on all aspects of the evaluation, varying between very good and excellent. Historically, both these UoAs have received significant funding for research in coproduction with industry, frequently from the Knowledge Foundation, sometimes from the Swedish Governmental Agency for Innovation Systems (Vinnova) and the Swedish Foundation for Strategic Research (SSF).

The strongest specific aspect of the Halmstad University research was coproduction and external collaboration. Four of the eight UoAs were rated excellent or very good in this area. EIS was rated excellent, while the Biological and Environmental Systems Research (BLESS), the Centre for Innovation, Entrepreneurship and Learning Research (CIEL), and MTEK were rated very good.

The weakest specific aspects of the university research were productivity, research environment and infrastructure, and strategies and plans for development. Two of the eight UoAs were judged insufficient in at least two of these aspects. The critical comments for productivity were that more effort should be spent on publishing in high-quality scientific journals and that the productivity can be very unevenly spread within the UoAs. Comments regarding the research environments and infrastructure indicated that not all UoAs functioned well as units, owing to a strong individualistic tradition; this has been detrimental to the UoAs' development and ability to attract external research grants. In two cases the UoAs were judged to have unclear future strategies and plans.

The panels' recommendations for future development can be summarized in seven general statements that apply to most of the UoAs: Increase research volume by obtaining more research funding. Establish advisory boards with external experts. Improve and support the strategic work and scientific leadership; focus on fewer research questions. Increase the number of doctoral students and the rights to grant doctoral degrees. Improve publication strategies. Make the coproduction and collaboration more visible. Expand international research networks.

Even though it is not within the university's power to follow all these recommendations, the suggestions from the various panels provide important input to the internal discussion of how to strengthen research and coproduction in every research area. For example, obtaining more research funding requires, to a large extent, political decisions external to the university; however, the number of external competitive grants won by Halmstad University researchers is growing, partly because of strategic university management decisions. Similarly, expanding Halmstad's doctoral education is a matter of accreditation, which depends on the available funds for research.

The other recommendations can be implemented through internal university decisions and priorities. Scientific leadership and improved strategic work will be supported in at least some cases with external advisory boards. The university library already works with the UoAs to improve their publication strategies. The university decided as early as 2012 to run a programme for increasing the international research network, a programme that is starting now. Thus, the results from ARC13 provide both short-term and long-term implications for research and coproduction at Halmstad University and for the university's further development. The Knowledge Foundation–funded *Research for Innovation* programme will be an important building block in implementing the necessary strategies.

Chapter 3
Research and Coproduction at Halmstad University

Research at Halmstad University was initiated—with very limited resources—towards the end of the 1980s and grew significantly during the 1990s. University management encouraged researchers to collaborate in "centres", each implementing a clear focus, a long-term research agenda, well-developed cooperation with industry or society, a relevant financing strategy, activities in PhD education, and strong connections with undergraduate education. Through this strategy, twelve centres were established, many of which were interdisciplinary. These centres comprised thematic building blocks in the broader schools, formed in a reorganization of the university at the turn of the century. In all five schools, research is now an integral part of activities, although the amount of research varies greatly between the schools.

Research at Halmstad University is often multidisciplinary—that is, it spans several different subject areas. Another characteristic is the university's close contact with trade and industry, external associations, and the public sector. The research undertaken reflects the university's profile and contributes to the general development of knowledge in society. At the same time, it provides courses and thesis projects with a link to research. More than half the money that finances research at Halmstad University comes from external funding organisations. The external financiers that contribute the most money to the

university's research are the Knowledge Foundation, the Swedish Governmental Agency for Innovation Systems (Vinnova), the European Union, and the Swedish Research Council (VR).

Following the tradition of centres, the research is organized according to research environments; today there are eight. These are the same as the eight units of assessment (UoAs) examined in ARC13 (see chapter 5 for a description of these). The variation between them is high, in their breadth of research fields, number of persons and budget of research, but all eight are connected to undergraduate programmes within the different schools—in some cases also to advanced programmes. They are all involved in national and international collaboration with academia, the public sector, and industry. In terms of PhD education, the graduate programmes are connected to three specific areas, and within each area a designated research environment guarantees contact with cutting-edge research; together they give the university a clear profile. Three of the eight environments—the three largest ones, called "base environments"—have the specific responsibility of guaranteeing the competence and research strength that is required for maintaining the university's accreditation on the doctoral level. Halmstad University has so far been accredited on the doctoral level in the areas *health and lifestyle, information technology,* and *innovation sciences*. The base environments are CVHI, EIS, and CIEL. The other five environments (BLESS, CESAM, FULL, KK, and MTEK) represent important complementary areas that are also expected to develop strong research activities and support the connection between education and research.

The three base environments are supported by a strategic overarching research programme called *Research for Innovation*, financed by the Knowledge Foundation. Based on a long-term agreement with the foundation, the university's most important research areas can be built up by initiatives of several kinds: research projects, strategic recruitments, graduate schools, master education, and research profiles—to name just a few. The initiatives in general need to be supported by industry through active collaboration. In order to benefit from all the available research strengths of the university, participation of the other five environments in *Research for Innovation* initiatives is also encouraged.

Research for Innovation should not be seen only as Knowledge Foundation–funded research; on the contrary, attracting funding from other sources is necessary to the programme's success. Currently, funding for *Research for Innovation* consists of one-third university funding, one-third Knowledge Foundation funding, and one-third external funding from other sources.

The direct government funding for research at Halmstad University in 2013 was SEK 54 million. This is about one-sixth of the direct government funding the university receives for education. At this level of research funding, intelligent and strategic use of the money is necessary. In practice, this requires that research be concentrated in a few areas, chosen so that a research connection is guaranteed for all the university's educational areas. Alternatively, it requires that education focuses on the areas in which the university's strongest research activities are taking place.

It is an important strategic goal for Halmstad University to increase the volume of research and strike a better balance between education and research. An important way to achieve this is through increasing the amount of external research funding. The amount of research funded by external grants is high (about 56 percent in 2013), and the level

is rising. The Knowledge Foundation–funded *Research for Innovation*, with its focus on quality development and a strategic build-up of thematic research programmes, is the university's most powerful tool for increasing it further. Well-developed coproduction programmes fostering collaboration with industry and society, coupled with active international academic networks, are necessary for this progression.

Chapter 4
Designing the Framework of the Assessment of Research and Coproduction 2013

Background and Guiding Principles

The Assessment of Research and Coproduction 2013 (ARC13) was a joint initiative of three Swedish Universities—Halmstad University, Mid Sweden University, and Skövde University—that aimed to develop a framework suitable for assessing research, collaboration, and coproduction in research at all three institutes of higher learning.

The process was initiated by the universities' vice-chancellors in order not only to evaluate the quality of research and coproduction by international standards but also to support the strategic development of the research. A steering group with representatives from the three universities was responsible for setting up the assessment framework.

The assessment process consisted of four steps: (1) identifying quantitative indicators and qualitative descriptors as part of an evaluation package, (2) collecting data for the indicators, (3) a self-assessment by each unit of assessment (UoA), and (4) a peer-review process conducted by international experts.

The three-university steering group met several times to define the terms of reference for the process and guiding principles for developing criteria for quality in research and coproduction. Throughout this process, experiences from previous research assessments performed by the Royal Institute of Technology (KTH) were discussed with Peta

Sjölander (project coordinator of the evaluation at KTH). Reports from other universities in Sweden that had already undertaken similar research assessments were also used as background material (Lund University, Uppsala University, Swedish University of Agricultural Sciences, and Örebro University), along with the indicators for coproduction developed by the Swedish Governmental Agency for Innovation Systems (Vinnova) and the report of the Swedish Research Council on citations (VR report 5:2012). Further, the Research Assessment Exercise[1] and the Research Excellence Framework[2] created in the United Kingdom provided input for the working groups.

Three working groups were created with the assignment to develop parts of the evaluation package: (1) assessment of research, (2) assessment of coproduction, and (3) bibliometry. For the first two, each university had its own local group, and the three-university steering group coordinated the work. For developing bibliometric indicators, only one working group was formed, and it included representatives from all three universities. Halmstad University started a specific project to support the bibliometric analysis and the quality control of the publication data.

The local working groups from the three universities were responsible for the dialogue with researchers at their home universities. The local working groups consisted of senior researchers representing the diverse disciplines at their universities who had both a mandate and the competence to develop a framework to guide the research environments in completing the assessment. The coordinators of all the working groups met regularly to share experiences and ideas in order to develop the evaluation package. Some aspects were highlighted as particularly important for guiding the development. For example, the evaluation package should do the following:

- Drive the quality of research and coproduction within the different UoAs.
- Measure the current status of research and coproduction.
- Identify areas of potential and options for strategic development.
- Result in concrete recommendations for future development.

Thus, ARC13 aimed to provide the means to strengthen the quality of the scientific activities at the three universities by offering reliable background material for the decision-making process related to future strategies. The reports from the UoAs (written and oral) on their own work, together with the bibliometric study, constituted the basic input for the evaluation.

Designing the Evaluation Package and Terms of References

Given that ARC13 addresses diverse research areas within each university, several discussions centred on identifying indicators that were applicable across disciplines. Extensive discussions on defining quality led to a choice of indicators for measuring both performance output and process, including a self-assessment (regarding the strengths, weaknesses, opportunities, and potential threats). The working group concluded that an

[1] Research Assessment Exercise. Retreived December 10, 2013. http://www.rae.ac.uk/
[2] Research Excellence Framework. Retreived December 10, 2013. http://www.ref.ac.uk/

evaluation of future plans and strategies was also important.

Furthermore, ARC13 set out to include indicators evaluating coproduction. Because cooperation and coproduction with society are important factors affecting quality and impact, these were also included in the evaluation package.

Data Collection

Once the package of common quantitative indicators had been developed, the collection of data started at each university. It was agreed that each individual university could add indicators reflecting its specific needs, but there would be a common base package.

Self-assessment

Every UoA had one coordinator who communicated with UoA members and collected input for the preparation of the evaluation package. The coordinator led the self-assessment writing and coordinated the programme for the panel visits with the UoAs. In preparation for the expert panels' site visits, each UoA performed a self-assessment. Though cumbersome, this process provided focus and initiated quality-driving activities in a form of formative assessment. Analysing the status and reflecting on how to proceed thus proved important parts of the process, in themselves ways to develop the research units.

Expert Reviews

A panel consisting predominantly of international experts was commissioned to review the research and coproduction for each UoA. The number of panel members (for Halmstad University) ranged between four and seven; six was the most common number (see appendix A for a description of the panels). Most experts were from Europe and had been chosen for their expertise and experience in evaluating research or coproduction at an international level. At least one member on each panel was selected to evaluate collaboration and coproduction.

The UoAs were asked to nominate experts for the evaluation, with motivations on subject and experience as well as comment on possible bias. The Chairman of the University's Faculty Board then nominated additional experts, in dialogue with the UoAs. There were three reasons for supplementing; to achieve better gender balance in the panels, to have more international reviewers and to have reviewers that were active outside academia. The Chairman of the Faculty Board contacted the nominated experts. When people were unable to accept, they were asked to suggest one or two people with similar competence. The final decision on panel experts was made by the University Vice-Chancellor. Approximately two thirds of the final experts were people that the UoAs had nominated.

The final panels consisted of 39 experts (19 women and 20 men); 16 active in Sweden and 23 from outside Sweden. There were 31 full professors in the panels.

The panels received the self-assessment of the appropriate UoA (including the indicators) at least two months ahead of their planned visit to the university.

The expert panels met with the UoA during a university visit that lasted for four days. All experts visited the university at the same time. During this time, the panels attended research presentations and visited various research areas, such as laboratories. In several

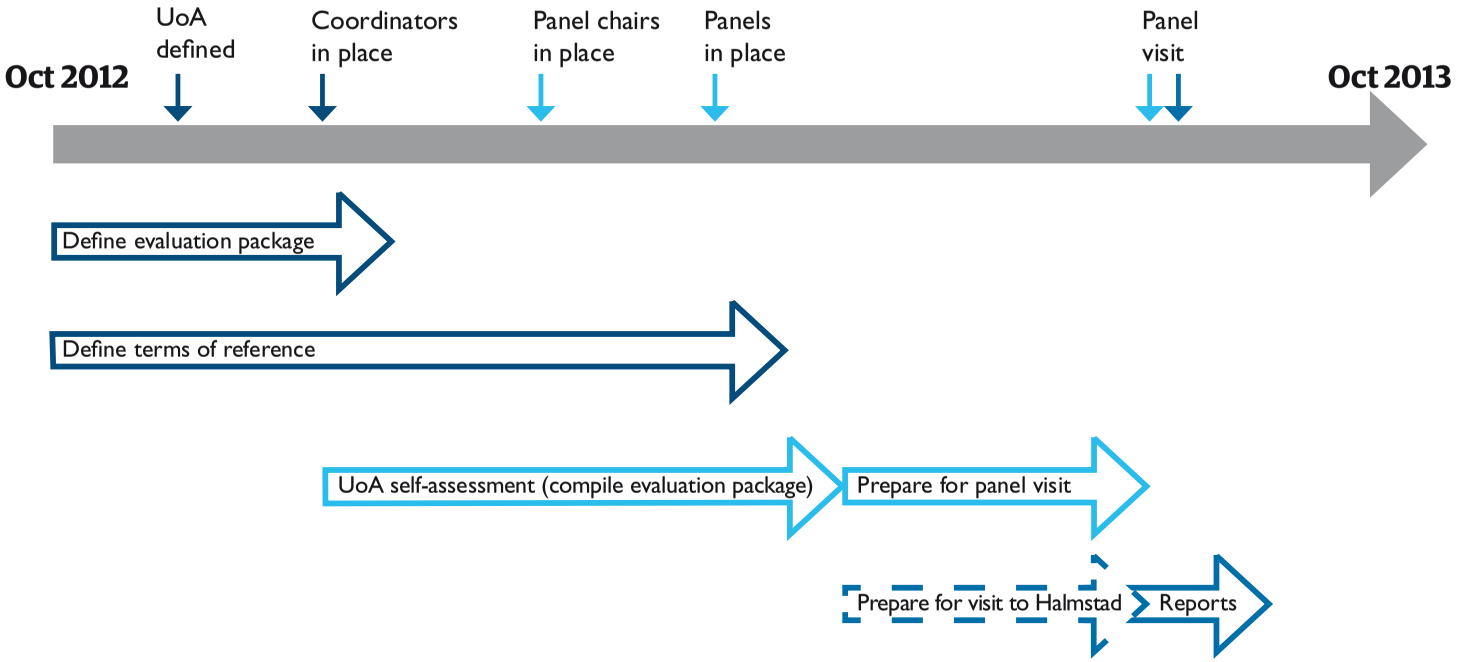
instances, the panels met with UoA partners who presented the joint coproduction of research and showed how research results were integrated into the activity of the company. Some panels even visited companies or other nonacademic collaborators.

In order to provide criteria for assessing the UoAs, guiding principles for the panels were developed. The expert panels were asked to assess the quality of each UoA's research from an international perspective. In particular, the panels were asked to identify strong research activities and potentially interesting opportunities for renewal. It is important to note that the evaluations were not intended to compare different departments and disciplines with one another. Instead, the aim was to probe the units' standing from national and international perspectives, reflecting the quality and potential for renewal compared to those of other universities involved in the same research field. The experts were asked to comment on the following aspects:

1. General assessment of the UoA
2. Quality of research (including the degree of international interest—that is, reach; the impact on the scientific community, e.g., in terms of citations; and publications in leading journals and monographs)
3. Productivity (the unit's volume of scientific output)
4. Research environment and infrastructure (organization, infrastructure, the constitution of staff, its resources, and their activities)
5. Networks and collaborations (the extension, quality of, and amount of collaboration in national and international academic networks)
6. Coproduction and external cooperation (the extension and quality of national and international collaborations with society except academia)
7. Impact (how and to what extent the research has had an impact in society)
8. Strategies and plans for development of the UoA (the visions, goals and strategies of the UoA, as well as their feasibility and prospects for success)
9. Experts' views on the unit's potential and recommendations for development
10. Other issues

Quality was rated according to the scale given (*insufficient* to *excellent*) for the aspects under categories 2–8 above. Criteria for the grades *excellent, very good, good,* and *insufficient* were identified in a matrix to simplify the experts' evaluations. The experts were allowed to make documented changes to these criteria if they felt that they were inappropriate. The description of the indicators and self-assessment appears in appendix B. The instructions provided to the panels can be found in appendix C.

Timeline ARC13

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Chapter 5

Presentations of the UoAs

Biological and Environmental Systems Research (BLESS)

Front row, from left to right: Henrik Gadd, Sven Werner, Mei Gong, Marie Mattsson, Siegfried Fleischer, Eva Strandell, Stefan Weisner.
Back row, from left to right: Ann Bremander, Urban Persson, Fredrik Ottermo, Lars-Gunnar Franzén, Anna Hansson, Clas Dahlin, Niklas Karlsson.

The BLESS environment has about 25 members involved in research, including laboratory staff and administrators. It has four full professors, one visiting professor, ten senior lecturers and five PhD students.

Description of the Research

BLESS is built on four fields: *Environmental*, *Biological*, *Energy* and *Exercise science*. In Ecology and Environmental sciences, it is important to understand the processes and mechanisms involved in the functioning of ecosystems. In the field of Renewable Energy, district heating, improved wind power systems and biogas production are the focus areas, and Exercise science research concentrates on studying the body's capacity for movement.

Key Research Contributions

The wetlands research has shown that the creation of wetlands is a cost-effective method for decreasing the transport of diffuse pollution from arable land and that wetlands are important for biodiversity. Dense vegetation in wetlands improves nitrogen removal, while diverse vegetation improves phosphorus removal.

Measurements in drainage water indicate that agricultural nitrous oxide (N_2O)

emissions can be decreased if the soil is ploughed late in the autumn or if a catch crop is grown over winter. Carbon dioxide (CO_2) emissions from agricultural soils indicate the highest loss of carbon during early summer. Incubations of soil with inhibited nitrification reveal a within-soil CO_2 sink. The magnitude of this sink indicates that this can be responsible for a large share of the still poorly explained northern CO_2 sink.

It has been shown that species diversity changes occur in complex patterns, not following any current models predicting species turnover caused by climate change for example. Anthropogenically changed landscapes may contain the high species numbers of pristine areas but consist of generalist species only. Different behaviours and morphological adaptations associated with egg-laying in insects evolved because of large-scale changes in water availability in the past.

In biochemistry, the photosynthesis project has provided new details of the molecular structure of one of the proteins involved in the photosynthetic light reactions. In the organelle biogenesis project, signals involved in protein sorting in green algae have been studied. In the ecotoxicological project, the molecular basis of tolerance to herbicides in microalgae has been analysed.

In district heating research, a threefold directly feasible expansion possibility for district heating in European urban areas has been established. About 60 percent of urban heat markets are within reach at current investment cost levels. New theoretical concepts, by which to characterise and evaluate excess heat recovery in district heating systems, have also been developed. Spatial mapping of heat and cold demands and of excess heat and renewable heat resources in Europe are now in place, and an analysis of customer interfaces has shown malfunctions both in heat demands and in the cooling of the circulated water.

The biogas research group has evaluated different pre-treatments and substrates for their suitability in the production of biogas and bio-manure. A 10 percent addition of sugar beets or fodder beets may increase, for instance, methane production in co-digestion with cattle manure with more than 50 percent.

Wind energy research is presently engaged in the investigation of the vertical wind power test plant in Falkenberg.

Muscle function and rehabilitation research has established that physical activity and strength training for those worst affected by a chronic inflammatory disease have positive effects on the health-related quality of life. Because of the existing limited methods, which evaluate strength and physical activity in this patient group, the researchers have developed and validated new strength equipment and training methods that are now used by people with decreased strength and impaired muscle function. In addition, performance studies of elite athletes have established new strength-training methods and measurements for enhanced power development and sports performance.

Centre for Social Analysis (CESAM)

Front row, from left to right: Anna Isaksson, Vaike Fors, Jeanette Sjöberg, Anders Nelson.
Back row, from left to right: Mattias Nilsson, Martin Berg, Mikael Sandberg, Lennart Hast.

The CESAM environment has about 25 members involved in research, including administrators. It has one full professor, one visiting professor, 16 senior lecturers and six PhD students.

Description of the Research

A wide range of social sciences is represented in CESAM: international relations, cultural geography, media and communication studies, educational sciences, sociology, social psychology and political science. Although the research has encompassed a broad range, it has mainly focused on areas such as gender and identity, technology and learning as well as politics and social change.

The developing of CESAM's profile proceeded as a two-step process.

First, *social and cultural change* was considered a common theme among the environment's researchers. Later sessions formulated *sociocultural change and emerging technologies* as a specification. A basic idea behind this refined focus was that sociocultural change interacts with the emergence, development and adaptation of technologies of various kinds. Sociocultural change on one hand is the result of the emergence of technologies since they provide new conditions for social activities. On the other hand, sociocultural change also shapes the technologies that, in turn, (re-)shape conditions for social life, and so forth. This dialectic theme was intended to highlight interaction

between sociocultural change and emerging technologies.

Second, the further refined theme *emerging technologies in sociocultural change* was formulated with three interrelated subfields: (1) information and communication technologies; (2) social and relational sustainability; and (3) political change.

The research revolves around the understanding and conceptualization of our current social conditions in an era of rapid change in communication technologies, interactive media, youth cultures, lifestyles and gender roles; the sustainability of our technological systems from the perspectives of the deterioration of the environment and our climate; and also a growing concern about the internationalisation of policy measures that create systemic and supranational institutions. We also recognise the potentials of "new" information and communication technologies as mechanisms for at least temporal replacement of the traditional forms of political and social mobilisation with new local, regional as well as transnational activism. In addition to this, some researchers have focused on core problems of educational science, international relations, sociology and political science.

Key Research Contributions

The research output has focused on book and book chapter contributions, rather than publications in scientific journals. The scientific output typically involves attempts at social theory contributions in order to understand widely selected cases of current social, technological and political change, in particular with reference to how we socially use media and other types of technology, how we communicate, educate, and how we can understand that from perspectives of gender, culture, learning, power, democracy, language and so forth.

The researchers in CESAM have made considerable contributions to the issues of media use in relation to *migration, citizenship, language* and *culture*—for example how media can be a tool for integration. Other CESAM publications relate to a variety of subjects, such as innovation and evolutionary economics; gender-typing of toys; evolution of democracy on a world scale the last two centuries; sports and male attitudes; undergraduate students' actorship, innovation and learning in a Swedish local context; performing guided tours and tourism; opinion, language, discourse and climate change; and finally one article in the topic as in the first group—migration, language, culture and media. One reprinted doctoral thesis presents an analysis of the triumph of technology over politics in the case of Swedish Television versus TV3.

Centre for Innovation, Entrepreneurship and Learning Research (CIEL)

Front row, from left to right: Per-Ola Ulvenblad, Mike Danilovic, Eva Berggren, Bengt Larsson, Deycy Sanchez, Hilal Pataci, Pia Ulvenblad.
Second row, from left to right: Joakim Tell, Arne Söderbom, Fawzi Halila, Gabriel Baffour Awuah, Marita Blomkvist, Henrik Florén.
Back row, from left to right: Ulf Aagerup, Thomas Helgesson, Ingemar Wictor, Richard Grönevall, John Lindgren, Svante Andersson, Mats Holmquist, Jonas Rundquist, Klaus Solberg Søilen.

The CIEL environment has about 60 members involved in research, including administrators. It has five full professors, five visiting professors, 19 senior lecturers and 28 PhD students.

Description of the Research

CIEL includes researchers from two major areas—*Business Studies* and *Industrial Management*. The research domains can be summarised under four headings: management of innovations; entrepreneurship processes; eco-innovations and environmentally friendly energy systems and market development and internationalisation (e.g. dissemination, commercialisation, market development and internationalisation of innovations).

The focus in *management of innovations* is on strategies for and management of innovation and product development processes, and social innovations. Research themes are the importance of learning, competence development and knowledge integration for success in innovation.

Entrepreneurship processes focus on early phases of innovation and associated entrepreneurial activities. The research themes are the role of entrepreneurial aspects

(learning, posture, career motives and decision-making) and organisational aspects on entrepreneurship (board empowerment, resource logic, academic entrepreneurship and incubators' management structure).

The focus in *eco-innovations and environmentally friendly energy systems* is on key factors supporting commercialisation of eco-innovations, i.e. the comparison of the success factors for eco-innovations with other innovations.

Market development and internationalisation deals with international business (born global firms, international entrepreneurship and international new ventures), specifically from perspectives of absorptive capacity, marketing capability-building processes, dynamic capabilities and managerial behaviour.

Key Research Contributions

In the area of *management of innovations,* CIEL has had academic as well as practical impact in the area of complex (product) development projects. The researchers have developed new methodologies in Dependency Structure Matrix (DSM) and Domain Mapping Matrix (DMM) approaches for complex project situations. CIEL has also shown that uncertainty and equivocality have to be managed differently to achieve front end success in innovation. In practise, CIEL has had impact by designing and supporting the process of developing the current project management system in use in the Halland regional government organisation.

In the area of *entrepreneurship processes,* the research has, e.g., produced a framework that explains the process of entrepreneurial learning as an experiential process. CIEL researchers have studied board empowerment in small companies and shown that this is a response to satisfy the demands from owners not directly involved in managing the company. Another contribution in this field relates to academic entrepreneurship; one CIEL study shows how a university contributes both directly and indirectly to regional development by the creation of academic spin-offs and by the strengthening of the absorptive capacity in the region.

CIEL has made key contributions in the area of *eco-innovations.* For example by identifying key factors that support the commercialisation of eco-innovations and by contributing with a classification system for eco-innovations. This has led to several international follow-up projects in China and in the African countries for instance.

In the area of *market development and internationalisation,* the main focus has been on born global firms. CIEL researchers have shown that managers in small international firms are more proactive in their networking behaviour; they delegate operative activities and devote more time to planned strategic activities connected to their international expansion than managers in other small firms. Another research thread explores the role of stakeholders in the marketing capability-building processes of international new ventures in Ireland, Sweden and Denmark. Different stakeholders play a critical role in influencing how international new venture firms build their marketing capabilities in order to respond efficiently to the dynamic nature of international markets in which they operate.

Centre for Research on Welfare, Health and Sport (CVHI)

Front row, from left to right: Lukas Linnér, Kristina Ziegert, Karin Weman, Gunvi Johansson, Berit Prack, Therése Mineur, Alina Franck, Margaretha Pejner.
Back row, from left to right: Andreas Ivarsson, Marie Lydell, Christopher Kindblad, Lars Kristén, Susanne Bergh, Helena Eriksson, Thomas Barow, Gunnar Johansson.

The CVHI environment has more than 55 members involved in research, including administrators. It has six full professors, one visiting professor, one adjunct professor, 24 senior lecturers and 23 PhD students.

Description of the Research

The welfare challenges that society is facing today (e.g. aging population, increased mental illness among young people and marginalisation of disabled people) require building interdisciplinary knowledge of health and lifestyle related issues. This should be done by focusing on people's participation in the processes of change. Health and lifestyle research at Halmstad University holds a strong position with a tradition of distinct relevance for users and practice, including studies at the societal, organisational, group and individual levels as well as the relations between them. Since 2013, Halmstad University has degree-awarding power on doctoral level within the area of health and lifestyle, and CVHI is the base environment with the main responsibility of doctoral studies in this field. The joint research environment efforts—focusing on understanding, explaining and modifying people's health and lifestyles—create conditions and opportunities for the interdisciplinary research and training of researchers contributing to the development of knowledge in the area of Health and Lifestyle, in terms of theory, research methodology and practice.

Joint knowledge formation within CVHI involves research focusing on people's health

and lifestyles based primarily on the subjects of nursing science, disability science and sport psychology. Research within health and sports pedagogy, health science, public health, cultural geography, odontology, social work, sociology, linguistics, special needs education and political science also constitute important contributions to the research focus. There is close collaboration with researchers at the university in the field of biomechanics and sports physiology, informatics and interaction design as well as with Health Technology Centre Halland. The research is conducted increasingly in collaboration and co-production, both internally between various research groups at the university and externally with national and international universities and partners from the public and business sector.

Key Research Contributions

The overall mission of research within CVHI is to study health, lifestyle and well-being and to develop knowledge about how these areas can be promoted by interventions and innovations.

Research on health and health care has developed knowledge on patient experiences of care and care organisation and on health promotion and illness prevention. This knowledge formation, especially in the fields of cardiac rehabilitation, psychiatric care and rheumatology, has been implemented through dissemination to public and private stakeholders and care organisations in regular care with impact on both care processes and patient outcomes. These contributions to health care development have established CVHI as a relevant partner for regional health care providers, professional associations, research networks and industry.

Multidisciplinary research—with an emphasis on the social aspects of daily life, health and living conditions of marginalised groups living with a disability or illness—has built knowledge and understanding of the causes, processes, experiences and effects of social categorisation. Through dissemination of research to user organisations, government agencies and other stakeholders, the research has contributed to changes and improvements for marginalised groups. The research has had a major impact on the public sector through contributions to governmental evaluation or expertise assignments in government investigations and commissioned research and education.

Research focusing on sport, exercise, health and lifestyle concentrates on the psychosocial mechanisms underlying susceptibility to injury in sport and exercise and has immediate relevance in society through direct collaboration with sport organisations and athletes. Additional research on career development and lifestyle management has had similar importance to athletes and resulted in models for handling career development and major transitions in sport and lifestyles of athletes.

Halmstad Embedded and Intelligent Systems Research (EIS)

Front row, from left to right: Maria Åkesson, Walid Taha, Björn Åstrand, Saeed Gholami Shahbandi, Anita Pinheiro Sant'Anna, Malin Bornhager, Olga Torstensson, Anna Mikaelyan, Siddhartha Khandelwal, Thomas Lithén, Ulla Johansson, Carina Ihlström-Eriksson.
Second row, from left to right: Asif Akram, Erik Hertz, Eva Nestius, Annette Böhm, Thorsteinn Rögnvaldsson, Antanas Verikas, Josef Bigun, Hans-Erik Eldemark, Slawomir Nowaczyk, Christer Rehnström, Zain-ul-Abdin, Le-Nam Hoang.
Third row, from left to right: Stefan Byttner, Jörgen Carlsson, Matthias Mayr, Esbjörn Ebbesson, Soumitra Chowdhury, Essayas Gebrewahid, Iulian Carpatorea, Fernando Alonso Fernandez, Roland Thörner, Eva Strid, Stefan Gunnarsson, Verónica Gaspes.
Back row, from left to right: Stella Erlandsson, Mohammadreza Mousavi, Jawad Masood, Urban Bilstrup, Bengt Leidhem, Tomas Nordström, Kristina Kunert, Magnus Jonsson, Nicolina Månsson, Mattias Weckstén, Süleyman Savas.

The EIS environment has about 85 members involved in research, including administrators and project coordinators. It has ten full professors, four visiting professors, 16 senior lecturers, six associate senior lecturers, three postdoctoral scholars, four researchers, three research engineers, and 31 PhD students.

Description of the Research

EIS is the largest research environment at Halmstad University in terms of research budget. EIS is one of three base research environments, with specific responsibility for the university's education on the doctoral level in information technology (IT).

The overall *mission* of EIS is to provide knowledge (solutions, theories, methods, tools) and competence (graduates) relevant to the creation of innovative IT products and services. Knowledge and competence range from enabling technologies, via systems solutions and applications, to valuable IT use. By this, EIS contributes to the increased competitiveness of its industrial partners and to the increased quality and relevance of the university education. EIS is organised in four "labs": *mathematics, physics and electrical engineering (MPE);*

computer science and engineering and data communication (CC); intelligent systems (IS) and *man and information technology (MI).* The main research focus at MPE-lab is nanoscience, specifically design, modelling and characterisation of nanomaterials and nanodevices for the future electronics/optoelectronics and sensor industries. The research is done in partnership with the Nanometre Structure Consortium (nmC) at Lund University. There are also research activities in high-frequency (RF) electronics in collaboration with researchers within CC-lab, focusing on the construction of extremely low-power RF transceivers for applications such as RFID and sensor networks. The research at CC-Lab focuses on "cooperative embedded systems" and they host the university's Centre for Research on Embedded Systems (CERES)[1]. This research has three main subjects: real-time communication; embedded parallel computing and domain-specific programming methods; and cyber-physical systems. The research at IS-lab focuses on "aware intelligent systems" and they host the university's Centre for Applied Intelligent Systems Research (CAISR)[2]. This research has also three main subjects: signal analysis (specifically image analysis); mechatronics/robotics and machine learning. The research at MI-lab focuses on innovation process knowledge, digital service and business innovation, interaction design, and design science.

The industrial application of much of the research at EIS is concentrated to a few areas (e.g. *health technology, intelligent transport systems and media*), and the majority of the projects are run in close cooperation with industries that are active in these areas. About two thirds of the research funding comes from external sources.

Key Research Contributions

During the period 2007–2012, EIS researchers published approximately 240 articles in scientific journals and 540 papers at scientific conferences (peer-reviewed). Twelve PhD students in EIS completed their PhD degrees in the period 2005–2012. EIS is part of ELLIIT[3]—a collaboration between researchers at Linköping University, Lund University, Halmstad University and Blekinge Institute of Technology—who won the Swedish national competition for special strategic excellence funding within information and communication technology.

Some highlights of past EIS research are: applications of nanoscale photonics and spintronics; a framework for reliable real-time communication and the leadership for a special task force for The European Telecommunications Standards Institute (ETSI); machine learning based system for colour control of print of newspapers and money bills, which became a commercial product; and research on multimodal biometrics that has gained worldwide recognition.

[1] http://www.hh.se/ceres
[2] http://www.hh.se/caisr
[3] http://www.liu.se/elliit

Research on Education and Learning within the School of Teacher Education (FULL)

Front row, from left to right: Ingrid Nilsson, Monica Eklund, Lisbeth Ranagården.
Back row, from left to right: Claes Ericsson, Annika Elm Fristorp, Monica Karlsson, Pernilla Nilsson.

The FULL environment has about 15 members involved in research, including administrators. It has two full professors, one visiting professor, seven senior lecturers and three PhD students.

Description of the Research

The research of teacher education comprises of two tracks. On one hand, it concerns subject didactical research (e.g. science, language and mathematical education) and on the other hand more general issues without a formal connection to a specific school subject. The research within the two tracks is closely linked to practice, and the contextual focus is pre-school, school and teacher education. The research is organised in three different subgroups but there is close collaboration between the groups.

Within the subgroup *Culture Analysis and Arts,* questions relating to different forms of arts expression in a school context are studied. Aspects of legitimacy, identity and knowledge formation in arts activities in school are central research foci. Further, the distortion that happens to occur between pupils' everyday culture and the school culture and the transformation process in this encounter is investigated. The research has been

conducted within the frame of larger empirically based projects.

Within the subgroup *Subject Didactics* there is an interest in studying the communicative processes of learning within different subjects and subject areas. Subject didactics focuses on how the teaching of a subject is planned, designed, evaluated/assessed and developed, and further investigates the encounter between the content and the teaching and learning of that specific content. In the subgroup there is strong collaboration with schools and pre-schools that are connected to teacher education.

Within the subgroup *Teacher Profession and the Development of Professional Identity,* there is a focus on student teachers' competence, development and socialisation into the profession through school-based practice and the induction year. There is also research on leadership, mentoring and supervision in teacher education as well as in school practice. In particular, there are projects concerning school development, action research and critical friendship.

Key Research Contributions

Several larger externally funded projects connected to subjects in the arts, including all school forms, have contributed to deepened knowledge in the field, especially in Music Education. In connection to Science Education, there have been a number of projects published in books and international journals that have contributed to science teaching, learning and assessment practices with a particular focus on the concept of Pedagogical Content Knowledge (PCK). The UoA further contributes with some major research outputs within pre-school science. Immigrant children's school situation has also been of interest as well as a larger project funded by the EU, which has provided a general picture of the educational situation that newly arrived children are confronted with. Several projects have contributed with knowledge about teachers' professional development, both general and content-specific. Finally, there have been a number of projects focusing on improving the educational situation for hard-of-hearing students in different school forms.

Context and Cultural Boundaries (KK)

Front row, from left to right: Kristina Hildebrand, Catrine Brödje, Cecilia Björkén-Nyberg, Jonnie Eriksson.
Back row, from left to right: Helen Fuchs, Karl Gunnar Hammarlund, Kristina Thorell, Linnea Gustafsson, Emilia Aldrin.

The KK environment has about 20 members involved in research, including administrators. It has 16 senior lecturers and three PhD students.

Description of the Research

The research environment "Context and Cultural Boundaries" at the Department of Humanities is small but diverse because of the many varied disciplines of the humanities. However, three primary research areas can be identified within the environment: *Culture Research, Research on Diversity and Identity Perspectives,* and *Research of Didactics*.

Regarding *Culture Research*, researchers are studying both the cultural and material processes of change as well as the emerging research field of sustainable tourism. R*esearch on Diversity and Identity* embraces theoretical perspectives concerning gender, class and ethnicity. Finally, *Research of Didactics* is connected to the disciplines that are part of the Teachers' Education Programme.

There are a variety of research areas within the ten different disciplines: Humanities, English Literature, Scandinavian Languages, History of Ideas, Comparative Literature, History, Art History, Religious Studies, Film, Ethnology, and Cultural Geography. This makes it possible for the UoA to sustain a good research connection to the department's

educational courses and programmes, which is of great importance.

Key Research Contributions

With exception of the English Literature researchers, the members of the UoA write mainly in Swedish and publish in Swedish or Nordic journals and anthologies. According to the tradition in the field of humanities, certain researchers also publish in monographs. There are key research contributions within each of the three research areas.

Within *Culture Research,* there are contributions in art history, where research is conducted on the reception of the *Halmstad Group* (post-cubism and surrealism, 1920s–1940s). One researcher also highlights the player piano and its relationship to the development of technology. Within the theme, there is also on-going research addressing our cultural heritage and the connection between culture and its assistance in nursing care, as well as intellectual traditions and contemporary theoretical issues.

The theme *Research on Diversity and Identity Perspectives* is vibrant thanks to the contributions of several researchers in the field. Research regards how first names and nicknames are connected to identity. Gender issues are also highlighted—from both a female and a male perspective—in these cases based on several disciplines, for example, through literature, language and history. Diversity and marginalization are taken up through an ethnic perspective as well as within theological, historical and literary research.

The third research area, *Research of Didactics*, is partly theoretical and partly practical (within the UoA). The theoretical perspective is conducted through subject-theoretical reasoning in subjects such as history. The practical part is conducted in close collaboration with on-going teaching. Here you will find examples from English as a second language and from Scandinavian languages as well as research regarding the evaluation of student performance.

Mechanical Engineering and Industrial Design (MTEK)

Front row, from left to right: Sabina Rebeggiani, Martin Bergman.
Second row, from left to right: Monica Lindström, Bengt-Göran Rosén.
Back row, from left to right: Håkan Petersson, Pär-Johan Lööf, Lars Bååth, Zlate Dimkovski, Frédéric Cabanettes, Per Henrik Nilsson.

The MTEK environment has about 18 members involved in research, including administrators. It has two full professors, three visiting professors, one senior lecturer, three postdoctoral scholars and seven PhD students.

Description of the Research

The research within MTEK is based on the already established area of functional surfaces. An expanded portfolio of research in industrial photonics and mechanical engineering relating to the on-going teaching activities is, and will be, further developed. The research spans disciplines such as manufacturing technology, materials engineering, engineering mechanics, mechanical engineering, photonics, metrology and microwave technology. The application areas are, e.g., vehicle surfaces, biotechnology surfaces, visual surfaces and flow of wind for wind energy development.

MTEK has established itself as a nationally and internationally recognized centre around functional surfaces and innovative manufacturing, characterisation and function.

Key Research Contributions

Any study of functional surfaces and structure must begin by measuring them and continue by characterising the measurements before these can be applied to any useful

practical purpose. MTEK functional surfaces research has resulted in the creation of "toolboxes and methods" for research and industry, facilitating the understanding, optimisation and communication of possibilities opening up industrial usage of advanced functional surfaces. MTEK has participated in the foundation of current International Organisation for Standardisation (ISO) standards introducing new methods for energy and environmentally sustainable engineering product surfaces.

Steel is cold-rolled into sheets onto which the texture of the mill rollers is embossed. The thin, flexible metal sheets are formed into automotive body parts between solid massive tools. Friction between sheet and tool must be controlled during the pressing process to prevent unsightly surface damage to the final part. The MTEK research in this field has resulted in a series of papers and projects developing novel insight in the influence of functional surfaces and possibilities using virtual simulation models for surface friction prediction.

The largest power losses in an internal combustion engine are due to friction between piston ring and cylinder. Surface roughness features sensitive to the friction and oil-consumption have been identified by the MTEK team, aiding production and quality control towards decreased pollution and energy consumption.

A fundamental problem of prosthetic design is to integrate the prosthetic device with living tissue. Dental implants are attached to bone by screws. To secure the attachment, bone cells must grow into the screw threads, a process known as bone-to-implant contact or osseointegration, which may take many months. The MTEK team has on-going long-term cooperation with leading institutes and industry in the field. Novel functional surfaces for osseointegration have been developed in this cooperation, and commercial implants based on this technology are made commercially available.

Important findings in metrology areas, ranging from galaxies to wind turbine and wooden logs, form the fundament for the further MTEK development of metrology development and online control capacity not only in the functional surface field, but also in fields to be further exploited by the group—wind power, materials analysis and steel production control.


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Chapter 6
Summaries of the UoA Impact Cases

Impact Cases—BLESS

Case 1: Evaluations of Created Wetlands

For 20 years, constructed wetlands have been used in Sweden as a cost-efficient method to reduce the transport of nitrogen to the sea, as a necessary complement to reduction measures at the source, as well as a method to enhance the biodiversity of agricultural areas. The first wetlands for nutrient retention in Sweden were constructed outside Halmstad in 1990, and since then subsidy programs aimed at farmers have resulted in a large number of wetlands.

The Wetland Research Centre at Halmstad University was commissioned by the Swedish Environmental Protection Agency and the Swedish Board of Agriculture to evaluate the effects of wetlands constructed in Sweden between 1996 and 2002 with regard to nutrient retention and biodiversity. The centre was later commissioned by the Swedish Board of Agriculture also to evaluate the effects of wetlands constructed in Sweden between 2003 and 2008.

An overall analysis of the effects of the wetland creation programs, partly based on these evaluations, is provided in a paper by Strand and Weisner (2013)[1].

Case 2: Öresundskraft, Helsingborg

Future energy systems will need to be smarter in order to obtain increased competitiveness. One condition for reaching this state is to increase the knowledge about the interface between energy providers and customers.

In this project, the interfaces between a district heating grid and more than 100 customer substations have been assessed. The results show that customers use too much heat by heating empty premises during nights and weekends. Also, the heat is often delivered with low temperature efficiency, giving higher heat supply costs for the providers.

From the assessment results obtained, routines for identifying outliers in the heat meter databases are being developed. The expected impact from the project will be lower demands and lower heat supply costs. If all substations in Sweden had the same characteristics as the best substations, the cost for heat supply would be cut by 1 billion SEK annually.

This project runs between 2009 and 2014 and has been financed by Fjärrsyn and Öresundskraft. The project has published two articles so far. Two further articles are planned.

Impact Cases—CESAM

Case 1: Media, Education, and Migrant Children

This case includes three projects, each of which inspired those that followed.

Children and Communication About Migration ("CHICAM", 2002–2004). This action project is designed with the cooperation of six European member states, resulting in an educational model for facilitating communication among dispersed and disadvantaged children within the European community. The project was disseminated through a hearing and a seminar in Brussels aimed at practitioners and decision makers, and created a network among media scholars and media workers around Europe, leading to further cooperation and publications.

Media Practices in the New Country (2004–2006). This project was disseminated in international publications and in a workshop of invited scholars from Europe and Israel (funded by a grant from the Swedish Research Council).

Integrating Refugee and Asylum-Seeking Children in the Educational Systems of EU Member States ("INTEGRACE", 2010–2012). A study of how European member states are integrating refugee and asylum-seeking children. Halmstad was contacted because of its previous participation in CHICAM and its acknowledged expertise in issues related to schooling and migrant children. Findings of this project are published in a handbook aimed at decision makers and practitioners (2012)[2] and in a U.S. textbook on migration and refugee issues (2013).

The findings of all three projects resulted in both practical and academic applications.

Case 2: Evolutionary Models of Change in Social Science: Democracy Diffusion, Green Innovations, and Attitudes towards Nuclear Power

Evolutionary models of social change provide a scientific foundation for the creation of a science-based understanding of social change—in this program with particular focus on

[1] Strand, J. A. & Weisner, S. E. B. (2013). Effects of wetland construction on nitrogen transport and species richness in the agricultural landscape – Experiences from Sweden. (Special issue). Ecological Engineering, 56, 14-25.
[2] (2012). Integrating Refugee and Asylum-seeking Children in the Educational Systems of EU Member States. Andrej Noncev & Nikolai Tagarov (eds.). CSD—Centre for the Study of Democracy.

(1) transitions to democracy and diffusion of democratic institutions on a world scale, (2) emergence and diffusion of green innovations among national organizations, and (3) the evolution of attitudes towards nuclear power plants in Sweden.

Impact has been seen in an internationally published monograph on the green innovation in post-communist Poland[3]. Two reports to the Swedish Nuclear Fuel and Waste Management Company (SKB) have been produced on Swedish attitudes towards nuclear power. Research on green innovation in Sweden, based on official Swedish statistics (from Statistics Sweden, SCB), is in progress, financed by the Crafoord Foundation. Research on transitions to democracy and diffusion of democratic institutions in cooperation with Stockholm and Lund Universities has resulted in articles in scientific journals and popular science articles. Results are already impacting Swedish parliamentarians. Several articles and books are in production, as is the development of a new dataset on political institutions and regime types.

Impact Cases–CIEL

Case 1: International Entrepreneurship—Born Globals and Rapid International Growth

CIEL has a research focus on so-called *born global* firms and their rapid international growth. The aim of this programme is to develop a better understanding of the innovative behaviour, development, and growth in international firms. External funding has been accessed from the Lars Erik Lundberg Foundation, the Swedish Research Council, and the Knowledge Foundation.

The research is conducted in the Centre for Technology, Innovation and Marketing Management (CTIM2) and has been diffused in both high-ranked international journals and in more specialized publications.

The centre is working in close connection with international firms such as Getinge, HMS Industrial Networks, Bufab, Camp Scandinavia, Redsense Medical, Axelent, Absolent, and Keback. The research has been the basis for knowledge exchange between the companies and academia, taking advantage of the long tradition of collaboration between small businesses and Halmstad University.

Case 2: Academic Entrepreneurship—Incubators, Schools of Entrepreneurship, and Innovation

The research programme *Academic Entrepreneurship—Incubators, Schools of Entrepreneurship, and Innovation* plays an important role within the Knowledge Entrepreneurship and Enterprise (KEEN) research platform at CIEL. It focuses on developing our knowledge about incubators and the support to both new business ideas and schools of entrepreneurship and innovation.

The programme was financed externally by the Knowledge Foundation, the Swedish Research Council, the Swedish Foundation for Small Business Research, and Swedish Governmental Agency for Innovation Systems (Vinnova).

The starting point for the programme was an earlier project, *Learning Entrepreneurship:*

[3] Sandberg, M. (1999). Green Post-Communism? Environmental Aid, Polish Innovation, and Evolutionary Political Economics. New York: Routledge.

The Importance of Student and Serial Entrepreneurs (2006–2008). The results from this project became an important platform for the next four projects involving KEEN members: (1) *Enterprising, Entrepreneurship and Regional Growth,* (2) *Indirect Effects of Commercializing Academic R&D,* (3) *Incubators and Schools of Entrepreneurship for Female Business Start-ups,* and (4) *Entrepreneurs' Communication Strategies in the Start-up Process.* Two more projects are in the initial stages.

The impact of this research program has been especially on the collaboration with important actors in the innovation system such as incubator managers.

Impact Cases—CVHI

Case 1: The Collaboration between CVHI and Research & Development Centre Spenshult

For more than ten years, Halmstad University and Research & Development Centre Spenshult (R&D Spenshult) have collaborated and formed a joint research group with senior and junior members from both CVHI and Spenshult. This has resulted in four PhD theses and 27 publications in international scientific journals, of which more than 22 have been published since 2007.

The work of the PhD students forms a base for a person-centred perspective in the care of people under advanced medical treatment. This is now being implemented at nurse clinics within rheumatology care.

The collaboration between CVHI and R&D Spenshult has resulted in qualitative methods being integrated with quantitative methods in the understanding of medical conditions and in the follow-up of care and rehabilitation.

This process has built on interdisciplinary work involving researchers from a wider national network including Lund University, Karolinska Institutet, and Jönköping University. The outcomes of this collaboration have gained national and international recognition.

Case 2: Developing Quality-Based Support for Young People with Violent Behaviour

The research programme was based on an earlier project: *Professional Support for Violent Young People* (2008). The aim of this project was to disseminate the results from the earlier study and to develop the quality criteria in collaboration with professionals who meet young persons with violent behaviour in their daily work.

The project was funded by the European Commission's Daphne III programme, with the participation of researchers from five countries.

The overall method used in the Swedish study was based on so-called *research circles*—a forum for dialogue between practitioners and researchers. The discussions in the research circle are documented in order to illuminate the tacit knowledge that the participants possess.

About 60 professionals participated. Through the research circles, participants had the opportunity to incorporate new knowledge into their work through a mutual exchange of experience. The method also created a more in-depth understanding of quality criteria that are important in the work with violent young people. This knowledge was presented in a report and is now the subject of several research manuscripts.

Impact Cases–EIS

Case 1: Intelligent Vehicles and Transport Systems

The area of cooperative vehicular communication and driving applications based on wireless communication is an important field to achieve not only traffic safety, but also improved comfort, reduced fuel consumption, and improved infrastructure utilization through, for example, platooning. In the near future, fully autonomous cooperative driving is anticipated, at least in restricted areas like parking lots, mines and harbours.

Wireless real-time communication is an area in which Halmstad University has worked since the end of the 1990s, thereby being among the first in the field. The research has been performed in tight collaboration with Volvo Technology in the Volvo Group, ensuring high industrial relevance. Together with Volvo Technology, the group participated in the EU FP6 project SAFESPOT. Halmstad was also involved in the standardization work coordinated by COMeSafety.

The Halmstad team (in collaboration with Volvo Cars Cooperation and Volvo Technology Corporation) was the second-best team out of nine (and the best Swedish team) in the GCDC competition in the Netherlands[3]. Among other prizes, the team also won the Swedish Embedded Award.

Case 2: Health Technology Center Halland with Sub-Case Collaboration with Tappa AB

The Health Technology Center Halland (HCH) involves partners from academia, the municipality of Halland, and the region of Halland. From its start in 2009, HCH has undertaken 110 projects with 90 companies, resulting in 40 products. Also, ten new companies have been founded. Since 2009, HCH has contributed in attracting external research funding of 35 million SEK.

One collaboration was with Tappa Service AB. The company contacted HCH and undertook an initial study that identified the need for new activity measurement tools. This led to the development of the ActiveMeter—an accelerometer-based device that measures how active an individual is. The device became a commercial product in 2012 and has been used in health-promoting activities with several companies. Examples of the ActiveMeter's societal impact are improved health, increased productivity, and the future financial growth of Tappa Service.

The company is now part of the Centre for Applied Intelligent Systems Research (CAISR) research program, co-sponsored by the Knowledge Foundation, and the next generation of measurement devices and algorithms will be co-produced by industry, academia, and health-care organizations. The product will be used in a clinical study in collaboration with the University of Gothenburg Centre for Person-Centred Care (GPCC).

[3] www.gcdc.net

Impact Cases–FULL

Case 1: Market Aesthetics and Everyday Culture in the Classroom: An Ideological Dilemma?—Identity, Dominance, and Knowledge Formation in Music Teaching in Secondary School

This is a project critically examining music teaching in the Swedish compulsory school. It has had a considerable impact on the discussion about the content of the music subject, and the results have caused a debate in the music educational sphere.

Among the events connected to the study, a large conference was held in May 2011, in addition to the release of the anthology *Perspectives on Popular Music and School*[4]. Most Swedish researchers with an interest in popular music and school participated in the conference and contributed to the anthology, which is a respected university study resource. Also, many music teachers participated in the conference.

The project will also be included as complementary material in the national evaluation of the music subject (concluded 2014) with the National Agency for Education as accountable authority and a researcher from the UoA as responsible. The results of the study will be spread through several reports—both nationally and internationally—and together with the empirical material collected within the frame of the evaluation.

Case 2: Learning About Science Teaching through Experience and Reflection in Teacher Education

This case is built around several projects conducted at Halmstad University during 2005–2011. All projects enquire into the relationship between (student) teachers' and students' experiences and perceptions on the one hand and the complex nature of school and teacher education practice on the other.

As a result of the different projects, course activities have been designed to better meet student teachers' learning needs. All projects have been published in international journals and book chapters as well as in Swedish channels such as popular journals, keynote presentations, Studentlitteratur, and a Swedish book for teachers and student teachers. The results from the different projects have been communicated and discussed among the staff of science teacher education at Halmstad University and have had an impact on how pre-service science courses are planned and conducted.

In summary, although it is built on smaller projects, in total the case has had a large impact on science teacher education—both pre-service and in-service.

Impact Cases–MTEK

Case 1: Energy-Effective Drivelines

This case is about improving the performance and longevity of the driveline components for the automotive industry—leading to reduced fuel/oil consumption and lower emissions. It also led to improved methods for functional and manufacturing inspection of the component surfaces.

Improved testing hardware and software has been a key factor for new projects. Software was used in the different projects to help industries choose more functional surfaces. The case has also led to a new kind of collaboration with companies.

[4] Bergman, Å., Björck, C., Ericsson, C., Georgii-Hemming, E. & Holmberg, K. (2011). Perspektiv på populärmusik och skola. Lund: Studentlitteratur.

The benefits are significant, not only for the automotive companies that have improved their products and competitiveness, but also for society because of reduced environmental impact. As a result, Halmstad University has become a highly competent and internationally recognized research institution in the field of surface engineering. The case also led to an intensified cooperation with the automotive industry and has contributed to two PhD degrees and a licentiate degree since 2008.

Case 2: Polishability of Tool Steels—Manufacturing, Metrology, and Surface Quality

The surface quality of injection-moulded plastic components is affected by the surface roughness and structure. A "standard" mould quality for high-gloss applications today means a nearly defect-free surface. Often, these surfaces can be achieved only by manual polishers using their experience and know-how.

Halmstad University started working within the field in 2006, in a two-year project with Uddeholms AB regarding the polishability of tool steels. The Polsurf-project started in 2006, followed by Polsurf II in 2009—resulting in a Licentiate and a PhD. The PoliMATIC project started in 2010—leading to new specifications on surface area characteristic parameters, a patented measuring instrument, and a spin-off company.

This case has led to Uddeholms and Halmstad becoming international leaders in the area of polishability and polishing research. For the university, four new projects and applications have been opened along with a new research area. The companies involved benefit as well, not only from the knowledge but also from using the inventions and the polishing guide, combined with a new nomenclature.

Chapter 7
Bibliometric Analysis

The Bibliometric Study

To complement and supply background information for the self-evaluations and the expert peer-review process in ARC13, a working group at the university library conducted a bibliometric study of research output and impact.

The study comprises three parts: publication/output, impact/citation, and coproduction/collaboration data. Each part has its own set of identified indicators, the definitions of which are summarised in appendix D.

Prerequisites

Regarding the structure and bibliometric indicators, ARC13 mainly built upon the KTH Research Assessment Exercise (RAE2012).[1] Some indicators from the Scopus database and Halmstad University's publication database, DiVA, were added to provide a more complete and multifaceted picture of the publication output, as well as more comprehensive co-authoring patterns.

[1]RAE2012: KTH Research Assessment Exercise 2012, Royal Institute of Technology, Stockholm, 2012

It is especially important to note that the study is researcher based; this in part explains its divergence from, for example, the citation data for Halmstad University presented by the Swedish Research Council. A researcher-based study is an estimation of an organisation's prospective capacity on any particular census date, in contrast to an affiliation-based study, which is based on the complete historical output of a specific organisation (and hence also includes publications by researchers who are no longer affiliated with it). For ARC13, this means that publications which originated from the assessed researchers' earlier places of employment were also included in the study.

Scope and Primary Sources

Included in the study were a total of 2,570 publication records for the eight-year period 2005–2012 that were registered in DiVA on the census date January 15, 2013. These records were retrieved using the local researcher ID for the 283 members of the eight units of assessment (UoAs); they were quality controlled and matched against records from Thomson Reuters's Web of Science (WoS) and Scopus.

WoS was used as the primary source for the citation count via the bibliometric system at Karolinska Institutet (KI). KI was likewise employed for field comparative data—that is, for the calculation of the international field normalized framework. The KI bibliometric system contains all the indices provided by WoS except the conference indices. Citation indicators in ARC13 are based on these publications in the WoS database for the period 2005–2011, with an open citation window to March 7, 2013. This was also the date for the rating of publication channels according to the Norwegian list (see appendix D).

Methodological Remarks

It should be noted that different research subject areas have different publishing cultures and patterns for disseminating results. In several cases, this makes the value of a citation analysis from a database with limited coverage (e.g., WoS) less relevant for evaluation purposes, especially in the humanities (as citations in books are not counted), the social sciences, and those disciplines in which conference papers are a major form of publication.

It should also be noted that in the citation study, the number of documents is sometimes below the mark for statistical certainty (at least 30 documents). Despite this, the results are included as an indication of size.

Bibliometric Profiles for the UoAs

BLESS—Researchers' Bibliometric Profile

The unit shows a considerable increase in publication activity during the evaluation period. Peer-reviewed articles are a major publication type. Of these, most were published in qualified journals on the Norwegian list: 74.5% at level 1 and 9.8% at level 2 (i.e., of highest international prestige).

With 33 publications in WoS used for the citation count, the unit narrowly achieves the level set as statistically significant (N = 30). Of its publications, 15.2% are among the top 10% most cited in the field.

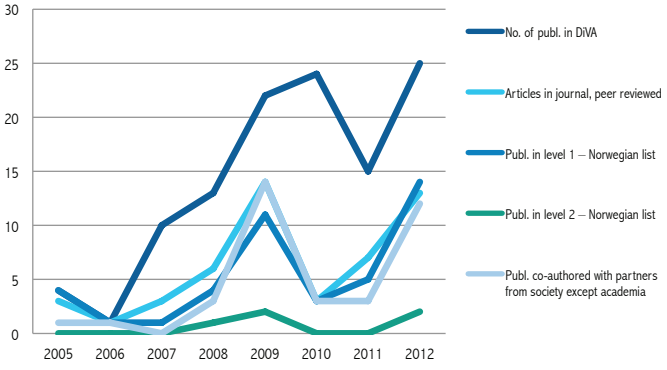
The unit's tendency for collaboration and co-authorship is quite significant, averaging 3.75 authors per publication; 52.4% of the publications were co-authored internationally, and 23.1% were co-authored with partners from outside academia.

Publication types

	Count	Share
Article in journal, peer reviewed	50	43.9 %
Article in journal, not peer reviewed	1	0.9 %
Article in journal, book review	0	0.0 %
Article in journal, review essay	0	0.0 %
Book	2	1.8 %
Edited book	0	0.0 %
Chapter in book	5	4.4 %
Conference paper, peer reviewed	27	23.7 %
Conference paper, not peer reviewed	11	9.6 %
Thesis, doctoral*	0	0.0 %
Thesis, licentiate*	1	0.9 %
Report	15	13.2 %
Other scientific publications	2	1.8 %
	=114	**100 %**

* The value is based on the researchers now active within the unit, and thus differs from the one in the evaluation package.

Publication trends



Key indicators

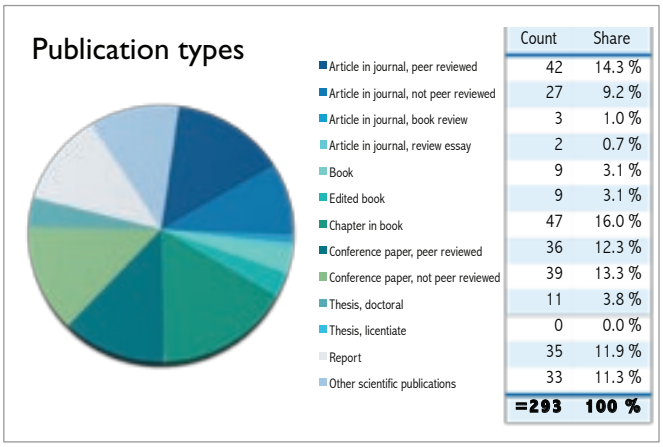
No. of publ. in DiVA	114	Av. Journal impact factor	2.31
No. of publ. fract.	55.2	Av. field norm. cit. rate	0.87
Av. annual publ.	14.25	Share of publ. among top 10 % most cited in field	15.2 %
Share of Halmstad University's publ.	4.4 %	Share of publ. among top 25 % most cited in field	19.0 %
WoS visibility	36.8 %	Av. authors per publ.	3.75
Citations in WoS	279	Publ. co-authored int. (WoS only)	52.4 %
Scopus visibility	39.5 %	Publ. co-authored with partners from society except academia	23.1 %
Av. journals' field norm. impact	0.98		

CESAM—Researchers' Bibliometric Profile

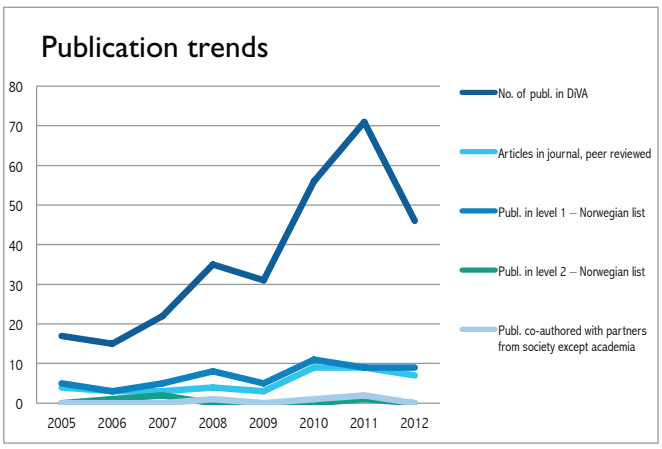
The unit shows increasing publication activity during the period studied. Its relative share of total publications across all UoAs has almost doubled, from an average of 9% in the first three-year period to 17% in the last three-year period.

The unit has a highly diversified publication pattern and a wide spectrum of significant publication types. The publication culture tends towards a certain amount of publishing in Swedish for a Swedish audience, often favouring individual authorship.

Since social sciences are poorly covered in WoS (and Scopus), the number of publications used for the citation count falls below the mark for statistical validity. On the other hand, 44.6% of the journal articles and 40.0% of the book publications are published in qualified channels on the Norwegian list.



	Count	Share
Article in journal, peer reviewed	42	14.3 %
Article in journal, not peer reviewed	27	9.2 %
Article in journal, book review	3	1.0 %
Article in journal, review essay	2	0.7 %
Book	9	3.1 %
Edited book	9	3.1 %
Chapter in book	47	16.0 %
Conference paper, peer reviewed	36	12.3 %
Conference paper, not peer reviewed	39	13.3 %
Thesis, doctoral	11	3.8 %
Thesis, licentiate	0	0.0 %
Report	35	11.9 %
Other scientific publications	33	11.3 %
	=293	**100 %**



Key indicators

No. of publ. in DiVA	293	Av. Journal impact factor	0.71
No. of publ. fract.	250.2	Av. field norm. cit. rate	0.13
Av. annual publ.	36.6	Share of publ. among top 10 % most cited in field	0.0 %
Share of Halmstad University's publ.	11.4 %	Share of publ. among top 25 % most cited in field	0.0 %
WoS visibility	5.4 %	Av. authors per publ.	1.5
Citations in WoS	8	Publ. co-authored int. (WoS only)	0.0 %
Scopus visibility	7.4 %	Publ. co-authored with partners from society except academia	1.4 %
Av. journals' field norm. impact	0.36 %		

CIEL—Researchers' Bibliometric Profile

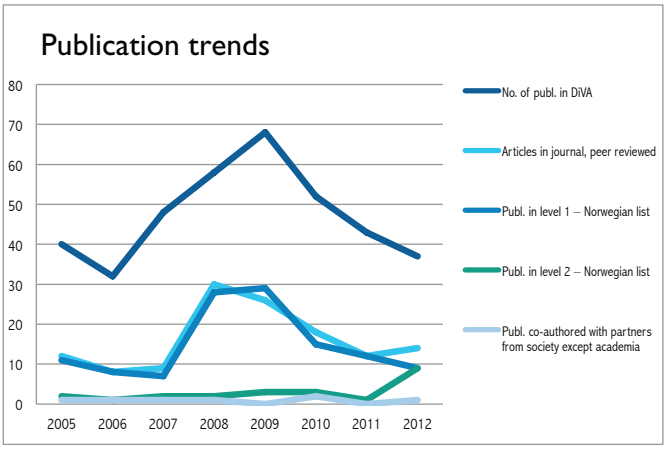
The unit's major publication types are peer-reviewed articles in journals, conference papers, and chapters in books. An increase in journal and book publications of international top prestige (level 2 in the Norwegian list) occurred in 2012.

Owing to the limited visibility in WoS—12.5% (compared to 35.7% in Scopus)—the number of publications used for the citation count (29) falls just below the mark for statistical validity (N = 30). The unit positions itself rather well among the top 10% and 25% of the most cited publications in the field. Its average field normalized citation rate—the so-called crown indicator—is 19 percentage points over the global mean.

Furthermore, a significant number of the unit's publications were co-authored internationally. Regarding co-authoring pattern, the average number of authors per publication is 1.96.

Publication types

	Count	Share
Article in journal, peer reviewed	129	34.1 %
Article in journal, not peer reviewed	1	0.3 %
Article in journal, book review	4	1.1 %
Article in journal, review essay	1	0.3 %
Book	12	3.2 %
Edited book	1	0.3 %
Chapter in book	60	15.9 %
Conference paper, peer reviewed	101	26.7 %
Conference paper, not peer reviewed	27	7.1 %
Thesis, doctoral	11	2.9 %
Thesis, licentiate	4	1.1 %
Report	23	6.1 %
Other scientific publications	4	1.1 %
	=378	100 %



Key indicators

No. of publ. in DiVA	378	Av. Journal impact factor	1.30
No. of publ. fract.	300	Av. field norm. cit. rate	1.19
Av. annual publ.	47.25	Share of publ. among top 10 % most cited in field	6.9 %
Share of Halmstad University's publ.	14.7 %	Share of publ. among top 25 % most cited in field	20.7 %
WoS visibility	12.5 %	Av. authors per publ.	1.96
Citations in WoS	182	Publ. co-authored int. (WoS only)	42.4 %
Scopus visibility	35.7 %	Publ. co-authored with partners from society except academia	1.9 %
Av. journals' field norm. impact	0.86		

CVHI—Researchers' Bibliometric Profile

The unit shows a considerable increase in publication activity during the evaluation period. The major publication types are peer-reviewed articles in journals, conference papers, and chapters in books. A large majority of the articles (92.2 %) were published in qualified channels on the Norwegian list, with a steady share (15.1 %) in publications of the highest international prestige (level 2).

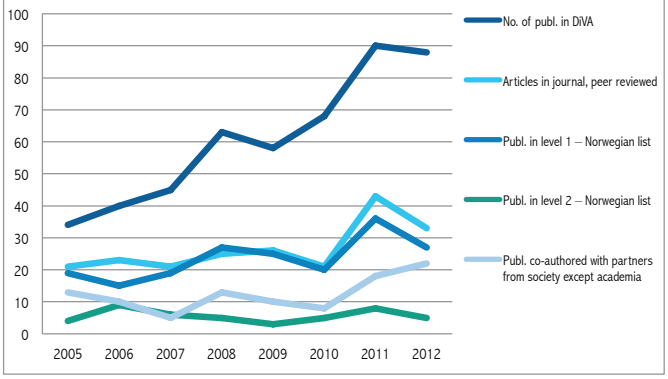
The unit positions itself rather well among the top 10% and 25% of the most cited in the field. Its average journals' field normalized impact was 5 percentage points over the global mean.

In the last two years, the unit has exhibited a growing trend of collaboration with representatives from society. Overall, its tendency for collaboration and co-authorship is quite significant, with an average of over three authors per publication (3.58 for all the publications in DiVA 2012 and 4.17 for the ones indexed in WoS the same year).

Publication types

	Count	Share
Article in journal, peer reviewed	213	43.8 %
Article in journal, not peer reviewed	13	2.7 %
Article in journal, book review	2	0.4 %
Article in journal, review essay	4	0.8 %
Book	3	0.6 %
Edited book	4	0.8 %
Chapter in book	43	8.8 %
Conference paper, peer reviewed	132	27.2 %
Conference paper, not peer reviewed	20	4.1 %
Thesis, doctoral	10	2.1 %
Thesis, licentiate	1	0.2 %
Report	34	7.0 %
Other scientific publications	7	1.4 %
	=486	100 %

Publication trends



Key indicators

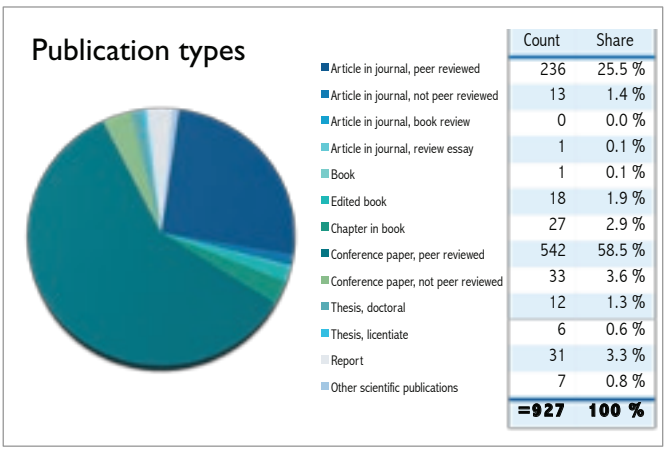
No. of publ. in DiVA	486	Av. Journal impact factor	2.55
No. of publ. fract.	277.6	Av. field norm. cit. rate	0.93
Av. annual publ.	60.75	Share of publ. among top 10 % most cited in field	5.6 %
Share of Halmstad University's publ.	18.9 %	Share of publ. among top 25 % most cited in field	13.6 %
WoS visibility	35.7 %	Av. authors per publ.	3.06
Citations in WoS	1 037	Publ. co-authored int. (WoS only)	11.7 %
Scopus visibility	43.0 %	Publ. co-authored with partners from society except academia	20.4 %
Av. journals' field norm. impact	1.05		

EIS—Researchers' Bibliometric Profile

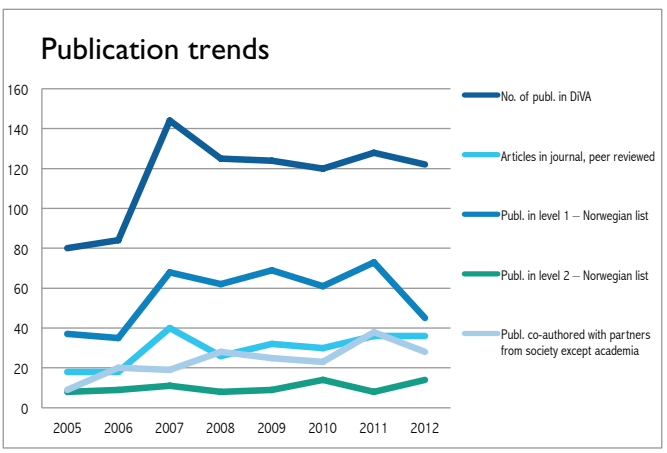
Peer-reviewed articles in journals and especially peer-reviewed conference papers are this unit's major types of publication. The large majority of these (87.6% of the articles and 52.9% of the conference papers) were published in qualified channels on the Norwegian list. Of the journal articles, almost a third (31.2 %) were published in channels of the highest international prestige (level 2).

The unit positions itself rather well among the top 10% and 25% most cited in the field. Moreover, both its average journals' field normalized impact and its average field normalized citation rate were over the global means by 7 and 11 percentage points, respectively.

The unit's tendency for collaboration is quite significant, with an average of 3.63 authors per publication, 42.5% of the publications co-authored internationally, and 20.5% co-authored with partners from society.



	Count	Share
Article in journal, peer reviewed	236	25.5 %
Article in journal, not peer reviewed	13	1.4 %
Article in journal, book review	0	0.0 %
Article in journal, review essay	1	0.1 %
Book	1	0.1 %
Edited book	18	1.9 %
Chapter in book	27	2.9 %
Conference paper, peer reviewed	542	58.5 %
Conference paper, not peer reviewed	33	3.6 %
Thesis, doctoral	12	1.3 %
Thesis, licentiate	6	0.6 %
Report	31	3.3 %
Other scientific publications	7	0.8 %
	=927	100 %



Key indicators

No. of publ. in DiVA	927	Av. Journal impact factor	1.99
No. of publ. fract.	433.7	Av. field norm. cit. rate	1.11
Av. annual publ.	115.8	Share of publ. among top 10 % most cited in field	8.1 %
Share of Halmstad University's publ.	36.1 %	Share of publ. among top 25 % most cited in field	28.1 %
WoS visibility	45.4 %	Av. authors per publ.	3.63
Citations in WoS	867	Publ. co-authored int. (WoS only)	42.5 %
Scopus visibility	66.4 %	Publ. co-authored with partners from society except academia	20.5 %
Av. journals' field norm. impact	1.07		

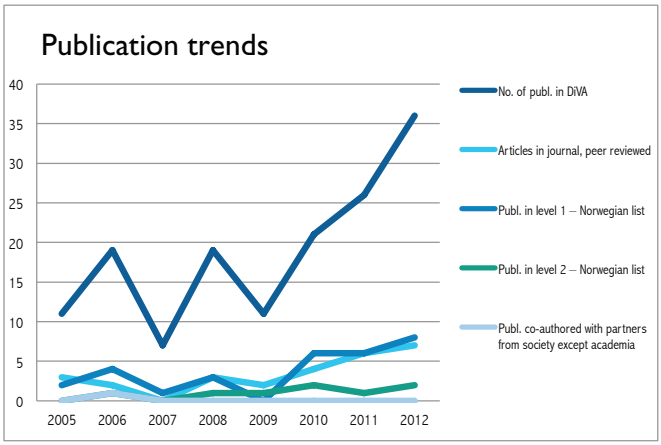
FULL—Researchers' Bibliometric Profile

The unit shows a strong increase in publication activity during the evaluation period. Peer-reviewed conference papers, articles in journals, and book chapters are the major types of publication. Most articles (86.7%) were published in qualified channels on the Norwegian list. One-fifth (20.0%) were published in channels of the highest international prestige (level 2).

The unit's publication culture tends towards a certain amount of publishing in Swedish for a Swedish audience. Regarding co-authoring pattern, the average number of authors per publication was 1.72. Social sciences are poorly covered in WoS (and Scopus), so the number of publications used for the citation count falls below the mark for statistical validity. However, the unit's average field normalized citation rate, based on these, is 55 percentage points above the global mean.

Publication types

	Count	Share
Article in journal, peer reviewed	27	18.0 %
Article in journal, not peer reviewed	3	2.0 %
Article in journal, book review	0	0.0 %
Article in journal, review essay	0	0.0 %
Book	7	4.7 %
Edited book	2	1.3 %
Chapter in book	29	19.3 %
Conference paper, peer reviewed	58	38.7 %
Conference paper, not peer reviewed	9	6.0 %
Thesis, doctoral	6	4.0 %
Thesis, licentiate	0	0.0 %
Report	9	6.0 %
Other scientific publications	0	0.0 %
	=150	100 %



Key indicators

No. of publ. in DiVA	150	Av. Journal impact factor	0.58
No. of publ. fract.	112.8	Av. field norm. cit. rate	1.55
Av. annual publ.	18.75	Share of publ. among top 10 % most cited in field	60.0 %
Share of Halmstad University's publ.	5.8 %	Share of publ. among top 25 % most cited in field	60.0 %
WoS visibility	5.2 %	Av. authors per publ.	1.72
Citations in WoS	30	Publ. co-authored int. (WoS only)	40.0 %
Scopus visibility	13.4 %	Publ. co-authored with partners from society except academia	0.7 %
Av. journals' field norm. impact	0.73		

KK—Researchers' Bibliometric Profile

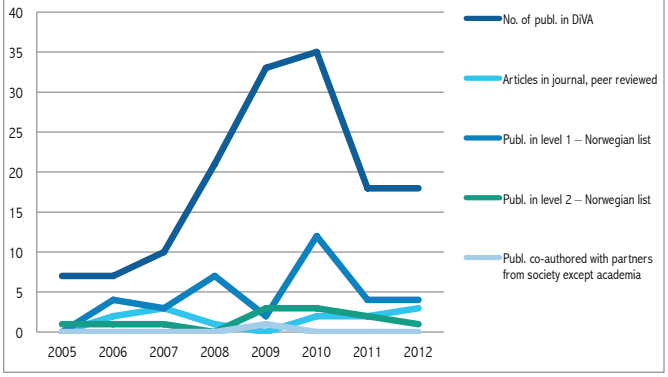
Chapters in books, conference papers, and articles in journals are the major types of publication for this unit. Two-thirds (66.7%) of the articles and 37.1% of the book publications were published in channels qualified in the Norwegian list. Of these, 16.7% and 9.7%, respectively, were published in channels of the highest international prestige (level 2).

The humanities have low coverage in WoS (and Scopus). The publications available for citation analysis are therefore fewer than the number needed for statistical validity. The publication culture tends towards a certain amount of publishing in Swedish for a Swedish audience, often favouring individual authorship. The average number of authors per publication was 1.33 for the period (1.78 in 2012). In 2012, of the total number of publications, 11.1% were co-authored internationally.

Publication types

	Count	Share
Article in journal, peer reviewed	13	8.7 %
Article in journal, not peer reviewed	10	6.7 %
Article in journal, book review	12	8.1 %
Article in journal, review essay	1	0.7 %
Book	3	2.0 %
Edited book	11	7.4 %
Chapter in book	48	32.2 %
Conference paper, peer reviewed	9	6.0 %
Conference paper, not peer reviewed	33	22.1 %
Thesis, doctoral	5	3.4 %
Thesis, licentiate	1	0.7 %
Report	3	2.0 %
Other scientific publications	0	0.0 %
	=149	**100 %**

Publication trends



Key indicators

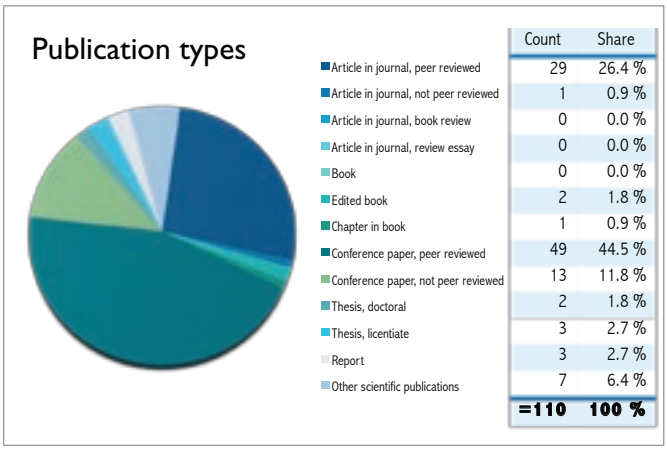
No. of publ. in DiVA	149	Av. Journal impact factor	0.09
No. of publ. fract.	133	Av. field norm. cit. rate	0
Av. annual publ.	18.63	Share of publ. among top 10 % most cited in field	0.0 %
Share of Halmstad University's publ.	5.8 %	Share of publ. among top 25 % most cited in field	0.0 %
WoS visibility	6.4 %	Av. authors per publ.	1.33
Citations in WoS	0	Publ. co-authored int. (WoS only)	0.0 %
Scopus visibility	7.7 %	Publ. co-authored with partners from society except academia	0.7 %
Av. journals' field norm. impact	0.37		

MTEK—Researchers' Bibliometric Profile

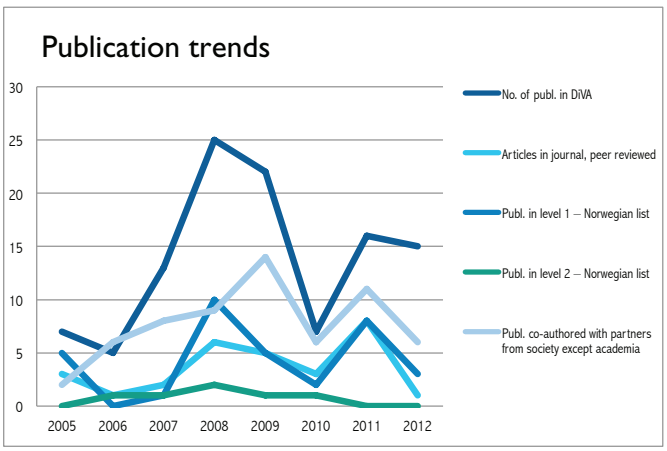
Conference papers and peer-reviewed articles in journals are the major types of publications for the unit. A large majority (96.7%) of the articles were published in qualified channels on the Norwegian list. One-fifth (20.0%) were published in channels of the highest international prestige (level 2).

The unit has 27 publications in WoS. This is below the mark (N = 30) for statistical validity in a citation analysis.

The unit's tendency for collaboration and co-authorship is significant, showing an average of 3.38 authors per publication; 36.7% of the publications were co-authored internationally, and a majority (56.4%) of the publications were co-authored with partners from outside academia.



	Count	Share
Article in journal, peer reviewed	29	26.4 %
Article in journal, not peer reviewed	1	0.9 %
Article in journal, book review	0	0.0 %
Article in journal, review essay	0	0.0 %
Book	0	0.0 %
Edited book	2	1.8 %
Chapter in book	1	0.9 %
Conference paper, peer reviewed	49	44.5 %
Conference paper, not peer reviewed	13	11.8 %
Thesis, doctoral	2	1.8 %
Thesis, licentiate	3	2.7 %
Report	3	2.7 %
Other scientific publications	7	6.4 %
	=110	100 %



Key indicators

No. of publ. in DiVA	110	Av. Journal impact factor	1.56
No. of publ. fract.	64.9	Av. field norm. cit. rate	0.56
Av. annual publ.	13.75	Share of publ. among top 10 % most cited in field	0.0 %
Share of Halmstad University's publ.	4.3 %	Share of publ. among top 25 % most cited in field	3.7 %
WoS visibility	32.6 %	Av. authors per publ.	3.38
Citations in WoS	71	Publ. co-authored int. (WoS only)	36.7 %
Scopus visibility	32.6 %	Publ. co-authored with partners from society except academia	56.4 %
Av. journals' field norm. impact	0.82		

Chapter 8
Summaries of the Panel Reports

Unit of Assessment: Biological and Environmental Systems Research (BLESS)

The general assessment of BLESS is that overall its research activity is *good* and parts are *excellent*. The unit comprises the departments of Biology, Biomedicine/Biomechanics, Energy Science, and Environmental Science. BLESS is an environment with cross-disciplinary ambitions, but it is not coherent, and its cross-disciplinary goals are not fulfilled.

In some areas, the quality of research performed in the UoA reaches a high international standard. In other areas it does not, and assessments vary widely, ranging from *excellent* to *insufficient*. As for productivity, the number of peer-reviewed papers with respect to the number of staff is *good*. The number of degrees granted is lower than might be expected and is deemed *insufficient*. However, it must be remembered that BLESS does not at present issue doctoral degrees. The research environment is currently *good* but needs be strengthened if the group is to grow at the rate currently hoped for.

The academic collaborations are *good*, and cooperation with nonacademic external partners is *very good*. The research group has a wide national and international collaboration

network, and the exchange is beneficial to all parties involved. The research is significant to society and its main impact is national. The panel finds that the grading criteria are not fully relevant in this case.

Overall, the plans and strategies for BLESS are *insufficient*. They are diverse and depend on individual researchers' interests rather than on the unit's collective needs. The future of natural science research at Halmstad University to a great extent depends on how this unit is allowed to develop. Significant parts of the research conducted within the unit are or have the potential to become high ranking. The main recommendation is that the university takes an active decision about the organizational home of the natural sciences and engineering research. The primary aim should be accreditation so that doctoral degrees can be issued in natural sciences at Halmstad University.

Unit of Assessment: Centre for Social Analysis (CESAM)

The general assessment of CESAM is that it is both heterogeneous and diversified. Established only last year, it consists of researchers from different fields.

The quality of the research is *good* and includes both chapters in books and conference presentations. Some articles have been published in international journals with a formal impact value, several of excellent quality. In order to evaluate the quality of research, the panel had to consider research conducted before the UoA was established. The quality of these projects is generally *good* to *very good*, and most other publications in the UoA are promising. The unit's productivity is rated *good*. It is uneven in the sense that some colleagues have published extensively, while many others have published practically nothing. The research environment and infrastructure are also *good*, despite having been established only recently.

Several researchers in the UoA have well-established national and international academic networks, and these are rated as *good*. Once the UoA has strengthened its identity, it will be able to engage in cooperation with other centres. Nonacademic collaborations are *good*. Some of these relationships seem more occasional than stable, but there are also long-term collaborations. Impact is rated *good*. The research is not suited to influencing society quickly. Instead, the UoA makes a long-term impact through media communication and political involvement, and by bridging university faculties.

Strategies and plans for the future at CESAM are *very good*, and a core group of researchers has started to outline a common research focus emphasizing technological and sociocultural change. The disciplinary backgrounds of all the researchers are diverse, and the UoA needs senior researchers and doctoral students. The panel has several recommendations for the unit, mostly focusing on making it more homogenous.

Unit of Assessment: Centre for Innovation, Entrepreneurship and Learning Research (CIEL)

The general assessment of CIEL is that it has a positive research culture and very diverse research. CIEL has exhibited impressive development in the past decade, generating a research environment that produces high-quality academic articles and action-oriented research that can be used by practitioners. That a number of senior researcher positions are currently vacant makes development difficult to assess.

The quality of the research is rated as *good*, even though it varies between and within groups. Only a few members have achieved a top international level of publication. Productivity is *very good*. More than one researcher stands out as a publishing star, and probably more than half of CIEL's members publish. Most publications are book chapters and conference papers. The strategy should be to publish more in higher-level journals. The research environment and infrastructure are *good*, but there is no strong focus or priority yet. Many things seem to be left up to individuals. A positive point is that the group is adept at attracting external funding.

Academic collaboration, apart from that with leading Swedish academic centres, seems to be somewhat limited and is rated *good*. For doctoral training the unit collaborates with other universities, including several institutions abroad. Nonacademic collaboration is rated *very good*. There is much cooperation with companies, institutes, regional Halland organisations, and governmental bodies—even some abroad. The unit's academic visibility is rather limited, but the UoA makes a strong impact in the region, warranting a *good* rating.

The strategies and plans for CIEL are *good*. However, there is a rather large gap between the present situation and what is planned. The panel recommends increasing the visibility of CIEL's research. The unit should focus on fewer research questions and recruit staff accordingly. Decisions must be made about what belongs to the research orientation. There is also a need for more international networking.

Unit of Assessment: Centre for Research on Welfare, Health and Sport (CVHI)

The general assessment of CVHI is that its three research areas—disability, nursing, and sports psychology—operate in relative isolation from one another. The three areas also organize differently on a national and international level, affecting their opportunities for publishing and networking. Because of this, the panel found it difficult to evaluate the research. The groups appreciate being part of the UoA, but it is not obvious what has been gained from the association apart from the establishment of the PhD programme.

Overall, the quality of research in the UoA is *good*, but it is not sufficiently integrated across the three areas. Despite some examples of excellent quality, we found that productivity within the UoA with regard to peer-reviewed journal articles was *insufficient* and not up to international standards. The research environment and infrastructure are *insufficient*. The entire UoA has an individualistic research tradition. This has several positive aspects but must be critically evaluated. The strategies for obtaining external funding are underdeveloped, but the UoA is well integrated into its local environment.

Academic collaborations are *good*, and positive initiatives are in place for developing

national and international networks. Nonacademic collaborations are also *good*—mainly owing to the UoA's strong regional links. Impact is *good* across the UoA as a whole; however, the potential for impact would be higher if the work were better coordinated, better planned, and more visible.

The strategies and plans devised by CVHI are *insufficient*, and the panel is not convinced that they are realistic. Although these plans propose valuable projects, these are not part of a coordinated approach. Thus, the panel recommends the following: Find a common focus on applied research, and develop interdisciplinary research within the three areas. Strengthen internal leadership, and balance coordinated research with academic freedom. Develop an active strategy to obtain funding, and capitalize on regional links. Prioritize publication in peer-reviewed journals. Address the gap between the senior and junior members and select PhD students with care.

Unit of Assessment: Halmstad Embedded and Intelligent Systems Research (EIS)

The general assessment of EIS is that its research is broad, relevant, and interesting. The UoA comprises a collection of diverse research groups covering a wide range of topics. There is great creativity and openness, and the research is very productive.

The quality of research is *very good*. All the research topics are fully international and the focus of intensive research at the best universities and corporate research labs worldwide. Productivity is *good* to *very good*. Overall, the focus seems to be on conference participation rather than on traditional scientific reporting in journals. The innovation activities are very successful. The research environment is also *good* to *very good*. Laboratory infrastructure is good, and in an impressive number of collaborative projects, the partners provide infrastructure and hardware. However, the number of PhD students is too low in relation to senior faculty.

Academic collaboration is *very good*. The UoA engages in fairly extensive collaboration, especially with other Swedish universities and many international institutions. Nonacademic cooperation is the strong point of this UoA and is deemed *excellent*. The main goal is to become a leading centre of excellence in Europe, and the UoA has an impressive list of local and international partners. Impact is *very good*. Some groups within the UoA publish in journals with impact factors higher than the international average, while others are lagging behind.

The ambition of EIS is to combine high-quality basic research with applied research, innovation, and industry collaboration. The panel recommends that an overall strategy be developed and that a scientific advisory board be established. The ratio between journal and conference papers needs balancing. Tighter collaboration within and across boundaries should be sought. Strategic recruitment is needed—especially of "stars"—and the number of PhD students should be increased. The Halmstad Colloquium must be retained at all costs.

Unit of Assessment: Research on Education and Learning within the School of Teacher Education (FULL)

The general assessment of FULL is that the unit has undergone many recent changes. As a consequence, the organization of research questions has been in constant flux and plans have changed in order to find solutions for the future.

Although the quality of research can be characterized as *good*, there are differences between the groups. Most of the research has been published as chapters in books. The UoA is relatively small, and its productivity is *good*. The number of publications varies between researchers. A positive point is that there are publications in journals with impact values. Productivity is increasing, but the number of licentiate and PhD degrees that have been awarded within the unit is low. The research environment is *good*. Internal funding has hitherto been successful, due to a privileged position in the university organisation, but from 2015 they will be treated like other research environments in the university. The research groups are well organized, but more senior researchers and doctoral students are needed.

Academic collaborations are *good*. The UoA has been active in establishing networks and collaboration both with other research centres and with national and international universities. However, these collaborations could be increased and deepened. Much of the research is closely related to society, and external collaborations are *good*. The impact of the UoA is also *good*. The research is suited to influencing society not quickly but, rather, in the long term. Cooperation in the area of teacher education, however, opens an important path to influencing society in many different ways.

FULL has a clear view of its future, and its strategies and plans for development are *very good*. The common theme is to collaborate with other research centres. The panel recommends that the unit identify and build on already strong research areas in order to become excellent, and then broaden the research through national and international collaboration. Other suggestions are incorporating visiting professors, publishing in more high-impact English journals, increasing the UoA's activities at international congresses, developing a postgraduate programme and a plan for a graduate school, increasing the number of postgraduates, and recruiting younger colleagues.

Unit of Assessment: Context and Cultural Boundaries (KK)

The general assessment of KK is that presently it is not a research unit; it is atomistic and lacks overall coherence and leadership. The panel found it impossible to identify specific areas of strength for the unit as a whole.

The quality of research is *insufficient*. This does not mean that all research lacks quality. A few instances might qualify as *excellent*; some are *very good*, most are *good*, and a few are *insufficient*. Based on uneven distribution within the UoA, productivity is also deemed *insufficient*. A few researchers are fairly productive, but most have published little. The number of articles in peer-reviewed journals is low. The research environment is *insufficient*. There is wide diversity within the UoA, which is both a strength and a weakness. Local resources in terms of libraries and so on are satisfactory, but members of the unit rely very heavily on the resources of other universities.

Academic collaborations are *good*. The UoA is actively engaged in both Nordic and international networks. This could become the basis for strengthening international collaboration. The UoA states that research is rarely done in collaboration with external partners, and nonacademic collaboration is deemed *insufficient*. On the other hand, there is ample evidence of collaboration on an individual level, and this could serve as the basis for partnerships. Impact must also be graded *insufficient*.

The original self-assessment submitted by KK exhibited a lack of strategic vision, but over the course of the evaluation the panel sensed recognition of this fact. Renewal in the UoA is therefore deemed *good* and has the potential to become *very good*. Although obliged to give the grade *insufficient* on several accounts, the panel firmly recommends that the university give this unit the opportunity to develop. As noted, there are individual instances of research of good quality upon which the unit can build. The discussions regarding the ARC13 report have resulted in positive self-reflection and a growing sense of responsibility.

Unit of Assessment: Mechanical Engineering and Product Development (MTEK)

The general assessment of MTEK is that the unit is visionary and characterized by excellent networks and synergies. The overall impression is *very good* to *excellent*.

Widely recognized in prominent channels and leading the field internationally, this unit's research is of *excellent* quality. The UoA has a strong scientific basis in in-depth investigations and produces well-grounded breakthroughs that are reported in well-known journals. The main research line in innovative functional surfaces is strongly supported by world-class research in Industrial Photonics. The unit has strong national and international visibility, and productivity is *very good*. The number of publications is *good*, and the number of PhDs above average. Much time is spent on networking, at the cost of research, but this is probably crucial to the unit's existence. The research environment and infrastructure are *excellent* in all respects, exhibiting strong leadership and teamwork, as well as good equipment. The UoA collaborates with several companies and has a strong interdisciplinary profile.

Academic networks and collaborations are *excellent*. The unit's national and international collaboration with high-quality partners are wide-ranging and relevant. Coproduction and external cooperation are *very good*. Collaboration with high-quality partners is extensive and relevant also in terms of the partners' contribution to joint research, which has great value for the external partners. The unit has a long tradition and strong experience in coproduction with both academia and industry. Its research has an international reach of significance to society, and its impact is *very good*.

The strategies and plans for MTEK are *very good*. The unit has clear visions and realisable strategies, even if they are partly dependent on external partners. The panel sees remarkable potential and recommends that the unit stay focused on the surface-engineering loop approach and strengthen its scientific basis. The unit is encouraged to continue finding new areas and should increase the group's critical mass with more PhD students and associate professors. It is also encouraged to widen its internal collaboration within the university. In the near future, it will also be necessary to invest in equipment.

Chapter 9
Reflections on Halmstad University and ARC13

by Mats Benner, Lund University School of Economics and Management

The last decade has witnessed a transformation in the governance, funding and monitoring of universities—stressing efficiency and goal attainment. Efficient as this may have been, it has fostered a somewhat myopic understanding of the role of universities in society. It has also lead to a somewhat unhealthy focus on a few "world-class" universities, ignoring the wide variety of roles and functions that the absolute majority of the world's universities play.

Fortunately enough, the focus seems to be shifting towards the core issue: what are universities for? How can they function as places of learning, interaction, action and reflection, and how can they be supported and governed to fulfil these roles? And what demand does this place on the universities themselves, in how they are led, run and organised?

From an international perspective, Sweden stands out with its ambition to create a comprehensive university system. In this system, new universities like Halmstad fulfil a central and vital role, complementary to that of older and broader universities. Different types of universities fulfil similar but not identical functions and should excel in that function and not according to a generic and all-inclusive concept of "quality" or "excellence". Instead of one monotonous concept of excellence, we should expect

"varieties of excellence". However, the fragile balance between the different university species is under threat, and it is of major importance to maintain a sensible understanding of the form and function of the entire university system and not only of an exclusive group of a few "elite universities". One critical element in such a discussion is overviews and critical studies of how universities are developing – which gives insights into their inner life.

ARC13 is a laudable example of this ambition. It provides evidence of the transformation of a small university college, primarily serving as a teaching-only extension of its "mother university", into a full-grown university in its own right. Halmstad University has developed considerably since its inception in the early 1980s. The ARC13 report depicts a university in rapid development, with focus areas and strongholds of international recognition, guided by a coherent vision and governance model. The strongholds do not form separate "mini-universities" but are joined together in a clear-cut vision of becoming a "real" university where collaboration, education and research are joined, and where the university itself sets the direction as an innovative university. The assessment shows that the university can indeed argue with credibility that it is in the process of developing such a unified identity. In certain areas Halmstad can compare itself with the best universities in the country, with some environments of excellent research and others where social and industrial networks are remarkably dense.

The main challenge that remains is to strike the balance between teaching, research and collaboration throughout the university, with recruitment and promotion tied to the university's self-identified goals, and the ability to mobilise external support to underpin and empower (and critically re-evaluate) that position and direction, not only in one or two areas but in all areas in which Halmstad engages. This is of course a daunting task but it will make academic leadership – another key feature of "successful" universities – more distinct and generalised throughout the university.

The main strength of Halmstad's activities lies in the close interaction of research and collaboration; its research strongholds are nurtured by active and knowledge-intensive collaborators outside academia in a self-sustaining and reinforcing manner. Such areas have also been highly successful in a national (and to some extent international) competition for research funding, where Halmstad's strongest environments can match those of older universities. The articulation between research and education has been a more elusive goal; environments with a large educational remit seem to have difficulties in developing an interactive academic culture. Concomitantly, environments where research and collaboration develop in parallel seem to be less active in education. The creation of "complete academic environments" should be a top priority if Halmstad wants to develop further and refine its distinct position in the Swedish and European university landscape.

Such complete environments and such a coherent academic culture depend on academic leadership. Academic leadership is, as the report rightly notes, based on setting priorities, formulating visions and realising them. The focus on a delimited number of areas is clear from the report, and has been so from the very beginning of higher education in Halmstad. It seems clear from the report that Halmstad has been consolidating its activities, with some notable successes and some areas that show promising signs of becoming more coherent (and others where the future direction is more open).

But prioritisation does not equal "narrowing". A key challenge should be to expand

internally by fostering innovative combinations of people, ideas and approaches between the current areas of specialisation.

The next logical step after the necessary consolidation phase would be to enhance internal networking and to maximise the impact and interaction between areas. Halmstad quite reasonably emphasises multidisciplinarity as a key to its success. This calls for a daily and regular interaction between fields, an interaction that is based on personal interaction but also on the supply of collaborative platforms within the university. Given the breadth of Halmstad's profile, ranging from literature to mechanical engineering, this should be possible and it should enable interesting and potentially path-breaking intellectual combination. In particular, it could form and shape an ambience of intellectual innovation and curiosity which would make Halmstad a site for cross-fertilisations and unexpected interactions.

If cross-fertilisation should be high on the future agenda, consolidation still seems urgent in the short-term perspective, in particular for the teaching intensive areas of the social sciences, teacher training and humanities. Thematic structures may serve as an integrative instrument here and as a way to create coherent environments in these areas. Consolidation may even call for parallel reductions and expansions, which may be painful and generate conflict but probably unavoidable if research activities are to become meaningful and discernable in the wider academic community. If the university is to maintain integrated with research, education and collaboration unified, the large teaching-intensive areas must develop their own specific research strongholds as well. Otherwise, the university will slowly disintegrate into two sections, each with its own specific logic and *raison d'être*.

Relevance is one of the historical characteristics of Halmstad University and it seems to be vibrant still. It seems clear; both from case studies and panel reports, that virtually all activities at Halmstad are marked and shaped by the ambition to interact with society. Some areas have even gained national and to some extent international status as collaborative partners. With the region's diversified industry structure, proximity to large markets, qualified labour force and general political commitment to growth and welfare, Halmstad operates in a very fertile environment and should continue to refine its interactive strategies and generalise them throughout the university.

As should be clear by now, the main risk that can be identified is that Halmstad develops a few "lighthouses" and "beacons" in an ocean of weaker and non-distinguished activities. To counter this, the University should continue to widen and deepen its unique strengths in the articulation of regional interests and needs, and the capacity to translate these into vehicles for research and education programmes supported by visionary leadership, external backing, recruitment, profiling and networking. On this basis, Halmstad could become a prominent example of an "integrated university" where complete academic environments operate in niche areas where the University can make a difference and where it creates value for students, teachers and collaborators. This would complement and enrich the Swedish university system by providing a focused, integrated and interactive academic environment of the highest international standard.

Chapter 10
Conclusions and Recommendations

The ARC13 expert panels were asked to assess the quality of research and collaboration in the units of assessment (UoAs) from seven different perspectives, along with an overall assessment (the grading criteria are provided in appendix C). The panels were also asked to provide recommendations for future development. The general picture from the expert panels' statements is that the high ambitions and perseverance of the university's leadership and faculty have been successful, but there is still significant potential for further improvement. The strongest recommendations relate to strengthening scientific leadership, organising the UoAs to work with more focused common goals, and improving their publication strategies.

Overall impressions from the panels' assessments of the seven aspects at the university level are summarised below; a summary list of their recommendations also appears.

Research Quality

About half the research done by Halmstad University faculty and PhD students, when measured in terms of research expenditure, is rated *excellent* or *very good*. This means that this research attains an internationally or nationally leading level. This is research that receives international attention and is published in recognised and prominent channels.

The UoAs that received the highest grades conduct research predominantly in natural science and technology. These are areas in which collaborative research with industrial partners has been prominent, funded by agencies like the Knowledge Foundation, the Swedish Foundation for Strategic Research (SSF), and the Swedish Governmental Agency for Innovation Systems (Vinnova). These UoAs have been able to fund their research with significant external funding (receiving about two-thirds of their total research funding from non-university sources) over a long period and can thus attract researchers with relative ease. A significant part of their research today is funded by the Swedish Research Council (VR) and the European Union.

Research Productivity

Research productivity has improved significantly in recent years but still needs development. No UoA received the grade *excellent*, although the experts assess some research groups quite positively. Several UoAs have low production levels. A comment that applies to many UoAs is that too much effort is invested in producing conference papers or articles for low-impact journals, as opposed to publishing papers in high-quality scientific journals. The panels also noted the low production of doctoral degrees, but this is explained by the fact that Halmstad University was only recently accredited to issue doctoral degrees.

The experts comment that research operation at Halmstad University is often a bit different from that at a traditional university. This applies especially to UoAs in the natural science and technology field. For example, substantial time is spent networking and collaborating with international and national institutes and companies, and this is probably crucial to successful research. The panels point to very high productivity in innovation activities.

Research Environment and Infrastructure

For most UoAs the expert panels think the research environment and infrastructure are *good* or better than *good*. One UoA is rated *excellent*, boasting high-quality cutting-edge equipment and "clear and visionary leadership". There are UoAs about which the panels express serious concerns regarding leadership and organisation; this is not surprising in itself—similar comments appear in evaluations of other Swedish universities. It is, however, clear that recruiting and mentoring for research leadership is something the university must more actively pursue.

The panels often comment that the number of doctoral students is low compared to the number of faculty and that the teaching load on the faculty is high, making it difficult to produce high-quality research. This is partly a consequence of external conditions, some of which have changed. The university was just recently awarded the right to examine on the doctoral level. Further, it was dominated by teaching for many years, and direct government funds for research were to a large extent used to guarantee research time for all categories of teachers, thus diluting internal research resources. The researchers' ability to attract external research grants has been and will continue to be crucial for conducting focused research. However, beginning in 2014 conditions will be much more conducive to focus internally funded research efforts.

Networks and Collaborations

More than half the research, when measured in terms of research expenditure, is rated *excellent* or *very good* regarding networks and collaboration. Some Halmstad researchers play key roles in national and international networks; however, the panels note that the networks tend to be connected to individual researchers and that this makes them vulnerable.

The panels often comment that the potential for collaboration within the university is underexploited and that strategies should be developed to increase this collaboration.

Coproduction and External Collaboration

Coproduction and external collaboration comprise one area in which Halmstad researchers excel. Most of the research is rated *excellent* or *very good* in this respect. The UoAs often have extensive and relevant networks that include the industrial and public sectors and gain access to partners' infrastructure, which is crucial for conducting research. The external coproduction and collaboration networks are very important for the impact of research.

Impact

The impact of research is generally rated *good* or *very good*, with only one exception. Half the research conducted at Halmstad University is considered to have made a *very good* impact. Close collaboration with external partners means that research is easily adopted by the partners. Some researchers participate in industrial standard-setting organisations.

A general weakness is the low visibility of the scientific publications owing to the venues in which they have been published and the consequently low impact they have in terms of citations. Some researchers have had a significant citation impact, but the panels recommend that better overall publication strategies be developed.

Strategies and Plans for Developing the UoAs

Half the UoAs are rated *very good* in terms of their strategies and plans. Yet it is a common comment that the strategic work is not adequate. In some cases, there are no clear future strategies. The panels' assessments show that there are UoAs in which strategic work must be improved significantly if the research is to reach a high-quality international level.

More than one panel comments that the UoAs are too broad in their research and that they should narrow their focus—that is, identify fewer joint research themes and direct resources at addressing these more specific issues. It is also pointed out, in some cases, that past research has been individualistic, that no common goal for the UoA has been articulated.

Recommendations

The panels' recommendations can be summarised in seven general statements that apply to many of the UoAs:

- Direct more research funds to the UoAs.
- Increase the number of doctoral students and expand the accreditation rights for

doctoral degrees to include more of the research.

- Improve strategic work and scientific leadership. Focus more, identify key research questions and themes, and recruit accordingly. Increase internal cooperation, and form research teams, possibly at the cost of individual freedom.
- Establish advisory boards for the UoAs composed of external scientists, company representatives, and public sector representatives. These should meet with the UoAs on a biannual or annual basis.
- Improve publication strategies. All the UoAs have weaknesses in their publication profiles. Provide more incentives to publish in high-quality scientific journals.
- Make coproduction and collaboration more visible than they are today, given that this is a specific strength of Halmstad University.
- Expand international research networks.

The distribution of government research funds depends on decisions that are external to the university; the same is true of expanding accreditation and the university's rights to engage in doctoral-level education. Halmstad University recently established a research-support organisation to help researchers apply for external research grants so as to increase its research volume.

The remaining recommendations are more closely connected to internal university decisions and priorities. The university will require and support stronger scientific leadership and improved strategic work. The university library will, through investments from the university, support the UoAs in improving their publication strategies. Better internationalisation will be supported; the university decided in 2012 to establish a programme to expand the international research network, a programme that was implemented in 2013. Last but not least, the Knowledge Foundation–funded *Research for Innovation* will be a very important tool in the work to meet many of these recommendations.

Appendices

Appendix A. Panel Presentations

Panel 1
Biological and Environmental Systems Research (BLESS)

Name	Role	Affiliation
Prof. Björn Zethraeus	Panel Chair	Linnæus University
Prof. Hans Brix	Panel Member	Aarhus University
Dr Sandra Hunter	Panel Member	Marquette University
Prof. Stefano Consonni	Panel Member	Politechnico di Milano
Dr Anette Rothberg	Panel Member	Swedish Energy Agency

Front row from left to right: Dr Sandra Hunter, Prof. Björn Zethraeus.
Back row from left to right: Dr Anette Rothberg, Prof. Stefano Consonni, Prof. Hans Brix.

Panel 2
Centre for Social Analysis (CESAM) & Research on Education and Learning within the School of Teacher Education (FULL)

Name	Role	Affiliation
Prof. Pertti Kansanen	Panel Chair	University of Helsinki
Prof. Göran Ahrne	Panel Member	Stockholm University
Dr Katarina Graffman	Panel Member	Inculture
Prof. Marja Keränen	Panel Member	University of Jyväskylä
Prof. Torlaug Løkensgard Hoel	Panel Member	Norwegian University of Science & Technology
Prof. Sonja Sheridan	Panel Member	University of Gothenburg

Front row from left to right: Prof. Göran Ahrne, Prof. Pertti Kansanen. Back row from left to right: Prof. Marja Keränen, Prof. Sonja Sheridan, Dr Katarina Graffman, Prof. Torlaug Løkensgard Hoel.

Panel 3
Centre for Innovation, Entrepreneurship and Learning Research (CIEL)

Name	Role	Affiliation
Prof. Koos Krabbendam	Panel Chair	University of Twente
Prof. Tomas Backström	Panel Member	Mälardalen University
Prof. Magnus Gulbrandsen	Panel Member	University of Oslo
Prof. Marian Jones	Panel Member	University of Glasgow
Prof. Qing Wang	Panel Member	Warwick Business School
Dr Anna Sandström	Panel Member	Vinnova

Front row from left to right: Prof. Qing Wang, Prof. Marian Jones. Back row from left to right: Prof. Tomas Backström, Dr. Anna Sandström, Prof. Koos Krabbendam, Prof. Magnus Gulbrandsen.

Panel 4
Centre for Research on Welfare, Health and Sport (CVHI)

Name	Role	Affiliation
Prof. Stina Johansson	Panel Chair	Umeå University
Seniorforskare Steen Bengtsson	Panel Member	SFI Denmark
Prof. Tiny Jarsmaa	Panel Member	Linköping University
Prof. Marit Kirkevold	Panel Member	University of Oslo
Dr Jonathan Boote	Panel Member	University of Sheffield
Prof. Lennart Raudsepp	Panel Member	University of Tartu

Front row from left to right: Prof. Tiny Jarsmaa, Prof. Stina Johansson. Back row from left to right: Prof. Lennart Raudsepp, Dr. Jonathan Boote, Seniorforskare Steen Bengtsson, Prof. Marit Kirkevold.

Panel 5
Halmstad Embedded and Intelligent Systems Research (EIS)

Name	Role	Affiliation
Prof. Helen Gill	Panel Chair	National Science Foundation
Prof. Ole Hanseth	Panel Member	University of Oslo
Prof. Maria Strømme	Panel Member	Uppsala University
Prof. Kalle Åström	Panel Member	Lund University
Prof. Erkki Oja	Panel Member	Aalto University
Dr Tord Wingren	Panel Member	Huawaei
Prof. Maja Pantic	Panel Member	University of Twente & Imperial College

Front row from left to right: Prof. Maria Strømme, Prof. Helen Gill. Back row from left to right: Prof. Ole Hanseth, Prof. Maja Pantic, Prof. Kalle Åström, Prof. Erkki Oja. Missing on picture: Tord Wingren.

Panel 6
Context and Cultural Boundaries (KK)

Name	Role	Affiliation
Prof. Björn Melander	Panel Chair	Uppsala University
Prof. Martin Hellström	Panel Member	University of Borås
Prof. Martin Kayman	Panel Member	Cardiff University
Prof. Birgitte Possing	Panel Member	The Danish National Archives
Prof. Britt-Inger Johansson	Panel Member	Uppsala University

Front row from left to right: Prof. Britt-Inger Johansson, Prof. Birgitte Possing.
Back row from left to right: Prof. Martin Hellström, Prof. Björn Melander, Prof. Martin Kayman.

Panel 7
Mechanical Engineering and Product Development (MTEK)

Name	Role	Affiliation
Prof. Reijo Tuokko	Panel Chair	Tampere University of Technology
Prof. Xiangqian Jiang	Panel Member	University of Huddersfield
Dr. Lars Lundin	Panel Member	Volvo Global Truck Technology AB
Prof. Marika Torbacke	Panel Member	Statoil & Luleå University of Technology

From left to right: Dr. Lars Lundin, Prof. Marika Torbacke, Prof. Xiangqian Jiang, Prof. Reijjo Tuokko.

Appendix B. Evaluation Package

Introduction

The following document describes the research and collaboration of defined units of assessment (UoA) at the University. The document includes indicators on research activities, research initiatives and collaboration in research in relation to academic, business, or public partners. The document also includes a qualitative self-assessment of the strengths, weaknesses, opportunities and threats (SWOT) of the UoA. The indicators aim to describe research activities in specific areas as well as in multi-disciplinary fields. Apart from direct research quality assessments, a number of different aspects are requested to be elucidated; description of the research field, research environment and infrastructure, research output, impact, engagement and co-operation with society (organisations within business and public sector, non-governmental organisations and the public) and opportunities for renewal and actions for successful development. The document also includes two case descriptions which are identified by the UoA as particularly important or significant (see C). The document is structured in three parts:

Part A – Strategic information about the UoA (general description and SWOT-analysis)

Part B – Quantitative data describing the UoA (general information, research output and co-operation with society)

Part C – Case descriptions (two impact cases)

The parts are complementary. Information provided in either part should be used to support and deepen the information presented in the other.

ARC13 generally assesses the period January 2007 to the end of December 2012 (see appendix 1), although some of the indicators cover a shorter period of time. The expert panels are asked to assess the quality of research (and collaboration) at the UoA in an international perspective. In particular, the panels are asked to identify strong research activities, strong collaboration with society and potentially interesting opportunities for development.

Part A: Strategic Information from the Unit of Assessment (UoA)

In this part of the evaluation package the UoA communicates information on organisation, co-operation and strategies chosen to ensure that relevant, high-quality research is conducted.

Table A0. *Name of the UoA.*
Name of Unit of assessment
Coordinator of Unit of assessment

A1. Description of the Research in the UoA

This is an overview of the current research areas, including primary missions and goals, within the UoA. (Max 4 pages, in template format)

A2. Summary of the Scientific Results

This is a qualitative summary of the most important scientific results of the UoA. The summary should reflect the width of the research and should make reference to no more than 30 publications (Table A2.1) and other research outputs (Table A2.2). The summary should include comments to the publication and citation profile as presented in section B2.2, including the coverage of output from staff no longer affiliated to the UoA. (Max 5 pages)

Table A2.1. *Selected peer-reviewed publications*[1].
[1] Publications should be listed in Harvard format. DOi=The Digital Object identifier system, for scientific publications is added in the following format: DOi: 10.1016/j. tibtech.2007.05.002 As a service for the expert panel, the listed publications are available to the expert panel as pdfs. Where the publication takes the form of a book, two copies should be provided.

Table A2.2. *Name of the UoA.*
Name of Unit of assessment
Coordinator of Unit of assessment
[1] There is a maximum allowed number of research output submissions. The number of key research outputs, whether publication or other research output, is limited to the total number of professors within a UoA multiplied by four. The number should be four in case the UoA does not have a professor. Internationally acknowledged research outputs such as new materials, products and processes, patents, software, computer code, standards documents, evidence synthesis including systematic reviews, analyses, meta-analyses, research-based clinical case studies that add new knowledge, physical artefacts such as images, materials products and processes, prototypes, digital artefacts such as datasets, software, film and other non-print media etc.

A3. Research Environment and Infrastructure

In this section, the UoA presents the research environment that constitutes the context and breeding ground of its research.

A3.1 Organisation of the UoA

A description of how the UoA is organised; how research is managed and quality-secured; a presentation of research groups; how efforts of fund-raising are structured. (Max 2 pages for UoA and an additional ½ page per group)

A3.2 Personnel

Present a general analysis on staff related to personnel tables in section B1.1 (Max 1 page)

A3.3 Infrastructure, Facilities and Funding:

Provide a description of the infrastructure of the UoA (not the general infrastructure of the university) that is used to do research (such as laboratories, specific ICT-support; infrastructure for fund raising, collaboration with society, etc.). (Max 3 pages)

A.3.4. Indirect Infrastructure, Facilities and Funding

This section describes the indirect research infrastructure available to the UoA. This is research infrastructure at external collaboration partners (laboratories, software, databases, equipment, etc.). (Max 2 pages)

A4. Impact, Engagement, and Co-operation with Society

In this section, the UoA describes its efforts to collaborate with society to ensure that research conducted has an impact on society. The section aims to provide the basis for a more holistic and situated evaluation of research impact than is possible from the cases (described in C).

A4.1. Collaboration with Society in the UoA

Give an overview of the most promising current collaboration, including primary missions and goals. Describe how current collaboration affects the quality of research. Include evidence and specific details/examples adopted by the UoA rather than broad and vague statements. Do not repeat specific details already included in the case studies (section C). (Max 4 pages)

A4.2 External Collaborations and Contributions That Support the Research within the UoA

Describe supporting key external research collaborations and contributions from actors outside the UoA. (Max 1 page)

A4.3 Innovation Activities

The UoA describes the most significant innovations during 2007-2012 making an impact (i.e., a change) on society (Max 3 pages). Examples of innovation are products, designs, processes, methods, etc. The innovations can be realized within the university or by a partner and listed at the end (not included in the three pages) and should not be more than 15.

A5. Self-assessment and Future Development

In this section the UoA should provide a self-assessment of its present opportunities for improvements. What does the UoA aim to achieve, e.g. in terms of activities within the UoA, external networking, interdisciplinary activities, joint publications and funding?

A5.1 Self-assessment of the UoA

Based on the quantitative data (part B) and qualitative assessment above, list strengths, weaknesses, opportunities and challenges (threats) of the UoA and of the research conducted. Strengths and weaknesses refer to properties of the UoA, whereas opportunities and challenges normally refer to external factors. Propose actions that would improve the quality of the research. Consider both purely academic factors and factors related to cooperation with external partners. Apply a long-term perspective of the strategic planning of the UoA and what priorities that will be made regarding future research (max 10 pages).

The UoA must grade, on a scale 1-8, and motivate their opportunities and ability for
– recruiting qualified staff and PhD students,
– attracting external research funding,
– international positioning of the UoA.
Here, 1 means poor and 8 means excellent.

Part B: Quantitative Data of the UoA

In this part of the evaluation package questions and tables are presented in 3 sections which contain quantifiable information about the UoA in support of the statements made in Part A above.

B1: Research environment and infrastructure

B2: Research output

B3: Impact, engagement and co-operation with society

B1. Research Environment and Infrastructure

B1.1 Staff Statistics

Provide information of the number of individuals and full time equivalents (FTE) of staffs' research activity. The "M" columns show values for men and "W" for women. The number of individuals refers to Dec 31st each year, whereas FTE is integrated over the whole year. FTE is only presented for 2011 and 2012.

Table B1.1.1. *Number of and full time equivalents of permanent research staff.*

Year	2007		2008		2009		2010		2011		2012	
Staff [1]	M	W	M	W	M	W	M	W	M	W	M	W
Professor												
FTE												
Assoc. prof. (Lektor and docent)												
FTE												
Assoc. prof. (Lektor, forskare)												
FTE												
Lecturer (Adjunkt)												
FTE												
Total Individuals												
Total FTE												

[1] Professor denotes persons employed as full professors. Associate professor denotes staff qualified to act as principal advisor for PhD students (docent appointment or similar). Assistant professors denote the rest of staff with a PhD.

Table B1.1.2. *Number of and full time equivalents of temporary research staff.*												
Year	2007		2008		2009		2010		2011		2012	
Staff [1]	M	W	M	W	M	W	M	W	M	W	M	W
Guest profs												
FTE												
Adjunct profs												
FTE												
Assistant prof.												
FTE												
Post-Docs and research assistants												
FTE												
PhD students												
FTE												
Total Individuals												
Total FTE												

Table B1.1.3. *Other staff supporting research in UoA.*												
Year	2007		2008		2009		2010		2011		2012	
Staff [1]	M	W	M	W	M	W	M	W	M	W	M	W
Research assistant/ Technician												
FTE												
Administrator												
FTE												
Total Individuals												
Total FTE												

[1] Fixed term and visiting research staff. Staff is included in the research output as well as in the bibliometric analysis.

B1.2 Research Funding

Sources of research funding and amounts given to the UoA annually during 2007-2012.

Table B.1.2.1. *External funding (spent money in SEK).*						
	2007	2008	2009	2010	2011	2012
Research Councils (VR, FAS, Formas etc.)						
Swedish Foundations (e.g. Wallenberg, SSF, Vinnova, RJ, KK, Swedish Energy Agency etc.)						
EU						
Other public bodies (e.g. county councils, municipalities, etc.)						
Direct external funding from industry.						
Others (please specify)						
TOTAL						

Table B.1.2.2. *Total Research Funding.*						
	2007	2008	2009	2010	2011	2012
Total external funding (from table B.1.2.1.)						
Faculty funding (governmental funding)						
Percentage external funding						
Research as competence development						
TOTAL						

B1.3 Major International Collaborations

Each UoA should record the number of major international activities under¬taken with partners outside of Sweden during 2011-2012 by permanent research staff.

Table B1.3.1 *International networks and collaborations.*	
Number of collaboration institutions[1]	
Number of research visits abroad (1 week to 1 month duration)	
Number of research visits abroad (of at least 1 month duration)	
Number of visiting researchers (1 week to 1 month duration)	
Number of visiting researchers (of at least 1 month duration)	
Number of funded international research consortia projects	

[1] Research collaborations given here are limited to those with joint research grants in excess of 100kSEK/year and/or joint publications with the UoA.

Table B1.3.2 *Name of project granted and role of UoA.*			
Project title	Funding body	Role (coordinator/partner)	Start year

B1.3.3 *Other major international activities according to the tradition of the research field*[1]	*Total No.*
[1] Please specify: scientific expeditions, field work etc. and list below including duration A maximum of five examples in total may be provided.	

B1.4. Participation in Scientific Community

UoAs activities undertaken during 2007-2012 that illustrate high quality leadership interactions with their scientific peers.

B1.4.1 *Participation in academic community*	Number
Plenary or keynote talk at international conferences	
Assignment as expert in research councils and foundations	
Assignment as expert evaluator for position as professor, associate professor (docent) and lecturer	
Assignment as opponent for PhD thesis	
Assignment as member of examination board for PhD thesis	
Assignment as opponent for licentiate thesis	
Assignment as editor or member of editorial board for journal	
Assignment as reviewer for international journal	
Member of national scientific councils	
Member of international scientific councils	
Chair of program committee (international conferences)	
Member of program committee (international conferences)	

B1.5 Recruitments

Number of recruited research staff, men (M) and women (W) during 2007-2012.

B1.5.1 *Recruitments*	Number	
Recruitments with doctoral degree from another Swedish university	M	W
Recruitments with a doctoral degree from outside Sweden		
Recruitment with doctoral degree from own university		
TOTAL		

B2. Research Output

B2.1 Promotions and Degrees

This section quantifies the development of scientific staff during 2007 to 2012 distinguishing men (M) and women (W).

Table B2.1.1. *Doctoral degrees awarded and promotion of researchers*

	2007		2008		2009		2010		2011		2012	
	M	W	M	W	M	W	M	W	M	W	M	W
No. Doctoral degrees												
No. Docent promotions												
No. Professor promotions												
TOTAL												

B2.2 Publications

Publications and other research output achieved during 2005-2012 to provide the publication profile of the UoA.

Table B2.2.1. *Total number of scientific publications produced by the UoA. Please specify citation index in each publication list.*

Publication types	'05	'06	'07	'08	'09	'10	'11	'12	Total	Total/ Annual average
Article in journal, peer reviewed										
Article in journal, not peer reviewed										
Article in journal, book review										
Article in journal, review										
Book										
Edited book										
Chapter in book										
Conference paper (peer reviewed)										
Conference paper (not peer reviewed)										
Thesis, doctoral										
Thesis, licentiate[1]:										
Student Master Thesis										
Report										
Other scientific publication										

[1] Licentiate is a Swedish and Finnish academic degree on graduate level corresponding to circa half a Swedish PhD.

Table B2.2.2. *Aggregate publication information*										
	'05	'06	'07	'08	'09	'10	'11	'12	Total	Total/ Annual average
Total number of publications in DiVA										
Number of publications in Web of Science										
Number of publications in Web of Science, author fractionalized										
Web of Science visibility										
(% publications included)										
Scopus visibility										
(% publications included)										
Journals´ field normalized impact										
Journal Impact Factor										
Norwegian score										
Norwegian score fractionalized										
Publications in level 1 journal – Norwegian list										
Publications in level 2 journal – Norwegian list										
Publications in level 1 conference – Norwegian list										
Publications in level 1 book publishers										
Publications in level 2 book publishers										

Table B2.2.3. *Citation indicators*										
	'05	'06	'07	'08	'09	'10	'11	'12	Total	Total/ Annual average
Total number of citations										
Number of citations, author fractionalized										
Citations per publication										
Share of publications not cited										
Average field normalized citation rate										
Share of publications among the 10 % most cited in the field										
Share of publications among the 25 % most cited in the field										

Table B2.2.4. *Authorship*										
	'05	'06	'07	'08	'09	'10	'11	'12	Total	Total/ Annual average
Average authors per publication										
Average countries per publication										

Table B2.2.5. *Role of key scholars*										
	'05	'06	'07	'08	'09	'10	'11	'12	Total	Total/ Annual average
Share of publications by 3 most active authors										

Table B2.2.6. *Productivity*										
	'05	'06	'07	'08	'09	'10	'11	'12	Total	Total/ Annual average
Number of publications in relation to funding (MSEK)										
Number of publications in relation to full time equivalents of research[1]										
Number of citations in relation to full time equivalents of research[1]										

[1] Data only presented for 2011 and 2012.

B2.3 Innovation Output

As well as engaging with society through contract research or education, researchers today sometimes patent their findings, commercializing these through multiple routes. Researchers also form companies either based on patents, or other forms of intellectual property e.g. materials, software or experience. These activities, often referred to as "innovation activities", are listed in the tables below for the years 2007-2012.

B2.3.1. *Patents*[1]			
Patent number[2]	Short description	Person(s) involved at UoA	Date of registration

[1] Data should match that held in DiVA.
[2] Awarded patents only, not patent applications.

B2.3.2. *Founded companies*[1]				
Company name	Founder(s) from the UoA	Company type	Date of formation	Current status

1 Included eligible companies must be a direct result of the university's research activities and have, or have had, an annual income in access of 100 kSEK.

B3. Impact, Engagement and Co-operation in Research with Society

B3.1 Introduction

This section presents activities related to co-operation in research with society and the impact of such activities. It includes the unit's general approach to enable impact and engagement from its research, and also specific examples of impacts that have been underpinned by research undertaken by the UoA.

B3.2 PhD Degrees

The number of doctoral degrees (PhD, etc.) earned within the UoA during 2007-2012 when the awardee has been externally employed. Number of men ("M") and number of women ("W") are recorded per year.

Table B3.2.1. *Doctoral degrees awarded to students externally employed*

	2007		2008		2009		2010		2011		2012	
	M	W	M	W	M	W	M	W	M	W	M	W
Number of doctoral degrees awarded												
Number of licentiate[1] degrees awarded												
TOTAL												

[1] Licentiate is a Swedish and Finnish academic degree on graduate level corresponding to circa half a Swedish PhD

B3.3 Major Research Related Co-operation with Society

Activities regarding research related co-operation with society should be entered into one of three categories in the table below: Table 3.3.1 lists mobility between academia and non-academic society, such as exchanged lectures with external (non-academic) organisations, the engagement of adjunct professors, and externally financed PhD students in collaborative research projects with partners from industry or other organisations in society; Table 3.3.2 includes the number of publications co-authored with individuals outside of academic institutions, and popular publications aiming at the general public; Table 3.3.3 counts the number of external partners of the UoA separated between SME, large enterprises, and non-industrial partners; Table 3.3.4 summarizes the amount of in kind funding from industry and non-industrial organisations in society.

Table 3.3.1: *Mobility between academy and society*

	2007	2008	2009	2010	2011	2012
No. of collaborative doctoral students[1]						
No. of temporary research positions outside university[2]						
No. of adjunct researchers						

[1]Number of doctoral students in the UoA who are financed by non-academic external partners. Note that this does not mean doctoral students who are financed by any non-academic funding body, but students who are financed by external partners to the UoA (e.g. industry or public sector organisations).
[2]Permanent UoA personnel who migrate from the university to non-academic society

Table 3.3.2: *Outreach activities*						
	2007	2008	2009	2010	2011	2012
No. of scientific publications with representatives from society (not academia)						
No. of popular science publications (popular science magazines, including the internet)						

Table 3.3.3: *Collaboration Organisations (please provide description in A3.1.)*						
	2007	2008	2009	2010	2011	2012
No. of partners from industry (SME)[1]						
No. of partners from industry (non SME)						
No. of partners from society excl. industry and academia						
[1]Enterprise with no more than 250 employee and an annual turnover not exeeding 50 M €.						

Table 3.3.4: *Indirect external funding (in M SEK)*						
	2007	2008	2009	2010	2011	2012
Indirect funding from non-industrial organisations in society (in kind[1])						
Indirect external funding from industry (in kind)						
[1]value of working hours done by external partner, value of equipment, databases, software, laboratories etc. that external partners provide in joint research projects.						

Part C: Case Descriptions

C.1. Impact Case

The number of cases required in each submission is two (max.). The case should have been carried out during the period January 1st 2007 to December 31st 2012. Each case must provide details not only of the academic impact e.g. publications in highly ranked journals, but also describe the impact of the excellent research on society (on e.g. economy, industry, society, culture, public policy or services, health, the environment or quality of life, beyond academia).

Table C1.1.2. *Template for impact cases (maximum 4 pages)*
Title of case
Describe and provide evidence of the specific impact, including: an explanation of the nature of the impact how far-reaching the impact is/who the beneficiaries are how significant the benefits are
Explain how the UoA research activity contributed or led to the impact, including: an outline of what the underpinning research was, when this was undertaken and by whom what efforts were made by staff in the unit to exploit or apply the findings or secure the impact through its research expertise acknowledgement of any other significant factors or contributions to the impact
Provide references to: key research outputs evidencing the impact (list of publications, patents etc.) other external reports or documents, or contact details of a user, that could corroborate the impact and contribution of the UoA
Any other aspect the UoA wants to highlight

Appendix C. Terms of Reference

Instructions to the Experts of ARC13

Assessment of Research and Coproduction 2013 (ARC13) aims at identifying strong areas of research and successful research constellations in the broad spectrum of research at Halmstad University. As such, ARC13 will provide means to strengthen the quality of the scientific activities at the university by offering reliable background material for future strategic decisions. The evaluation will also support the units of assessment (UoAs) in their work on formulating plans for future research. The evaluation is aimed at assessing performance and prospects of the unit of assessment as a whole, not individual scientists. The reports and presentations from the UoAs (written and oral) on their own work constitute the basic material for the evaluation.

Objectives and Criteria of the Evaluation

The research of the University is organized in research centers and research specializations (named UoAs in ARC13) with a relatively heterogeneous research structure, in which research of diverse character is conducted. Each UoA has been assigned an expert panel. In those cases where research at different UoAs are sufficiently related, have these been grouped together to represent a research area that can be evaluated by one expert panel. The expert panels are constituted by both national and international experts in the field of their UoA and should work as a group to attain a collective assessment, making use of the complementary expertise among the members.

The expert panels are asked to assess the quality of research and collaboration in research of the UoA in a national and international perspective. In particular, the panels are asked to identify strong research and research with potential to grow strong. The evaluation does not intend to compare the UoAs at Halmstad University with each other. Instead, it aims at probing the standing of the UoA in national and international perspectives, reflecting the quality and potential of each UoA compared to that of research groups at other universities involved in the same research field. The quality rating applies to the research and collaboration presented to the panels, which may not include all activities. The report (one for each UoA) from the expert panel should be organized under the following ten headings:

1. General Assessment of the UoA

Give a brief account of the overall impression of the research conducted in the UoA.

2. Quality of Research

Quality of research includes the degree of international interest (reach) and the impact to the scientific community (e.g. in terms of citations), and publications in leading journals, conference proceedings and/or monographs. It is founded on the reputation and position of the unit within the community of researchers. The quality is assessed on the basis of the ability of the unit to achieve and present clear scientific analyses and new results. The assessment reflects the position of the unit in relation to the frontier of research.

3. Productivity

Productivity relates to the total volume of scientific publications of the unit. The quantification of production is evaluated by means of bibliometric indicators. Productivity includes also number of licentiate and PhD degrees awarded, and promotions of docents and professors. Productivity and its impact should be judged in relation to the number of researchers and their time available for research at the UoA.

4. Research Environment and Infrastructure

Comment on the research environment, its organization, the constitution of staff, its resources and their activities. Comment on the infrastructure, e.g. in terms of it being adequate and sufficiently available. Also comment on the research environment with respect to issues like diversity, synergies, multi- and interdisciplinary activities, outreach, demographic, gender profile and leadership. The research environment and infrastructure can be distributed, i.e. collaborators may provide key infrastructure. If this is the case, please comment on this and the research environment's ability to make use of these external resources.

5. Networks and Collaborations

Comment on the extension, quality of, and amount of collaboration in national and international academic networks. To what degree are academic partners integrated and contribute with their competence to joint research?

6. Coproduction and External Cooperation

Comment on the extension and quality of national and international collaborations with society except academia. To what degree are non-academic partners integrated and contribute with their competence to joint research? Evaluate the importance of coproduction and infrastructure provided by partners. Does the coproduction and cooperation improve the conditions for and the quality of the research?

7. Impact

Comment on the impact of UoA research on society. Specifically evaluate the significance, the reach and the benefits of the impact cases presented by the UoA.

8. Strategies and plans for development of the UoA

Assess the visions, goals and strategies of the UoA as well as their feasibility of realization and prospect for success. Comment on impressions of junior faculty activities. Comment on the UoA's development potential.

9. Experts' Views on Potential and Recommendations for Development

Give recommendations for further improvement of any aspect of the UoA with relevance for quality of the research.

10. Other Issues

Comment on other issues.

Grading the Research

Comment on the quality of the research from a national and international perspective, with emphasis on identifying strong research and successful constellations. Rate the quality of the research according to the scale given (insufficient to excellent) for the aspects under heading 2-8 above. The table "Grading scale" (see attachment) suggests criteria for the grades "Excellent", "Very Good", "Good" and "Insufficient".

The evaluation is done for different subject areas with perhaps different views on what constitutes appropriate criteria for these levels. The criteria table should therefore be considered as suggested criteria. If you feel that the criteria need to be modified for the specific research field that you are evaluating, then you are welcome to do such a modification as long as you document and motivate it in your report.

The following expressions for the rating of quality of research should be used:
Excellent – Excellent in an international perspective.
Very good – Very high quality that attracts wide national and international attention.
Good – Attracting national attention and possessing international potential.
Insufficient – The research is insufficient and publications have not gained wide circulation or do not receive national and international attention. Research activities should be revised.

In some cases, research of very high quality may not have been published outside of a national context due to traditions in the research field or within the research group. If you see examples of such research that should have been made available to the international research community, then please comment on this.

In all cases, the grading is for the UoA as a whole and you must decide on what grade that best describes the UoA. You are welcome to comment on individual research groups within the UoA if you feel that they warrant special attention, e.g. if they perform better than the overall UoA.

	Quality	Productivity	Infrastructure	Collaborations	Coproduction	Impact	Renewal
Excellent	Wide international attention, most prominent channels, internationally leading research.	Very high number of PhDs, promotions, and publications in relation to UoA resources.	Leadership, constitution of staff, activity, ability to attract external funding is excellent in all aspects.	The national and international collaboration is wide and relevant with very high quality partners. Academic partners that contribute to the research.	The collaboration with very high quality partners is wide and relevant regarding partner contribution to joint research. The research has high value with strategic importance for the external partners.	The research has international reach of high significance to society.	Strong, clear visions, and realizable strategies. Very promising junior faculty activities.
Very Good	International attention, recognized channels, nationally leading research.	Above average number of PhDs, promotions, and publications in relation to UoA resources.	Leadership, constitution of staff, activity, ability to attract external funding is very good in most aspects.	The national and international collaboration is wide and relevant with high quality partners. Academic partners that contribute to the research.	The collaboration with high quality partners is wide and relevant regarding partner contribution to joint research. The research has a high value for the external partners.	The research has international reach of significance to society.	Clear visions, and realizable strategies. Promising junior faculty activities.
Good	National attention, recognized channels, near the research front.	Average number of PhDs, promotions, and publications in relation to UoA resources.	Leadership, constitution of staff, activity, ability to attract external funding is satisfactory in all aspects.	The collaboration is wide and relevant. Academic partners contribute to some extent to the research.	Relevant collaboration partners. Non-academic partners contribute to the research. The research has value for the external partners.	The research has national reach of some significance to society.	Visions and strategies need some development. Sufficient junior faculty activities.
Insufficient	The research is insufficient and reports have not gained wide circulation or do not receive national and international attention.	Clearly below average number of PhDs, promotions, and publications in relation to UoA resources.	Leadership, constitution of staff, activity, ability to attract external funding is clearly unsatisfactory in several aspects.	The collaboration insuffiently developed.	The collaboration insuffiently developed.	Lack of reach, or minor significance of research to society.	Unrealistic or lacking visions and strategies.

Appendix D. Data Sources and Bibliometric Indicators

Data Sources

DiVA is the publication system (institutional repository) of Halmstad University. In this database, all research publications for the UoAs were registered.

Web of Science (WoS) is a bibliographic database from Thomson Reuters, Inc. that covers more than 12,000 scientific journals.

SciVerse **Scopus** is a database from Elsevier B.V. containing bibliographic data of about 20,000 peer-reviewed journals and 5.5 million conference papers.

The Karolinska Institutet bibliometric system is a database with citation statistics based on data from WoS and MEDLINE (the largest international database in biomedicine).

The Norwegian list documents publication channels (e.g. journals, series and publishers) for estimating scientific impact. Each channel is evaluated according to certain criteria established by the Norwegian Association of Higher Education Institutions. These qualified channels are divided into two levels: level 1, which includes approximately 80% of the publication channels in a given field, and level 2, which includes approximately the top 20% publication channels in the same field. For more information, see http://dbh.nsd.uib.no/kanaler/.

Bibliometric Indicators (Summary)

P_{DiVA}—Total number of publications in DiVA. The publication must be published (i.e. not submitted or in press) in order to be retrieved.

P_{rDiVA}—Number of publications in DiVA, author fractionalised. This is the sum of a unit's publications divided by the number of authors (for each individual publication).

p_{WoS}—Web of Science visibility. This factor is calculated by dividing the number of publications in WoS by the number of publications of the same type in DiVA for the same period.

C—Total number of citations. This is the sum of citations to all the unit's publications in WoS for the period 2005–2011. Self-citations are included.

p_{Scopus}—Scopus visibility. This factor is calculated by dividing the number of publications in Scopus by the number of publications of the same type in DiVA for the same period.

j_{cf}—Journals' field normalised impact. This indicator shows the journals' relative impact related to its field of discipline. The field normalised citation rate (cf) is calculated taking into account citations for each article published in the journal during the three preceding years, as well as the average field normalised citation rate for the subject area.

Then an average cf value is calculated for the journal. The international average value is 1.

JIF—Journal impact factor. This indicator for ranking of journals comes from Thomson Reuters. It is calculated based on a three-year period and can be understood as the average number of times published papers are cited up to two years after publication.

c_f—Average field normalized citation rate. This is calculated by first dividing the number of citations to each of the UoA's publications by the average number of citations to publications published in journals assigned within the same subject category in WoS, published the same year and of the same document type. Thereafter, an average of these citation rates is calculated. The international average value is 1.

p_{top10}—Share of publications among the 10% most cited in the field. This is the share of publications in WoS for the period 2005–2011 that are among the 10% most cited publications in journals of the same subject category, the same publication year and the same document type.

p_{top25}—Share of publications among the 25% most cited in the field. This is the share of publications in WoS for the period 2005–2011 that are among the 25% most cited publications published in journals of the same subject category, the same publication year and the same document type.

a_p—Authors per publication. The sum of the number of authors in DiVA divided by the number of publications.

pi_{WoS}—Publications co-authored internationally. This is the percentage of publications in WoS whose authors' addresses represent at least two different countries.

P_{lev1}—Number of publications published in level 1 channels—Norwegian list. See Data Sources (above) for a description of the list.

P_{lev2}—Number of publications published in level 2 channels—Norwegian list. See Data Sources (above) for a description of the list.

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