MER14
MDH:s Evaluation for improved Research quality

Research evaluation conducted at Mälardalen University in 2013-14
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Mälardalen University (MDH) is situated in the densely populated and expansive region around Lake Mälaren and is characterised by close partnerships with businesses and the public sector. Today, research is conducted within a fairly large number of subjects falling within MDH’s six different research specialisations.

Our academic quality must be internationally competitive, and at the same time the research needs to remain relevant to society and to the demands of first- and second-cycle education. However, a general trend in many countries, including Sweden, is to allocate an increasing share of the research funding on the basis of performance and perceived quality. This leads to competition between universities for both public and private funding. In this context, external evaluations, both national and self-initiated, are becoming increasingly important and common, and MDH must adapt to these new circumstances.

Thus, in order to identify excellent research as well as opportunities for improvement, and to be better prepared to handle future challenges, we have conducted our first self-initiated research evaluation. This evaluation, MER14 (MDH’s Evaluation for improved Research quality), is also an important part of MDH’s Research and Education Strategy for 2013–2016.

The evaluation was based on a peer review procedure. International scholars were invited to evaluate MDH’s past and present research performance as well as plans for the future, based on self-evaluations, bibliometric analyses and site visits. Two bibliometric analyses of research publications from MDH in the period 2008-2013 were undertaken, one Web of Science-based study by CWTS at Leiden University and one complementary study by the MDH Library.

Six expert panels, one for each research specialisation and with a total of 45 panellists, were appointed and made a site visit to MDH during one week in May 2014. These expert panels, as our critical friends, have been deeply committed to the task, and their generous sharing of advice, recommendations and conclusions is highly valued.

It should also be acknowledged that a research evaluation like MER14 puts considerable strain on the units to be evaluated. I want to express my appreciation of the professional work of the school’s management and faculty members, as well as other personnel, in carrying out the tasks that have been requested of them.

In this report, the background, the process and the results of the evaluation are presented. The panel reports show that, overall, the quality of research at Mälardalen University is good and that we have been successful in our ambition to conduct research through close partnerships with businesses and the public sector.
The results from MER14 will now be analysed at several levels within MDH: from the University Board, via the schools and divisions, to individual researchers and staff. Information gathered during the evaluation will also be used to develop MDH’s next Research and Education Strategy, and it will provide input for future strategies and decisions by the MDH schools.

I would like to conclude by thanking everyone who took part in our research evaluation. It is inspiring to note that in many cases MER14 has already been regarded as an opportunity to discuss and formulate visions, strategies and strengths.

Västerås, August 2014

[Signature]

Dr. Karin Röding
Vice-Chancellor, Mälardalen University
Executive Summary

The assessment panels were very impressed by the commitment of MDH to growing and developing research and scholarship, and commend the University for the bold step of inviting international, expert study of its research in such a wide-ranging review. They greatly appreciate the warm welcome that they received from the staff and students of the University, and the opportunity to meet in an open and collegial atmosphere in which staff were willing to discuss issues and happy to receive feedback. They also appreciate the thorough and detailed information that they were provided in advance of the meeting.

MDH is a national university with a regional focus and a significant emphasis on teaching. It is also a young university, and its research groups are at a number of different stages of development. In some subjects there are well-established, influential and highly productive research teams of world-class standing, for example in embedded systems and future energy. In other subjects, high quality, productive research is done but perhaps without the concentration of effort to be world-leading. In other subjects the research is less well-established, with areas of lower productivity and impact. The panels felt that, despite the diversity, there was justification across the subject areas for some optimism. A number of the less strongly performing sub-groups were on a clear upward trend. Staff showed good understanding of the challenges faced, and there was a widespread openness to suggestions to guide the future development of research. In this regard the assessment panels were able to make a number of recommendations to assist the University and its staff and students in achieving their ambitions.

A number of solid foundations exist on which the development of MDH’s research can be built. A good standard of work environment is enjoyed in terms of buildings, accommodation and library facilities, and in the information technology and logistical resources, and the new campus development in Eskilstuna promises exciting opportunities. The location of the university in the Mälardalen region offers proximity to large multi-national industries, active SMEs and enthusiastic regional organisations, municipalities and county councils etc. This creates a rich and supportive environment for collaboration that MDH has been very successful in exploiting through its ‘co-production’ strategy. And at the heart of any university are its people, in which regard the panels were fortunate to meet dedicated and enthusiastic staff and confident and articulate research students that gave the strong impression of a diverse and vibrant community of scholars.
The panels had recommendations for the development of each of these foundations. Firstly, a strategy is needed to ensure that future facilities will be able to support planned research activities as they expand, and the other aspects of the environment need regular review to ensure that research has the appropriate level of support. Secondly, while very good examples of co-production were seen, the concept was not always well understood or articulated. For some panels the difference between co-production and the more conventionally used collaboration or co-operation was initially not clear, although it came to be understood as a direct and true cooperation in projects, not only data transfer, advice, explanation of industrial views, etc. In this regard the concept of co-production might be more systematically applied in the University’s research, but there is a note of caution: in a number of subjects the research portfolio is rather dominated by an opportunistic industry-project-oriented approach that may limit opportunities for concentration of important research threads. Thirdly, research staff and doctoral students need assistance and support in their professional development. Academic leadership should be strengthened in areas such as mentoring and career development advice, guidance in the preparation of proposals and in achieving high standards of rigour in academic publication, and opportunities to engage with their national and international peers and to participate in external collaborations and research visits.

A key issue reported by a number of panels concerned allocation of sufficient resource to research to achieve a critical mass of activity. A number of research themes are pursued by small groups of academic staff, sometimes working in relative isolation, and there is significant dependence on a small number of senior staff. Some groups are vulnerable to the loss of key staff to retirement or to external actors. The situation is compounded by the relatively small amount of time that some staff have available to devote to research, and thus careful management of staff time, by the University, and by the staff themselves, is necessary to protect research time. Two further resource issues concern the availability of doctoral studentships and of research funding. In some aspects of the University’s work studentships are plentiful, especially industrial and (in certain subjects) public sector studentships, although the flow of studentships may vary somewhat with time. In other areas the availability of studentships is a significant constraint. The level of research funding in some areas is quite high, especially with (in-kind) industrial support or through research councils and foundations. However, the overall level of research funds available to the University is low, and research finances are made more challenging by the project and PhD funding rules that pertain in Sweden and by the somewhat uneven distribution of research funding between older and newer universities. This all merits a continued careful dialogue with government, regional and industrial funders.

Research focus and leadership, the achievement of critical mass by research teams, the balance between project-driven research and more long term hypothesis-driven research, and targets for research funding are all strategic issues and in this regard the panels recommended more systematic consideration, aided for example by the establishment of Research Committees to assist Research Directors, and Advisory Boards for those groups with extensive external stakeholders. Other important strategic issues include clear criteria and operational procedures for assessing research productivity, a framework for setting of targets for individuals and teams to achieve (and associated reward mechanisms) and systematic methods for reporting research outputs and impacts, the latter with a view to preparing for national research assessment exercises.
A further strategic issue concerns engagement of the research teams with the national and international peers. The leading groups at the University have a continuous flow of international visitors as well as visits by MDH faculty and PhD students to universities abroad. The whole University should aspire to such practice, and to engagement with international academic societies including the hosting of conferences and other research meetings. Routes to wider research collaborations, for example funded by the European Commission, would be a fruitful topic for discussion with the University’s coproduction partners.

Finally, while the assessment panels concentrated principally on research within subject areas, it was clear that there would be significant merit in exploring what opportunities exist for interdisciplinary collaborative work between the subject areas, for example the use of embedded systems in healthcare or assistive technologies, or eco-innovation through combination of work in future energy systems with innovation and produce realisation. National and international research is increasingly directed at societal grand challenges. MDH has the mix of expertise to make significant contribution to tackling these.

August 2014

Chris McMahon
Chair for the IPR-panel, on behalf of the Chair group
Chapter 1:
Introduction

1.1 The context of MER14
Research and higher education have become increasingly significant and are often seen as an important vehicle to facilitate economic growth, knowledge and democracy. The number of universities and research institutes has increased in many countries during the last decades, and in 2014 at least 18,000 university-level institutions can be found around the world. With a corresponding increase in the number, and global mobility, of students and researchers, strategic planning and resource allocation have become more intricate both on the national and on the institutional level.

In the last decades, different systems have been tested and introduced to both evaluate and allocate resources to research and higher education. In Sweden, research evaluations started in the late 1970s, with national evaluations of the natural sciences, economics, sociology, etc. These evaluations were carried out by the different research councils, but without direct links to research funding.

In recent years, an algorithmic model has been introduced to reallocate direct government funding for university research. Initially, 10% of the research funding was reallocated based on the different universities’ ability to attract external funding and their success in citation analysis. The reallocation frame will now be increased to 20% of the research funding, and the national model is expected to also include elements of external peer review from 2016.

Apart from research, higher education too has been subject to evaluations by national bodies. The focus and scope of these education evaluations have shifted, but the current Swedish system also includes some reallocation of funding based on quality estimates.

In addition to these national evaluations, self-initiated assessments of research and/or education have been conducted by most Swedish universities in order to measure and improve quality or to allocate resources internally. More comprehensive, self-initiated research evaluations of whole universities started at Uppsala University in 2007 and have since then been conducted by at least 12 Swedish universities; see Table 1.
Table 1: Swedish universities which have conducted self-initiated research evaluations where all research activities are assessed simultaneously

<table>
<thead>
<tr>
<th>University</th>
<th>Self-initiated research evaluation conducted (year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uppsala University</td>
<td>2007 and 2011</td>
</tr>
<tr>
<td>Lund University</td>
<td>2008</td>
</tr>
<tr>
<td>KTH Royal Institute of Technology</td>
<td>2008 and 2012</td>
</tr>
<tr>
<td>Swedish University of Agricultural Sciences</td>
<td>2009</td>
</tr>
<tr>
<td>University of Gothenburg</td>
<td>2010</td>
</tr>
<tr>
<td>Örebro University</td>
<td>2010</td>
</tr>
<tr>
<td>Karolinska Institute</td>
<td>2010</td>
</tr>
<tr>
<td>Mid Sweden University, Halmstad University, University of Skövde</td>
<td>2013 (partially financed by the Knowledge Foundation)</td>
</tr>
<tr>
<td>Blekinge Institute of Technology</td>
<td>2013</td>
</tr>
<tr>
<td>Mälardalen University</td>
<td>2014</td>
</tr>
</tbody>
</table>

Most of these general research evaluations have followed the same basic layout, with self-evaluations and external bibliometric analysis supplemented by a peer review assessment from international panels. Several other Swedish universities are considering or planning similar research evaluations, while others are awaiting the final layout of the new national model, expected to be decided by the Government in 2015.

Trends influencing Swedish universities are, for instance, changing conditions for research funding with less direct government funding and more competitive external funding through public or private bodies. In many cases, universities are also expected to cooperate when making proposals for research projects, and to develop their research facilities and milieus based on clear and long-term priorities and plans.

Mälardalen University has, in its Research and Education Strategy for 2013-2016, specified a number of priorities, including a strategy model with six research specialisations on different levels of ambition. The strategy model is not an issue of statistics, but by recurring evaluations and follow-up MDH intends to develop its research activities.

The strategy model forms the basis for internal allocation of funding for research and third-cycle programmes, taking into account research base and performance, but also additional funding for the centre of excellence and the three development environments, as well as temporary strategic support when justified. The MER14 research evaluation is one important step in estimating the fulfilment of MDH’s research strategies and priorities, as well as finding new options to further improve the research quality in the years to come.
1.2 The MER14 report

The main part of the present report comprises the panel reports that were produced during and after the site visits by six expert panels. Another major part of the report are two bibliometric analyses conducted, one by CWTS/Leiden University and one complementary analysis by Mälardalen University (MDH) Library. The Appendices describe some important decisions and instructions on which the evaluation was based.

The six panels, one for each research specialisation, were encouraged to use a specific report template when formulating their conclusions and recommendations, but else were free to choose how to document their work. However, due to different characteristics, scopes and prerequisites of the research specialisations evaluated, the panel reports differ in form. Since the goal of the MER14 evaluation was not to compare the research specialisations with each other, but rather to estimate the scientific level of each compared to other similar milieus at other universities, this poses no problem for MDH. It should, nevertheless, be pointed out to external readers of the report, who might be confused by the diversity regarding the panel’s reports.

It should also be pointed out that no attempt has been made to present a summary of the reports by the different panels, to avoid evaluating and selecting specific conclusions and recommendations from the panels. However, the Executive Summary has summarized the panel work and main conclusions from the perspective of the panel chairs.

Before turning to the panel and bibliometry reports, the evaluation will be put in context by briefly summarizing the Swedish system of research and higher education, as well as some characteristics of Mälardalen University. In addition, the planning and implementation of MER14 will be described in more detail.
Chapter 2:
Mälardalen University and the Swedish system of research and higher education

2.1 The Swedish system in brief

There are today some 50 higher education institutions (HEI’s) in Sweden, compared to just a few such institutions a half-century ago. In the latter part of the twentieth century, there was a huge expansion of HEI’s and the student population grew enormously to the present level of some 360,000 students. Institutions were founded throughout Sweden to enable access to higher education for everyone.

Sweden’s national target has been that 40-45 per cent of all 30-34-year-olds should have at least two years of tertiary education by 2020. As a result of the expansion of higher education since the 1990s, this target has already been met. According to an EU follow-up, 48 per cent of 30-34-year-old Swedes had at least two years of tertiary education in 2013.

In terms of the numbers of employees, 65,000, higher education (HE) is also the largest public sector in Sweden. The overall expenditure for HE is more than SEK 60 billion, or just under two per cent of Sweden’s GDP.

The Swedish system can be said to be based on the Humboldt principle that research and higher education should exist in parallel. The business and corporate sector, however, accounts for most, or around 75%, of the research spending in Sweden, concentrated in a small number of multinational companies, such as ABB, Volvo and Ericsson. Research that is not pursued by industry is concentrated to universities. The number of research institutes is very limited, which distinguishes Sweden in international comparison.

2.1.1 Swedish universities

Of the 50 HEI’s in Sweden, 34 are universities. In addition, there are some smaller institutions within theology, psychotherapy, caring sciences, etc., that are private or run as foundations. The majority of the universities are public authorities, subject to the same legislation and regulations as other public authorities in Sweden, as well as the particular statutes and regulations relevant to higher education.

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1 Primarily based on Higher education in Sweden – 2014 status report (Swedish Higher Education Authority, 2014)
Of the 34 universities, eleven can be categorized as old ones, five as middle-age, and 18 as new ones. The prerequisites for these vary significantly when it comes to size, funding levels or the right to issue degrees. Table 2 summarizes typical numbers for some key figures related to these different types of universities. Mälardalen University (MDH) is one of the 18 new universities in Sweden.

Table 2: Typical numbers/ intervals for some key factors related to the different types of universities in Sweden. Numbers for MDH in parentheses. (Source: Swedish Higher Education Authority: Higher education in Sweden – 2014 status report)

<table>
<thead>
<tr>
<th>Type of HEI</th>
<th>New</th>
<th>Middle-age</th>
<th>Old</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of first- and second-cycle students (2013)</td>
<td>5,000-10,000 (MDH = 9,093)</td>
<td>10,000-15,000</td>
<td>15,000-30,000</td>
</tr>
<tr>
<td>Total number of degrees, first- and second-cycle students (per year)</td>
<td>1,000-2,000 (MDH = 2,013)</td>
<td>1,500-2,500</td>
<td>2,000-6,000</td>
</tr>
<tr>
<td>Teaching and research staff (FTE)</td>
<td>300-400 (MDH = 434)</td>
<td>500-600</td>
<td>1,500-3,000</td>
</tr>
<tr>
<td>Funding, total (MSEK)</td>
<td>400-600 (MDH = 845)</td>
<td>1,000-1,500</td>
<td>3,000-7,000</td>
</tr>
<tr>
<td>Ratio of &lt;funding for research&gt; / &lt;funding for education&gt;</td>
<td>0.2-0.4 (MDH = 0.35)</td>
<td>0.5-0.7</td>
<td>1-4</td>
</tr>
<tr>
<td>Third-cycle (PhD) students</td>
<td>50-150 (MDH = 202)</td>
<td>300-500</td>
<td>1,000-3,000</td>
</tr>
<tr>
<td>PhD degrees (per year)</td>
<td>=10 [1/month] (MDH = 11)</td>
<td>=50 [1/week]</td>
<td>&lt;300 [1/day]</td>
</tr>
</tbody>
</table>

As can be seen from Table 1, the numbers of first- and second-cycle students are on comparable levels. However, staff numbers, total funding, ratio between research and education funding, and numbers of third-cycle students and degrees typically differ with a factor of >10, between new and old universities.

The degree of freedom for the new universities is limited, especially within research. The data show that the resources for research are limited more in the new universities. The limited research funding from the government is difficult to compensate for by external funding which often requires co-financing with own resources.

2.1.2 Education versus research
An increasingly important role is played by research in higher education. For a number of years, Swedish HEI’s have experienced a period of expansion with rising revenues, but it is mainly funding for research that has increased; see Figure 1, and it has mainly been distributed to the larger universities.
For several years the Swedish state has been making major investments in research and their impact has taken the form of a substantial increase in the resources for research at the HEIs. The reforms that have affected courses and programmes, however, have mainly been funded through different types of reallocation. This development continued in 2013, when revenues for research and third-cycle courses and programmes rose more than for first and second-cycle courses and programmes. The difference in developments in the two different areas was not as obvious as in the previous two years but still large enough to further extend the gap between courses and programmes on the one hand and research on the other.

The HEIs’ revenues in 2013 totalled SEK 62.8 billion, which in current prices is SEK 1.7 billion more than in the previous year. Of the total sum, 57 per cent was for research and third-cycle courses and programmes. In 2003 the corresponding proportion was 53 per cent. In other words there has been increasing emphasis on research in the higher education sector.

The total expenditure of the HEIs on their operations in 2013 amounted to SEK 62.5 billion, which corresponds to 1.7 per cent of Sweden’s GDP. This is the same proportion as in 2012. In addition to these operating costs there were also the costs incurred for student finance (SEK 11.1 billion) and for central agencies in the higher education sector (SEK 0.5 billion). Altogether, expenditure in the higher education sector totalled SEK 74.1 billion. This is somewhat less than in 2012, which can be explained by a drop in the costs for student finance because interest payments on loans are now being handled in a new way. Expenditure on the higher education sector in 2013 corresponded to 2 per cent of GDP.

There is a substantial difference between the ways funding is provided for research and third-cycle courses and programmes and for first and second-cycle courses and programmes. Alongside its direct allocation to the HEIs the Government channels a large share of the resources for research through agencies that provide research funding. In addition, research funding is also provided by many foundations and other sources.

The funding received by most HEI’s for education is based on student full time equivalents (FTEs) and annual performance equivalents (APEs). There is no national guideline specifying the number of allowed student slots to be offered in higher education. The HEI’s themselves largely decide what courses and programmes they will offer, with different compensation for different subject areas, but funding “caps” set the maximum amount that each HEI may receive for education purposes.

Sweden used to offer higher education without charges, in the sense that no fees were paid by the individual student once admitted to a study programme or course. However, since 2011 students from countries outside the EU/EEA must pay tuition fees. The Government cut the funding allocated to the HEI’s in connection with this reform, since tuition fees were expected to provide an alternative source of funding for universities. Even if fee revenues are rising, they matched only about half of the corresponding cuts in 2013.
2.1.3 Research funding
Research and third-cycle courses and programmes are funded directly by the Government but also by different external sources; see Figure 2. The public sector finances research with grants paid directly to HEI’s and with funding channelled through research councils and sectorial research agencies. The latter type of funding is dependent on political decisions but in most cases allocated competitively. The Swedish Parliament grants research funds in all of the ministries’ areas of responsibility, not only in higher education.

Other external sources of funding for research are the public foundations established in the mid-1990s, municipalities and county councils, and also the EU. However, a significant proportion of the research at HEI’s in Sweden is funded by the private sector, primarily by private foundations and non-profit organisations.

A long-term trend has been that the proportion of external sources (research councils, foundations, EU, etc.) has grown, while the proportion of direct government funding has decreased. In the beginning of the 1980’s, typically 70% was direct government funding for research, while in 2012 this share had decreased to 40%.

For Mälardalen University in 2013, 139 MSEK of the research funding was external, in the form of grants and assignments, while 78 MSEK (36% of the total funding) was direct government funding.

Figure 2: Revenues by Swedish HEI’s for research and third-cycle/PhD courses and programmes 2003-2013, SEK billions in 2013 prices (Source: Swedish Higher Education Authority: Higher education in Sweden – 2014 status report, p. 55)
2.2 Mälardalen University (MDH)

Mälardalen University was founded in 1977, then as the University College of Eskilstuna/Västerås, in response to the regional need for engineering education and with ABB and other major industries as promoters. In the 1980’s, a group of programmers from ABB moved to MDH and initiated education and research in robotics and programming. In 1990, MDH became the third-largest engineering educator in Sweden after KTH Royal Institute of Technology and Chalmers Institute of Technology. During the 1990’s, a rapid expansion took place, including education in health care and education, and new research areas.

A few facts about MDH, as of 2014, are the following:

- Education and research across four schools - Business, Society and Engineering; Education, Culture and Communication; Health, Care and Social Welfare; and Innovation, Design and Engineering;
- 51 study programs and some 1,000 single-subject courses within four educational areas: economics, health and welfare, teacher education, and engineering.
- The following programmes are taught in English:
  - Bachelor’s programme (3 years, 180 credits) in Analytical Finance; and International Business Management
  - Master’s programme (2 years, 120 credits) in Financial Engineering; Innovation and Design; Intelligent Embedded Systems; Product and Process Development - Production and Logistics; Software Engineering; and Sustainable Energy Systems. A new Master’s programme in Health and Social Welfare is planned to start in 2015
  - Master’s programme (1 year, 60 credits) in International Marketing; and Software Engineering
- Some 13,000 undergraduate and graduate students enrol for classes, corresponding to about 7,400 full-time students
- 900 employees, including 70 professors
- Some 150 international collaborative agreements in 40 countries
- Turnover (2013) of 845 MSEK; 26 % of which for research and graduate education
- External research funding accounts for 64 % of the total funding for research and postgraduate (doctoral) education
- Postgraduate education includes over 200 doctoral students, of whom 70 are external (employed for instance by industry, county council, etc.)
- Postgraduate education is organized into six areas in which the university has been granted degree-awarding powers for research studies: Didactics; Embedded Systems; Environment, Energy and Resource Optimisation; Health and Welfare; Industrial Economics and Management along with Work Life Studies; and Innovation and Product Realisation

Mälardalen University is a government authority, directly subordinate to the government. The University Board is the University’s supreme governing body and the Vice-Chancellor reports directly to the Board.
The Faculty Board has overall responsibility for education and research at MDH. This includes handling matters of strategy and planning as well as follow-up and quality assurance. The head is the Dean of the Faculty Board, with support from two Pro-Deans of the Faculty Board. The Faculty Board has subcommittees, handling matters for the Board, as well as taking certain decisions with delegation from the Board.

Since 2008, MDH is organized in four schools with two main campuses, in the cities of Västerås and Eskilstuna. At MDH, a school is the organisational unit where higher education and research are conducted and it is led by a Dean of School, appointed for four-year terms by the Vice-Chancellor. Each school is divided into divisions, but on the whole each school can be organized in accordance with its own needs.

Some functions or positions are mandatory to have at school level, to ensure a similar management structure, for instance a Director of Studies and a Director of Research. The Director of Research, one per research specialisation, is responsible for developing research and postgraduate activities, and to coordinate research funding.

### 2.2.1 Strategy for MDH 2013-2016

The vision of Mälardalen University is to be the leading higher education institute in Sweden for excellent co-production and co-creation with different societal actors, both internationally and nationally, by 2016.

In accordance with the Research and Education Strategy for the period 2013-2016, MDH will concentrate its efforts on continuing to develop research-based education as well as educationally relevant research of value and benefit to society by means of co-production and internationalisation.
2.2.2 Focus and challenges
Focus activities 2013-2016 include:

- Continued development of the education portfolio
- Quality of education at all levels
- Research evaluation MER14
- Diverse research funding
- More co-operation agreements
- Planning a new campus in Eskilstuna

After 35 years of close co-operation with the surrounding community, MDH has unique experience and a high level of competence. Within the “Social Contract” (Samhällskontrakten), MDH together with the municipalities of Eskilstuna and Västerås has developed structures for co-creation in the areas of education, health and welfare, and sustainable urban development.

Other examples are the long-term co-operation agreement between MDH and ABB Sweden, which will be a springboard for new research projects involving several of MDH’s schools, the appointment of MDH as “Academic Preferred Partner” by the Volvo Group (globally), within the areas of Production System Development and Embedded Systems, and the strategic cooperation agreement regarding research and education issues between MDH and Bombardier.

2.2.3 School of Business, Society and Engineering
The School of Business, Society and Engineering is an interdisciplinary environment with education and research that range from the social sciences to business and technology.

About 2,000 students study at the school, and some 120 faculty and staff are employed. The total research funding in 2013 was 44 MSEK.

CURRENT RESEARCH AT THE SCHOOL
Industrial Economics and Organisation - covered by panel 4 in the evaluation

The school comprises a wide range of research areas within economic sciences. The research covers six subjects:

- Marketing
- Organisation
- Accounting
- Commercial Law
- Economics
- Political Science

The group participates in the national Swedish graduate Research School of Management and Information Technology, which focuses on research at the intersection between business studies and informatics.

Future Energy Center - covered by panel 5 in the evaluation

The research in Future Energy is organized within three key tracks:

- Renewable energy, primarily solar power and bioenergy conversion
- Energy efficiency and emission mitigation in electricity, industry, transport and the building and commercial services
- Smarter modelling/optimisation and management of energy systems, to provide robust tools for diagnostics, advanced control, and load management
2.2.4 School of Education, Culture and Communication

The School of Education, Culture and Communication offers subject studies in languages (English, German, Swedish), comparative literature, intercultural communication, chamber music, didactics, and mathematics and physics.

About 2,500 students study at the school, and some 190 faculty and staff are employed. The total research funding in 2013 was 31 MSEK.

CURRENT RESEARCH AT THE SCHOOL - covered by panel 6 in the evaluation

The school comprises a wide range of research areas within educational science and mathematics/applied mathematics. The research is divided into five research environments:

- Children and young people in school and in society (BUSS)
- Mathematics, science and engineering education (MNT)
- Language studies and comparative literature including subject didactics (SOLD)
- Society, interculturalism, leadership and evaluation (SILU)
- Mathematics/Applied Mathematics (MAM)

2.2.5 School of Health, Care and Social Welfare

The School of Health, Care and Social Welfare is mainly organised around the subjects caring sciences, health care education, medical science, public health sciences, physiotherapy, social work, sociology, and psychology. The school is one of Sweden’s largest educators of nurses, with over 280 nurses graduated each year.

About 3,000 students study at the school, and some 200 faculty and staff are employed. The total research funding in 2013 was 27 MSEK.

CURRENT RESEARCH AT THE SCHOOL - covered by panel 1 in the evaluation

Co-operation with society at large, for instance counties, municipalities, patient organisations, as well as other educational institutions, is considered important for the research. Within the health and social welfare area there are five research environments:

- Children and youth research (ICU-CHILD)
- Health and welfare in multicultural working life
- Individual centred research milieu
- Innovation and implementation research
- Older people’s health and welfare

2.2.6 School of Innovation, Design and Engineering

The School of Innovation, Design and Engineering carries out research and educates in the areas of innovation, computer science, embedded and real-time systems, robotics, electronics, innovation, entrepreneurship, product and process development, network technology and aeronautical engineering.

About 1,300 students study at the school, and some 220 faculty and staff are employed. The total research funding in 2013 was 106 MSEK.
CURRENT RESEARCH AT THE SCHOOL

Innovation and Product Realisation (IPR) - covered by panel 3 in the evaluation

IPR combines research on art and design, engineering, and innovation/entrepreneurship, with a common focus on design science and by the shared Centre for Product Realisation. The main objectives of the centre are to support the companies and other actors in their development of products and services, and to provide the prerequisites for innovation, competitiveness and growth in our society.

Intelligent Sensor Systems (ISS) and Mälardalen Real-Time Research Centre (MRTC) - covered by panel 2 in the evaluation

ISS conducts research within artificial intelligence, biomedical engineering, robotics, and wireless communication. The focus is on applied research on mobile and wireless sensor systems within two application areas: health technology and industrial systems.

MRTC conducts research in computer science, computer engineering, software development and some electronics, with a shared focus on industrial applications such as automation, vehicle systems, and telecommunications. MRTC has its research focus on embedded software, to provide research that enables industry to take advantage of software in products and production systems.
Chapter 3:
About MER14

3.1 Introduction

In “Mälardalen University’s Research and Education Strategy for 2013-2016” (p. 10), approved by the University Board of MDH, it is stipulated that an external evaluation should be carried out of all the university’s research specialisations. The Vice-Chancellor made the formal decision on implementation and conditions regarding a research evaluation on 28 May 2013; see Appendix 1. The name for the evaluation project was determined to be MER14 (MDH’s Evaluation for improved Research quality).

The primary goal of MER14 was to evaluate all of the research at MDH in order to identify strong areas of research and successful research constellations, thereby supporting the preparation for the next Research and Education Strategy. The evaluation was designed to provide means to strengthen the quality of the scientific activities by offering reliable background material for the decision-making processes in the future. It would also offer research specialisations and schools support in their own work on formulating plans for the future. MER14 was, furthermore, intended to be a learning process, in preparation for the expected future national evaluations. The evaluation was not aiming at comparing different disciplines within the university with each other.

Probing prospective potential in research is certainly more difficult than assessing past performance. The latter can be estimated through different forms of result, impact or prestige indicators or measurements. This rear-view mirror perspective is, however, of less relevance in predicting future performance. One obvious aid when looking forward is to rely on conclusions from critical friends in the form of peers. Assessment by expert panels of opportunities for renewal and development can be of vital importance for the strategic planning of research.

Subsequently, the MER14-evaluation is based on several pillars: an internal self-evaluation exercise, internal and external bibliometric analyses, and an external peer review in which invited experts during a week-long visit to MDH got a comprehensive view of conditions, activities and achievements in research. The expert panels had access to the bibliometric analyses, as a complement to presentations by and discussions with the research milieus at MDH.

A total of 45 international experts from 18 countries, forming six different panels, evaluated the research carried out within the university’s six research specialisations. Each panel consisted of
a chairperson, at least one Swedish panelist from another university (to contribute with knowledge of the Swedish research system), and 4-7 other experts. 36% of the panelists were women.

The overall time schedule is presented in Figure 4, and in what follows, the different elements of the research evaluation are described in more detail.

<table>
<thead>
<tr>
<th>Time schedule MER14</th>
<th>2013</th>
<th>2014</th>
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<tbody>
<tr>
<td>Establish project organisation, time schedule etc</td>
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<td>Define units of evaluation</td>
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<tr>
<td>Create template for self-evaluation</td>
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<tr>
<td>Nomination/invitation of international panelists</td>
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<td>The research specialisations engage in self-evaluation</td>
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<td>Compilation of indicators and ratios</td>
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<tr>
<td>Bibliometric analyses are conducted</td>
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<tr>
<td>The evaluation panels visit MDH (19-23 May)</td>
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<tr>
<td>Panels submit their final panel reports</td>
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<tr>
<td>The final report is assembled and printed</td>
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<tr>
<td>Final reviews and project wrap-up (31 October 2014)</td>
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<tr>
<td>Follow-up - Seminars, workshops, and so on</td>
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Figure 4: Time schedule for the planning and implementation of MER14

3.2 Project organization

3.2.1 Project management
The project was initiated by the University Board and the Vice- Chancellor; see Figure 5.

The major work effort was carried out by individual researchers, groups, and management at the schools and research specialisations as they analysed and compiled the data to be sent to the panels beforehand. They also prepared and made presentations of their research activities during the site visits.
A dedicated steering group was appointed to the project, with meetings once a month. Members of the steering group were initially, during 2013:

- Paul Pettersson, Deputy Vice-Chancellor (Chair)
- Peter Dobers, Dean of the Faculty Board
- Yvonne Eriksson, Pro-Dean of the Faculty Board for research and third-cycle studies
- Peter Gustafsson, Pro-Dean of the Faculty Board for first- and second-cycle studies
- Annsofie Oscarsson, Director, MDH Library
- Malin Gunnarsson, Director, Division of Education and Research Administration
- Niklas Ulfvebrand/Johannes Rytzler, Doctoral students

A new faculty board was elected in 2014 and the following members were supplemented to the steering group:

- Lene Martin, Dean of the Faculty Board (newly elected)
- Anne Söderlund, Pro-Dean of the Faculty Board for research and third-cycle studies (newly elected)

During 2014 Lisa Petersen took over as Library Director, and subsequently replaced Annsofie Oscarsson in the steering group, while Sara Cederbom replaced the earlier doctoral student representatives.

The day-to-day tasks of MER14 were managed by a project team with the following members:

- Project Manager: Professor Roland Svensson
- Deputy project manager: Professor Monica Bellgran (until February 2014)

**Project support**

- Project Coordinator: Per Andersson
- Bibliometrics Coordinator: Per Nyström and Viktor Öman
- Event Coordinator: Karin Engström
- Web Coordinator: Anna Ax Andersson and Per-Arne Hermansson
- Graphic Designer and Final Report Editor: Erika Johansson

Further support to MER14 was given by many employees in the University administration, by administrators in the different schools, and also by a group of student guides during the site visit.

In connection with the administration of the external panel visit, the project team was supported by Academic Conferences, a professional academic event organizer based in Uppsala. CWTS in Leiden University was contracted as external supplier of bibliometric analysis.

### 3.2.2 Method of evaluation

The background material made available to the external panels contained self-assessment documents, facts and figures relating to activities, selected and representative publications, and CV’s of MDH researchers. The week-long site visits were considered necessary in order for the panel to acquire an in-depth opinion about the status and future plans of the various research milieus.

The review work was distributed across six expert panels with an average of eight panellists in each panel, in total 45 panellists (another five panellists had to withdraw, for various reasons, shortly before the site visit).

Each expert panel had a chairperson who was responsible for the panel work and for the writing of a report summarizing the recommendations and conclusions of the panel. Prior to the visit, the panel chairs were invited to participate in selecting the other panel members, and to discuss
the schedule of the site visit. The panel report was written in a format defined by a template, and the main conclusions were presented by the panels to the MDH management at an exit interview on the last day of the visit. The panels then had three additional weeks to finalize the panel reports before submitting them to MDH.

3.2.3 Project portal and web

The project used an Internet portal in order to make information available to the panel experts. MER14 used a read-only adapted portal in Blackboard®, a tool used widely at MDH by teachers and students. Panel members could access the portal which contained self-evaluation documents, selected publications, CV’s of MDH researchers, terms of reference and other background material (see further below).

The project portal offered an efficient means to collect and distribute information and documents. It facilitated the work of the panellists in terms of reading background material, as this was available from any location with Internet access, on smart phones etc.

Furthermore, an internal MDH web page provided general information in Swedish and English about the project, as well as access to all the documents that were produced in the course of the evaluation.

3.3 Defining units of evaluation

A school at MDH is a “legal” unit in the university organisation and thus suitable for handling the various phases of the evaluation process. However, after internal discussions it was decided that the primary units of evaluation (UoE) for MER14 should be the six research specialisations; see Figure 6. The research specialisations are fairly focused with regard to research activities, and each specialisation has an appointed Director of Research that could act as coordinator on the UoE level. The school management still had an important role, since formulating a condensed written self-evaluation could require elements of negotiation, and two schools were also represented by two different research specialisations.

Figure 6: MER14 primary units of evaluation

To define sub-environments, or sub-groups, within each primary UoE proved to be a more laborious task. Some UoE’s were divided by subject, other more according to processes or projects, etc. After proposals from the schools, the final layout was decided by the steering group; see Figure 7.
3.4 Selecting experts

The strategy for the recruitment of the expert panels was to gather a number of international panellists complemented by at least one member per panel from another Swedish university than MDH. The panel chair should be a well-recognized generalist researcher with a high degree of integrity and experience. Initially, six panels with eight panel members each were anticipated. The panels were planned to be set up with an even gender distribution in mind – at least three panellists of either gender should be included in each panel of eight. A document specifying the requirements for panellists to be nominated is found in Appendix 2.

The assignment of evaluators for research is a delicate task in the sense that panellists should have a high degree of competence along with integrity. The panellists should also be trusted and accepted by the researchers to be evaluated, and not incite claims of conflicts of interest. In MER14, the directors of research for each research specialisation coordinated the compilation of a list including 20-25 panellists in order of priority for each specialisation. This process required cooperating closely with professors and senior researchers within the specialisation. Nominations were generated in different ways: from within the research specialisation, through recommendations from external fellow researchers, and from lists of (proposed) panellists in other Swedish research evaluations.

Each panel chair was selected first, and the panel chairs were invited to participate in the process of selecting the rest of the panel. The nominees were screened by the project management with respect to conflict issues, and in a few cases nominees were found to be disqualified due to too close associations. For instance, a waiting period of at least five years after co-publications between MDH researchers and panellists was verified in Web of Science and Scopus before invitations were sent out. Searches were also made for participation in common projects, as well as funding overlaps. Panellists who participated in the project also had to sign a Declaration of Conflict of Interest in response to the sensitive nature of the task.
To cover the various research specialisations with their sub-environments, between six and nine panellists were engaged in each of the six panels. 16 (36%) of the panellists were females, and 29 were males. Nine panellists were Swedish, eight were from a Nordic country (except Sweden), 19 were from the rest of Europe, and nine were from non-European countries. In total, 18 different countries were represented in the panels. The youngest panellist was 42 years old, the oldest 77, and the mean age was 59. The selected panel experts are presented in Appendix 3.

3.5 Evaluation package
The self-evaluation package was designed to balance the relation between information value and work load for the units of evaluation, and to provide condensed and informative background material for the panellists prior to the site visit. In particular, it was designed to stimulate a process where researchers at MDH would work together to arrive at a common description of on-going research within the research specialisation, as well as to formulate visions for the future. It was envisaged that this process in itself would be a beneficial exercise.

The first part of the self-evaluation document was a written description of research activities completed by the primary unit of evaluation (UoE). The second part was a quantitative summary of certain research-related activities, also completed by the primary UoE, and the third part comprised data extracted from common databases by the university administration. Each self-evaluation document, with its three parts, contained some 40 pages of text and data. The template for the self-evaluation can be found in Appendix 4.

3.5.1 Part A: Strategic aspects of research
The first part comprised a written description of on-going research activities and plans and visions for the future, in the form of a self-assessment by the UoE. In order to achieve condensed written material, the amount of text was limited to a certain number of pages for the different sub-sections.

Since co-production is one of MDH’s salient features, specific sections were dedicated to describing how the UoE is working with co-production, and how it plans to develop ways of working with co-production. This included presenting a number of cases where the implementation and results of co-production were apparent, with the following foci: results achieved, how the co-production was carried out, impact, positive effects, plans, partners involved, and economic conditions.

The units of evaluation were also asked to list important regional, national and international collaborators, together with the focus and scope of cooperation, and to list the most important external funders and the respective levels of funding.

Finally, a limited number of publications or other research outputs, representing research activity and renewal, were to be selected and listed. In addition, the entire publication list was available to the panels through the Mälardalen University Academic Archive On-line, DiVA.

3.5.2 Part B: Quantitative summary of research activities
The second part of each self-evaluation contained an account of achievements, assignments and other factors that can be assumed to have some correlation to quality. These factors were engagement and involvement in the scientific community, actions for renewal, international collaboration, co-production aspects, and other engagements and interaction with society.

These factors were accounted for in terms of total numbers or frequencies, during the period 2008-2013. Typically, a smorgasbord of indicators was proposed for each factor, and the research specialisation could select the most relevant indicators, or define similar relevant indicators, and then add the corresponding numbers.
Detailed lists were not requested in the self-evaluation document, but could be asked for by the panels during the site visit. Even though each individual factor (or indicator) should not be ascribed very high importance, the overall picture may provide some hints regarding the level of research quality within a research specialisation.

3.5.3 Part C: Data extracted from common databases

The contents of the third part were extracted from the common databases at the university. It offered a brief account of the situation on 31 December 2013 for the research specialisation with respect to staff, research degrees, and economic conditions. Publication data was presented separately, in the two bibliometric analyses available to the panels prior to the site visit.

Staff numbers were given in terms of full time equivalents (FTE) for a number of different categories: professor, adjunct professor, visiting professor, senior lecturer, etc. Information about the administrative staff was also provided. The total number of employees linked to the research specialisation was presented, as well as the average age and the percentage of females for the different categories of staff. All figures reflected the situation as of 31 December 2013.

The statistics of research degrees concerned PhD and Licentiate degrees, annual averages for 2008-2013 and totals for 2013. The share of women, age upon examination, as well as gross and net study time were also presented.

The economic conditions of the research specialisation were presented in terms of total revenues, total costs, as well as revenues and costs for a few major categories such as income from appropriations research, income from grants, income from fees & other charges, staff costs, premises, travel expenses, consultancy fees, other running costs, depreciation, and common costs. Figures for 2013, after closing of the books, were provided.

3.5.4 Terms of Reference and Panel Report Template

The anatomy of the MER14 research evaluation was described in the Terms of Reference document; see Appendix 5. It was supposed to be the steering document for the expert panels.

The Terms of Reference document provided a background for the evaluation project, stated the objectives and described the method adopted. It furthermore presented evaluation criteria and the recommended working procedure within the panels. The panels were asked to state their conclusions and recommendations in a Panel Report Template under ten different headings:

- General assessment
- Research environment and infrastructure
- Networks and collaborations
- Co-production (co-creation) and external co-operation
- Productivity
- Impact and relevance
- Quality of research
- Renewal - Strategies and plans for development of the unit of evaluation
- Potential and recommendations for development
- Other issues

Besides conclusions and recommendations falling under these different headings, the panels were also asked to submit quality ratings for seven of them (marked in bold in the list above).
The quality rating for on-going research activities was primarily to be expressed in terms of international standing, and recommended ratings were Excellent, Very good, Good, or Insufficient. The application of the quality ratings was to a high degree based on the knowledge and definitions of international standing by the panel experts.

3.6 Site visits
In order for them to be able to properly assess strengths and weaknesses it was considered vital to allow panel experts enough time for visiting the research specialisations. Therefore, and also because the panels were expected to write the main parts of their reports during the visit, an extended site visit was planned. In most cases, the panels submitted a draft report before leaving, and the final report was delivered within three weeks after the visit.

Each of the six expert panels paid a one-week visit to Mälardalen University, with five working days; see Appendix 6. The visits for all panels were organized during the same week, 19-23 May 2014.

For the panel members, the site visit started on Monday morning with an introduction to the evaluation process. After lunch, presentations of the schools and research specialisations were given by the Deans of School and Directors of Research, and the panels were then given time to plan their visits during the week.

Tuesday, Wednesday and Thursday were devoted to research specialisation visits and internal panel meetings. The detailed time schedules for site visits were worked out by the research specialisations in communication with the respective panel chair.

The last day of the visit included a final internal meeting of the panel to finish the draft of the panel report. In the last part of the meeting, Directors of Research, subject representatives and Deans of School were invited to an exit interview, where the panel chair gave a summary of the findings, conclusions and recommendations of the panel. The site visit was then concluded for all panellists except for the chairs.

A separate meeting with the panel chairs was organized on Friday afternoon. The university management and the MER14 steering group were invited to this meeting. The objective was to raise issues of a multi-disciplinary and cross-faculty nature that might not have been attended to in a satisfactory way till then, but also to offer the panel chairs an opportunity to prepare a joint Executive Summary.

At the end of the week, the panellists were given the opportunity to answer a short questionnaire regarding their views on the preparation and execution of the evaluation. A summary of the results is presented in Appendix 7. Finally, some photos from the site visit are included in Appendix 8.

3.7 Bibliometric studies
As a separate part of the research evaluation, two bibliometric studies of research publications from Mälardalen University in the period 2008-2013 were undertaken. The first study was carried out by external expertise, the CWTS at Leiden University. The second, complementary study was conducted by the MDH Library. The expert panels were provided with the results of these studies prior to the site visit.

The validity of bibliometrics varies among different disciplinary areas of research, owing to the varying publishing traditions. However, there is usually no disagreement that the output of pub-
lications constitutes a reasonable measure of performance. The differences in points of view concern the channels for publications, and how these differences should be handled. While journal articles in English constitute the main form of publication in the natural sciences, articles and books in other languages than English are a common form of dissemination of ideas among scholars in the humanities and in several fields of the social sciences, while conference presentations are predominant within information technology.

The results of the bibliometric studies are presented in chapters 11-12, with an introduction in chapter 10.

3.8 Some overall conclusions and reflections on MER14
As stated earlier, no attempt will be made to summarize the reports by the different panels, to avoid selecting and evaluating specific conclusions and recommendations from the panels. However, a few overall observations can be commented upon.

3.8.1 Quality ratings
The panels were asked to submit quality ratings (Excellent, Very good, Good or Insufficient) for seven aspects of research:

- Research environment and infrastructure
- Networks and collaborations
- Co-production (co-creation) and external co-operation
- Productivity
- Impact and relevance
- Quality of research
- Renewal - Strategies and plans for development of the unit of evaluation

The rating Excellent was mentioned in a more than a dozen cases. Excellent was in fact used by all panels, and occurred for all the aspects above, to a varying extent.

The main part of the ratings, almost 70, was however to be found on the middle of the scale, Very Good or Good (or between these).

The rating Insufficient was used in a few cases, mainly for the Productivity aspect and for newly established groups, or groups in transition. Also, Insufficient was used for groups too small to be viable as research groups. Several panels commented upon the lack of an additional rating between Good and Insufficient (e.g. Satisfactory). It is likely that such a rating should have been used in some cases, had it been available.

3.8.2 Feedback on the evaluation process
In the end of the site visit week, the panellists were asked to comment also on the evaluation process. The feedback from the panellists (see Questionnaire summary, Appendix 7) was predominantly very positive. Many panellists commended MER14 as being very constructive, and commented upon the open-minded environment at MDH but also within the panels. Overall the research evaluation was considered to be almost perfectly organized, with strong involvement of the members of the faculty. However, as is the reality of any evaluation, some also commented upon the magnitude of issues to cover in a short period.
Overall, all panellists agreed upon that the practical arrangements during the site visit were satisfactory, that the preparation had worked well and that the panels had the necessary competencies needed for the review. Slightly less positive, but still very good, responses were obtained for the value of the bibliometric analyses, and how well the self-evaluation covered the research activities.

3.8.3 Side effects
Side effects of the evaluation should also be mentioned. In the preparation phase an extensive effort was carried out by individual researchers, the schools and the MDH Library. DiVA was updated with many new records, and several thousand records were supplemented with a unique author index (ORCID) to improve the quality of the following bibliometric analyses. In fact, MDH are presently the best university in Sweden when it comes to the total number of unique ORCIDs, and also the percentage of scientists with an ORCID. ORCID is one of the elements in SwePub, the Swedish national database for research publications, and will probably be mandatory when applying for research funding in the future.

After the completion of the two bibliometric analyses, the MDH library arranged a series of seminars where the results were presented and discussed internally. It proved to be a valuable exercise in itself to discuss the possibilities and problems with bibliometry, and the impact of bibliometry in relation to present and potential publication strategies.

3.8.6 Final comments
Finally, the evaluation as such must be considered as a useful process, and a good preparation and learning exercise towards future similar initiatives. Many concrete recommendations and conclusions have been put forward by our “critical friends” in the panels.

One of the remaining tasks is to internally evaluate the MER14 research evaluation, now that the results have been presented - Have the objectives been met? Are the results corresponding to the needs of schools and individual researchers? Was the process relevant? etc.

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2 See: http://librisbloggen.kb.se/2014/06/23/orcid-i-swepub/
Panel reports
Mälardalens högskola
Eskilstuna Västerås
Chapter 4:  
Health and Welfare - Report from Panel 1  

Panel Members:  
Arja Rimpelä, Tampere University, Finland (Panel Chair)  
Ravinder Barn, Royal Holloway, University of London, UK  
Philip Darbyshire, Monash University, Australia  
Hanneke de Haes, Academic Medical Center, The Netherlands  
Östen Wahlbeck, University of Helsinki, Finland  
Paul Watson, University of Leicester, UK  
Andrew Watterson, University of Stirling, UK  
Lena von Koch, Karolinska Institutet, Sweden  

1. General assessment (good)  
The panel is grateful for meeting in such an open and collegial atmosphere. The teams we encountered were willing to discuss issues and happy to receive feedback.  

The School is divided into eight sub-environments in research and into five research environments. The latter were established in 2013. The panel found the concepts research environment and sub-environment difficult to understand and will use in the following report, the terms: research cluster and discipline respectively.  

The evaluation of the research environment at MDH by the Swedish Research Council was the starting point for the new organization and the recent creation of five research clusters. It was recognised that although the clusters are broad and still under development, they are a step towards a more research orientated and scholarly environment. Focussing and clear prioritisation in research will be helpful and required in both research clusters and in most disciplines.  

2. Environment / Infrastructure  
The fundamental orientation of the School remains teaching and research has not been seen as a top priority by many so far. There is a strong sense that research is still seen as ‘icing on the cake’, or as an optional extra that may be undertaken after the ‘real work’ of teaching has been done. For the majority of staff, thinking about research involvement and particularly, involvement in international scientific research and publishing quality papers is not familiar. A fundamental
change in attitude and approach is needed with support from management of the school. In fact, large teaching duties (3000 students) has made the panel wonder whether the curriculum could be reorganised and teaching methods developed so that these are less person intensive, thus freeing more time for research.

Central methodological skills for staff, such as skills in grant writing and writing both scientific research and scholarly discussion papers should be developed. In tandem with such specific 'skills development', a broader cultural change is also needed. Academic staff often seemed trapped in a “teaching culture” or ‘teaching treadmill’ that offered few possibilities for research involvement. It also seemed that staff were operating in working modes that prevented them from envisioning different ways of reorganising or reorienting their lives as academics.

The lack of research and publications cannot be ‘explained away’ by claiming that “we have no time”. In many universities across the world it is often the ‘busiest’ staff who are the most research and publications productive. Large ‘chunks’ of ‘extra time’ are unlikely to emerge in academia and waiting for this to happen is not a sound strategy. Strategic and operational support and encouragement from managers and leaders are needed here, but individual staff must also ‘step up’ and take responsibility for their own personal research and publication ‘strategies’, planning and productivity.

Research within the clusters and disciplines was sometimes understood as something that occurred primarily through PhD students’ work, which is a rather parochial and constraining view. Well developed long-term research programmes or agendas should be seen as an area that attracts PhD students to join and not vice versa. The move from a large number of small, fragmented, individual projects to large and sustainable research ‘themes’ or ‘programmes’ is a prerequisite for the development of a true research-oriented school.

In some areas of methodology and specific expertise, the School is vulnerable. This is the case with e.g., health economics and advanced statistics given the limited availability of people with expertise in the areas.

In part, the school demonstrated ability to attract external funding but success was patchy and lacking in strategy.

The panel spoke to a representative group of PhD students. The PhD programme was established in 2012 in Health and Welfare. The doctoral students were a confident and articulate group who were satisfied with the quality of their supervision. They appreciated the mentoring support and social / pastoral / peer support aspects of their experience. They valued the coordination and the programmes available for their studies. They were also positive about the availability and quality of supervision. Some critical issues raised were that more general training of advanced statistical methods and other knowledge sources would have been valuable. The students would also have valued mandatory, focused support and input in relation to academic publishing. To have a mentor was appreciated by the doctoral students who had a mentor from elsewhere. Finally, the students were unclear as to how well their current doctoral preparations and training were supporting them in relation to their future careers, whether this be in education, research or practice.

3. Networks and collaboration

In general, the disciplines have different national networks and collaborations. This varies for the disciplines but is generally good. There is a need in all disciplines to strengthen their international collaboration and networks so that they can progress from ‘connections’ and perhaps ‘memos of understanding’ to more recognised and valued research outcomes. There are opportunities to extend networking and research collaboration inside the school that the new research clusters
will facilitate. A lack of research collaboration within the School’s research groups in relation to several ‘projects’ and research areas of the other Schools at MDH was evident.

Disciplines which presented to the panel tended not to emphasise research collaborations with ‘clinicians / practitioners’ and service providers. No doubt the School has some valuable and established clinical / practice links and this seems an under-developed area with potential to improve the School’s research culture and to help bridge the ‘teaching OR research’ divide.

4. Co-production
The panel sees that in certain disciplines there is already some good evidence of meaningful co-production. The ‘Robocat’ project was a good example here. However, there was a sense gained that the concept of co-production was not well understood or articulated. Co-production in a research context was rarely described in ways that were congruent with MDH’s strategic plans and vision to become a ‘co-production University’ where this was a unique differentiating feature. Researchers often described co-production as a rather vague ‘working with, or being funded by local authorities’.

The panel suggests that staff can use the concept of ‘co-production’ more systematically and valuably throughout the research process. For example, at the research formulation and design stages, there should be explicit public as well as a patient/client/user involvement, possibly through an effective ‘reference group’ within each research environment as a matter of both principle and strategy. Co-production could also be a key element of any Knowledge Translation or Knowledge Transfer strategies planned for a project.

Again, collaboration with technological developments exists but there are many opportunities for further development.

5. Productivity
In international scientific publications, the productivity is low even when taking into account that the teaching load is considerable. There are also remarkable differences between disciplines in this respect.

It was notable that in some of the team presentations, staff seemed to have very little idea of what their ‘norm’ should be for research productivity, i.e. how many research grants they should submit or how many papers they thought that they should publish in a year. This suggests again that research may not be seen as a ‘priority area’ or indeed as a core element of their work as academics.

The number of PhD students is currently still low but is planned to increase in the near term, which will enhance productivity.

6. Impact and relevance
There is some international reach but so far impact is mainly on a regional and national basis. MDH’s co-production emphasis and growing international profile are important levers in future attempts to achieve impact and relevance.

7. Quality of research
The staff that we spoke to were generally well motivated towards improving research performance. Yet, there is still a tendency to publish mainly in Swedish for a number of disciplines, and in less highly ranked scientific journals. Even when publishing internationally, it mostly takes place in low to middle impact or non-impact journals. The strategy of the university to move to
a more research-oriented direction calls for specific publication strategies. There is also a further cultural shift required away from the choice of journal or language being a ‘personal preference’ to being a more value and outcomes driven decision.

Some of the discipline groups seem to adhere to qualitative methods exclusively. While there is a case for developing strong methodological expertise, these groups may limit their potential for further development, given that some research questions will require a broader approach. The collaborations formed in the new research clusters should provide a valuable opportunity for more creative mixed-methods approaches and is to be commended.

8. Renewal
If striving for excellence, the School needs a concerted effort to help staff appreciate the realities of the current world of Higher Education, national & international funding mechanisms, research quality audit imperatives and how such forces directly impact on how the School must operate. This means a drastic culture and mindset shift for a number of staff members. Even among ‘research active and interested’ staff, there is a need to fully understand the pragmatic and practical implications that such ‘external forces’ should exert on their work, from the selection of research topics / projects, to the choice of potential research partners to the choice of in which journals to publish. In short, staff need to “Get it”.

A culture of entitlement, an academic position as a ‘job for life’ regardless of productivity and ‘equality as universality’ where ‘everyone should receive the same resources and rewards’ as opposed to ‘everyone should receive the same opportunity to excel’ is untenable. The School should develop a more meritocratic culture where enthusiasm, effort and achievement are supported, celebrated and rewarded.

Currently, the School does not have a culture of publication as an expected ‘norm’ and ‘core activity’ of academic staff. This has to change.

All publications and outputs are not the same and staff and School strategies and efforts should be directed towards those publications that are most valuable; for the School and for staff’s developing ‘track record’ as researchers and for policy and practice.

We heard frequently the metaphor of ‘Let a thousand flowers bloom’ as a ‘model’ of research in the School. This may work in replanting a prairie or meadow, but it will NOT let you cultivate a winning orchid at the Chelsea Flower Show. All flowers are not equal, nor can they be. In other words, a generic approach will not do. Excellence needs to be rewarded where it merits such an accolade.

The School’s collaboration in the robotic area and with other technology departments that are available in MDH may bring a great opportunity for success for its innovation. There should be a concerted effort to explore potential collaborations and research synergies across, and not merely within, each of the six ‘Research Specialisation’ areas within MDH.

9. Recommendations for development
The School can thrive in a research culture where clear expectations of high quality research performance are ‘the norm’ and where a panoply of support, encouraging and enabling structures and incentives exist to help staff translate their passion, interests and effort into mutually valuable research, scholarship and co-production goals and outcomes.
1) **Strategic thinking and development**

*“No strategic plan ever failed in the formulation”*

1. At the levels of the disciplines, research clusters and the school at large, a strategic plan is needed to strengthen the productivity, profile and continuity of research and the different research clusters. Such a strategic plan should cover:
   
   A. the longer term focus and profile in research,
   
   B. its relation with the emerging research clusters as well as societal priorities,
   
   C. recruitment related to this focus,
   
   D. an outcome directed publication strategy, with explicit, set norms for output expectations,
   
   E. the quality enhancing policy. In such a plan, specific actions leading to the goals set should be formulated. The setting up of a School Research Committee would be helpful to formulate such a strategic plan and to drive and monitor research performance.

2. An action plan should be developed alongside this in order to establish agreed approaches to reach the goals set in the strategic plan.

3. Given the limited time that some of the senior staff members have for research, MDH should consider a more diverse allocation of research time. More research time could be provided for intermediate ranks like Associate Professor than the 10% currently given. The current difference between this 10% and the Professors’ allocation of 75% time for skills development and research related activities, including own research (which we consider appropriate) seems excessively large. In line with this, diversity among teaching and research obligations of staff members can be considered rather than having a similar standard for all.

4. The strategic plans should be taken into account when planning for following up positions where the current staff is likely to retire within the near future.

5. As a vital foundation of the University’s vision, identity and role, ‘co-production’ seemed to be understood in very different ways. In many cases it seemed to be simply that ‘funding was received from a local authority’.
   
   A. The School should enhance the understanding and operationalising of this term ‘co-production’ so that it becomes a clear thread within the school’s research policies and practices, from conceptualisation, through the research itself and through to knowledge transfer and translation.
   
   B. The School can further develop a strategic and formal approach aimed at initiating and developing more ‘practice-focused’ research collaborations involving faculty and staff in health promotion and clinical areas along general ‘practice development’ or ‘action research’ lines. The specific involvement of external health professionals and practitioner in the School’s research projects, e.g., clinicians and managers in local hospitals, or allied health or social worker colleagues ‘in the community’ is critical for meaningful ‘co-production’.

6. The School could establish a competitively allocated ‘seed-funding’ research award to support promising strategic research that shows the potential to attract external funding (eg from SRC or FORTE). This may also support ‘co-production’.
7. A policy and organisational practice review is needed into how the university/school research structures operate and how high end policy is made, implemented and then evaluated. Aligning university, school and discipline approaches to research strategy with the research clusters now proposed is critical.

8. The School should collaboratively create an updated Research and Scholarship Strategy with a prime focus on its desired outcomes, operation and monitoring. A ‘one page’ version of this should be available that shows the strategy and goals clearly and ‘at a glance’. No member of staff should subsequently be able to claim that ‘we don’t know what the strategy is’ or ‘that is not my business’.

2) Research culture

“Culture eats strategy for breakfast every day of the week” - Peter Drucker

9. Not publishing or producing valued scholarly outputs should not be an option for any academic staff at the School. Currently, the School does not have a ‘Publish or perish’ culture as much as a ‘Publish, or don’t publish’ culture, depending on how you feel or how ‘busy’ you think you are”. Publications and outputs are not ‘all the same’ and so the School should prioritise and direct its research and publication support, if not exclusively, then predominantly, towards high quality publication outputs, and the related “other means of dissemination” that would underpin and exemplify “co-production”. Norms expressed in numbers of publications, their expected impact and influence, and quality of publications should be formulated for all positions.

10. There seem to be few if any opportunities and formal mechanisms that enable staff within the School’s different areas to meet to share and discuss research and opportunities. The School should initiate more frequent research-focused meetings with explicit expectations of participation. The school should also examine which of its current meetings are the least productive and valuable; these should cease to enable time for the new meetings to occur.

3) Quality and performance mechanisms

11. In its commitment to ‘inclusivity’, the School may be diluting its efforts and resources by spreading them too thinly and on a basis that is not outcomes and performance directed. The School should develop policies and practices that clearly reward and support success and productivity.

12. The school should establish and rigorously maintain a register of research projects in order to monitor progress and to attract future research and higher degree students to specific areas of research.

13. The school should produce an annual research report identifying projects, dimensions of co-production, income and outputs; this should be published on the MDH website.

14. The School’s website is the “window” to the school, the subjects and the research. It is essential that the School and Subject website pages are regularly and accurately updated to communicate effectively with the external world.

15. The School should establish a “Research Committee” to coordinate, drive and monitor the overall research efforts within the School.

16. Current contracts of employment, position descriptions and performance review systems seem to have little meaning or relevance for staff in relation to their research and scholarship attitudes or efforts. These should be reviewed to clearly state the research
expectations and to reinforce the research aspirations and strategies of the school and university. The organisation needs to implement a performance management system in relation to research to promote and enable an improvement in the scientific output of staff and to maximise the scientific credibility of MDH.

17. All grants applications and publications ‘leaving the school’ should have benefited from internal and/or external peer review.

18. Communication mechanisms where the university engages with staff with regard to research structure and support should be reviewed and revised to ensure that genuine ‘two-way communication’ is being achieved.

19. Better structures to enable research clusters to make decisions are needed. Allocation of some budget for the clusters is recommended to increase autonomy, competence and prioritisation.

20. The physiotherapy group has already demonstrated excellent potential for such a small group and deserves increased support to become an internationally recognised research unit.

4) Staff development and research leadership

21. The School should establish more formalised support and research development for staff regarding research methodologies, strategic approaches and specifics, such as grant writing and winning grant funding. The School’s leading researchers, as exemplars of success in publishing and grant funding, should be active participants in a vibrant research seminar programme or similar events. Staff and research students need to learn from the best.

22. Professors need to demonstrate stronger research leadership and would benefit from high-quality staff development and training themselves to fulfil this role more effectively.

23. Staff would benefit from invited talks from research funding organisations to understand and appreciate funding priorities and the process of research bid evaluation. The university’s Research Support Office needs to take a lead on this.

24. Workshops in key research areas such as competitive grant writing, writing for a range of publications, creating a personal research strategy, ‘marketing your research’, and research culture development for staff to increase research skills and output are needed. These workshops and similar opportunities would also be vital for PhD students.

25. Professional and skilled research support through a “Research Support Office”, headed by a professional Research Manager, will be important for the School as it continues to develop its research profile and culture. The ‘ethos’ of such an office and how its role is perceived by the School should not be an ‘admin and clerical support’ model, but a more of a ‘professional partnership’ model. (see e.g. http://www.uhr.no/documents/PFA_7_International_networks_VAD.pdf (network of professional research managers).

26. Key functions of this Research Support Office” could include:

   A. Systematic support, assistance and education in grant-writing and broader ‘grantsmanship’/’grantspersonship’.
   B. Critique, review and “sounding board” for ideas and proposals.
   C. Available contact with and opportunity to learn from successful researchers.
D. Research mentoring opportunities.
E. Help with the “paperwork, procedures and policy” issues involved in grants.
F. Administrative support and project management for existing grants.
G. Advice and support with the ‘politics’ of grants, how to be ‘research and grant streetwise’.
H. Orientation to the expectations around research priorities and valued outcomes, and knowledge about ‘what counts’ in research and scholarships. Invited and dedicated talks from senior staff in funding bodies could be one way to fulfil this function.
I. Research career advice and specific knowledge about ‘what is needed to succeed’.
J. Help with building connections with other colleagues and departments across the university.
K. Creating clear targets and strategies so that staff know what they are ‘aiming towards’.
L. More celebration of and knowledge about what research people are actually doing.
M. Keep important research information centrally, up to date and accurate so that staff do not need to provide the same data to multiple people on multiple occasions.
N. Enhanced research education, seminar programmes and other opportunities to learn about and from other researchers.
O. Providing specific writing and publication support, skewed towards top quality journals, e.g. help with English translation and internal ‘critical friend’ peer reviews.
P. Having specific expertise in the area of Health and Welfare in the above mentioned areas.

27. Mentoring and appraisal schemes should be reviewed to ensure they are fit for purpose and conducted by staff with the necessary research credibility. Appropriate training and support may be necessary here.

28. Staff who are predominantly in teaching roles and who are not ‘research active’ should nevertheless be publishing about the practice and scholarship of their discipline, about teaching & learning and about the innovations in which they are involved.

29. Any current system of ‘research rewards’ within the School seem poorly understood and only partially valued by staff. Rewards, incentives and successes should be better publicised and ‘marketed’ to staff. A website link to all reward and support initiatives and their details would help but this should not just be a list of application forms. Create a ‘FAQ’ section that answers all potential questions, show some ‘success vignettes’ of staff who have won such support and show how it has benefitted them, include some ‘YouTube’ or Video-casts from the research leaders in the School encouraging people to apply. In short, create some ‘buzz’ around these incentives.

30. MDH should consider a system of incentivisation to reward good practice and success in research. This could involve:

A. A proportion of the overheads (e.g., 5-10%) taken from each externally funded income stream should be reinvested towards the successful applicant, to be used at
their discretion to develop research capacity further.

B. Central resources that could be used e.g. for short sabbaticals to produce high quality research or to obtain high competitive research income.

C. In the staff’s yearly appraisals not only teaching should be on agenda but research productivity (output in terms of publications and/or obtaining grants) should also be a clear performance criterion.

SUB-ENVIRONMENTS / SUBJECTS / DISCIPLINES

I. CARING SCIENCES

1. General assessment (Good)

   This is the largest group in the School with 74 employees, including: 2 Chair Professors 7 Associate professors and 3 post docs. The School will reasonably expect this to be one of its best performing groups. On the positive side, this is an established disciplinary area within the University as opposed to a ‘new group’ - a potentially advantageous position to be in - that is interested in and active in a very broad range of research areas across the nursing and ‘care spectrum’.

   The panel had several concerns and suggestions for this group, that were not specifically unique to them but often applied across the disciplines. The group lacked a coherent and clear ‘focus’ for their research efforts. All projects seemed to be ‘equal’ and there was no sense of an overarching framework or compelling theoretical/policy/clinical orientation that distinguished their work from that of any other school in Sweden or worldwide. If the question was asked of this group: “What is special/unusual/distinctive about this research group and their work?” It seems unlikely that a clear answer would be forthcoming. This is an area of research development that requires systematic critical reflection, focused ‘self-questioning’ and the development of research strategising skills, not just for this group but School wide.

   As with many groups and staff within MDH, the website and ‘staff pages’ were often incomplete, unreliable and outdated. Some researchers had recent good publications that were not listed on their staff pages, some pages were ‘dead links’, some had no staff page at all and others had not been updated since 2012.

2. Environment / Infrastructure

   This is a large group which offers advantages over much smaller groups. This is a ‘plus factor’ that should be exploited.

   ‘Synergies’, multi-disciplinary work and collaboration across other groups is possible and some progress here was evident. However, it was also clear that opportunities for collaboration and ‘research strengthening’ may be being missed, eg in working with the Sociology group on research into patient complaints and communication/relationships breakdown in hospital. The same staff ‘concerns’ about resources were expressed, i.e. a lack of time and lack of funding. However, there were no suggested ideas or strategic approaches forthcoming as to how these challenges (that are fairly universal) could be addressed. There were no indications as to how any additional resources would be used to improve specific research performance outcomes. The sense was that more resources would simply enable ‘more of the same’ to happen.

   The group has developed and is keen to develop research collaborations and connections within Sweden and worldwide. The Thailand connection is a good example of the international reach of this group and one which is demonstrating outcomes in relation to publications, external funding (from Thailand), attraction of doctoral students and staff exchanges. However it was less
clear as to the demonstrated benefits and research/publications outcomes resulting from other mentioned ‘collaborations’.

As with the university overall, there seemed a need for specific research management support via a ‘Research Office’ that could enable grantsmanship, writing workshops, publication strategy development, systematic peer review of developing proposals, awareness of funding opportunities and more.

3. Networks and collaboration
This group have established fairly productive collaborations, e.g. with Thailand that have been fruitful but that could also be ‘notched up a gear’. At times it was hard to discern, from the University perspective, “What’s in it for them?” from such collaborations. These benefits and value propositions should be clearly evident and easily articulated.

Many other ‘collaborators’ were mentioned but again, it was hard to see the detail of how and why these came about, how they are being strategically developed and for what purpose, who is being involved and included and why and what research outcomes are being specifically sought and ‘hard-wired’ into the projects.

4. Co-production
It was hard to see evidence of such ‘co-production’ and its systematic application from initial idea, through proposal development, study undertaking and subsequent publications and knowledge translation. The Thailand work seemed more successful here as it was clear re: the Thai government involvement and the collaborative exchanges and interchange between Thailand and University staff. Other projects and potential projects were more vague regarding co-production. For example, is the group working with any of the local hospitals and healthcare providers as co-providers, and if so how?

5. Productivity
The group would be average to good for scholarly output and research productivity, publishing occasionally in top ranged nursing and ‘caring science’ journals, but also publishing in journals with little or no status or impact.

From the bibliometric analysis provided, this group would be considered to be around ‘average’ in their scholarship, publications and external research grants performance. They are publishing in a very ‘mixed bag’ of journals and outlets. Some of these are among the most highly regarded journals for nursing publication, such as Jnl of Advanced Nursing, Jnl of Clinical Nursing, Nursing Inquiry and Qualitative Health Research. Others, however are of of much lower or almost ‘invisible’ standing.

It seems that a small number of staff in this group are responsible for most of the quality journal publications.

To their credit, this group, when asked about publication expectations for faculty, suggested rather higher numbers of publications regarding what should be ‘the norm’.

6. Impact and relevance
These were hard to determine but our assessment is that these too would be average. A question that was raised was where is ‘Nursing’ in this group’s research profile?
There was little or no mention of knowledge transfer or knowledge translation in relation to the question of “What difference does this group’s research make?” It is a very ‘tough question’, but one that health researchers will be increasingly asked and expected to answer.

7. Quality of research
The group’s outputs were variable and there is considerable scope for ‘raising the bar’ in relation to the quality of journals selected and the external competitive research grants applied for and won.

8. Renewal
The group is vague and unclear about their future directions and developments other than that they would like to develop further, somehow. Future directions and credible work in developing a coherent programme of studies, moving into intervention studies or evidence-based practice work are unlikely to eventuate given the group’s current focus and approach.

9. Potential recommendations for development
There is a danger for this group in being seen as limited and restricted in their ‘vision’ and orientation. A focus on ‘health and wellbeing’ is wonderful and specialising in qualitative methods can be extremely valuable, but NOT at the expense of acknowledging illness, disease, injury and Nursing and the need to address some health research questions that require quantitative approaches.

We note that in a cursory search of the MDH website we found this course on: “Methodology and Concepts in Caring Science/Nursing 7.5 credits”. Significantly, this course proposes only one methodological approach that is suitable for “Caring Science Research” and that is qualitative research. Quantitative or other approaches are simply not mentioned.

We raise the question of how ‘welcome’ or ‘at home’ a quantitative colleague or researcher may feel within this group.

This group has huge potential in being able to ‘make real’ the University’s mission of co-production. They could begin a renewed, strategic and deliberate process of generating research programmatic questions in partnership with other MDH groups, clinical/health professional colleagues and service providers, purposefully involving patients, clients and ‘service users’, in the research process and carrying this co-production through to dissemination and implementation stages.

10. Other issues
The term ‘Caring Science’ is popular, especially in Scandinavia. There may be an issue however with the term’s international recognition, especially within health services research. There is a related ‘marketing’ and awareness issue in that the group may be “missing out” on taking advantage of the ‘brand’ called Nursing, which is one of the most consistently valued and highly rated in the world. It seems strange not to have Nursing featuring more prominently within this group’s identity and work.
II. HEALTH CARE EDUCATION

1. General assessment  (Insufficient)
This group is too small to be viable as a research group. The group is not addressing health education in the traditional sense but rather is directed at health care education for professionals. Such education of professionals and in higher education is their central research theme. Relevant subjects are teamwork specifically and leadership also. Originally this group was associated with nursing yet later it became linked more closely to psychology and sociology.

2. Environment / Infrastructure
The group’s environment is still limited. The number of staff is very small, three persons currently. There are some connections but it is not strongly embedded in other research environments of the school.

3. Networks and collaboration
Presently, the members of the group are doing research in collaboration with other universities rather than inside the School in MDH.

4. Co-production
Work is mainly pursued with other universities, no co-production outside academia.

5. Productivity
The productivity as regards international scientific publication is so far limited. The work is mainly published in Swedish textbooks, papers and monographs.

6. Impact and relevance
The books written may have been useful for teaching, which would provide the research with a national reach of some relevance to society, but this was difficult to assess.

7. Quality of research
Not applicable

8. Renewal
Not applicable

9. Potential recommendations for development
There is potential for the members of this group to be involved in and to contribute to the newly established clusters. Through their expertise in team work the group could contribute to the development of high performing research teams. Furthermore, there is a great opportunity within MDH to study health care educational development. Excellent opportunities exist for research of international interest regarding some unique educational developments, such as the integration of behavioural medicine within the physiotherapy undergraduate program.

10. Other issues
Not applicable
III. MEDICAL SCIENCE

1. General assessment (Insufficient)
As with Health Care Education, this is too small to be viable as a research group, nor does it appear to have the potential to become one as it is. At the same time, this group can be of enormous support for the School in a consulting role.

2. Environment / Infrastructure
The leader of this group is associated with the school for 10% of the time only. Thus, there can be little expectation of building a strong infrastructure or network.

There is currently no external funding.

3. Networks and collaboration
Collaborations at present seem very limited. This may be partly due to the small size of the group but there is another dimension that should be openly discussed within the school. This is a perceived ideological ‘divide’ between notions of ‘caring science’ as being exclusively concerned with ‘care’ and ‘health’ and having some perceived moral superiority over notions of ‘medicine’ and ‘illness’. This is like a replay of the old and fruitless battles about ‘the medical model’ vs ‘the nursing model’. Such polarizing and dichotomising is pointless and ultimately destructive for the school and its research efforts.

4. Co-production
There is co-production with the Medical Products Agency (Läkemedelsverket).

5. Productivity
There is little scientific productivity of the group in the context of the School.

6. Impact and relevance
This group has minimal influence and impact as it is presently constituted. This is not a reflection of the group members but more a comment on the structure of the organization to meet the requirements in the undergraduate education. In itself the subject of pharmacology and safety is highly relevant and of global interest.

7. Quality of research
Not applicable

8. Renewal
Not applicable

9. Potential recommendations for development
This group could have a more marked and powerful impact were they to be used as consultants where their specific expertise was brought in to enhance closely related projects.

There is potential for the members to be involved and to contribute with specialist medical knowledge in the newly established clusters if appropriate mechanisms and commitment exist from all divisions within the school.

10. Other issues
Not applicable
IV. PHYSIOTHERAPY

1. General assessment (very good)
This is a well organised if small group with potential to develop from a very good national group to one with an international reputation. Although the group is only relatively young it has already achieved some good productivity as well as a clear strategy and vision for its future research area and development. The focus of the group is clear - the integration of behavioural medicine into physiotherapy - is innovative. There was a clear link between the research and the integration of this into the undergraduate curriculum which is almost unique.

2. Environment / Infrastructure
There needs to be attention to how adequate supervision will be provided and how capacity in PhD supervision can be built into the staff experience. There is only one professor which is a potential limiting factor in the development of the PhD numbers. The inclusion of external professors as supervisors is to be encouraged and should be applied to all PhDs but the department needs to grow the supervisory capacity internally.

To move this group to the next level it needs to develop more sophisticated research proposals with exemplary health economic evaluations and statistical support for example to perform strong multicentre RCTs.

This group currently has a very good leadership and ability to attract external funding.

3. Networks and collaboration
The group demonstrates connections with national centres of expertise in behavioural management of chronic conditions in particular musculoskeletal diseases. There are some connections with national and international institutes but it is not clear if these are firm connections. It is recommended that the group investigate developing links with other groups working in this area in particular Keele University UK and possibly Fritz (Utah, USA).

The group has good links with local higher education organisations to help develop research ideas.

Some of the studies on physical activity monitoring may benefit from investigating links with other departments such as design technology and embedded systems.

The group needs to look at developing links with other departments to enhance research for example information technology.

The group has a good level of collaboration but this could be improved.

4. Co-production
Research mainly of interest to the team rather than evidenced by the interests of the group. There is some evidence of co-production in the area of whiplash and chronic pain in young people.

The group recognises the importance of patient and public involvement in the development of research ideas and have considered how this might work. They are to be encouraged to develop this further to include these groups in developing research ideas.

This group has a good level of co-production which would be improved by attention to the above.
5. Productivity
The number of high impact papers is adequate but the group should look towards targeting papers towards better journals rather than those of lower impact. It was not clear how many papers are ‘in press’ ahead of publication or in preparation, from the reports. There does appear to have been significant external funding to support this output and more may be pending.

For its size the group has a high level of publication productivity compared with other disciplines in MDH and given the number of research staff.

This group has a very good level of productivity and we expect this would rise to excellent with adequate support as outlined in this report.

6. Impact and relevance
The research and its integration into physiotherapy undergraduate teaching is to be commended and is a demonstration of an immediate impact on changing the education and possibly the practice of physiotherapists. This also is a potential area for research as part of the teaching process and this should be investigated with the health care education group.

The area of interest, behavioural medicine in physiotherapy, is of considerable international interest and the group should promote their research to a wider, international audience to achieve greater impact.

The impact of the research is very good with reference to the impact on physiotherapy practice, with a greater degree of international exposure this will rise.

7. Quality of research
A lot of the output in the papers was from studies conducted while the staff were employed elsewhere. However, there is evidence that staff have been involved in high quality research with publication in middle ranking journals. This research should be graded at very good and with more support could reach excellent research of international standing.

The quality of the research is very good and has the potential to improve further with the groups planned activity and provided the group gets support.

8. Renewal
The group has a clear vision of its future direction. This may be limited by the current size of the group and the support particularly with respect to health economics and statistical and methodological support.

The inclusion of an assistant professor into the group will enhance student supervision, provide additional time for grant preparation and submission, and enhance the prestige of the group.

The group has an excellent strategy and vision of the future which is achievable.

9. Potential recommendations for development
This group has the potential become an internationally recognised group not only for the research but also for the integration of the behavioural medicine approach into the undergraduate curriculum.
Some challenges exist:
Supervision issues – The expansion of PhD student numbers will be limited by the number of staff able to supervise in the current system. Development of training should look at enabling staff to gain experience in supervising PhD without risk to the students.
This department would benefit from the addition of an associate professor post to support the work done and to enable adequate support for future PhD students.
There is an urgent need for improved statistical, health economic and research methodological support and enhance the quality of grant submissions

10. Other issues
This group has the potential to go from a very good national research group to a group of international standing, however, this will not be achieved without institutional support, including the provision of an associate professor to a group which has already demonstrated it is productive and which has a clear research strategy to attain a position of excellence.

V. PSYCHOLOGY

1. General assessment (good)
The psychology research group consists of a medium size staff (1 professor, 3 associate professors, 8 senior lecturers, 5 lecturers and 2 doctoral students). The group is fairly new in this school (1½ year). The group focuses on three main themes, being; health psychology, social psychology and work & organisational psychology. There appeared to be a range of research projects in line with these themes. At the same time, the number of and difference between projects may also reflect a substantial diversity within this relatively small research community. This can make it vulnerable and makes it difficult to gain a clear profile and international standard in all respects.
There are a reasonable number of publications but these are unevenly distributed within the staff group. There is international collaboration but again, this is unevenly distributed. At the same time, the cohesion of the group is limited. Neither is the strategic thinking well developed.

2. Environment / Infrastructure
The panel does not have precise information regarding the (level of) funding of the psychology group. Yet, it has received a number of funds, some of which, especially the EU funding, are quite prestigious. Although differences between subgroups can be seen, the group might have to become more productive in this respect in the future.
The group feels there is, so far, limited support for administration and, e.g., a grant support office and would like more central support.
The group seems to have an open and liberal leadership. Thus, the researchers are free to work on the subject they are really interested in. Yet, this may have disadvantages such as a dispersed and less focussed research programme. To obtain a well recognised internationally recognised profile such clear focus as well as high level collaboration would be needed for some of the psychology groups. A more directive leadership may be helpful in this respect.

3. Networks and collaboration
This group seems open to collaboration. Members look forward to further collaboration with their respective research clusters. The collaboration in the context of EU work life studies seems fruitful. In this area there is a visiting professor also. In the health psychology and social psychology there is some collaboration nationally as well as internationally (the UK and the US).
4. Co-production
Essential is the relationship with the public sector, regional county councils and National Board of Health and Welfare.

5. Productivity
The panel suggests the group might consider stimulating writing more in international peer reviewed articles. In this respect clear ambitions are limited so far. Explicit norms depending on the type of staff function could be made explicit. Writing review publications are an interesting way to further the group’s impact. There is a reasonable number of publications but these are unevenly distributed within the staff group.

6. Impact and relevance
Relevant topics are addressed throughout the subject line. Yet, more impact may be expected when integrating in the newly formed clusters. Obviously the working life area has good potential. Some studies are also more theoretically driven (like empathy) or psychometrically oriented. These may have more long term impact but this is less easy to establish right now. It should be noted that focussing on interests pursued by individual researchers may result in a vulnerable position in the long run. In fact, societal or science related priorities may have to be established explicitly to serve the group and its focus.

7. Quality of research
The publication record of the group is still limited. This small group addresses three different themes and, as such, the participants seem to have limited aims in common. The panel would like to see a more consistent line with the potential to create continuity. Therefore, the newly formed research clusters are important for them and maybe even more important than the psychology context.

8. Renewal
The panel has seen limited renewal in this group so far. There does not seem to be a clear plan for the future yet. Within the group the researchers operate from different perspectives. Different forms of intervention studies might be pursued to further successful output.

9. Potential recommendations for development
The panel suggests that this group especially needs to develop strategic management to strengthen their productivity, profile and continuity such as suggested for the school as a whole (see above). A professor in work life studies is much wished for by the group. The work on empathy has such a direct relevance to nursing and health care and should certainly be linked to projects in the caring sciences.

VI. PUBLIC HEALTH

1. General assessment (good > very good)
This is a small to medium sized long established group with a range of staff although several are at retirement age or work on 10-20% contract. In terms of research, it is a mature group but one in transition that has gained major EU and national funding producing outputs in peer-reviewed journals of international importance. How their new research strategy will play with the new research clusters cannot yet be established. It should benefit grant applications and help to increase high quality research publications. The new departmental research strategy, also if
focused effectively within the field of inequalities and major intervention methodologies, should ensure effective work in epidemiology, health economics/health service research and statistics. This could additionally be central to developments across the school. Critical to the group will be succession planning as leadership changes are due in the future.

2. Environment / Infrastructure

The current staff constitution is substantial with 2 experienced professors, one associate professor, five senior lecturers, 7 lecturers of which 4 are PhD candidates. Staff have a broad range of interests and it is difficult to identify groupings of staff in the middle term that indicate the existence of coherent ‘research programmes’ rather than lone researchers. The department utilises senior researchers from outside the University as well, which is both a strength and a resource and a potential weakness. The team have been able to attract important external funding at a national and international level from the EU, Sweden (including the Swedish Public Health Institute, the Swedish Council for Working Life a Social Work and the Swedish Association of Local Authorities and other Scandinavian countries). In terms of infrastructure, staff access 3 research sub-environments and it is too early to assess the impact this will have.

3. Networks and collaboration

The department has links with a range of key networks within Sweden, Scandinavia, the EU and China and has collaborations with several high quality public health partners - both academic and professional - in these networks with several grants resulting.

4. Co-production

The subject of public health is a key one in terms of policy and practice for local government, national agencies and funders, employers and international organizations. The department engages in the public sector and the wider civil society. It has some high quality partners and the research outcomes should be relevant to those partners. Opportunities may exist for enhanced co-production and greater research impacts.

5. Productivity

This varies. The department has an above average number of peer reviewed papers in internationally recognized journals. Smaller number of staff produce several papers a year in well respected peer reviewed journals. Mentoring and appropriate appraisals may well be able to increase productivity further in association with the changing school and university approach to research.

6. Impact and relevance

The department has worked in areas capable of having health service as well academic impacts and is very relevant to major public health challenges – evaluations, migrant research, road traffic injuries for example and tobacco, alcohol, gambling, nutrition and obesity. Their outputs have had a relatively wide reach including outputs in the international domain.

7. Quality of research

The research in multi-authored papers as expected in this field has gained international attention in recognised channels and produced some nationally leading research. The balance between WEBS/DVV outputs could in the future be higher but it has achieved a high Scopus and Web of Science score within the school at MDH.
8. Renewal
Senior staff retiring in coming years mean that succession planning will be critical to the group and provides an opportunity to recruit new staff at senior and post doctoral level and further develop new fields. This should be linked, if at all possible, to retaining good PhD students going through MDH’s own programme. The new research strategy will need to be detailed and made explicit in the new research clusters with regard to increasing research funding, high quality outputs and co-production that shows relevance to partners and the School.

9. Potential recommendations for development
Currently, and to be expected at this stage, it is not yet clear how the group will work in the research clusters it has chosen or how exactly these will be managed. Inequalities and interventions research is very relevant. Ambitious but manageable targets can be set for work in these areas. The department could fruitfully link to several cross-cutting themes in the school: lifespan, work life and health and health care programmes but should not be viewed simply as a service department. Significant potential for growth should be possible because of the public health policy agenda that now exists nationally and globally especially with high level methodological expertise in health economics, epidemiology and statistics from existing and new staff across the research clusters. Generation shift is critical to dealing with succession planning.

10. Other issues
The general issues raised in other assessments with regard to further developing and supporting a research culture led by the professors and associate professors apply. The development of senior lecturers will be the biggest challenge.

VII. SOCIAL WORK

1. General assessment (good > very good)
The social work group shows considerable promise and potential for further growth. The group is relatively new as a unit and is now in a good position to offer professional social work education at MDH. Research education programme is also a recent development and bodes well for the growth of the research culture and environment of this group. The group’s work reflects interdisciplinarity that incorporates sociological and psychological approaches in the study of social work. There is a good history of obtaining external research funds.

The panel rated social work as ‘good-very good’ recognising their key strengths in obtaining external funds, networking/collaborations, and research output. Their areas of research were regarded as coherent and focused.

2. Environment / Infrastructure
There is evidence of successful research grants as lead investigators and co-investigators from key sources including research councils, central and regional agencies and the European Union. However, this is rather top-heavy and junior researchers need to be encouraged and supported to be part of this research culture. Senior professors demonstrated evidence of leadership for such activity however a stronger steer is needed to achieve a paradigm shift. The growth in PhD studentships and post-doctoral positions would provide the group with the required impetus, however this is contingent upon dedicated funding. The university needs to give serious consideration to retention of budding researchers with the offer of core-funded appointments.
3. Networks and collaboration
The social work group are engaged in research activity at local, regional, national and international level. Examples include research activity in a range of areas including work in children and families, disability, and migration and ethnicity. There is good evidence of further strengthening existing international links through securing external funding to undertake comparative work in Japan and South Korea. The social work group have been successful in an application to the Swedish Research Council in networking with other universities that have social work to receive funding for National doctoral school in social work. This is an important development and it is to be commended.

4. Co-production
There is evidence of considerable co-production research with local and regional agencies. An example of one study which had focused on ‘children in sheltered living’ was provided by the group in their presentation. It was noted that this study was not only co-produced but had led to some tangible organisational change in the care of children in such settings.

5. Productivity
The group have written a number of peer-reviewed and other publications between 2008-2012. A total of 15 of their publications appear in the Web of Science with a citation score of 0.8. This could be further strengthened by targeting journals with a higher impact and significance including the British Journal of Social Work, Journal of Social Work, etc. Some senior lecturers appear to be doing some important work in the area of migration and ethnicity, but are only publishing in Swedish. Lead professors need to formulate a clear strategy to work in partnership with and/ or support such staff to publish in English and in high-impact journals.

6. Impact and relevance
The group’s research output is significant and appears to be relevant to local/regional and national and international actors. This is manifest in examples where the group’s research output and reach has led to securing research funding from key agencies, for example, in the area of intimate partner violence and the impact on children (see BBIC Swedish framework for assessment). International work with Asian countries is also a consequence of the impact of the work of this group. This demonstrates enormous potential and needs to be showcased as a good example for other staff to begin to engage in such partnerships.

7. Quality of research
In recent years, there is evidence of publications in high quality/high impact social work journals. This is uneven however and needs to be strengthened and sustained over time and other journals with higher impact need to be targeted (see 5 above).

8. Renewal
The group’s strengths and dynamism in obtaining external funding, working regionally, nationally and internationally and in writing research publications in peer-reviewed journals were recognised and commended by the panel. Within this activity, the qualitative research tradition was noted as a dominant approach. The panel observed that the development of a mixed-methods approach could help the group to further realise its evidence-base and intervention focused research ideas/plans. With the impending retirement of the senior professor, the university needs a risk management action-plan to ensure a good succession plan. It is suggested that the incoming
professor appointed should have expertise in mixed-methods particularly in complex quantitative methodologies.

9. Potential recommendations for development
Stronger leadership is needed with a clear strategy and focus to support staff in publishing for the international stage – in English and in high-impact journals.

Appointment of a strong mixed-methods/quantitative background professor to replace the retiring senior professor would be beneficial.

A clear strategy to target journals with a higher impact should be developed.

10. Other issues
More research into direct social work policy and practice could help to forge an important identity and strengthen the profile of the group.

The social work website is in need of improvement. It is suggested that all staff and PhD students have a profile on the website - in both Swedish and English. Information about research income, publications and other research activity needs to be regularly updated. A systematic/uniform format would help provide clarity and consistency.

VIII. SOCIOLOGY

1. General assessment (good)
Sociology is a relatively small subject in the School. The subject is new to the school but not the university and growing with potential. The group seem to be “finding their feet” and trying hard to establish their particular research identity within a new research grouping.

The development of qualitative sociology in Sweden could be a real opportunity for this group, who have the potential to be at the forefront of this methodological drive.

This group had a strong and dynamic sense of strategic thinking and showed initiative taking ownership of their own research directions and planning and considering what their research and publications direction should be in the future. Taking into account both the positive and negative aspects presented below, the overall impression grading of this group is good. The productivity in terms of internationally recognised publication record is insufficient so far. On the other hand the group has good co-production, show social significance and clearly displays ambition and strategic thinking. Therefore, it has good potential for the near future.

2. Environment / Infrastructure
A motivated staff exists in sociology. The present professor was appointed as professor in 2012. A small number of sociology staff joined the School in 2013. The group had an awareness of both opportunities in the School and challenges to adapt to the School.

3. Networks and collaboration
The group has extensive contacts in both research and teaching, both nationally and internationally, but the outcome of this collaboration is unclear.

Within the MDH the subject can contribute a valuable sociological profile to the new research clusters.
4. Co-production
Co-production exists, the subject had several partners and projects, some that clearly can be
called co-production. The research has value for the partners and for society at large. The funded
projects often tend to produce reports written in Swedish rather than academic publications in
English. It is not obvious to what extent the co-production improves quality of research.

The basis for some excellent co-productions exists but it was not clear among the group as to how
these could be taken to the next level. For example, in the ‘complaints’ study, the initial work
is promising but this could be raised to a whole new ‘co-production’ level. If for example, the
hospital quality assurance department were involved as co-researchers, if there were strategies
to translate findings into altered and improved hospital policies and staff training approaches
and if there were interventions that were subsequently evaluated, hypothetically showing a 50%
reduction in patient complaints and if these results were published in top quality journals. Now,
that would be a co-production project.

5. Productivity
There is a wide variety in the publication activity among the staff. Scientific productivity is not
directed towards reviewed international articles, which is a problem for this group. The group
has predominantly published monographs and books/chapters. While this is important, this
may not be the most valuable publication strategy for this group’s future efforts for international
recognition.

6. Impact and relevance
While the group’s impact in publications and citations is modest, the activities of the group has
had some national impact and relevance, for example the study of elite sport and gymnastics.
(see eg
http://www.svt.se/sport/barn-plagas-i-svensk-elitgymnastik)
http://www.svd.se/sport/stark-lakarkritik-mot-barngymnastik_7996836.svd

7. Quality of research
The research in ethnic and cultural diversity has drawn international interest. There are promis-
ing developments in terms of the overall quality of the research, but it is still not at the frontiers
of the research field.

8. Renewal
The group has potential. The staff has vision and strategies, but they need to be developed. The
group wish to expand and to recruit new people. The staff had a good sense of the challenges
the group experienced. The group needs to target high-impact journals such as Sociology, British

9. Potential recommendations for development
The group should be commended for their proactive and strategic sense of the “ways forward”
required. The challenge now is to “walk it like you talk it”, ie, how to turn the rhetoric into a
valuable reality of focused research questions and meaningful collaborations with other groups
within the School. The group can enable synergy effects with other subjects and research clusters
at the School. The group needs to learn how to publish internationally.
RESEARCH CLUSTERS

CHILDREN AND YOUTH RESEARCH (ICU-CHILD)
The panel observed this group to be cohesive with a clear and focused research activity involving a range of historical and current studies in the broad areas of children and risk, child rights, and more generally the 'New Sociology of Childhood'. Working with a group of 40 researchers (3 Professors, 4 Associate Professors, 11 Senior Lecturers, 9 Lecturers, 2 Post-Docs, 7 PhDs, and 4 guest lecturers), there appear to be a range of research projects in line with local and national research priorities. Given the paucity of research attention in this area, the group also emphasized their new activity of 'child protection' as an identified area for study in Sweden.

Some areas for consideration are identified for this research cluster below:

A. A careful consideration of opportunities and threats facing the group is needed. It was believed that the idea of sub-dividing this group could risk the current cohesiveness.

B. Participation of children in working with the research group needs to be seriously considered - perhaps as a 'reference group' that can meet on a periodic basis to advice on research priorities, methodological concerns in engaging with children etc. Ethical issues in involving children in this way, or as researchers requires careful thought however.

C. A more systematic research activity on a regular basis including seminars and conferences showcasing the output of this group could be an important opportunity in the dissemination of knowledge. Inclusion of local and national researchers, practitioners and policy-makers at such events could be potentially beneficial in developing future research priorities and agenda, as well as in realising the potential of research output.

HEALTH AND WELFARE IN MULTICULTURAL WORKING LIFE
The cluster includes researchers using a variety of disciplinary, theoretical and methodological approaches in the behavioural and social sciences. Of interest is a variety of questions, especially the impact of work and working life on learning and development, wellbeing and the health of workers, including the role of participation and gender equality in social services and other services. The cluster also covers studies of leadership, management, development and change in individuals, teams and organisations, wellbeing and performance of individuals, teams and organisations. The cluster is broad and apparently includes a multitude of interests. It partly has its history in the working life studies environment at the university. Sociology presently plays a large role, but also other subjects are mentioned as partners in the process of restructuring.

The higher seminars 5 to 6 times per semester are obligatory for PhD students. Working life issues are the focus. History, psychology, public health sciences and sociology altogether have 40 researchers, 4 professors, 4 Assoc. Profs, 26 lecturers and 6 PhD students.

The cluster as such has, so far, not established new national and international networks. Several of the projects and plans that are gathered under the umbrella of the cluster includes aspects of co-production.

The productivity of the cluster can still not be commented upon since the whole cluster is under construction. Its impact, relevance and quality will depend on how well the cluster can build a viable research environment. The cluster presently largely builds upon a previous working life studies environment. There are plans and a potential for renewal, but this is still an on-going process.
The cluster needs to grow beyond the present focus on sociology. The other subjects of the school hold considerable expertise in the fields of immigration, diversity and intersectionality that can contribute significantly to the multicultural focus of the cluster. The cluster also needs to build contacts with similar international research environments. It is positive that the intention is to submit an application for funding from the call ‘Horizon 2020’.

**INDIVIDUAL CENTERED RESEARCH MILIEU**

The cluster contains about 40 members, including 2 professors, 1 adjunct prof, 6 associate prof and about 15 PhDs and 7 PhD students, 5 junior lecturers. The name “individual” was partly chosen to be different from The University of Gothenburg Centre for Person-centred Care. The term individual indicates that the focus is not only patients but also clients, users, dyads etc. The cluster activities includes meetings and seminars to get more acquainted and to plan projects and work on research proposals.

There is clear potential in terms of productivity based on the cluster’s reference to what the members have produced in 2013: 45 peer reviewed scientific papers, 2 editorials, 30 conference abstracts, 1 book, 2 book chapters and 2 reports.

The impact of the cluster is potentially good given the broad methodological perspective and collaboration assembled within the cluster. The renewal of the cluster is an on-going process and the cluster is presently working with conceptualisation which may not be an easy task.

It is important that the group formulates and pursues a niche to make them recognisable from other groups working in the area around the world. Right now the definition is broad and therefore does not clearly distinguish their contribution from that of others.

**INNOVATION AND IMPLEMENTATION RESEARCH**

All disciplines are represented in the cluster except Psychology - which may join later.

There are regular meetings. Clarifying the field and planning developments have been the cluster’s first priority. It is, however, not clear to the review group exactly what innovation and implementation are and how projects described by the cluster differ from research already underway within disciplines.

The cluster hopes to obtain a budget from the school in the future. In addition to defining the cluster’s field and objectives, knowledge transfer and potential should be highlighted in the future. The cluster will need to ensure that its uniqueness in this field is both clearly understood and accepted as valuable by funders and co-production partners, e.g. how does implementation differ from interventions and action research leading to research implementation and knowledge transfer.

The cluster contains 20 members: 2 professors, senior lecturers, 5 associate professors, 4 to 5 PhD students from a majority of departments within the school and demonstrates there is significant interest in some form of interdisciplinary research in this field. It is at a very exploratory stage but the cluster has expertise across disciplines and with different research approaches which could be a strength. Existing networks within the departments have facilitated the development, review and submission of 2 research proposals for which funding is still being sought. The group should act as a catalyst and could be another bridge for the school across university and with partners outside. There is already some co production engagement with the County Council.

The current projects presented have potential policy and practice impacts and appear relevant to health bodies and governments, civil society groups and funders. There are various journals on innovation but the cluster will, we assume, be aiming to publish in higher ranked journals.
and achieve higher impacts (However, HealthCare: The Journal of Delivery Science and Innovation: an Elsevier publication, would not be one of the highest impact journals to aim for).

If and when this cluster can demonstrate its relevance and distinctiveness, based on funded projects and outputs then appropriate budgetary support should be provided for the cluster.

OLDER PEOPLE’S HEALTH AND WELFARE
The cluster is a multiprofessional group. Good evidence of interdepartmental working evidenced by ‘Robocat’ which also led to a spinoff company and a possible patent. This is an exemplar of co-production and collaboration in the MDH. However, the actual implication of the project and the extension of the project to implementation is not clear.

This is a newly developed group, which has had only a short time to develop.

Much of the research activity and subsequent publications, with the exception of the above, appears to have been developed and conducted when staff were in other institutions.

The group should critically appraise their performance and reflect on the direction of the group and the future focus of research. Their core research questions and abilities need to be clarified.

The group reported that they were multidisciplinary and consisted of 40 people including 2 Professors, 5 assistant professors and 7 PhD students. There is little evidence of a coherent research strategy. The presenters reported that 4-6 research projects were in development but it was not clear what these were or how they were related to any long-term strategy or what the proposed method of funding was.

There appeared to be an over-reliance on PhD funding through MDH, although a recent application had been made for programme funding but this had not been successful.

We recommend a stringent method of reviewing grants with possible external review. This should be linked with on-going education on grant development and writing support for research active staff.

How post docs are to be developed is not clear from the presentation given by the cluster; this should be clarified.

The cluster is networked into local research organisations, but this appears to be historical and not pro-active to meet the needs of future research.

There is a good network with the departments and subject areas within the university and with other department within the University.

More joint discussions and planning with other groups is recommended.

The Robocat project involves a local company for production of the robot and this is a good example of co-production.

The group should develop a method of public and patient involvement in identifying potential areas of research and canvass their opinion when developing research ideas.

Most of the research papers appear in moderate to low impact journals. There is a preponderance of non-citable publications in the DiVa database with fewer available through Web of Science. The group should be more strategic and targeted in their publication strategy to improve their profile.

The cluster is relatively new and so it is difficult to assess its impact and relevance. The research area with Robocat and falls prevention have merit but there needs to be a strategy to develop these areas further and currently it is not clear how these will be developed.
It is difficult to assess the quality of research at this point in the development of the group; individual projects have resulted in a few papers in moderate to low impact journals, a lot of these were developed and published before the development of the research theme but demonstrate the potential of the group.

The group is too new to have made a judgement on strategies and plans, but it must conduct a strategic review and develop a strategy for the future as a matter of urgency.

This is an important area with a national research focus and is not only an opportunity but also represents an area of considerable competition from other institutions. The group needs to ensure that it has the resources including access to high quality advice and support on research methodology, statistics and health care evaluation, without this it unlikely to be successful in this increasingly competitive area.

There is an urgent need for the group to produce a strategic plan for the future of this group. There is potential in this research group and the strengths need to be identified.

CONCLUDING COMMENTS

There is much in higher education and in management that may reasonably be seen as fad and fashion, but there are no indications at all on the national or international scenes that research and scholarship are likely to become less important in the foreseeable future. On the contrary, every indication is that they will assume an even greater prominence and become an ever more omnipresent expectation for every university, School and academic staff member. This is the international reality that should focus the mind and efforts of the School.

There is real cause for optimism in this review and for the School as a whole. There are certainly problems to overcome and challenges to face but the optimism comes from several quarters.

No one in the School could doubt the commitment of MDH to growing and developing research and scholarship within the University. MER14 alone is a significant investment in time, money and other resources by any University standards. Our panel highly commends MDH for this bold and courageous step in inviting such international, expert scrutiny of its research. Inviting such critique and reflection is an indication of maturity and confidence and a clear message that at MDH, ‘resting on our laurels’ will not be an option. All staff and researchers within the School could boost their ‘quality assurance’ significantly by emulating this critical approach and ‘mind-set’ within their own ‘individual’ and ‘cluster’ research cultures.

Given the extent of this investment, we would expect that MDH’s executive leadership will certainly want to take action on many of the MER14 panels’ recommendations. This is not a report that is likely to simply ‘sit on a shelf’ and nor should it.

The openness and honesty shown by staff in their discussions with us and their desire to ‘do better’ in their research efforts are part of a promising foundation on which to build.

MDH is a ‘young’ university and as such it need not be hampered or ‘bound’ by traditions and conventions in the ways that many ‘older’ universities may be. MDH can ‘show the way’ in entrepreneurial and creative approaches to research development, enabled and encouraged by managers and structures that are as free as possible from bureaucratic and initiative-sapping processes, practices and policies.
Chapter 5:
Embedded Systems - Report from Panel 2

Panel Members
Wilhelm Schäfer, University of Paderborn, Germany (Panel Chair)
Antonia Bertolino, ISTI-CNR, Italy
Tiziana Margaria, University of Potsdam, Germany
Françoise Simonot-Lion, Université de Lorraine, France
Herbert F. Voigt, Boston University, USA
Kazuya Yoshida, Tohoku University, Japan
Bertil Svensson, Halmstad University, Sweden
Åke Öberg, Linköping University, Sweden

1. General Assessment
The panel appreciates very much the warm welcome by the Embedded Systems (ES) group, as well as by the whole university. Discussions were always open-minded, constructive and responsive. Embedded Systems at MDH as a part of the IDT school clearly is an internationally recognized, research- (and opportunity-) driven and very open-minded place. It is thus an attractive place for senior and junior faculty as well as graduate students. (The panel did not assess any undergraduate teaching, which is why we do not discuss it here.) The visit was also extremely well organized, leaving ample time for the necessary detailed discussions.

2. Environment and Infrastructure
Fourteen (14) research groups (of which we met representatives from twelve (12)) have build a strong research-driven environment for ES. Each group is led by a professor and has well-focused research topic and agenda. In many cases, these groups form strategic alliances to address upcoming calls of national and international agencies. Cooperation is driven by a very flexible and interactive style of working among the groups but also within the groups across all levels of the academic hierarchies, including professors and lecturers, but also Postdocs, PhD and M.Sc. students.

Many of the groups (see details below) are headed by internationally recognized people with a clear and strategic vision. Building on such strong leadership, the research specialization Embedded Systems at MDH is an internationally renowned place.
International visibility and the attractive work environment are underlined by the fact that ES at MDH hosts many international visitors and many international PhD students and these constitute a very strong part of the whole group. They all praise the excellent working conditions in terms of an open-minded, interactive and vision-driven place. KKS funding is used efficiently to support short- and long-term stays of guest scientists.

Hiring policy in recent years has clearly led to an adequate mixture of senior and junior researchers as well as male and female researchers.

Obviously, these conditions have not only produced an impressive amount of high-quality papers (although there are some differences among the groups in ES as described below), but also to an impressive amount of funding in comparison with “competing” Swedish universities, even with the so-called “old” ones. As far as the panel understands, the proposal writing and application process of the whole group is very effective and especially persistent when it comes to submitting and re-submitting applications, as evidenced by the high degree of externally funded research (78 percent).

On the education side, the panel was impressed by the unanimous views expressed by a number (5) of selected PhD students who provided a very good coverage of the different stages of a PhD project as well as national and international students. They all greatly praised the organization of the PhD program by MDH, which includes sufficiently high salaries, guarantee of a 5 year contract to complete the PhD, flexible contract negotiations with options to include less or more teaching duties, two types of thesis are accepted (monographs or composition from published papers), a lot of support by frequent interaction with supervisor(s), generous financial support for conference visits, fostering of publication activities and visits abroad, industrial cooperation, summer schools, and an individual study plan as a written agreement between student and supervisor and acknowledged by the faculty board. All in all these offers are really at the top level of an international research place.

Excellent research and especially project acquisition and implementation is supported by RECO, which is an internal school unit, to help in making contacts but also in managing all the administrative details very successfully, including the administrative details when applying for research funding. All researchers confirmed the effectiveness of RECO such that it might become a role model for the whole university.

Finally, the panel visited a number of labs and appreciates an appropriate and adequately equipped lab space. The robotics lab, in particular, provides good facilities for the Master program in robotics. Lacking a 3D printer on this campus, however, seemed a bit surprising as quite a large amount of construction work is going on.

Despite this excellent environment there is, as always, some room for improvement. The panel agreed on the following recommendations concerning the ES environment and infrastructure:

As far as the panel understands, university funding currently covers ca. 22% of the overall annual ES budget, whereas the remaining part comes almost exclusively from (competitive) grant money. This ratio is for sure at the lower level in terms of an international standard. The fact that a substantial part of the university funding needs to be used as matching funding to some of the externally funded projects makes the situation even more extreme. High-caliber research usually requires not only project-driven research but also some more long term hypothesis-driven research to be sustainable and enable strategic planning for future projects as well as to develop further the group’s strengths. With the current budget, the panel thinks that ES has reached a ceiling of annual grant money income, and may be subject to risk facing a sudden drop in case
funding policies change or an unusual number of applications failing. Internationally ca. 30% to 35% funding seems more appropriate. This highly “project-driven” approach, though very successful, should be carefully revisited. The panel thinks that the ES group needs a strategic “master plan” that identifies key strategic areas and corresponding hiring policies on a ca. 10 year time frame. Of course, the panel understands that research goals need to be adaptable but expertise and competence cannot be changed easily and in short time.

Negotiations between upper level management at MDH should result in certain financial guarantees from the university board and in turn a resilient plan by the ES group about research visions, areas and goals and how to achieve them. The current composition of the ES group by six so-called areas or sub-units is not very convincing. Even the terminology itself, namely whether to call them areas or sub-units, is not used consistently within the group. More importantly, the areas are partly highly overlapping, sometimes orthogonal, sometimes not thoroughly underpinned by existing work (see details below).

As a side remark, the panel noticed that MDH may have benefitted from an internationally rather unusual situation, namely less flexibility in changing work places by Swedish researchers such that a number of senior, high-caliber people from neighboring places went to MDH rather than considering moves to other more remote places. This trend may change and, as a consequence, not enough high-caliber people who live “close by”, might be available. When not taking care, the whole system could suffer from some form of “inbreeding” in the future.

**Grade:** excellent – very good

### 3. Networks and Collaborations

Excellent cooperation with international high-caliber academic partners around the whole world is in place. This fact is underlined by many EU projects but also by a “continuous flow” of international visitors as well as visits by MDH faculty and PhD students to universities abroad.

However, the sheer amount of current existing agreements might also require some strategic planning in the future and a selection process that is guided by clearly identified objectives for each agreement. Only clear objectives guarantee that all existing partnerships can be managed appropriately. One example could be the suggested and needed partnerships for the SS&H area (see below).

**Grade:** excellent

### 4. Co-production (co-creation) and external co-operation

As highlighted by the rather unusual term “co-production”, which is used by MDH, the ES group has an excellent standing concerning cooperation with industrial partners. Based on a long term strategic relationship with major players like ABB and Volvo, the group runs many national and international joint projects. All company representatives who participated in a meeting with the panel praised the flexible and cooperative relationship with MDH including flexibility in terms of contract negotiations concerning IPRs. The group runs a variety of different types of projects besides the project-specific cooperation. Such projects include most notably a successful, impressively well-received so-called industrial PhD student program (altogether ca. 40 students are industry sponsored) as well as internships going both ways, namely faculty spends part time in industry and people from industry work as part time lecturers or professors in the department.

Successful cooperation with industrial partners was underlined by statements from representatives from Swedish funding agencies. Even in very competitive programs, ES at MDH is very successful. Some representatives called MDH the number one place in Sweden when it comes to finding an academic partner in the area of embedded systems.

**Grade:** excellent
Such an excellent situation should and could be exploited even more: The panel makes the following recommendations by appreciating that some of the points may not be implementable. The panel does not know all details and constraints that might exist.

A. Establish an Industrial advisory board for the whole ES group or maybe even IDT as a whole
B. Endow chair(s) from industry to guarantee continuity (as required by industrial partners)
C. Extend industrial PhD program to other places in Sweden (or even abroad) to raise MDH visibility
D. Identify longer term strategies for project acquisition together with industrial partners

Grade: excellent

5. Productivity
Overall the group’s output in terms of papers published to a large extent in high-caliber conferences and in top journals, is impressive. In general, the panel does not believe in sheer numbers but rather value the quality of the contents. As a number of panel members publish in similar venues as members of the ES group, the judgment is based on actually having read and evaluated a number of the group’s papers before the meeting on various occasions. High productivity again varies between the different groups in ES as described below.

The high number of successful PhD graduates each year who usually receive very good offers very quickly, is another indication of very high productivity.

Grade: excellent – very good

6. Impact and Relevance
The high number of national and international publications as well as citation indices that are definitely above average in general demonstrate clearly impact and relevance of the group’s research. Again, the panel does not strongly believe in sheer numbers as given by citation indices. In addition, the provided figures from the Leiden report are of no use, because major publication venues in computer science are not considered by this report. More helpful is the group’s self-evaluation report that identifies h-indices based on Google Scholar. They clearly underline that many, but not all, of the ES group members are highly visible and recognized on an international scale.

In general it has to be mentioned that computer science as a field has many very prestigious conferences with very low acceptance rates (down to 10 – 15 %). Publishing in these conferences is considered within the community at least as rewarding as top quality journals, which also exist of course. The panel has taken this fact into account and made corresponding comments when assessing the work of the individual research areas below.

Further indicators of impact that the panel considers equally important as bibliometric figures, are industrial relevance, “production” of successful graduates on all academic levels and attractiveness of the place for international visitors and students. As a general comment the ES group shows excellent performance in all these parameters. More details will be given below as performance varies between the different research areas.

Grade: very good
7. Quality of research
This section will give an individual report on each research area or sub-unit and explain the identified heterogeneity between the different areas. This heterogeneity will also explain the panel’s view that a better positioning of the group’s research profile is possible than using these areas or rather the selected topics.

Assessing the quality of research was based on presentations and interviews with key members of each area and a poster session that was run by graduate students (all PhD candidates).

In that poster session about 15 PhD students presented their individual projects. Each panel member discussed individually with a large percentage of that group. Despite a very good general impression by the panel members, there was quite some heterogeneity in the individual presentations. Some students had problems giving an account of the state-of-the-art and also a description of technical details and anticipated results of their approach during the discussions. This was rather surprising because as said above publication records are in general very good. As a conclusion, the panel assumes that the identified cases might require a more thorough interaction between supervisor(s) and student(s). However, the panel appreciates that these cases were rather the exception than the norm.

Research Area: Real Time Systems
This research area gathers 5 full professors, 2 associate professors and 4 senior lecturers and in a near future, an adjunct professor (ABB Corporate Research) will complete the group together with a postdoctoral fellow from TU Eindhoven. Several guest professors are regularly providing additional skills to this core team (scheduling under resource constraints or flexible real-time communication as examples.) Their presence on the team is always the source of fruitful collaboration in the medium/long term as evidenced by a significant number of co-authored publications. Five research groups are involved in the Real-Time area bringing several know-how allowing the group to tackle both the design of time critical systems as well as the quantified evaluation of their performance (response time, end-to-end response time). It has to be noted that several members are the source of several well-known techniques in the real-time community (schedulability analysis, distributed real time architecture, deployment of hierarchical schedulers) and that the whole team is internationally renowned in real time scheduling/schedulability analysis.

During the evaluation period, 4 PhD and 7 licentiate (source DiVA web site) were graduated. This looks few, but in May 2014, 11 students were involved in a PhD course working on basic research while 3 others were industrial PhD students. This demonstrates a very good tradeoff between basic and applied research. These 14 students are supervised by 14 seniors demonstrating so a very good and serious supervision activity.

The real time research area is strongly connected with other research area in the embedded systems specialization; in particular, several members of this area are also deeply involved in the software engineering and dependability ones. The link with the Verification and Validation area is mainly focused on the WCET analysis while certain methods developed in the V&V area, especially those dealing with time-critical system testing, could enrich the work on the time critical systems design. The links with the two last areas (SSH, R&A) are, at the time of evaluation, not visible while these two themes could provide concrete case studies for staff members as well as for students of the school.
The RT research area members have, for a long time, developed several strong and regular collaborations with the best universities working on the real time topic. These collaborations are attested by numerous co-authored publications. Furthermore, the senior members are involved in the technical committees/editorial boards of the most prestigious conferences/journals relevant to the real time area (RTSS, ECRTS, RTAS, etc.) Finally, they are / were involved in the main European networks for the real time topic and in particular in ARTEMIS, ARTIST / ARTIST2, RetNet.

As all the other research areas in Embedded System specialization, the RT area has developed strong, regular and formal cooperation’s with prominent industrial partners (end-users, tool suppliers). Beyond, the collaboration within punctual projects, one has to underline the involvement, for example, of ABB in a strategic recruitment and through an adjunct-professor position of an ABB engineer.

The contributors of the real time research area produced 388 publications between 2008 and 2012. All the staff members are [co-]authors of publications. The average number of publication per senior researcher and per year is high (7.7). One can identify 11 (resp. 126) papers published in international journals (resp. international conferences) relevant to the real time thematic. Beyond this impressive number of publications, one has to highlight the quality of certain publications. Numerous papers were published in the best journals (Real Time Journal, Journal on System Architecture, IEEE Transactions on Industrial informatics) and very selective conferences (Real Time System Symposium, Euromicro Conference on Real Time System, IEEE Real-Time and Embedded Technology and Applications Symposium, etc.) Furthermore several results provided by the real time area members were deployed and / or commercialized in several companies. One more time, this is a proof of a good trade-off between basic and applied research.

The increase of software intensive systems in all the sectors of the society (energy, transport, city, health, industrial production, etc.) brings several important problems: the need for a strong and efficient design method of new systems (competitiveness of the involved companies under cost constraints), the optimisation of resources in parallel with the dependability assessments required by international / national standards. For most of these systems, the real time constraint is of the utmost importance. The research topics developed by the RT area are completely relevant to this problematic. They propose 1) solutions for a RT system to deliver a result just in time while avoiding the oversizing of these systems (network or CPU bandwidth) and 2) to prove that the proposed technique is compliant with dependability constraints that can be expressed as time constraints. In this sense, a strong advice is that this area has to keep a strong cooperation with the Dependability research area. The way the RT research area members tackle the problem of the design of real-time systems is fully consistent. They provide original methods taking into account both the optimisation problem (minimisation of energy, resource consumption, costs versus maximisation of performances) and the fact that these systems have to be proved dependable. The development of scheduler based on the concept of hierarchical scheduling is very convenient for this purpose. In numerous papers, they champion this approach and provide scientific developments of both the scheduling policy and the corresponding schedulability analysis. These papers are often cited in the real time community and the team is recognized, at an international level, as one of the top specialists of this technique. Moreover, this technique has nowadays two main interests: it allows the design of adaptive systems and the separation of time critical and non-critical parts of a system through virtualisation. These two topics are identified as future challenges by the team.

Moreover, in parallel, the team has recently started certain works on a probabilistic approach of the schedulability analysis of real time systems. This new way is fully justified because nowadays it’s quite impossible, without a very costly over sizing of a system, to have a deterministic as-
essment of timing properties. It should be noted that the team is among the pioneers of this approach. This program is fair and we strongly encourage the members of the RT area to go in this direction. Nevertheless, the team has to be aware that the second sub-topic will involve two kinds of competencies (competencies in scheduling and competencies in probability); two cultures that could be difficult to integrate. An academic collaboration of medium- and long-term duration with a group of researchers in mathematics could be beneficial.

The panel also appreciates the group’s intention to put forward another topic, namely to continue the work on hierarchical scheduling for complex architectures (multiprocessors), on the one side and virtualisation (mixed criticality systems), on the other one.

Grade: Excellent

Software Engineering

The SE area includes the group (Industrial Software Engineering) led by Prof. Ivica Crnkovic and the group (Model-Based Engineering of Embedded Systems) led by Prof. Mikael Sjödin.

Prof. Crnkovic led the presentation to the panel committee. The research activity in the area is specialized in the application domain of Embedded Systems, and mostly addresses the modelling phase. The team yields a very strong expertise and is internationally renowned in Component-based and Model-driven technologies. Research also covers modeling of non-functional properties and the specification of processes for the development of component-based systems.

The team yields a truly international nature. Many (most) PhD students and post docs come from abroad, thanks also to the double degree master that ES shares with France and Croatia. There is also an active exchange of adjunct and visiting international professors.

The presentation highlighted the clear orientation of the team towards industrial-oriented research, with many advanced projects carried out in cooperation with big industries (including ABB, Volvo, Ericsson) and local companies. The group has successfully transferred to industrial usage several products of research, among which, as notable examples, the Rubus component model and framework, which is now used in Volvo, and the Chess model-driven framework for guaranteeing non-functional properties of component-based systems, which is now used in Ericsson. Furthermore, the group has provided major contribution to the establishment of industrial PhD schools specifically focusing on the software engineering of embedded systems.

The panel acknowledges the long-term and internationally recognized prominence of the team into their field of expertise. The group has an excellent scientific profile: researchers have published in top journals of the field such as IEEE Transactions on Software Engineering, IEEE Computer, and Journal of Systems and Software, as well as in the premiere conferences and events, including the flagship International Conference on Software Engineering (ICSE), the Int. Conf. on Automated Software Engineering (ASE), the Symposium on Component-based Software Engineering (CBSE), among others. These publications come together with other lower level ones. In this respect the panel encourages the team to maintain its high international reputation, pointing with greater determination to top level venues.

As for the whole unit of ES, this team is also very active and successful in acquiring funded projects, at both international and national levels, and in direct cooperation with companies. The number of project currently active and the amount of external funds raised by the SE team is impressive and moves towards the highest range if compared to internationally comparable groups. Moreover, as again happens for all sub-groups of ES unit, many of the projects are carried out in tight collaboration with other research groups. Indeed, during the presentation the group showed a very good motivation to cooperative research.
The very strong industrial profile and the rich network of industrial partnerships suggests big potential for the group because the discipline of software engineering has intrinsically a practical vocation. Differently from other more theoretical disciplines, all research results in Software Engineering subfields must eventually demonstrate their validity through case studies or real world evaluations, and, in fact, most top level publication venues do not accept submissions lacking empirical validation. In this sense, the SE team is well positioned to address the most prominent publication venues.

Another strength to be underlined is the potential provided by the good number of PhD students, in comparison with the number of professors and researchers in the SE team. Some of the SE students interviewed during the panel session present already have a discrete number of good publications.

Finally, the group is very well integrated in the international community and cooperates intensely to the organization of top events, routinely taking leading roles not only within the program committee, but also in chairing many of them. It is however the case that such connections are due most exclusively to the team leader, Prof. Ivica Crnkovic, who is moving in a few months to another university.

This introduces one potential threat to the group’s international profile. Although the panel understands that some discussion is undergoing, a strategy does not yet exist for managing the leaving not only of the strongest SE researcher but also of a charismatic figure in the whole ES unit. There will be a transitory stage in which Prof. Crnkovic will bring to completion ongoing projects and supervise the ongoing PhD theses. However, the team needs to keep at level with their reputation and find who will take over the leadership.

Another potential threat, which is shared with all the ES groups, is the high and continuous effort devoted to proposal writing, following the call openings as they come out, and leaving limited possibilities for long-term basic research. Concerning future research directions, the team currently addresses three main subjects, namely the engineering of software for heterogeneous systems (HW-SW, multicore, critical), cloud-systems, and decision support for CBSE. These seem interesting and original topics, and the specific research problems presented were convincing. However, the field of Software Engineering is undergoing profound mutations in recent years, with novel paradigms and new development processes arising at a fast pace. In such a rapidly evolving environment, it is important to invest effort in exploring potential renovation routes of the group expertise and long-term research objectives.

Finally, the name of this area does not deliver a good characterization and has actually been perceived somehow as confusing. Software Engineering is a broad field, and is generally recognized as comprehending topics chosen as the names of other areas presented under the umbrella of “Embedded Systems”, such as Verification & Validation, and to some extent also Dependability. Although the panel understands that some overlap is unavoidable whatever classification of research topics is attempted, some more meaningful naming and key wording should be worked out to better valorize the different expertise of the ES sub-groups. Perhaps this area could be better characterized as Modeling and Design, or something similar.

Overall the Software Engineering sub-unit yields an outstanding position at the international level, however there are threats that should be addressed to maintain such excellence.

Grade: excellent
**Dependability**

One of the fairly newly composed areas is dealing with this highly topical subject, namely dependable systems. It responds to the fact, that many of today’s systems are software-intensive and highly influential concerning welfare of the society as a whole. The area is led by three full professors, namely Hans Hansson, Kristina Lundquist and Sasikumar Punnekkat. The ES group as a whole can definitely contribute to such systems but the term dependability covers much more than what is currently addressed by the ES group at MDH. The ES group takes research mainly from the previously mentioned areas as well as V&V below and thus addresses mainly the safety property (analysis) of dependable systems as well as its component-based development. This view is actually supported by the dependable systems group presentation to the panel.

However, many other aspects of dependable systems are neglected by and large, e.g., interdisciplinary development (systems engineering), reliability of hardware and the interplay of hardware and software, and very importantly security. Consequently, publication records and impact are not very strong especially concerning dependable systems as a whole. In fact, it is not easy to identify top journals or conferences that have a focus on dependability in all its facets. This statement does not diminish the quality of the individual researchers who work in safety analysis and component-based development. Their outstanding work is highly appreciated but it is assessed in other areas, namely real time, software engineering and validation and verification.

As a recommendation, the panel thinks that the term dependability is not expressing the ES group’s strength very well. Of course, the group delivers strong contributions to this area but as a key research area of ES, it would only make sense, if significant expertise is added to the ES group, namely in areas like systems engineering and security. This, of course, requires hiring new staff or/and building strategic alliances with other groups at MDH, like product realization at Eskilstuna. However this panel has not visited Eskilstuna and is thus not able to judge whether such alliances could be of any benefit.

*Grade:* very good (due to strength in safety and component-based systems)

**Validation and Verification**

The activities in this group are led by Prof. Björn Lisper, Prof. Paul Pettersson and Ass. Prof. Cristina Seceleanu, with additions concerning Software Testing in cooperation with Ass. Prof. Markus Bohlin and Ass. Prof. Daniel Sundmark (both with double affiliation with SICS) and Prof. Sasikumar Punnekkat (who did not participate to this presentation). Prof. Lisper and Prof. Punnekkat are also significantly active in the RT and Dependability groups. In fact it is very difficult to tell what exactly is the concrete distinction between the activities of the dependability and the V&V groups, given that the specific subset of dependability studied in that group is also very close to V&V and has to do with high assurance characteristics of systems that often need real time and nonfunctional characterization and analysis.

In this highly collaborative context, the work of the Programming Languages group is very strong: The WCET-related research, the SWEET tool and other contributions are definitely internationally very appreciated and successful also with industry, but it is not easy to carve out which percentage of it now belongs to the V&V, to the RT or to the Dependability areas.

The V&V group is renowned worldwide for the skills in a real time model checker Uppaal that P. Pettersson co-developed at Uppsala and Aalborg prior to joining MDH. Together with this goes the observation that the one paper cited over 1000 times (actually over 1400) is the seminal journal paper (in the first issue of STTT, Int. Journal on Software Tools for Technology Transfer) that presented and discussed UppAal as a tool for real time verification, as an alternative to HyTech.
and Kronos. While back then HyTech and Kronos were the “established” approaches, this picture has radically changed: the standard tool now is Uppaal, and it got the CAV Award 2013 as the foremost tool suite for the automated analysis and verification of real-time systems.

The reason for this success is due to the rigorous, but case-study driven, approach that the Uppaal developer team took, this approach made Uppaal a usable and fun tool to play with early on as well as a serious analysis tool for industrial and large scale case studies.

This is the philosophy that is now behind the work of the entire V&V group.

In fact, this group can be seen as the one that within the ES area has the most advanced sense of strategic development apart from the group of Prof. Lisper, which is stable:

- With Paul Pettersson, a young full professor of world class in his expertise area, that as Deputy Vice-Chancellor takes a significant role (and visibility) in shaping the future of the entire MDH and has a record of successful cooperation with the dependable systems group,

- With Cristina Seceleanu, an experienced Associate Professor with a complementary background that has successfully closed the ranks with the Software Engineering group (with several joint PhD students and industrial researchers and adjunct professors),

- and an identified new direction in Software Testing that is still being built up, but it is demand-driven by the industrial partners, has with S. Punnekkat an internationally well-known expert, links again to a different area of the Dependability group, has an internationally renowned strategic visiting professor (Elaine Weyuker), and has started to produce first international results.

- The hiring strategy is also forward looking: getting young colleagues (e.g., the 2 associate professors in joint appointment with SICS), and also well-known guest professors like Elaine Weyuker, who brings senior expertise to the group and at the same time creates international awareness.

In this area we see therefore an outstanding output in RT verification, an excellent activity in verification of component based resource models and architectures, and a new direction in testing that seems very promising.

The international cooperation (including in EU projects, which not in all groups are as good as here) are very strong, and the industrial cooperation are very successful, as shown among others by the very recent case of platforms in ABB (see paper in Nov. 2013 – IEEE Computer). Also with industry there is a continued tradition of adjunct professors (e.g., Dr. Magnus Larsson, Dr. Tiberiu Seceleanu) and other collaborators (e.g., Dr. Aneta Vulgarakis).

There is no specific education program in V&V, rather the experts contribute with classes to the CS programs at the BSc and MSc level.

The bibliometric indicators (for what they mean, given that in several communities inbreeding and exaggerate cross-citations spoil the usefulness of these numbers as indicators of real significance of certain research) show this as one of the top groups in the school. Two professors with H-index 47 and 38 lead a group with a total h-index of 67.

20 very good journal papers and over 130 conference papers in the considered period are clearly a strong footprint, and there are significantly many A-quality publications. Also younger members of the group are highly encouraged to present their papers in international venues, and they often succeed.
The number, quality and international mix of PhD students is very good to excellent.

Regarding the future, this group is certainly one that has reached the ceiling of the co-financing of projects. Strategically, it would be useful to consider if the V&V itself should not be better featured as a cross-cutting horizontal concern and expertise, that provides backing in high assurance and high quality proofs to all the other application areas.

Overall the V&V sub-unit yields an outstanding position at international level, and it is well positioned to maintain such excellence in the international arena, but should reconsider the own most advantageous positioning in the context of the 6 sub-areas within the Division.

Grade: excellent

Sensor Systems and Health

With four Professors, one Visiting Professor, four Senior Lecturers and 13 doctoral students, the ESS-H group is one of the larger groups within Embedded Systems, and like the other groups, the ESS-H is flexible, energetic and persistent. The group is focused on sensor technology, system integration, signal processing and decision support with applications within the public health care sector. The research can also have applications within safety at work.

Maria Lindén, Professor, who heads the Biomedical Engineering group, gave the 15 minute presentation.

Other participants: Mats Björkman, Mikael Ekström, Elisabeth Uhlemann, Johan Åkerberg.

It was satisfying to learn that Professor Lindén was recently promoted to her current position; she is an excellent role model for others in the group.

The environment within MDH is mainly constituted by other parts of the Embedded System group but also companies and other networks with an interest in the public health care sector.

The ESS-H group has an extensive number of collaborative partners and networks within and outside MDH ES. The ESS-H is a collaborator in many industry- and society-oriented networks. These networks give access to many opportunities to evaluate ongoing projects and research results that are very beneficial in commercializing research results, which can become products on the market.

Members of this group are active in international activities through the International Federation for Medical and Biological Engineering (IFMBE), which is an NGO for the World Health Organization (WHO), providing access to a number of potential International collaborators.

The members of the panel felt that the connection with the end-users could be improved. Stronger ties are urged for clinical environments – hospitals, nursing homes – and clinical practitioners – doctors, nurses, occupational and physical therapists, sports trainers, etc.

The programs presented are all excellent. All categories interviewed seem positive to the flexible possibilities for collaboration.

The enthusiasm for the early progress and success in terms of attracting research support from external sources may lead to less focus on long range planning.

The scientific productivity is very good in terms of scientific papers in leading journals with a referee system. So is the case also for papers given at international conferences. The number of Ph.D.’s who graduated in the first years is a bit low. This may have been a result of all start-up efforts and low initial external support. However, the present figure for PhD students is quite satisfactory so even this measure of productivity seem positively convincing for the future. First
year students are encouraged to attend conferences. This is laudable and will likely increase future research productivity.

As this area of research effort is relatively new for MDH, its impact has yet to mature. As the Swedish population ages, increased attention will be paid to home health care. The interest of the ESS-H group has a growing focus in this area. The relevance of the work is high and will remain high for the foreseeable future. In general, biomedical engineering (world-wide) is drawing some of the most talented young people attending college today seeking both undergraduate and graduate degrees in biomedical engineering.

The quality of research is very good, both as regards publications, industrial collaboration, international activities and registered active PhD student. The technical environment is extremely good for technical development of new sensor systems.

We lack documented evidence suggesting that there are close collaborations with clinical work in which future end users of sensor systems can propose improvements of obsolete techniques, evaluation of early sensor prototypes in the ward or operational theatre etc. The personal meetings between the end-user-clinician and the biomedical engineers are very important to promote innovations and new ideas around sensor development. Inspiration leading to new innovations very often is the result of close contact between physicians and bioengineers in research collaboration.

One suggestion for plans for development is to create an External Advisory Committee made up of representatives of other units of MDH, other Swedish Universities, local industry and some members of the international biomedical engineering community. This group could be called upon to help identify areas for future development.

A second suggestion is for the MDH to consider forming a Center for Biomedical Engineering.

A third suggestion is for the ESS-H to consider hosting a future Swedish BME Days conference.

Summary:

i. The technical environment at ES is perfect for the goal to develop new sensor systems for health care.

ii. The quality of the scientific production in terms of scientific papers, presentations and innovations is very good. The number of graduated Ph.D.’s is a little bit low during the first years but with increasing external economic support, this problem seems to be solved regarding the registered Ph.D. student numbers today.

iii. Direct collaboration with the end user of sensors, i.e., physicians, nurses, personnel at community health centers or homes for elderly is very important for the scientific and technical result. This type of network is currently lacking.

iv. To focus on a special type of sensors can improve the quality of work. The choice can be based on medical problem areas like electrophysiological sensors, blood flow sensors or respiratory sensors or on various technologies like optical sensors, semiconductor sensors or chemical sensors.

v. Physiology has developed from a science dealing with problems at organ level but is now more and more investigating problems at the cellular or subcellular level. Bioengineers can find very interesting problem areas by following this trend. The field of optical biopsies is one example in which the status of a particular tissue type can be examined with optical techniques in vivo and not by taking tissue sample for laboratory examination. In long range planning within a sensor group this development should be considered for the future.
vi. This group, just like the ES group, would benefit from engaging the services of an external advisory committee. This Committee could help identify new targets of opportunities in clinical and industrial areas.

vii. ESS-H should consider hosting a Swedish BME Days conference.

viii. MDH should consider forming a Center for Biomedical Engineering.

*Grade: very good*

**Robotics and Avionics**

Considering bibliometric figures, the h-index for the group of Robotics & Avionics is 33; this number by itself is not so bad. Looking closely, however, a large number of the groups’ citations are for Professor Lars Asplund and his top 25 papers, which are not directly related to robotics research.

In the research field of Robotics and Automation, the following journals and international conferences are considered at the top level of the world:

- The top three robotics journals with respect to impact factor:
  - International Journal of Robotics Research (IF=4.1); Journal of Field Robotics (IF=3.6); IEEE Transactions on Robotics (IF=3.1)

- Major robotics conferences:
  - IEEE International Conference on Robotics and Automation (ICRA, every spring); IEEE International Conference on Intelligent Robots and Systems (IROS, every autumn)

In the publication list of Robotics & Avionics members, however, there are no articles published in the journals listed above and a very few contributions to ICRA or IROS; those that are, are mostly made by Professor Lars Asplund.

Younger members of Robotics & Avionics group are highly encouraged to present their papers at the ICRA every spring and the IROS every autumn.

The research activities presented to the panel include (1) the high-speed stereo vision project (SVAHLA: Stereo Vision Assisted Hauler and Loader Alignment) (by a student poster) and (2) the underwater robotics project (with demonstration in water-pool.)

The high-speed stereo vision project is to achieve 6D pose estimation and mapping in real time by using a FPGA-based embedded stereo-matching system. The project is based on the strength of the group in embedded systems and therefore a good example of their achievement. There are several conference papers published from this project. But in terms of citations, the results are not at the top-notch research level.

Regarding the underwater robotics project, the panel was happy to see the robot hardware that lively work in the given environment. The onboard electronics were designed by the faculty members and students, and the robot-body hardware was designed and fabricated by an internal co-production with the group of Innovation and Product Realization on the Eskilstuna campus.

Underwater robotics has a strong potential for the application in the subsea oil mining and production industry, but the current robot models are primarily for students’ competition. The project looks nicely on-going and it is certainly contributing to the students’ skill training, but there are many more elements required to become a top-notch research hub in the very competitive robotics research community.
The group has a very ambitious plan to create a new research center called the Mälardalen Aerospace and Robotic Center: MARC. To make this happen, the group needs to recruit a certain number of top-level professors who have strong leadership skills to investigate new research directions and excellent academic reputations to which a number of excellent students are attracted.

The Robotics & Avionics group is well-situated in Robotdalen and has received benefit from the strength of embedded systems at MDH. This indicates that there is strong potential for future excellence in Robotics & Avionics activities. The group, however, is still immature. There is much work to be done in order to achieve internationally recognized results and recognition. Recruitment of top-level professors is also a priority issue for this group.

**Grade:** Insufficient

### 8. Renewal – Strategies and Plans for the development of the ES group

Clearly, the ES group as a whole exhibits very strong potential for future research activities. The planned activities are in line with current industrial developments and open up many possibilities for future cooperation with industrial partners. They also leave room for exciting new basic research such that the panel sees a high potential for a successful development and growth of the group. The group presents a nice balance between senior and junior faculty. The group also attracts a high number of senior-level faculty as well as international students who all contribute to a very fruitful exchange of research ideas.

As explained above, however, there are substantial differences among the different research areas. Some areas have excellent future prospects, while others still lack a clear identification (e.g., software engineering) or breadth (e.g., dependability) or would have to be extended by additional staff and expertise.

**Grade:** very good

### 9. Potential and recommendations for development

As mentioned several times, the ES group by and large consists of excellent and highly internationally recognized groups and leaders. It provides excellent support for PhD students, exhibits a high group interaction, and is just “a fun place to be and to work”.

High-caliber research, however, usually requires not only project-driven research but also some more long term hypothesis-driven research to be sustainable and enable strategic planning for future projects as well as to develop further the group’s strengths.

This highly, though very successful, “project-driven” approach should be carefully revisited. The panel thinks that the ES group needs a strategic “master plan” that identifies key strategic areas and corresponding hiring policies on a ca. 10 year time frame. Of course, the panel understands that research goals need to be adaptable but still expertise and competence cannot be changed easily and in short time.

In more detail the recommendation is to design a research program at a medium- and long-term perspective. It should include a clear strategy, research sub topics, objectives in terms of targeted results, licentiates, PhD students to recruit, involvement in projects (academic, industrial), and the resources needed (funds, manpower, guest professors, etc.). Yearly (internal) evaluations should show whether the plan is on track or needs to be adjusted.

A final recommendation is to join forces with other departments at MDH. For example, as mentioned above, an area like dependable systems could benefit a lot from cooperation with product realization.
10. Other issues
The panel noticed based on discussions with some funding agencies that the Swedish system might favor the so-called “old” universities, which might not always be considered appropriate. Though this effect exists in other countries as well with very established vs. “young” places, a country like Sweden might benefit from going to a purely peer-review based systems which includes also a large number of international peers (if applicable).

Further, the discussions with other panel chairs showed that MDH as a whole seems to be somewhat outbalanced in terms of being research-driven vs. teaching-driven. If the current situation becomes even more unbalanced in the future, it would put a lot of stress on MDH on how to distribute its resources. A recommendation that is, of course, difficult to implement, is to try to encourage other schools to invest more in research and according hires. The panel also sees a possible potential in increased collaboration between the different schools of MDH.
Chapter 6:

Innovation and Product Realisation - Report from Panel 3

Panel Members:
Chris McMahon, University of Bristol, UK (Panel Chair)
Alain Bernard, Ecole Centrale de Nantes, France
Neil Mansfield, Loughborough University, UK
Janet McDonnell, University of the Arts London, UK
Helinä Melkas, Lappeenranta University of Technology, Finland
Hendrik van Brussel, Katholieke Universiteit Leuven, Belgium
Mike Danilovic, Halmstad University, Sweden

1. General assessment
The unit of evaluation for Panel 3 was the Innovation and Product Realisation (IPR) research group, one of two research profiles in the School of Innovation, Design and Engineering. The IPR group is associated with six Bachelor programmes and four Master programmes, and a PhD programme in Innovation and Design, and undertakes a variety of research focused largely on the development of industrial products and systems. The group is divided into three sub-groups in Product Realisation (PR), Design and Visualisation (DV) and Innovation Management (IM) which together bring perspectives of the engineering sciences and human sciences to the research of the group.

The IPR research group is relatively young and has had over the past ten years a rapid growth in research income and academic staffing. It is also a diverse group: the three sub-groups represent both the engineering sciences (PR) and different aspects of the human/social sciences (DV and IM). The DV group comes very much from the applied art tradition while the IM group aligns more with the management sciences. This diversity of IPR is both a potential weakness of the group – two teams are quite small while one is relatively large – and also a potential strength in that together the research teams can bring a unique combination of perspectives to bear on the topics that they study.
The IPR group is extensively connected to industry, especially to industry from the local region, and this is a further strength of the group. Its research is firmly grounded in industrial need and the economy of the region, and this ensures its relevance and the impact of the education provided by the research team at all levels. But together with the diversity of the disciplinary specialities the industrial links lead to a need for the research team to be very clear on their research focus and on the academic research questions that they choose to pursue. The team does not have the ‘critical mass’ to cover the whole range of topics involved in product realisation from design through manufacture and product support. It has chosen to focus on production system design and on the study of innovation processes, workspaces, design and visualization and the associated communication challenges, and within this focus it needs to develop clear scientific identities for each of the sub-groups.

The IPR group has ambition to increase its international profile and the quality of its research outputs and is in the process of identifying appropriate strategies to achieve this ambition. The group had provided an extensive and helpful self-evaluation prior to the visit, and during the visit the panel had wide-ranging discussions with researchers from the group as to the nature of these strategies and to help clarify the way forward and it was clear that the young and diverse staff of the IPR team has the enthusiasm and energy to put these strategies into operation. There are however significant challenges: there is a need for recruiting senior staff to all three sub-groups to increase the pool of experience (e.g. in applying for research grants with collaborators internationally, in publishing work in international journals); increased precision is needed concerning research outcomes and their originality, significance and rigour; the research portfolio is dominated by an opportunistic industry-project-oriented approach that limits opportunities for concentration on important research threads; the overall resources available to the team are limited. The research team is aware of these challenges and with the support of the University and with the opportunities offered by industrial collaboration and a new campus in Eskilstuna, the prospects of strong development in the future are good.

2. Research environment and infrastructure
A number of aspects of the IPR research environment and infrastructure are very positive and our overall assessment is very good. IPR has a young, diverse and enthusiastic staff with a range of backgrounds. Research support services are good. The research environment is supportive with good evidence of collaboration and good communication in the team. An industrial doctorate programme established in 2012 has included the recruitment of 15 industrial doctorates, and a bid is in place for a further 8 (which we believe have now been awarded). But the small number of senior staff is thinly spread and the physical research environment is limited in terms of laboratories and equipment. New recruitment of senior staff and the planned new building will improve these factors but their planning has to be included in the strategic development of the group. The panel also recommends that more attention be given to providing staff opportunities to develop their research, through research visits to international universities, sabbatical leave and fellowships as well as increasing the internationalization through more visiting international professors.

3. Networks and collaborations
The academics of the IPR group have declared their intention, in line with the University’s mission, to develop their national and international networks and in this respect they have made big strides. They have involvement with nationally supported research projects with KTH. They have research collaborations with researchers from a number of Swedish universities. Visiting academics have joined the team from Europe and the USA. Participation in research societies,
conferences and summer schools is on the increase. All this supports an evaluation of **good** in this topic. The research team is advised to develop further their links with societies such as the CIRP\(^1\) and Design Society\(^2\) and to exploit their involvement with their international company collaborators with strong academic networks and with national projects and organisations such as XPRES and SWEREA respectively. The team is also urged to seek to form partnerships with research teams in Sweden and beyond that can complement their expertise, especially for example in the innovation sciences, cognitive sciences, work psychology and engineering design.

4. Co-production (co-creation) and external co-operation

During the visit to the University the panel met with representatives of the town, region and industrial research collaborators and were enormously impressed by their clarity of understanding of the benefits of working with MDH and by their long-term commitment to the collaboration. This is clearly a significant strength of the IPR group and supports an evaluation of **very good** in this category. Some more detailed remarks are made under this heading for each of the sub-groups but in summary we encourage close collaboration with co-creators in setting the research agenda of the IPR team as a whole (for example through their involvement in an Advisory Board comprising industrial and civic representatives and national and international academic colleagues), but we note that co-production must be mutually beneficial and the academic team needs to carefully articulate their own longer term research goals and how individual co-production projects build towards this in the addressing of their research questions. If well managed this can lead to a better balanced ‘win-win’ situation.

5. Productivity

The area of scientific productivity and output is one in which the IPR group is most clearly in transition. Some of the staff have been quite active in publication while for others outputs have been limited. The importance of publication has traditionally been very different for the different academic disciplines represented in the group. The recent imperative seems also to have been the need to establish research themes and teams, to attract research funds and to integrate new members of staff and so publication has suffered from being of a lower priority. It was clear from our discussions with IPR staff that they were aware of these issues and are putting in place plans to achieve a step change in outputs, but nevertheless the outputs in the period of assessment overall are **insufficient**\(^3\). In the longer term this is also an aspect that needs careful and continual management. For example the success in attracting two large blocks of PhD funding is giving rise to supervision work load peaks in the group and this can make managing outputs problematic.

6. Impact and relevance

For a research team with an industrial focus such as IPR, impact can have a number of faces. Industry can directly use the research outputs in its products, processes and systems. The outcomes of research contribute to the development of trained manpower through the unit’s courses, and the industrial PhDs themselves contribute trained manpower to regional and national industry. New methods of design and for the stimulation of creativity and innovation can indirectly lead to impacts from the companies that apply them in their activities and processes (although these may of course be difficult to measure!). In all of these respects the IPR team has achieved

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2. [http://www.designsociety.org](http://www.designsociety.org)
3. Note that in the panel’s discussions there was a general agreement that we would have liked to have seen a further category of **satisfactory** between **insufficient** and **good** in the rating scales. It is likely that we would have judged the productivity of the IPR team in that case to have been satisfactory.
good impact and relevance, although more obvious impacts such as exploitation through patents and spin-outs have not to our knowledge taken place. In the longer term, we believe that there are significant opportunities for the IPR team to contribute to society in a wider sense, as design or innovation research outcomes are applied for example in healthcare, in supporting the aged and infirm in society or in other public services.

7. Quality of research
When considering the research outputs of the IPR team we considered both the quantity of the outputs (measured through productivity) and the quality in terms of the originality, significance and rigour of the work. It is clear that the research team is doing some interesting and very relevant scientific work, is beginning to present it in some of the leading conferences and is increasing its rate of journal publication. At this stage, however, it is not possible to give an assessment of the quality of the research of the group as higher than good. It was clear that the management of the IPR team was well aware of this issue: a strategy is needed to identify the most appropriate journals to target and to ensure that the work meets the standards of rigour that highly-rated journals demand.

8. Renewal - Strategies and plans for development of the unit of evaluation
As noted, the IPR team is diverse in its academic and methodological traditions. The team is small and each group is challenged in a number of respects – for example by its size, by its youth, by the lack of senior staff and by the range of projects that it has to address. The challenges could prove difficult to surmount but we believe that by working together and in conjunction with their excellent collaborators the IPR team can achieve more than the sum of its parts. With a strong commitment to work together, to nurture junior staff, to build a research culture, to plan investment in facilities and to plan for the future the potential for renewal of the group is very good. In this regard a new building which will allow development of new research facilities is a great opportunity (however the loss of any of the facilities in the current accommodation would be an additional challenge). Issues that need to be considered include the planning of links with other Swedish centres, the development of a strategy for European engagement and creation of a publication strategy.

9. Potential and recommendations for development
The overall conclusion from our evaluation of the IPR group is that this is a young group with a lot of potential that needs support and nurturing by the University. The group has good prospects for research contribution in a range of disciplines: it is unique in Sweden in information design; it can be part of a flourishing network of academic teams in Sweden in design, manufacture and innovation management. The work of recent years forms a sound foundation but concentration on research goals is needed if the full potential is to be realised and the reach of the research is to go beyond Sweden. Our recommendations for the key steps to be taken to realise this potential include in the short term:

• Continuing to work together to articulate a research strategy for the overall group and for each sub-group, in line with the University’s mission.

• Creating an Advisory Board for the IPR research group, for example with members from universities in Sweden and abroad, local and national industry and government, to advise on research strategy and help in preparing major initiatives.

• Setting up a team to plan the research spaces to be included in the new campus building and their equipment, with a view to creating a high-class laboratory/studio suite to support the unit’s research and attract research collaborators.
• Working with existing industrial collaborators to foster international links through their academic networks.

• Developing opportunities for early-career IPR researchers to visit leading research labs in Europe, and more senior researchers to have periods of concentration on their research in addition to also being able to visit/spend time internationally.

• Developing the publication skills of the research staff and students, for example by participating in publication workshops such as that held by INP Grenoble (http://www.designsociety.org/news/189/3rd_international_publish-ed_workshop_to_foster_publication_in_engineering_design).

• Communicating a clear publication/dissemination strategy using outlets considered high quality by external organisations.

• Participating in international learned societies such as the CIRP (www.cirp.net) and the Design Society (www.designsociety.org).

• Extending the taught elements of the research programme of the group to cover a wider range of research methodologies especially, for example, action research and grounded theory.

• Making regular assessments of the industrial and societal impacts of the work of the group. Consider including ‘impact case studies’ in the Annual Report of the IPR group.

In the medium term:

• Exploring the opportunities for joint research programmes with disciplines outside of engineering e.g. healthcare and social care.

• Seeking to participate in EU supported research programmes, for example by working with key industrial collaborators or by seeking participation with synergistic teams in Europe.

Our overview of the strengths, weaknesses, opportunities and threats for the whole team are summarised as follows:

STRENGTHS

• The Mälardalen region, which offers proximity to large multi-national industries, SMEs and regional development organisations creating a rich environment for collaboration that MDH has been successful in exploiting.

• The established track record of industry-relevant projects based on long-term, strong co-production links with industry in Sweden and particularly in the local region; these supporting a rich variety of mutually beneficial activities from training to research projects.

• Senior staff open to new ideas and challenges who have a strong awareness of their strengths and areas for development; a collective commitment to contribute to society through research at the highest level.

• Good systems in place to communicate internally (visually, through seminars and so on); to share knowledge from projects and potential for internal and external collaboration.

• A strong presence of appreciative PhD students who exploit the opportunity to work on industry-relevant research problems, and a well-supported environment for PhD training to which staff from each specialism contribute effectively.
WEAKNESSES

• Lack of clarity of over-arching research aims and goals for each sub-environment and theme within it caused by the imperative to fund research activity through a succession of projects with industry that tend to have short term foci to serve industry objectives.

• Lack of international experience such as opportunities and resources for staff to hold visiting professorships, work with colleagues internationally (e.g. through sabbaticals).

• The titles of the research group (IPR) and its sub-groups which do not effectively convey, to an international audience, the field and topics the group addresses in their work to best advantage e.g. to international collaborators seeking partners.

• Dependence on a very small number of senior, key staff, each having responsibility for several strategic activities (research group/sub-group leadership, taught course leadership, programme management, and PhD supervision).

• Lack of diversity in external funding (e.g. EU funding).

• Level of collaboration and integration between research sub-groups and thematic linkage between individual projects.

• Almost exclusive reliance on research projects which tend to be opportunistic rather than driven strategically.

OPPORTUNITIES

• To use IPR’s strong reputation in industry-relevant work in EU contexts.

• To make use of the strong research through co-production paradigm as a framework for PhD education; to take a lead in this for theoretical positioning within which diverse research methods can be incorporated.

• To exploit the potential of collaboration between sub-groups beyond individual projects to pursue thematic concerns.

• To make better use of the extensive data collected in individual projects.

• To exploit the international arena within which research operates, e.g. international PhD students, European academic mobility funding and EU research grant sources.

• The new campus at Eskilstuna; facilities as a draw for new collaborations within and beyond MDH.

THREATS

• Introduction of metrics for the distribution of research base-level funding which dis-advantage the group; currently one vulnerability is the low volume of high-quality, internationally peer-reviewed journal articles.

• A rigid university business model which limits the extent and variety of external fund- ing (e.g. lack of flexibility in dealing with overheads); the requirement to underpin all taught curriculum by research activity, leading to thinly spread research expertise.

• Attention to excellence in co-production consuming resources at the expense of generating high quality academic outputs and the pursuit of internationalization.

• Major perturbations of the environment in which industry operates as research relies almost exclusively on collaborative projects with industry.
• Over-dependence on companies setting the agenda for projects dictating the academic direction.
• Widening scope of research activity without expansion of senior faculty, which will exacerbate the stretched/thin spread of such staff.
• Loss of facilities and spaces for research activities (labs/studios etc.) in the new campus.
• Poorly distributed workloads and calls on support funds caused by irregular sized intakes of PhD students (e.g. recent large single-intake PhD cohort).

10. Other issues
All organisations operate within constraints imposed by the internal rules and norms of the organisation and by external bodies such as customers, government and regulators and research units are no exception to this rule. In the course of our assessment visit we came across a number of factors that materially affect the ability of the IPR group to operate, and which may affect its ability to be competitive on an international basis. These include:
• The Swedish mode of project funding and academic time accountability, and in particular the problems of overhead recovery and of maintaining salaries of PhD students beyond the end of project funding.
• The relative lack of opportunities for research active academic staff to concentrate periodically on their research careers through sabbatical leave, fellowships and research visits.
• Reconciling the demands of the University mission (coproduction/internationalisation/academic excellence) may be very difficult to fully achieve as success in one area limits time to excel in other areas.
• Limited opportunities for support for research collaboration, network building and large project application writing (maybe from Swedish Government or University) - equivalent to network research grants in the EU or UK.
• The ‘collection of papers’ approach to PhDs may limit opportunity to explore the rich empirical data gathered in coproduction-based research. Maintaining the freedom to choose whether to write dissertations as a collection of papers or a monograph allows greater variation.

The panel further understands that there will be a new system of evaluation of University research quality introduced by the Swedish government at some time in the near future. At this time the precise nature of the assessment and any metrics to be used are unknown and therefore it is unlikely that the School will be able to respond strategically in time for the first assessment. Nevertheless, the assessment panel considers that it is important for the IPR group, in making its internal assessments, to emphasise quality of outputs and to beware of a single emphasis on quantity.

Product Realisation Sub-group
1. General assessment
The Product Realisation (PR) sub-group is active in a variety of areas related to the design, manufacture and operation of engineered products especially the design and operation of production systems, sustainable production, automation and virtual manufacturing and change management. The sub-group is relatively young, having only been able to benefit from the University’s permission to award PhDs from 2001 onwards, but has recently expanded rapidly, with a large
nationally funded collaborative project with KTH and the industrial graduate school (described in the overall IPR assessment) starting in 2010 and 2012 respectively.

The evaluation panel questioned whether the title ‘Product Realisation’ correctly reflected the activities of the sub-group, which currently involves little of the actual processes of manufacturing or of the production systems needed to realise the product.

The sub-group staff include a number of full-time staff and researchers but also a number of Adjunct Professors and researchers whose activities are split between the University and industrial employers. Included in these is the former head of group, now 80% of full-time employee of Volvo CE, but still active on 20% basis in supporting the supervision of a number of industrial doctorate students. The staff as a whole have done an admirable job in developing a growing team, but it is clear that there are a number of challenges in developing an expanding programme with a wide range of research topics and multiple industrial partners, especially a lack of experienced researchers, and somewhat of a lack of focus in the research activities.

2. Research environment and infrastructure
The PR sub-group is considered to have a very good research environment and infrastructure overall but with some weaknesses. It has good physical facilities but with limited research equipment. It has a young, enthusiastic and diverse staff in terms of gender and nationality but with only a small number of senior staff and thinly spread academic leadership. Nevertheless, the infrastructure in terms of the programme of taught courses and seminars and the supportive and collegiate environment are impressive.

3. Networks and collaborations
The networks and collaborations of the PR sub-group are good. It has naturally concentrated in establishing its research presence and activity in building up national links with other universities and with key industries. It is now well placed to expand these to international links.

4. Co-production (co-creation) and external co-operation
Co-production is clearly a strength of the PR sub-group and is considered to be excellent. It has a very impressive set of industrial collaborators. The companies are strongly engaged in support for the students and in setting the research agenda. The team should build on these strong links by emphasising the real benefits of their work and on accelerating transfer to the shop floor. The team should also be conscious of the constraints of the current business model and should be wary of being pulled in too many directions by the needs of the partners.

5. Productivity
On the face of it, productivity has been low to date, and can only be considered insufficient overall, although some staff have been quite productive. However, this needs to be seen in the light of a rapidly rising income and number of researchers and PhD students. With suitable emphasis on academic production we expect to see a significant improvement in productivity in the near future. In this regard we saw clear evidence of good management of the academic ‘pipeline’ of paper production, but the team needs to be cautious that the demands of co-production and of maintaining external income can be a barrier to productivity.

6. Impact and relevance
The impact and relevance of the Product Realisation sub-group is at present good, but we expect it to increase rapidly to very good as the international presence and publication rate of the team increases.
7. Quality of research
At this stage it is difficult to give an assessment of the quality of the research of the sub-group as higher than good. The team is doing some interesting and very relevant scientific work, is beginning to present it in some of the leading conferences and is increasing its rate of journal publication. But staff need to concentrate on achieving the highest standards of academic rigour in their work. In that regard they are very well placed to access a great deal of very relevant empirical evidence from a range of industries that might form the basis of a significant contribution to the community.

8. Renewal - Strategies and plans for development of the unit of evaluation
The potential for renewal of the sub-group is good, with parts very good. The team is developing a clear vision for its academic development (although it has some way to go in that respect). It has a young, enthusiastic and committed academic staff with excellent industrial and regional support. It has able and mature PhD students. But there is a need to be able to focus and concentrate to achieve the highest impact.

9. Potential and recommendations for development
In summary, the strengths, weaknesses, opportunities and threats for the PR sub-group are as follows:

STRENGTHS
• Committed and decisive members of the research group.
• Healthy environment of enthusiastic staff working between industry and academia and movement between these two, bringing highly industry-relevant skills, knowledge and competencies among academic staff.
• With their strong strategic relations with industry and business life, the PR group succeeds in attracting large amounts of external funding.
• The group’s innovative and successful approaches to external funding of PhD students (e.g. InnoFacture) resulting in a large cohort of committed, industry sponsored PhD students.
• The recent growth of the research group is impressive, but it should not be seen as obvious and as a goal in itself for the future. Time is needed to stabilize and consolidate the research group in the long run, with long-term stable funding and strong senior staffing.

WEAKNESSES
• Research topics are predominantly case-based, not leading to generic results.
• Weak international network results in lack of visibility internationally as an academic research partner.
• Broad range of research topics for too few senior researchers, thus lack of critical mass in some research areas and in international collaborative projects.
• A focus on written outputs which are industry case accounts, thus high number of national conference publications at the expense of journal publications that address an international research agenda.
• Weakly developed research labs.
OPPORTUNITIES

- The research/production infrastructure of the industrial partners provides an enormous potential to be used by the PR group.
- To strengthen the link with KTH to add complementary competences enabling to tackle more integrated projects.
- A large cohort of high-quality, mature PhD students whose outputs might contribute to the international profile of PR at MDU.
- The planned new building creates a unique opportunity to create labs for production and realization and simulation.
- PR has the potential to be a very attractive partner in EU-funded research in Horizon 2020 for example if it is able to bring industry partners with it, to address an internationally-recognised research agenda.

THREATS

- Research agenda too much dictated by the industrial partners.
- Upcoming funding uncertainties due to changes in national funding model.
- Staff transferring to industry to follow funding.
- National research grading system unknown and not enough time to strategically respond to performance indicators.
- Loss of labs when moving to new building.

Overall the impression is of an enthusiastic and active team, very well linked to industry and with expanding links with national research teams, but poorly connected internationally and with the ‘growing pains’ of a young and rapidly expanding group. The sub-group is at a crossroads, but with consolidation of research focus, scientific vision and with the support of the University it can become an internationally respected group.

10. Other issues
No further comments.

Design and Visualisation Sub-group

1. General assessment
The Design and Visualisation (DV) sub-group is a small group within the IPR unit of evaluation. For the early part of the period of assessment it comprised two members of academic staff but these numbers have recently been expanded with the recruitment of two new senior lecturers and a researcher with skills complementary to those of the rest of the staff, and in addition a number of doctoral students work within the group. The research of the group is centred on the design and communication processes for images, texts and spaces, in particular in an industrial context - for example for engineering documentation and displays in a production and assembly context, although work is also carried out in diverse areas including communication for the visually impaired. A ‘human sciences’ perspective, drawing on expertise in art history, philosophy and illustration, is taken. The research field is quite specialised, and it is believed that it occupies a niche in Sweden, if not in the whole Nordic region. Nevertheless, the evaluation panel questioned whether the title ‘Design and Visualisation’ correctly reflects the activities of the subgroup, given its apparent concentration on the design of information and spaces.
During the visit the panel met with three of the academic staff of the group, a newly recruited researcher and a PhD student. These gave the impression of a self-aware group with a clearly developing research agenda but with a need to decide in which direction they wish to grow and with what partners and collaborators. They are working in a domain which is inherently multi-disciplinary and therefore they need to articulate the core competencies of the team as well as to consider where strategic links are needed (for example the collaboration that they are developing with cognitive scientists at the University of Skövde).

2. Research environment and infrastructure
The DV sub-group is considered to have a very good research environment and infrastructure overall but with some weaknesses. It has a young and enthusiastic staff with an experienced leader and a good gender balance, but the total resources available to the team is quite small. The physical infrastructure is good and the group organisation is reasonably clear.

3. Networks and collaborations
The networks and collaborations of the DV sub-group are good. Thought has been given to the development of appropriate collaborations and useful links at national and international level have been established (e.g. with Prof Lucienne Blessing of the University of Luxembourg). The development of further strategic links, especially with complementary academic disciplines (e.g. applied psychology, human-computer interface, cognitive sciences) is encouraged.

4. Co-production (co-creation) and external co-operation
The DV group shares the culture of co-production that exists in the IPR theme and has a set of industrial and public sector collaborators that provide good (tending to very good, considering the discipline) support for its current activities. Industrial collaborators provide support for research students and help to set the research agenda. Public sector groups provide support for the work on braille communication. Further development of the co-production model is encouraged, but the team should be selective in pursuing collaborations that support the development of excellent research.

5. Productivity
The small size of the DV team and the effort needed to grow the research activity mean that although a number of papers have been produced they have not been targeted on high quality journals and the overall output is thus considered insufficient, although some staff have been quite active. Nevertheless, the recent expansion of the team and in particular the number of PhD students now close to submission mean that we expect to see a significant improvement in productivity in the near future. The DV group work in an area without a well-established tradition of journal outlets; however, at least some aspects of the work could be well-placed in some of the ergonomics/human factors and technical communication literature.

6. Impact and relevance
The impact and relevance of the DV sub-group is at present good, and in particular, as noted, the team occupies an important niche. Furthermore, we expect an increase in impact as the international presence and publication rate of the team develops.

7. Quality of research
At this stage it is not possible to give an assessment of the quality of the research of the sub-group as higher than good. The team is doing some interesting and very relevant scientific work, is
beginning to present it in some of the leading conferences and is increasing its rate of journal publication. But a strategy is needed to identify the most appropriate journals to target and to ensure that the work meets the standards of rigour that those journals demand. In that regard we consider that the work of the group is likely to be well received by a number of journals for example in the area of design, information management and human factors.

8. Renewal - Strategies and plans for development of the unit of evaluation

The potential for renewal of the sub-group is good, tending to very good. The team is developing a clear vision for its academic development (although it has some way to go in that respect). It has a young, enthusiastic and committed academic staff with good industrial support. It occupies a niche in Sweden and perhaps in Scandinavia. It has an expanding number of able and mature PhD students. Plans are developing for a new building which will allow development of new research facilities. But there is a need to be able to focus research questions and concentrate effort to achieve the highest impact.

9. Potential and recommendations for development

In summary, the strengths, weaknesses, opportunities and threats for the DV sub-group are as follows:

**STRENGTHS**

- Good industrial relations for the disciplinary area offering access for empirical studies which are novel and highly relevant to industry.
- Expanding cohort of PhD students and opportunities for post doctoral retention.
- Emerging strong leadership.
- Measurable success in a short time since formation of the group (1-2 years); a developing presence internationally through conference contributions.
- Proven track records of staff bringing strong disciplinary backgrounds to bear on shared research issues.

**WEAKNESSES**

- Diversity of project portfolio resulting in some lack of focus and collaboration internally.
- Low publication output in terms of volume and performance against quality indicators.
- Future research strategy undefined.
- Lack of clear publishing strategy and expectations from collaborations externally.

**OPPORTUNITIES**

- To consolidate core competencies to improve visibility.
- To contribute distinct ‘work packages’ to augment collaborative projects led by others in MDH and to offer collaborators internationally.
- To develop existing and potential links into full collaboration with international academic partners.
- To define the scope of the group in a clear way to add value to the innovation aspects of ‘IPR’. 
• To increase critical mass (e.g. to benefit from completing PhD students and new faculty members).
• To build on opportunities with complementary disciplines with common interests e.g. cognitive science, psychology, linguistics.
• To develop niche areas of work exploiting current competencies.

**THREATS**
• Scope of accepted projects continues to dictate research focus.
• Difficulty of pin-pointing appropriate high quality journals which meet external quality indicators.
• Loss of research facilities in new building.
• Small size of group in relation to workload especially PhD supervision.

Overall the impression is of an enthusiastic and active team, well linked to industry and with developing links to national and international research groups, but with too broad a research portfolio for its size\(^4\). The sub-group is at an early stage of maturity, but with consolidation of research focus, scientific vision and with the support of the University it can become an internationally respected group.

**10. Other issues**
No further comments.

**Innovation Management Sub-group**

**1. General assessment**
Innovation management is a topic of strong interest in Sweden and worldwide, especially when combined with entrepreneurship studies, with a number of research groups and teaching programmes in Swedish universities. The Innovation Management (IM) sub-group at Mälardalen University was founded a couple of years ago by merging research about entrepreneurship, creativity and business intelligence, and it is in the process of developing a programme of research centred on innovation processes, workplace innovation and democratizing innovation, three areas in which there are clear synergies with the work of the PR and DV groups and which are potentially ‘hot’ research topics nationally and in the EU. In common with the other groups the IM team is expanding, with newly appointed members of staff joining an established professor (with a second on the point of retirement). The team takes a complex systems research stance, adopting qualitative and case study research methodologies.

During the visit the panel met with five of the academic staff of the group and two PhD students. These presented a research programme divided into many small projects (in common with the other sub-groups), with some interesting developing strands of work, clearly positively influenced by the three international visiting researchers with whom the sub-group has worked, although the overall programme is not yet sufficiently mature for its importance and direction to be completely clear. The panel considered that there are significant opportunities for good research outcomes in the future, especially given the level of industrial collaboration in the IPR, but the team will need to pay attention to its focus and its methodological stance.

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\(^4\) Although suggested by the group’s name, the actual product design process and methodology is not significantly included in the research portfolio of the group
2. Research environment and infrastructure
The assessment panel considered that it did not really have sufficient information to make a very clear evaluation of the research environment and infrastructure of the IM group, but what evidence that was available suggested a **good** overall level. It has an experienced researcher as leader but (in common with the other sub-groups) the team does not have very extensive experience in the research area and total resources available to the team is quite small for the range of projects being undertaken.

3. Networks and collaborations
The networks and collaborations of the IM sub-group are **good**. There has been good input to the group from established academics in Italy, the UK and the US, and research links are being established with a range of European universities in art-driven innovation. Research funding has been obtained both nationally and at a European level. The team has plans for development of its collaborations and these are to be encouraged.

4. Co-production (co-creation) and external co-operation
The IM group shares the culture of co-production that exists in IPR as a whole, and has a set of industrial and public sector collaborators that provide **good** support for its current activities. Industrial collaborators provide support for research students and help to set the research agenda, but further dialogue with these collaborators to refine the research focus and to build opportunities for more extensive empirical research is encouraged.

5. Productivity
The small size of the IM team and the effort needed to grow the research activity mean that although a number of papers have been produced they have not been targeted on high quality journals and the overall output is thus considered **insufficient**, although some staff members have been quite productive. The recent expansion of the team offers the possibility to rectify this but it will be important to concentrate effort on improving the quality and impact of the work.

6. Impact and relevance
The impact and relevance of the IM sub-group is at present **good**. The national importance of the area of research suggests an opportunity to increase the impact to very good by focusing research efforts.

7. Quality of research
As seen widely in IPR, the IM group is young and still in transition. A number of experienced staff have left the group and the team is re-establishing its core competences. At this stage it is difficult to give an assessment of the quality of the research of the sub-group as higher than **good**. The challenges of the research field mean that a careful strategy is needed to identify the most appropriate journals to target and to ensure that the work meets the standards of rigour that those journals demand.

8. Renewal - Strategies and plans for development of the unit of evaluation
The potential for renewal of the sub-group is **good** tending to **very good**. The team has a young, enthusiastic and committed academic staff led by an experienced professor and has good industrial support and international links. It has enthusiastic and mature PhD students. It is researching in an area of high national and international interest, and there is a great opportunity for collaboration outside the group. But there is a need to be able to focus research questions and concentrate effort on research methodology to achieve the highest impact.
9. Potential and recommendations for development

In summary, the strengths, weaknesses, opportunities and threats for the DV sub-group are as follows:

**STRENGTHS**
- Historically strong position nationally in Innovation Management.
- Reasonable volume of publications.
- Diverse portfolio of research projects.
- International visiting professors.
- Research projects from both industry and public sector (broader funding base than other sub-groups).

**OPPORTUNITIES**
- Innovation Management is a recognized current ‘hot topic’ in Sweden and internationally.
- To clearly identify the opportunities of democratizing innovation in new areas (e.g. using 3D printing).
- To foster collaboration across the IPR group through shared projects (such as Kaikaku)
- To theorise co-production.

**WEAKNESSES**
- Insufficiently developed publication strategy.
- Low number of publications in highly regarded journals.
- Lack of performance indicators to assess research outcomes.
- Lack of clarity and definition of scientific position (definition of innovation and position of the group in relation to this).

**THREATS**
- Projects dictate the research scope and activities.
- Expansion of areas of engagement without increase in staffing.

Overall the impression is again of an enthusiastic and active team, well linked to industry and with developing links to national and international research groups, but with somewhat too broad a research portfolio for its size. With consolidation of research focus and scientific vision and with the support of industrial partners and the University it can become an internationally respected group.

10. Other issues

No further comments.
Chapter 7:

Industrial Economics and Management -
Report from Panel 4

Panel Members:
Thorvaldur Gylfason, University of Iceland, Iceland (Panel Chair)
Silvia Gherardi, University of Trento, Italy
Damian Hodgson, University of Manchester, UK
Edward Page, University of Warwick, UK
Jan-Ake Tornroos, Åbo Akademi University, Finland
Charlie Karlsson, Blekinge Institute of Technology, Sweden
Jan-Erik Vahlne, University of Gothenburg, Sweden

1. General observations
To succeed, a regional university such as MDH needs to fulfill three main conditions: (a) It must have a critical mass of faculty and students to allow for sufficient breadth of scope in teaching and research, and preferably also sufficient internal interaction; (b) the teaching faculty, or at least several of them, must be actively engaged in research to stay at or near the forefront of new developments in their fields of expertise; and (c) both teaching and research must be internationally competitive to make it possible to attract and keep good faculty and students and to facilitate interaction with the rest of the national and international academic community. Preferably, it also needs to generate research synergies across the four disciplinary domains of the university: management, health and welfare, teacher education, and engineering and technology. A faculty whose active research contingent is too small and isolated from the rest of the world and where high-quality research is the exception rather than the rule is unlikely to be able to provide students with a strong motivation and high-quality training by international standards on a sustainable basis.

At MDH, four of the six units in the department of Industrial Economics and Management (IEO) are quite small, measured in terms of the number of faculty members, raising questions about whether they reach the critical mass needed to facilitate a balanced, fully fledged program of teaching and research in each academic field in question. What constitutes critical mass is not
known with certainty, however; some would say a minimum of eight to ten faculty members per unit constitutes a minimum and on top of that there is a need for at least a similar number of PhD students. Ideally, this would call for increased resources, including the establishment of enough new faculty positions where appropriate to achieve critical mass but also to broaden the competence profile. Also, it might be worthwhile to consider strengthening the disciplinary area by bringing together all those related to business and management within the department or by establishing joint affiliations for faculty such that, for instance, all economists, all business administration faculty, etc., would belong to the same unit. The effect would be to increase critical mass within the department and to reduce the extent of multiple teaching – that is, teaching the same course several times to students in different departments. This could be a significant cost-saving measure. If this is not feasible in the short term within the current administrative structure, merging units may be advisable or building bridges between them through the formation of interdisciplinary programmes or joint outreach activities.

All the same, it is important to keep in mind that it is common for research networks at universities in Europe and America to be individual, not institutional, meaning that many faculty members work more closely – that is, write more joint papers and books – with colleagues at other institutions than their own. For this reason, active research visit programmes can do much to promote research collaboration and thus enhance research impact. Increasingly, co-authored articles are becoming the norm and co-authoring across national borders is becoming more and more common. Furthermore, by utilising complementary competences, joint work encourages research productivity.

The panel notes that the research time of a number of faculty members has been, and continues to be, constrained by heavy administration and teaching loads. A consistent theme of the site visit was that researchers have interesting project ideas but these ideas often are not brought beyond the planning stage due to extreme time pressure and a lack of core research time for research-active and research-interested staff. The time available to researchers, of between 10 and 15 percent for both primary research and personal career development, is below national and international standards and poses a significant barrier to the development of long-term research objectives and programmes. In terms of administrative support for the department, it appears that most resources are devoted to teaching-related activities, and it was unclear what if any dedicated resources are available to units or unit heads to reduce their administrative burden and so maximise time for research. The result is that the knowledge-producing potential of the department is not currently maximised.

MDH faces a dilemma in that it is intended, by the government, to be primarily a teaching institution. Even so, it is commonly understood among the faculty, and held to be a general truth in higher education, that being active in research enables instructors to stay at or near the forefront of new developments in their fields of expertise, which is generally supposed to be a prerequisite for consistent high-quality teaching. Therefore, a teaching institution like MDH that assigns 90 percent of the working time of most its faculty to teaching and only 10 percent to research faces an uphill battle in its efforts to promote research for its own sake as well as to improve teaching quality.

Excessive teaching resulting in too many hours being spent in class by the average student at the expense of independent work does not appear to be an issue at MDH, and it seems an initiative is in place to reduce the total number of courses taught, which we welcome. The division of student time between the classroom and independent work also appears close to the norms observed at research universities. Even so, due in part to its significant contingent of minority students, the student body at MDH may on the whole require more attention by faculty members than at other universities with fewer minority students.
2. Research environment and infrastructure

In terms of resources and infrastructure, the panel was impressed with the high standard of the work environment enjoyed by IEO in terms of buildings, accommodation, and library facilities, and in broad terms the organisation of physical infrastructure (through the co-location of units, for instance). The department similarly appears to enjoy excellent information technology and logistical resources.

IEO comprises six units whose activity covers a broad range of social science disciplines, including international business, marketing, organization and management, economics, accounting, commercial law, and political science. The department is, therefore, host to a broader range of research activity than is the norm for a single departmental entity. This breadth poses a number of challenges, but also offers opportunities, in terms of developing and maintaining a high-quality research environment pursuing multi-disciplinary research through joint research projects and programmes. This underlines the need for a robust and appropriate internal structure and mechanisms within the department which are supportive of research and research-active faculty.

The top-level management and organisation of IEO is impressive, with strong links and an apparent harmony of purpose between the Research Director, the Head of Department and the Dean of the School of Business, Society and Engineering (EST). Beneath this level, the units represent the main engine of research. At present, there appears to be substantial variation in research practice, research leadership, frequency of meetings, collaboration, and mentoring within the units, which has implications for research output, career development, and, to an extent, morale within the groups. Of the six units, two stand out as possessing the critical mass required to conduct research at a national and international level but each group only has one professor, which makes them vulnerable were the current professor to be recruited by another university. Four groups are smaller and, in many research institutions, would be combined or merged with the larger research groups to secure critical mass. For one unit, the challenge posed by lack of size is also exacerbated by the absence of a professor-level faculty member, which could prove a barrier to the development of the unit in terms of representation, recognition, and the securing of internal and external resources. The formal role of the units within the department does not appear to be clear, either within the department or university, which also undermines their evident potential to provide a cohesive community for staff, a mechanism to represent collective interests and a research identity which might be communicated across the university but also nationally and internationally. The two largest units have clearly made substantial progress in recent years in forging some collective identity, driven in part by clear research leadership, and this seems to be a vital step if the department is to build a research culture ‘from the bottom up’.

IEO has a somewhat skewed gender profile relative to comparable research units in Sweden, with relatively few female mid-career scholars and no female professor, and an ageing staff structure. The department is in the process of recruiting a number of early-career scholars but, in general terms, the age range of the established faculty is higher than average, in particular at Lecturer and Senior Lecturer levels. A number of key staff in some units are nearing retirement age, raising challenges of continuity and sustainability.

Recruitment of professors and senior lecturers, including internal promotion, needs to be open and competitive and based on academic merit, preferably with external review committee members involved in senior appointments. All appointments must be based on internationally accepted selection criteria.

The role of Research Director was seen to be a critical one in terms of harmonising activity across the research groups and providing senior research leadership. It was also clear that researchers
now have access to a certain amount of financial support in terms of national and international conference funding, administered at the discretion of the research director.

However, the department at present lacks a dedicated research committee to support the director’s activities, which is now considered best practice for academic units of comparable size located in international research institutions. Each unit has an academic lead, which is good practice, although the role does not appear to be formalised, resulting in discrepancies in the nature and extent of research leadership, in terms of direction, mentoring, and representation.

In terms of interdisciplinary collaboration, it was less clear to what extent these unit leaders interact in order to co-ordinate research activities across the different groups, to develop common research projects and programmes, or to enhance the department’s research environment in general terms. The department has recently re-launched a departmental research seminar, which should improve the conditions for inter-group coordination, knowledge sharing and cooperation. However, there appears no formal mechanism or arena through which a collective research strategy might be developed in a way which is driven and shaped collectively by the units themselves. In terms of cross-group collaborations, there are some interesting existing research projects and cooperative activities taking place across research groupings. Nevertheless, there is great potential to enhance existing collaborative efforts by developing common research themes, projects, and programmes in the future in order to enhance the policy-relevant research output of the department, forge strong professional relationships, and to enhance collegiality among units. In terms of interdisciplinary activities beyond the department, again there is potential in that some staff members have contacts with researchers from science and technology research units at MDH, but there appear to be structural and political challenges which impede the development of obvious interdisciplinary research opportunities across the university. In terms of external outreach, some members of the department are engaged in a fairly extensive set of activities that involve local and national media and stakeholders, although the unit could do more to publicise its research and dissemination activities.

In terms of specific administrative support for research activity, the department has the possibility of support for discrete academic events (such as research workshops and conferences) designed to enhance the research reputation of the department and MDH generally. However, the department appears to lack a more permanent research support service presence, in terms of a proactive and informed administrative position dedicated to the communication of research opportunities, the support of idea generation, the provision of advice on sources of funding and of practical support in the development of strong funding applications.

Finally, we note that early-career scholars within IEO have the potential to be a driver of innovation, research excellence, and a strong research environment. It was observed that the department has relatively few doctoral students for a department of its size and breadth and that resources should be devoted to this area as a matter of urgency. Although relatively small, the doctoral community appears vibrant and broadly positive on academic and infrastructural support at MDH. Most appeared positive about their supervision at MDH although the panel noted specific challenges relating to supervisory coordination, financial support, progression pathways, and the mechanisms for representing the interests of the doctoral students collectively within the department and university, detailed below.

- Regarding supervision, it was noted that several were jointly supervised, with one supervisor, sometimes the primary supervisor, being located in another university. While offering clear benefits in terms of external networks, there was concern that in some situations this gave rise to communication difficulties and a lack of accessible, local support. It is important to recognise that in such situations, the primary burden of pastoral care inevitably falls on the supervisor based in MDH.
• Regarding financial support, it was apparent that funds were available on a discretion-
ary basis for conference attendance, etc., although the amount available and the means
by which this was allocated seemed rather opaque.

• While progression and completion rates appear normal, it seems that the main formal
means of monitoring and evaluating progression is through the submission of an Indi-
vidual Study Plan (ISP) on a six-monthly basis. Rather than a powerful mechanism to
enable students to measure progress, however, these were broadly perceived as a bu-
reaucratic process with little connection to meaningful intellectual, professional, and
personal development.

• Finally, there may be some value in improving the collective representation of PhD
students within the department, given their distance from the nominated university
doctoral representative located outside IEO.

3. Networks and collaborations

To maximise the potential of IEO, given its relatively small size and selective disciplinary domain,
and issues already mentioned regarding critical mass, research collaboration on a national and
international scale is vital. However, the process of developing useful collaborative relationships
outside the university is a time-consuming process which involves several stages:

• Developing a clear individual and/or collective profile in specific areas of research.

• Participation in key academic (and industrial/governmental) forums through which to
communicate this profile (for instance, national and international conferences).

• Engagement in dialogue with researchers at other institutions in Sweden and abroad
to establish areas of common interest and eventually concrete research projects and
programmes.

There is some evidence already of active and productive collaborations across the established
research units, as evidenced by joint research projects (under preparation or in operation) and
joint publications; the Complementary Bibliometric Analysis Report supplied highlights of au-
thor collaborations with Copenhagen Business School, Uppsala University, Aalto University, KTH,
Stockholm School of Economics, and Jönköping International Business School, among others.
These networks appear to be predominantly, but not exclusively, national and even regional
in reach. As yet, most such collaborations tend to be limited to dyadic relationships between
individual researchers and their counterparts in other universities. Moreover, it is not clear how
far faculty members with such relationships have been able to leverage these by involving col-
leagues within the department into such collaborations, not only within but also across units
(building on shared and cross-cutting research themes within the department).

The recent appointments made within IEO have clearly strengthened the connectedness of the
department, as new faculty members bring with them existing working relationships and knowl-
edge of potential areas of collaboration with their previous institutions. As a consequence, units
which have not recruited significantly in research-active staff in recent years may be relatively
more isolated, and require greater efforts to forge active links outside the university.

The panel offers the following recommendations regarding the establishment of networks

• Need for the creation and communication of a clear research identity reflecting core
research themes within the department and specific units which are meaningful out-
side of the university.
4. Co-production and outreach
The panel appreciates the more advanced way of co-operating named co-production as set out during this week, and elaborated upon in the presentation by the Organization research unit. We believe that this approach can be fruitful as explained in section 8 (“Renewal”) below. Relationships with outside organisations, in the public and private sectors, are of high value and frequently such relationships can lead to co-production. We believe that the value of these networks is clearly understood and in some areas there is already evidence of co-production with the local community. However, we believe that much could be gained, as argued below, by working harder to include larger institutions in the local and regional business sector as co-producers.

5. Productivity
We have been given reports on the amount of journal articles and dissertations produced in recent years. This output has been placed in relation to the number of researchers employed. This method of calculating research productivity is not altogether reliable and we think there is no need to dig into the details behind these numbers at this stage. The low productivity is more pronounced when it comes to international journal articles. In terms of dissertations, however, the output is larger. We would like to balance the above observations by stating that the time and resources provided for research is low indeed, and there is broad agreement within the department that research productivity should be improved.

Our sense, though, is that change is underway and that the atmosphere has changed over the last year or two: enthusiasm and energy radiate from several of the groups and we believe productivity in these areas can improve given appropriate support. Effective research leadership and greater commitment to mentoring are needed to ensure that the recent improvements continue, and that research efforts are effectively focused on high-quality journals with substantial international impact.

Another, intermediate output which impacts on the number of journal articles published, is engagement in national and international research communities, such as appearance at conferences, visiting faculty positions, membership of boards and steering groups of international bodies, assignments as journal editors or reviewers, etc. These activities take time but are valuable in establishing IEO and its members as important members of the international research community. In this regard, the productivity is quite satisfactory.

6. Impact and relevance
Impact of research
IEO currently has two fairly strong areas of research activity in (i) marketing (including international business and networks) and (ii) organization and management. In these two research areas,
the impact of researchers is manifested in publications, doctoral research, on-going research collaborations within and beyond the university, and external funding contracts with external agencies. Connections to other research units, as well as international and national research partners, are also in place. In the department’s other research areas (political science, accounting and commercial law, and economics) steps should be taken to enhance the scientific impact of research conducted in the department as a matter of urgency, even if some new and promising research is in development here. Political science, for example, has been successful in securing external funding for its research in environmental policymaking and sustainable urban development, and has published reports and journal articles, but the grouping is currently rather small and lacks the resources to exploit fully the wider scientific impact of its research.

The panel was concerned that IEO has not yet developed a common vision or strategy for the integration of the diverse range of research activities conducted within the six research groups; the department does not appear to have a specific scientific impact plan designed to exploit the socially relevant research it currently conducts. The panel acknowledges the genuine differences of focus and methodology that exist among, and to some extent within, the research groupings but also sees significant benefits in developing some common research agendas and projects to enhance the research impact of the department. The industrial renewal theme developed by the department is a definite step in the right direction, but this agenda is arguably too broad – and is not sufficiently original – to be the focus of a distinctive scientific impact agenda.

In terms of public engagement and the broader social impact of the research within IEO, the department has significant links with local industry but these links, particularly between researchers and the local strong industrial cluster of firms, should be strengthened so that research is informed by relevant practice in industry and is relevant to the needs of industrial stakeholders and research partners. The department has been less successful in terms of projecting and disseminating the research it conducts in the local, regional and national media – although it does have at least one staff member who might act as an ‘impact champion’ in this sense. It is notable that the department has recently employed highly competent personnel from outside the university and this should enhance national and international impact in the future. However, there is also an urgent need to exploit the potential social impact of existing research being undertaken in IEO by strategic investment in personnel with a proven track record of engaging with external stakeholders in industry, media, government, and civil society.

**Impact of teaching**

MDH has traditionally been a teaching-focused university institution and this is still the reality today. As only about 10 percent of the working time of most of the staff is devoted to research, the relationship between teaching and research remains a fundamental challenge in the future development of both the and IEO. The success of IEO in attracting students to the university and also in attracting students from other parts of MDH means that the staff is stuck with heavy teaching responsibilities.

Combining teaching with research on the local business landscape could potentially develop the impact of both teaching and research. One issue not discussed during the stay of the panel at MDH is that of executive education which, more than ordinary university teaching, provides an excellent avenue to knit closer bonds between managers and researchers, facilitating access, and eventually leading to meaningful co-production. We believe the professional bonds forged between individuals through executive education can be valuable for research. Moreover, teaching in executive programmes helps faculty members to learn about current issues on the minds of managers.
Focusing also on the co-production strategy and industrial renewal in practice in the region would be a way to strengthen the impact of teaching in the local and regional context, but also nationally and internationally due to the large MNCs located in the region. Stronger and clearer academic standing as a research-based university will help the department to develop its impact in this regard.

**Impact and practice**

MDH has undergone a fairly radical change when the business school was broken apart in 2008 and split into diverse entities. This means that business and economics researchers and staff are now working in different units of the university. The panel had serious reservations as to whether this is the right way to go since, by increasing the dispersion of like-minded scholars, it undermines efforts to create a critical mass where the resources and potential positive interdependencies can be exploited fully. Creating a new identity and image among key stakeholders in the region, nationally and internationally, should be a priority issue alongside the development of the IEO as an integral component of MDH’s research and teaching activity. MDH cannot merely be a place for the delivery of courses to undergraduates with basic skills in business and management but must also devote resources to retaining the ability to solve more complex practical and social problems. In this way, the ties, bonds, and links with the surrounding firms could be strengthened and thereby enhance the impact of both IEO and MDH.

<table>
<thead>
<tr>
<th>Practice</th>
<th>Research</th>
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<tbody>
<tr>
<td>Develop and strengthen relationships and a role and position with stakeholders in the region, nationally and internationally</td>
<td>Impact positioning in research and developing projects, international publishing in conjunction with academic excellence</td>
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<th>Teaching</th>
<th>Image-identity-position</th>
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<tr>
<td>Impact on teaching that aligns with both research and practice in a more consistent manner in positioning IEO and MDH in parallel</td>
<td>Communication and forming a MDH-and-IEO identity based on the strategy of the department and the university through renewal and co-production where the identity and image overlaps</td>
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**Table of potential impact issues to develop concerning IEO in relation to MDH strategy**

Impact can also be related to national rankings of universities. The IEO and business studies of MDH seem to be ranked in the middle or a bit lower in a national comparison (Lindmark 2011). This position needs to be strengthened. MDH has a vision to do this and the impact in research has made progress in this respect, especially in two subjects, and some attempts in other subjects. The impact in relation to the MDH strategy of co-production and industrial renewal needs a plan. Some problems prevail:

- The different perspectives and epistemological traditions of the subjects covered by the IEO can be seen as both an opportunity and a potential obstacle to developing a research strategy. A common research theme or research programme where these different perspectives could find fertile ground could be a way to deal with the matter. Using this potential can affect the impact of IEO both within MDH and also in the eyes of key stakeholders.

- Developing common research themes forming a suitable platform for research and teaching and visibility to work towards through the different competencies and viewpoints of IEO in the five subjects.

- Aligning IEO and its relationships and its embedded nature with other departments of MDH is a matter that deserves attention. Are there overlapping activities that blur the image of the university and its research and teaching?
• How is co-production and renewal articulated in the IEO setting and how should the department come to terms with these issues of MDH strategy?

• How is the identity and image of the present and past affecting the future vision and identity as well as the key impact? How can we move beyond a past (and maybe still existing) view with a new and more research-based personality and identity?

• The impact and identity, as well as image, of IEO would be clearer if the business school were to be re-established as an own organisational unit of MDH.

Concerning relevance, IEO shows an interest in research concerning a number of research specialisms. Corporate, social, and environmental sustainability is one of the most frequently mentioned issues that attract interest in the units that presented their research. This accords well with the strategic focus on co-production (with regional firms, the local and regional authorities, and national partners). International business management and marketing and the network perspective have a strong potential with the industrial landscape and actors in Mälardalen and can have a focal impact on the positioning of the department. The planned study of growth in economics also seems highly relevant in this respect.

The IEO department regularly produces a surplus in its budget (around 3 million SEK in 2013). As this surplus is used to cover deficits in other parts of the MDH, it cannot be used for the benefit of the department and its position within the school. This matters also for research and development of the department and its potential and capability to become a strong entity and have an impact on society and in the Mälardalen region. A business school embedded in MDH with sufficient resources should enable an identity in business and economics at MDH and the surrounding society. It should also benefit through co-operation with other parts of MDH.

7. Quality of research

Accounting

We find that the research output in accounting holds a satisfactory quality. However, the heavy teaching load for the accounting faculty together with limited research time allocated have limited the research output of the group. In view of the important role of accounting on the educational side there seem to be strong grounds for increasing the research time for the accounting faculty as well as for recruiting more senior faculty in accounting that could strengthen the research environment.

Economics

The small and cohesive group of economists is clearly dedicated to research and has demonstrated ability to conduct high-quality research as evidenced, for example, by a recent book by one of its members published by Oxford University Press. The small size of the group means, however, that its research is dispersed across a wide range of topics from economic growth, the environment, and political economics to operations research, optimisation, computable general equilibrium models, and economics and accounting, a welcome cross-disciplinary research and PhD supervision effort.

International business and marketing

The research output in the area of international business is excellent. Research issues are at the research frontier, and relevant theory is used to motivate empirical studies of a high quality. Often the work is produced in collaboration with the most prominent researchers and published in the most highly ranked journals in the area.

Concerning the subject of marketing the research is closely related to the business network
approach and industrial marketing issues and perspectives. This has started off very well and research is on-going as well as publications. The stream of research is well aligned with the aforementioned international business stream where a common conceptual and epistemic ground in conjunction with strong academic leadership and a well connected research community is established.

**Organization and management**

The research produced by the organization and management unit is strong, displaying a clear character that qualifies them as both distinctive and thought-provoking within the field of organisation studies. The work of this young and active group of researchers shares an epistemology which is still emergent but draws predominantly on qualitative, interpretive and critical approaches to social science. The publications of the unit largely aim to understand and explain how certain organisational phenomena emerge in practice and are transformed by practice. This stream of research has a strong innovative character and has been published in respected journals directed both at the Scandinavian and international community. The productivity in this field is highly consistent both in quality and quantity, benefits from solid academic relationships outside MDH both nationally and internationally, and the internal cohesion of the group is highly promising given stability, support, and the space to grow individually and as a collectivity.

**Political science**

The research output in political science, generated by a small group of scholars with diverse research interests and methodologies, is of a good standard as evidenced by a series of recent reports and peer-reviewed journal articles published by group members. The group has research strengths in environmental policy, sustainable urban development, and the politics of gender. While some members of the group have been successful in gaining research funding to increase their research time, the research output of the group has been constrained by heavy teaching loads together with limited research time. In view of the significant potential of political science to provide an important bridging role between several of the department’s research groups, it is notable that the group currently lacks a professorial-level research leader to strengthen the group’s internal and external research profile as well as to develop research priorities to enhance the identity and integrity of the group. The group’s research on sustainable urban development has attracted significant local and national media interest – as evidenced by an impressive set of radio and television appearances by one of its researchers – and the considerable social relevance of this research could be enhanced by greater emphasis on dissemination and collaboration with scholars in Swedish and international research institutes focused on issues of sustainable regeneration, social justice, and urban planning.

**8. Renewal – Strategies and plans for development of IEO**

Renewal as concerns research has to be dealt with at several levels of the organisation and will include also actors outside of MDH itself. Volume, productivity, quality, and content of the research should be improved upon with the ultimate goal being that the research output should have an impact on industry, society, and the global research community. A successful strategy of renewal can only be implemented if the senior management of MDH and EST actively take the lead in this process.

As to the volume of research, it is obvious that the resources available for research need to be increased. It is also obvious from the material made available to us that the small Swedish universities are allocated much less financial resources for research from the government than the larger institutions. Clearly, the vice-chancellor of MDH and the dean of EST will have to lobby
in ways suitable to change this. However, the research groups and the individuals concerned, including the PhD students, will have to be more active themselves than in the past to make efforts to secure funding from available external sources. Among those sources, local and regional actors should not be forgotten. We believe a change for the better has already begun. Improved quality, innovation, and productivity will be important in this regard. The human resources will also have to increase when financial resources so allow by hiring academics from other universities with proven research ability and by admitting new PhD candidates. And it is also important to stimulate faculty not yet involved in research in order to enhance the volume and quality of research being undertaken, to strengthen the research culture prevailing at IEO, and to improve teaching quality.

There are no shortcuts to improving on the research and teaching quality. Attending PhD courses and summer schools also internationally will have an impact. A suitable seminar culture is a critical ingredient, requiring senior leadership, a high degree of attendance and preparation when internally produced research is discussed. The seniors will have to take the lead and by making seminars rewarding, to authors and attendants, they will gradually make seminars the centre of the academic activities. Attending international conferences, networking, and cooperating nationally and internationally will have an impact. Submitting papers to refereed international journals and receiving feedback from reviewers is an excellent learning device. Our impression from the meetings we have had with the research groups indicates that serious efforts in this vein have already been initiated but are suffering due to lack of enough financial resources.

The context of MDH, with large well-established universities close by and generally the size and the relatively late arrival into the international research arena of IEO, indicates to us that differentiation, developing and implementing a unique and useful character of the research, should be the central aim of the strategy-making. An effort was made by trying to establish “industrial renewal” as a joint focus for the different research groups. This is generally a good idea but it seems to us that for the moment this intended focus has no impact on the formulation of research problems and is not necessarily immediately meaningful in a broader context. Perhaps this focus is too wide and the meaning of it not enough discussed and analyzed. Preferably, the focus should be narrower and the intentions and goals made clear. Perhaps more dimensions could be added. Such dimensions could include co-production with the large international companies, Swedish and foreign, in the region by focusing on issues of relevance to senior and middle management in these companies. We think that IEO then would exploit the comparative advantages of its local and regional environment for global benefits.

MDH is located in a region with a high accessibility and the presence of many large multi-national engineering companies in region is unique. Co-production could include not only individuals concerned in these companies, but also members of several research groups within IEO, relying upon different but complementary approaches, and also researchers from the various engineering units of MDH, such as the “Embedded Systems,” which has excellent relationships with regional companies but no in-house business-type researchers. This would be useful as many of these companies are technology and R&D intensive and export knowledge-intensive products to most parts of the world as well as manage global supply chains. The participating companies should also contribute financially, thereby adding to the research funding. The output must be publishable, which should not exclude consulting for the companies according to strict limits and rules. More frequent and more intensive cooperation with companies in the region also increases the options to get ideas for bachelor and master theses. The participating academics need not necessarily invent the research issues but invite managers from the companies concerned for informal discussion in order to identify what issues are on the minds of the managers. Notes and conclusions could be circulated for further value to be added and discussed at follow-up meet-
ings. At the end of such a process, it is hoped, there would be a research agenda with committed
managers, companies, research groups, and individual researchers.

Co-production should also include faculty up to now not performing research. This could imply,
for example, authoring of cases for teaching purposes or other “academic product development.”
Such activities could give ideas to research and gradually make teaching faculty part of the local
research community. Relevant incentives could play a role here. As research faculty are gener-
ally free to develop their own research agendas, if management of IEO would consider a focused
research effort of the sort described above, a major drive to find new sources of external funding
should be undertaken. Securing new funding streams will stimulate individuals to join in on the
focused research. In this respect, research called for directly from companies and organisations
forms a possibility to develop as well. This can create new research opportunities and also op-
portunities for enhanced impact. One possibility would be to market such efforts as the promo-
tion of the “Mälar Valley” as an extraordinary region for location of R&D activities and advanced
engineering product development and manufacturing.

9. Potential and recommendations for development
The panel holds that IEO has substantial potential for development not least given its location
in a region with a very significant presence of a number of leading Swedish and foreign-owned
multinational firms, especially in electrical and mechanical engineering. To realise this potential,
we believe that there is a strong need to initiate a strategy process both at the school level and at
the department level to develop a focus strategy and a vision that can function as guidelines for
the development over the next 5-10 years.

For the strategy work, we suggest that the possibility to re-launch a business school at MDH
should be seriously considered, possibly with a focus on sustainability and industrial renewal or
alternatively on research and education of direct relevance for multinational firms of the type
that are present in the region. In the latter case, the focus would be on international business,
international management, international marketing, international production and logistics, supply
chain management, international politics and relations, international finance, and interna-
tional economics. Given the situation in the region and the competitive situation for business
schools in Sweden, we think that names such as “The Swedish School of International Business”
or “The Swedish School of Engineering Management” could be considered. This would make it
possible to develop a distinct identity but also a brand name that can be used in the marketing of
both the education programmes and the research in the future and make these activities more
visible and better known. Of course, it would be essential to cooperate closely with the manufac-
turing industry in the region and its large multinational firms, and with the engineering educa-
tion at MDH. To be successful, the education programmes and the research within the business
school should be tailored to meet the needs of the large MNCs in the region and to a large extent
developed in close cooperation with these firms to meet their needs in terms of both personnel
with a business education and new business-relevant knowledge. Besides traditional training
in business and economics, we see good language training in several languages as an essential
feature of a new business school. Furthermore, the planning and launching process should be fol-
lowed by an international board of advisors with 10-15 professors from leading business schools
in North America and Europe. With a good business school established, MDH would secure an
instrument to serve companies, municipalities, and other organisations, such as schools, in the
region with executive and leadership education. The panel held that it would be fully realistic
to launch the new business school with a faculty consisting of around ten professors to cover
the main research fields within the chosen focus area. Realistically, a business school could be
launched at MDH within two to three years.
A natural ingredient of a re-launched business school should, of course, be an integrated research school – a graduate school – in industrial economics and management (given the current examination rights at MDH). The focus of such a research school must be to prepare the PhD students for future academic careers, which implies that dissertations should be written in English and preferably as a collection of papers, so that the PhD students are trained in writing papers that can be accepted for publication in good refereed international scientific journals. However, we are aware that in some cases the overall research question can be such that a dissertation is better written as a monograph but, of course, also in this case the PhD students should be encouraged to write papers that can be published in international journals. Substantial efforts should be made to recruit “industrial PhD students” from the MNCs in the region.

An alternative in the short run to the pursuit of the business school idea would be to construct a more “pointed” or “acute” institution in line with the research focus proposed above. A tentative name, signalling the intention, could be “Mälar Valley Tech” (MVT) or “Mälar Valley Business Tech” (MBT). This institution would be strongly specialised in subject areas such as management of R&D and technology, corporate entrepreneurship, project management, production economics, supply chain management, and international business and marketing. This focus would secure a close connection between research and teaching, and being attractive to engineering companies in the region. The focus would be appealing also to faculty and students.

This focused approach would differentiate MVT/MBT from direct competition with the large, well-established universities. The focused approach would lead to superior services being delivered and, therefore, preferred by the regional engineering companies.

Competition in the business school market has intensified, and with more mobile students choosing a higher education institution more intelligently than going for the one being closest to home, MVT/MBT would make itself and MDH more visible. In this way, MVT/MBT could bypass the rankings of general business schools and appear as No. 1 in its own chosen area.

Besides the above major recommendations, we also make a number of specific but equally important recommendations:

- The panel recommends that MDH reflects carefully on the substantial advantages of locating all faculty within business administration, economics, and political science in the same department within one school. In the long run, this is the most effective decision that MDH can make to strengthen the research milieu in these disciplines and, moreover, enhance the contribution of these disciplines to the university as a whole.
- The research time for all research faculty, especially professors, should be substantially increased.
- Recruitment of new faculty as well as internal promotions need to be open and held to a high international standard with the help of external evaluators located in Sweden and overseas.
- The research strategy of the department should be supported by the formation of a research committee, chaired by the Research Director but also including representation from each unit, ideally in the form of the nominated research lead.
- A formal administrator role dedicated to research should be considered, to identify sources of funding and support the composition of research bids by both faculty and doctoral students.
The doctoral students represent a vital component of the research community at MDH, and their activity can be enhanced by the creation of a Director of Research Degrees, enhanced research funding, the strengthening of the progression procedures, and clearer representation of doctoral students in relevant committees and meetings.

Assuming IEO and EST do not currently engage in executive education, we recommend that IEO and EST investigate the market for such activities.

The ambition should be to organise at least one international scientific workshop, symposium, conference, etc., per year in the region – this is important to increase the visibility of the research in business administration, economics, and political science at MDH.

The funding for participation at international scientific workshops, symposia, conferences, etc., abroad must be increased, in particular, for the PhD students to give them an opportunity to present their research to an international audience but not least to help them develop strong international networks – the target should be that each PhD student shall be able to participate in a couple of international scientific meetings each year.

To increase research productivity, all faculty and PhD students should be encouraged to co-author papers locally, nationally, and, in particular, internationally.

It should be made obligatory for PhD students to do at least one semester at a foreign university and the necessary financial resources for this must be secured.

At least one electronic working paper series with full international access (RePEc, etc.) must be started to make the research more accessible and visible, and consideration paid to the idea of supporting and funding open access for key articles published by departmental faculty. An incentive system should be introduced to encourage faculty as well as PhD students to publish their research papers as working papers.

There should be a joint weekly research seminar for all faculty and all PhD students, where PhD students (and junior and senior researchers) can present and get feedback on synopses for papers, full working papers, and revised papers.

We suggest that a number of visiting professor positions is opened up to broaden the available faculty in terms of competencies and specialisations. This is important not least for the PhD students at the department, since it offers opportunities for extra supervision but also for co-authorships.

We suggest that clear output targets in terms of publication in journals recognised by Web of Science are set up for all junior and senior researchers in relation to the research time in their employment contracts and that an incentive system is created in relation to the impact factor of the different journals; for example, the introduction of a bonus system through which faculty members are rewarded by extra payments or additional time for research based on their published research in refereed journals might be considered, an arrangement that has worked well at the University of Iceland.
Chapter 8:

Future Energy Center - Report from Panel 5

Panel Members:
Philip de Vaal, University of Pretoria, South Africa (Panel Chair)
Bogdan Dlugogorski, Murdoch University, Australia
Deng Shiming, Hong Kong Polytechnic University, Hong Kong
Ruiqin Zhang, Zhengzhou University, China
Banu Örmeci, Carleton University, Canada
Thore Berntsson, Chalmers University of Technology, Sweden

General assessment
The panel is satisfied that the Future Energy Center (FEC) is mature and well-established and is performing very well. There is no doubt that its outputs will be even better in future, compared with its already high level of performance.

There is excellent integration with the local community and industries and FEC should be commended on the solid relationships which have been established, with what they have achieved to date and with the multidisciplinary approach followed to achieve this. It was strategically a very good decision to utilise the networking capabilities of this center via a highly-regarded journal (Applied Energy).

The following important recommendations:

i. Fire Protection Engineering (FPE): The panel could not see any other “home” for this group than in the FEC. It is however understaffed and, since there is no full-time director (Professor), there is insufficient means to elevate this to its rightful position – especially from a research perspective. It is clear that this unit fulfills an important need in the education system and also in the local and regional community and is highly regarded in this respect. It is recommended that the university management takes a decision on whether to continue with this unit, or not. Should the decision be positive, as this panel strongly recommends, then it should be supported with adequate staff and funding to attain its objectives – also in terms of enabling research outputs.
ii. A strategy is needed to ensure that laboratory facilities will be able to support research activities.

iii. More emphasis must be placed on making the contributions made to society more visible, i.e. to capitalise on the significant achievements in this regard.

iv. There is no formal mechanism to support young staff aspiring to become academics. This includes time to focus on research (sabbatical) as well as some initiating funding mechanism.

v. It is important to have per capita performance indicators. This provides a more realistic framework against which outputs of institutions of varying size can be evaluated. MDH is very good for their size but cannot really compete with larger entities in terms of total output.

vi. With a view on preparation for a national assessment, it is recommended that detailed information on all outputs be provided to enable quantification of performance indicators in a better way. This should also include:

- Detailed breakdown of funding obtained from national as well as from private sources
- Student-to-staff ratio’s
- Number of researchers (SLE) on which per capita outputs can be based

vii. In light of the above, clear performance targets for expected outputs should be set by MDH top management.

viii. Be careful for opportunistic project-based research. Rather move towards more fundamental research – this should also attract more funding from government.

ix. Is providing seed funding to establish start-up companies and retaining fractional ownership to generate a growing third-stream income, a feasible option?

x. FEC is giving away IP in return for in-kind industrial support. There are different ways to handle the IP issue, and it can be nicely worked out with the industry (other universities are doing this). The current set-up is completely at the disadvantage of the centre and MDH.

Wish list:

Track 2 needs a house (dwelling), well-instrumented, as a laboratory, to study the effect of detailed electricity and energy metering. This will include the effect of Electric Vehicle (EV) charging, noise emissions and could very well be combined with research on Communal Fire Safety (Safe@home project).

2. Research environment and infrastructure

2.1 Future Energy Centre

The Future Energy Centre (FEC) is part of the School of Business, Society and Engineering (EST) FEC is led by a research director, Prof. Erik Dahlquist and track leaders, with an external reference board for strategic guidance and links to the industrial sectors. Research covers energy, environmental and building engineering.

Research activities are guided making use of three tracks, namely:

i. Track 1: Renewable energy technologies, headed by Prof. Jinyue Yan
ii. Track 2: Energy efficiency and emissions mitigation, with Dr. Fredrik Wallin as track leader and Prof. Björn Karlsson as scientific leader and

iii. Track 3: Tools for diagnostics, advanced control, optimization and load management, headed by Prof. Erik Dahlquist.

Use of tracks rather than formalising groups – more to guide participants in the strategically determined direction, is a very useful and effective management, planning and support approach, which seems to be effective.

There are 26 researchers (8 are professors and 5 associate professors) and 45 Ph.D students. Researchers and Ph.D students present courses and do research. Associate Prof. Emma Nehrenheim is the Research Education Director who is in charge of Ph.D students’ education. There is a supervisors’ committee, which meets regularly to assess Individual Study Plans (ISP).

Research environment
FEC has a good organization and runs smoothly. Each track is properly managed and active with regard to application of allocated funding, organising research teams and setting up relationships with international and industrial partners. They have accomplished much to date.

According to the University of Leyden bibliometric analysis, the MNCS is 1,94 which is excellent. FEC has built a good reputation through the journal *Applied Energy* published by Elsevier since 1975. Prof. Jinyue Yan has been the editor-in-chief since 2007 and Prof. Erik Dahlquist is a key editorial board member. The Journal has 12 issues per year; 53 members in its editorial board and publishes ca. 40 – 50 articles per issue, or 500+ papers/year. There are currently ca. 200+ submissions per month. The Journal has a SCI Impact Factor of 4.78 (2012), with 1,200,000 downloads in 2013.

Several international conferences are organised through the FEC, or with their direct involvement. The International Conference of Applied Energy has taken place 5 times, will take place in 2014 in Taipei and has drawn 700 full papers. Other international conferences include the annual conference of the Scandinavian Simulation Society (in Västerås 2003 and 2011), EUROSIM 2016 in Oulu (every three years), the 2007 International Green Energy Conference in Västerås and the 2013 IWA 1st Holistic Sludge management conference in Västerås.

FEC has a budget of 32,6 MSEK, which includes research funds of 20,3 MSEK and postgraduate funds of 12,3 MSEK, resulting in approximately 780 KSEK per researcher. In reality, approximately 43 MSEK is available when industrial PhD students and adjunct professors are included.

<table>
<thead>
<tr>
<th>Total</th>
<th>Postgraduate education</th>
<th>Research</th>
<th>FE 2013</th>
</tr>
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<tbody>
<tr>
<td>9,3 MSEK</td>
<td>3,7 MSEK</td>
<td>5,6 MSEK</td>
<td>Faculty funds</td>
</tr>
<tr>
<td>23,3 MSEK</td>
<td>8,6 MSEK</td>
<td>14,7 MSEK</td>
<td>External funds</td>
</tr>
<tr>
<td>32,6 MSEK</td>
<td>12,3 MSEK</td>
<td>20,3 MSEK</td>
<td>Total</td>
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</tbody>
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The composition of the staff is adequate and representative in all respects. There are 26 researchers who are from 10 countries, who graduated from 11 universities, and have industry background related to 10 companies.

There are 45 Ph.D students who are from 18 countries while 21 are Swedish. They have industry background related to 28 companies.

Professors focus on application of funding, research and management. Adjunct Professors supervise projects and Ph.D students. Senior lecturers carry a heavier teaching load than Professors. Ph.D students typically have a 4 year appointment and spend one year for teaching work.
As far as diversity is concerned, there is a good distribution of local and international origin amongst staff and students. The research team has good synergies through the established international network. They have a lot of multi- and interdisciplinary activities though very broad research scopes.

FEC has a very good relationship with industry, local as well as international, such as ABB, Fortum, Rolls Royce, UKVattenfall, SIDA, SINTEF, SP, IVL, Susbiz, BWT and SEG. It has built cooperation relationships with international partners such as the EU, China, and excellent relations with local universities such as KTH, Chalmers, Lund etc.

Regarding gender profile, the female staff at FEC are adequately represented and have a good work environment. They are enthusiastic and committed staff members and participate in all activities, including day-to-day management of the group and its activities (Prof Eva Thorin is the deputy dean and Prof Emma Nehrenheim chairs the postgraduate committee), while also dealing with the normal challenges of maintaining the balance of family and work.

Infrastructure

In the FEC, there are 3 laboratories for education and 4 research laboratories related to energy efficiency, control and optimization, bio-energy and waste water treatment. There are relatively limited analysis instruments. The researchers have their own offices and Ph.D students have their own desks for daily work. They also have joint laboratories with, for example, KTH, ABB, and the local Department of Fire Safety. There are 2 technicians to maintain the running of the laboratories. Other infrastructure resources, such as human resources, information, and financial support is available via the normal MDH infrastructure.

The laboratories have adequate equipment and the facilities are in good shape. They can conduct most of their research work within their laboratories. For some large programs and special programs, they have cooperation partners which have the capabilities to fulfill additional tasks. The leading researchers, associate and adjunct professors, have sufficient abilities to ensure that access to external resources are available, when needed for a specific purpose. Within the FEC, the researchers can access any critical local infrastructure, e.g. laboratories, analytical facilities, pilot plants, etc.

Of importance here is the fact that, through good interaction with industry, which is close-by, students and researchers can be exposed to pilot-to-larger-scale facilities. Also, some off-campus laboratory and analytical facilities are accessible to students and researchers with the benefit that running and maintenance costs need not be carried by MDH, which can be seen as a substantial benefit, provided that access can be maintained.

Concluding remarks:

FEC has established an excellent research environment with very good infrastructure. In some aspects, they are excellent, namely with respect to international networking, cooperation with industrial partners such as ABB and Mälarenergi. They do excellent research work in gasification, integrated energy supply systems using PV, system optimization and pulp digestion. The composition of their staff is international and gender profile is good. They are enthusiastic and committed.

Recommendations:

FEC has a broad research scope and should trim their research programs in order to concentrate their human resources and budget to focus on a smaller number of research directions in order to create leading and internationally acclaimed research outputs. Given the current approach
to use off-site research equipment via partners and collaborators, FEC should consider investing more to improve and expand the special research equipment and systems if they want to enhance fundamental research and R&D achievements.

The grade for FEC in the assessment area of Research environment: Excellent; in the assessment area of infrastructure: Very Good.

2.2 Fire Protection Engineering (FPE)

Research environment
The Fire Protection Engineering (FPE) group within FEC comprises of one adjunct professor (20%), 3 full-time lecturers and 3 Ph.D students, with external supervision support from 2 former staff members. Adjunct Prof. Anders Lönnermark and Lincentiate Lecturer Mia Kumm are key persons. Their research fields include underground constructions, fire and rescue service operation, explosions and their effect on structures and fire development. Their activities are valuable and needed by the society. They have strong links and very good cooperation with the Department of Fire Safety and the Fire Training Center. Within the tracks of the FEC, there is ample support for PhD and other research activities, as current PhD projects show.

The fact that there is no full-time professor involved has an effect on the research outputs of this sub-group.

Infrastructure
FPE shares the same general support resources as FEC. FPE can share some research Labs with FEC and has a joint Fire Test Lab with Department of Fire Safety. They are good at collaboration and to get external resources for their research. (A total of 18.1 M SEK was obtained for various projects during the last 5 year period). They have access to local infrastructure, e.g. laboratories, analytical facilities, pilot plants and the fire training centre.

Concluding remarks:
The organization of FPE is small and simple. The key leading persons are capable in some aspects such as experimental tests and communication. The issues of fire safety engineering are special and needed by local society. The current resources are not enough to support its growth.

Recommendations:
FPE needs big support both related to human resources and funding to develop into a productive research unit. FPE needs some senior appointments. MDH or local government should invest for its growth.

The grade for FPE in the assessment area of Research environment and infrastructure: Good.

3. Networks and collaborations
Of the 45 PhD students currently enrolled in FEC, 21 are Swedish while the remainder are from other countries. This gives a good indication of the extent of international academic interaction.

The assessment on networks and collaboration is separated into two aspects, i.e., academic and non-academic, both at three different levels: regional, national and international, for the two sub-groups within the FEC, i.e., Future Energy (FE) (Part A) and Fire Protection Engineering (FPE) (Part B).
Part A Future Energy (FE)

Academic
International level

The networking and collaboration for FE at international level appears to be of the highest quality, with the highest possible level of involvement by carrying out high-level joint research projects inside and outside Europe such as the Baltic Sea Region EU projects, and the EU-China Applied Energy CSC program involving 15 EU partners and several Chinese Universities, with 100 PhD students and 50 Post-Docs from each region. Other examples include collaborations with universities and research organizations in other continents such as America and Africa. High level of outputs include book chapters, joint PhD student supervisions and PhD student examinations, high impact journal papers, joint project funding, etc. It is clearly demonstrated that the extent of such networking and collaboration is widespread, highly relevant and visible, bearing fruitful outcomes.

It is worthy specifically mentioning that one staff member of the FE is the Editor-in-Chief of a leading and highly respected academic journal in the energy field, namely Applied Energy. This has provided FE with a unique platform upon which strong international network and collaboration has been built. The journal has organized annual international conferences on applied energy since 2009 and has a network of more than 50 editorial board members who are experts in the energy field from all over the world. This has certainly helped place FE in a very strong position in the international arena with regards to networking and collaboration.

National and regional level

The network and collaboration in terms of stated outputs are less visible as compared to that at international level, but collaborations with other Swedish Universities such as KTH and LNU, Uppsala University (UU), the Swedish Agricultural University (SLU) and Lund University (LTH) and other Swedish research organizations, such as the National Gasification Research Centre, IVL and REESBE, have also been fruitful.

Non-academic
International

Although international collaborations were mentioned, clear outputs emanating from these, were not visible.

National and regional

Given the nature of some of the research work carried out in FE, networking and collaboration with national and regional related industries are likely to become prerequisite in order to facilitate project implementation. Examples include SLU and Mercatus Engineering AB for biogas production, SICS, SSAB and Forum for optimization of industrial process and power plants, ABB on energy optimization related to process industries and Bombardier on energy optimization in train transportation. FE also employs a large number of industrial Adjunct Professors who basically have full time work for these industrial collaborators. These adjunct professors also help FE on a part-time basis by co-supervising PhD students and helping securing industrial funds which are often of the scale of multi-million SEK. This certainly enhances the funding situation of FE, enabling FE to attract more PhD students and get more publications. Nevertheless, it is worth pointing out that industrial-based collaboration has the potential side-effect of research direction being led by the short term problem-solving demands faced by the collaborators. This is also to be addressed elsewhere in this assessment panel report.
It is interesting to note that the term “coproduction” has been extensively used in the self-evaluation document. Through extensive panel discussion, the term was better understood in that the level of involvement of industrial partners/collaborators goes much further than that of collaboration commonly understood elsewhere. This is perhaps Swedish specific, but its values are highly visible by having and maintaining long term and relatively stable networking and collaboration relationship, in both monetary and education terms. For example, for the agreement with three industrial partners, Malarenergi, EEM and Vafab Miljo, the cash value currently stands at 2.65 M SEK/Year and will be increased to 3.6 M SEK/year from 2015. On the other hand, the agreement with ABB stipulated that ABB pays the salary for two adjunct professors and one adjunct researcher.

Concluding remarks:
Networking and collaboration at different levels with both high quality academic and non-academic partners/collaborators are widespread and relevant, with fruitful outcomes from networking and collaboration in terms of high quality journal publications, sizable research funding generated and research students trained, with significant impact on related scientific communities and industries.

Recommendations:
The current level of network and collaboration with both academic and non-academic partners at different levels should be maintained and possibly enhanced. However, with respect to collaboration with non-academic partners, i.e., industrial collaborators at both national and regional level, caution should be exercised to avoid research direction being led or heavily influenced by the short-term problem solving requirements. This particular issue will be also addressed elsewhere in this assessment document, in particular with respect to research quality and in future research direction.

The grade for FE in the assessment area of Networks and collaboration: Excellent.

Part B: Fire Protection Engineering Group (FPE)

Academics
International level
Currently, international networking and collaboration is mainly provided via the adjunct professor working at SP, with most universities coming from Europe. In addition, there are also a few other universities in Europe and the USA. agreements for collaboration in fire education and research are in place, although the outcomes from implementing these agreements are not visible. Other networking activities at international level are mostly via attending international scientific conferences and presenting papers, which should be encouraged but the effects are yet to be materialized.

More outreach to other universities in the international arena such as those mentioned in the self-evaluation document, Section A2.ii, should be explored.

National
Not too visible except the mention of LTH in Sweden without giving further details on the extent to which the collaboration has been defined. Other possible channels for networking and collaboration at national level were via leadership of KCBU (Swedish Center of Excellence for Fire Safety in Underground Construction) where most fire groups working on fire safety in underground construction from Swedish Universities are also members.
Regional
Not visible.

Non-academic
International
Not visible

National and regional
Clearly the current level of networking and collaboration with non-academics at national and regional level was extensive, as evidenced by the long list of non-academic collaborators at regional and national level and the amount of research funding obtained from these collaborators/sponsors, and the involvement in a number of externally funded projects. However, similar to the dilemma faced by the FE group, the nature of the current work is also heavily dominated by the short-term problem-solving requirements from funders/sponsors.

Concluding remarks:
Networking and collaboration at different levels with high quality academic partners/collaborators are limited, in particular at international level. For non-academics, collaboration and networking appears to have achieved some degree of success, although there are opportunities for more in-depth collaboration.

Recommendations:
Networking/collaboration need to be enhanced, particularly for networking/collaboration for academics at international level to be significantly enhanced. However, it appears that this issue cannot be dealt with in isolation and should be looked after together with the overall research quality of this particular research sub-group, such as critical mass of researchers, in particular at senior level.

The grade for FPE in the assessment area of Networks and Collaboration: Good.

4. Coproduction (co-creation) and external co-operation

Background
Coproduction with industry has become one of the “trademarks” for MDH. It is mentioned in the vision for MDH that it shall become the best coproducing Swedish university and on the front page of their brochure MDH is characterized as the coproducing university. Due to the importance of this labelling, the evaluation group has as one of its tasks to evaluate coproduction. Hence, below, all different aspects of the interactions between MDH and industry are discussed and evaluated. The wording “coproduction” comes from KK-stiftelsen, which is the Swedish foundation for supporting R&D and close industrial cooperation in regional universities and hogskolor.

Definition
The difference between coproduction with industry compared with collaboration/cooperation, was not clear to us from the beginning. After discussions with staff at different levels, we have understood that coproduction, in this context, means a direct and true cooperation in projects, not only data transfer, advice, explanation of industrial views, etc.

Means and approach for creating coproduction instead of collaboration
In our discussions with the staff, it became obvious that the ambitions from the top level to
transform MDH into a coproducing university has not yet been diffused down in the organization fully. It is somewhat unclear how it shall be implemented in the cooperation with industry. Cooperation in different ways has been done traditionally and is being done at MDH as well as at other universities. It seems therefore important that the FEC develops a description of what it means in practice and a strategic plan for implementation.

**Coproduction in research, general**

The interactions between MDH and industry are carried on in several different ways, above all:

- Cooperation/coproduction in projects with industry, mainly performed as parts of PhD thesis work (employed at MDH)
- Cooperation/coproduction performed with “industrial PhD students” (employed primarily in industry)
- Cooperation/coproduction in the form of adjunct professors
- Smaller cooperation projects, in many cases MSc thesis projects

There are mainly two types of industry involved in the cooperation, i.e large international companies with some core business or strong representation in the region (ABB, Bombardier, Volvo CE) and local/regional companies (EEM, Mälardalen Energi, Vafab, etc). This means that the type of industries are typically manufacturing ones or regional utility companies. There are no large process industries in the cooperation regionally, but there is a cooperation with pulp and paper industries, both in the Gävle region and in South Africa, in the automation research area. In addition to this, FEC has cooperation with a large number of companies, mainly nationally but also internationally. Examples are Vattenfall, Fortum, CICS, SSAB, Mercatus, JM, Riksbyggen, Göteborg Energi. The coproduction development is, however, mainly directed towards the regional cooperation.

Some examples presented in the self evaluation of coproduction were:

i. The FEC participation in the Swedish Gasification Centre.
   This is a good example of close cooperation between industry and several universities. This means that FEC participates in this centre as one of several academic partners, with a relative small part of the total university funding in the centre. The types of cooperation with industry is the same at FEC as at the other universities.

ii. A system for detailed electricity metering.
   This cooperation means that it would be possible to achieve new price/tariff structures in electricity use in households and commercial buildings

iii. Radio frequency scanning (RF) to measure moisture in wood and other biomass using radio frequencies.
   With this technology it is possible to measure moisture in biomass online, which has several important advantages.

All three examples mentioned above are good examples of collaboration between university and industry. However, there were no descriptions about the approach or methods to achieve coproduction or what in these projects that could be examples of coproduction rather than cooperation.

The total annual expenditure for FEC is approximately 33 M SEK. The contribution from industry, i.e cash funding, is approximately 3 M SEK. In addition to this there is much in-kind contribution. The basic funding from the government to MDH (totally 78 M SEK to the whole university in
2013) is very small. FEC is partly dependent on two larger, long-term projects for their funding. These are the Future Energy project from KK-stiftelsen and the Swedish Gasification Centre. The small contribution in cash from industry is a problem for creating or maintaining a long-term, scientifically high-quality, research and coproduction activity with industry. This has, of course, been identified by MDH, but it is important to point out the importance of increasing the cash contribution from industry. With too much in-kind contribution, there is a risk of moving into too many short-term, very applied, projects.

The danger of being too dependent on the needs, sometimes short-term, of industry with a high degree of industrial cooperation was discussed at the evaluation. The staff expressed very clearly that it was possible to combine long-term scientific approaches with industrial interests.

The number of industrial PhD’s is 24 out of the total of 45. This is a high share, probably also when compared with other Swedish universities. On the one hand, this creates a closer cooperation with industry, while on the other hand it means a closer dependence on industrial needs. Obviously the industrial PhD student projects are of the same scientific quality, generally speaking, as the internal ones. These students seem also to be well integrated in the MDH organization, in participation in internal workshops, meetings, etc. They constitute therefore a good link between academia and industry.

Also the number of adjunct professors is high, i.e 5 in the relatively small group of FEC. Their professor contribution is typically 20% of their time with their main employment in a large industry or, in one case, a national institute. Their main task is to supervise or co-supervise one or two PhD students. Adjunct professors are an important asset, especially, in a fairly small organization, and can contribute heavily to a closer link with industry. However, most of them seem not to participate to a high extent in teaching or in internal meetings, workshops, giving presentations, etc. An even better integration of the adjunct professors would facilitate the development into coproduction rather than cooperation.

The contribution from industrial PhD’s and adjunct professors is, as shown above, considerable. This is, however, not visible in the description of the economy for the group. The total expenditures shown only includes the internal part. The economic value of the external contribution is, based on a rough estimate at the evaluation, around 20 M SEK annually, i.e more than 50% of the internal part. This should be made more visible, as it gives a better picture of the total situation and total resources in the group.

As mentioned, it seems that if coproduction has not yet been implemented fully in the cooperation projects. However, the high number of both industrial PhD students and adjunct professors constitutes a good base for this development.

One threat for a further development and maybe expansion is the risk of a saturated “market” for future coproduction in the region. MDH already cooperates closely with the major industries in the region and the staff does not see a big expansion within these collaborations. A project has therefore been started to identify possible new partners in SME’s. This can be a good development. However, SME’s are normally not R&D intensive and have in most cases small or no resources for this. National grants for supporting and developing SME’s can be one way forward.

**Dissemination/information on research coproduction to society and potential students**

A university has three major roles, i.e. teaching, research and impact on/benefits for society. The latter role has become increasingly important lately in the Swedish university system. MDH has several activities with their cooperating industries for dissemination of results in the form of seminars, project presentations, etc. However, no strategy for improving dissemination activities...
more generally to society was presented. With such a high share of industrial cooperation and applied research projects, there should be many results of interest for society. There is therefore most probably a potential for improving dissemination of findings.

To identify and quantify benefits for society, research findings must in many cases be put in a “meta” context, i.e. different development routes in different research projects must be compared, quantified economically, etc. This is a task for Swedish universities of increasing importance. Coproduction activities could to a higher extent be looked upon in this perspective and be disseminated to society and industry in general. For this the cooperation with economic expertise should also be further developed.

Improved activities in benefits for society, based on coproduction development as described above, would probably also lead to improved opportunities for information to potential students in the region, thereby creating a higher interest to choose the FEC education areas.

**Coproduction in education, means and approaches**

The traditionally high cooperation with industry in the group has influenced the education and development of courses considerably. Study visits, guest lecturers from industry, examples from the cooperation in the courses, case studies and MSc projects are examples presented at the evaluation. With a further development into coproduction, this situation could be even further improved. As mentioned above, also a stronger involvement by the adjunct professors could improve this.

The education situation at FEC is now in a development phase with new courses and changes in the programs that can be chosen by the students. This can therefore be an opportunity to improve benefits from coproduction even further in the education curriculum.

**Conclusions**

Cooperation with industry is very good in content, but possibly more generalized impact and dissemination/information should be improved. The movement into coproduction should be clarified at FEC in terms of definition, approaches for achieving this and a strategy to implement it.

Impact from the good industrial cooperation on teaching is very good and important for the region. It is obviously in a developing phase. Description of achievements and dissemination/information could be improved, especially what has been achieved through coproduction. Information to potential students about the traditionally good cooperation with industry is good but information about benefits for society from coproduction/cooperation could be improved.

The future impact and potential by coproduction must be considered as to be good. However, there is at least one important threat, i.e. the risk of saturated “market” for coproduction regionally.

Their vision of MDH is to become the leading Swedish university in coproduction. They have a potential to become that, but only “per capita”. Their coproduction activities can become large, but maybe not leading seen as absolute figures (concerning e.g. number of cooperating industries and total annual funding from industry, also other universities will most probably develop their cooperation with industry into coproduction).

**Recommendations:**

- Develop a strategy for implementation and further development of coproduction
- Try to increase the in-cash contribution from industry (easy to say…)
- Develop a strategy and an implementation plan for identifying and quantifying benefits
for society and industry in general

- Involve adjunct professors even more in the organization
- Inform potential students about the special situation for good coproduction at FEC
- Show the total economy and total resources and not only the internal part

(The contributions to MDH and FEC in particular from government as well as from industry, should be expressed in relation to that received by other universities in Sweden, probably based on student/staff numbers. This would assist in putting funding into better perspective)

Overall grading for coproduction/cooperation with industry: Very good

5. Productivity

Publications:
Although FEC includes only three out of 71 professors at the University, between 2008 and 2013, it produced 108 out of 529 MDH publications included in the CWTS Citation Index (CI). As this data base captures 30.9% of the outputs, FEC is credited with 424 publications, between 2008 and 2013. At present, FEC has 19 academics, including three full Professors, two Adjunct Professors, five Docents, three Lecturers and five Postdocs. This means that an average academic in FEC produces 3.7 publications per year. This reflects high productivity of the group. (Approximately the same figure is obtained when using the number of ISI-journal credits produced in 6 years is divided by 26 researchers, in stead of 19 academics)

The academics in FEC publish in mainstream and high quality journals and their papers make significant impact in the field, significantly exceeding the world best standard. The group is extremely competitive internationally. Typically, the publications for FE come out in the *Journal of Applied Energy*, and for FPE in *Fire Safety Journal*. Both are the leading journals in their respective fields, as confirmed by the average normalised journal citation impact of 1.5. The bibliometric data indicate that FEC punches considerably above world average, with 50% of its papers in the top 20% of the most cited papers in the field. Part of the group citation success lies in its extensive network of national and international collaborations that translates into co-authorship of journal papers. Finally, FPE has also produced a number of important industry reports, including the results of the underground-rail (Metro), biomass-storage and mine-tunnel projects. The panel recommends publication of these results in peer-reviewed literature.

PhD Completions:
Between 2008 and 2013, FEC completed 21 PhD students, averaging 3.5 completions per year, or around 0.4 FTE per supervisor per year. FEC has a target of five completions a year between 2016 and 2020, which appears to be within reach, considering the number of PhD students presently enrolled in the program. However, the number of licentiate examination between 2008 and 2013 of 9 (6 in FE, 2 in FEC and one undefined) seems low, indicating a flow on effect on lower numbers of graduating PhD candidates between 2013 and 2015. Fluctuating numbers of PhD/Licentiate examinations are not unusual at other universities, especially in smaller research groups. PhD completions normally coincide with cycles of research funding, and with related consideration of recruitment of new PhD students. In view of the Panel, the productivity in terms of PhD completion is high, on par with research intensive universities in other countries. Likewise, the average net period of study, i.e., 3.6 years per graduating students, is on par with similar data for doctorate degrees in other countries.

Load of PhD Students:
According to the information provided to the Panel during the interviews, FEC has 45 PhD stu-
dents, with 5 of them residing in FPE (Hansen, Kumm, Meyer, Nyman and Palm). This appears to be significantly more than the number of 19 FTE PhD students, as extracted from the University data base. The reason for the discrepancy is that some of the students are parttime and some are sponsored by industry. The students are supervised by 9 senior academics (Professors, Adjunct Professors and Docents), with the average supervisory load of 5 PhD students per academic. This figure is in line with typical supervisory loads of PhD students at research intensive universities in other countries.

Eight of the nine academics, who have seniority that allows them to supervise PhD students, are part of FEC. There has been a recent change in FPE with Adjunct Professor Anders Lönnermark taking over from Adjunct Professor Haukur Ingason, with Professor Ingason continuing to supervise some of the PhD students in FPE. With this observation, the Panel concludes that, in terms of productivity, the supervisory load remains similar in FE and FPE.

FEC has implemented rigorous admission, student progression and completion processes, including interviewing students prior to admission, establishment of supervisory committees, development of individual study plans and the quality of assurance. In view of the Panel, the PhD candidates undertaking their studies in FEC at MDH receive high quality education delivered at above world standards.

**Promotions:**

Only one of 19 academics in FEC, an Adjunct Professor, works in FPE. Except for FPE, FEC has sound plans for promotion and renewal of its academic workforce. At least two out of five Docents in FE appear to be ready to apply for promotion to the professorial level. Strengthening of the FPE by recruitment of new academics appears to be urgently needed for MDH to take advantage of genuine research and collaborative opportunities in Sweden and abroad, and to capture FPE student market in central Sweden. (Two other FPE programs operate in Sweden, one run by Lund in the south and one by Lulea in the north.) At present, teaching of five undergraduate units in FPE relies on the work of PhD students who appear to be stretched beyond their capacity, but deliver good, practically-oriented courses with help of local fire brigades and SP.

**Research funding:**

Over the past six years (2008-2013), the group has attracted 139.6 MSEK for FE and 18.1 MSEK for FPE. These numbers indicate the capacity of both FE and FPE to raise significant research funding of 1.38 MSEK per academic per year. This funding is in line with successful international research universities. The panel notes that FPE, in spite of its small size, has been very effective in winning external research support.

Irrespective of the details used, the FEC performed very well in terms of productivity, as the CWTS Bibliometric Report for Mälardalen University and supplemented by the Complementary bibliometric analysis of the FEC by Mälardalen University Library, indicated.

Depending on which indicator is used, outputs can be quantified in various ways. It was not the intention of this panel to propose any “best” way of quantifying outputs. Based on the information supplied and substantiated by the experience and personal knowledge of the panel members, it is clear that FEC’s research outputs are excellent by world standards.

Indicators normally used used for this are:

i. Peer-reviewed journals

ii. Number of PhD’s

iii. Books
iv. Book Chapters
v. Conference contributions
vi. Patents
vii. Reports to international and national programmes

Other indicators which can also be used include:

i. Number of rated scientists according to a national rating system
ii. Special Awards, including Fellowships of learned institutes, membership of national academies
iii. Funds obtained from industry and from alternative state-related and other entities in addition to standard allocations. Success rate with application for research grants
iv. Number of graduates employed within 1 year of graduation.
v. Number of graduates filling academic positions (after 10 years)
vi. Ratio of PhD’s:M’s:B-degrees awarded.

The available information did not make a proper assessment of most of these possible. It is also necessary to use a norm or benchmark against which the overall outputs can be measured.

**Recommendation:**

National norms for outputs should be used, internal targets specified and statistics based on this be used to position the performance of all research specialisations at MDH, including this one. Sufficient information should be supplied to rate outputs on a per capita basis.

**Conclusion:**

The productivity of this unit is of a world class standard. Quantifying these was difficult based on lack of specific detail.

Overall grading for productivity: **Excellent**

**6. Impact and relevance**

Impact of the Future Energy Centre (FEC) (Tracks 1, 2, and 3) research can be examined in two groups:

1. Academic impact, and
2. External socio-economic impact.

MDH has already taken the right steps to evaluate the “academic impact” of the Centre and the university by facilitating the preparation of the bibliometric report. However, the “external socio-economic impact” of the Centre’s research appears to have been overlooked, almost completely, in this process. Socio-economic impacts are becoming one of the main criteria used by governments and funding agencies to evaluate the success and accountability for universities, and will likely play a key role in determining the level of support provided to the universities in the near future.

- The Future Energy Centre has very strong ties with industry. The relationship is mutually beneficial and results in research that has direct impact and relevance for the industrial partners. Research results are directly utilized for the development of new tools, products and processes as well as optimization of systems including in-line and real-time optimization/automation systems.
• It is very important for the University and the Centre to be able to **quantify these benefits**. So far the efforts appear to have focused on quantifying the research and educational benefits in traditional ways such as the number of publications, citations, journal impact factors, number of students, employment rate of graduates etc. as detailed in the self-evaluation report and bibliometric analysis. Overall, these numbers are very good and show the high-quality research that is being carried out at the MDH, but they are insufficient to capture the direct impact of the Centre’s research on the efficiency and profitability of industrial partners, local and national economy, creating jobs, generating wealth, training highly-qualified and sought-after future work force, etc. It is these impacts that will give a substantial boost to MDH when compared to other larger universities.

• Technological, economic, environmental, and social benefits of the research are in fact tangible but more difficult to quantify. Some of these benefits can be translated to SEK values rather easily (e.g., new product sales, cost savings in operation, etc.) but the majority require data collection and analysis and following up with the industrial partners on the success of the projects and the uptake of research results. It is advisable to start collecting this information as soon as possible. It is also a good starting point to collect the impact data from the completed projects in the past 5 -10 years. On-going or recently-completed projects may not have much to show yet but the projects that were completed 5 years ago may have already lead to new products, systems, and improvements that can be illustrated in a quantifiable manner.

• Some of the impact and relevance parameters that can be considered:
  • new or improved process, procedure, protocol, method (e.g., manufacturing process, detection method or technique, treatment protocol, professional practice);
  • new or revised concept, model, framework, plan, strategy (e.g., decision-making framework, development plan, forecasting model, risk-mitigation strategy);
  • new or improved product;
  • new or improved service;
  • spin-off companies;
  • contribution to job creation;
  • provisional patents, patents, trademarks, industrial designs, copyrights;
  • new or revised policy, regulation, guideline;
  • new or revised bill, law, government program or measure;
  • cultural or intellectual enrichment (e.g., documentary, multimedia presentation, performing arts, visual arts, creative writing, etc);
  • public education and awareness initiative;
  • knowledge-sharing exercises outside of academia;
  • expert advice to elected government officials, government officials, private sector, other organizations;
  • collaborations within Sweden, Europe etc., with private sector as well as non-profit organizations;
  • citations outside of academia (citation in a policy document, design manual, engineering code, etc.)
  • other benefits or notable impacts beyond academia.
• In addition to collaborating with local industrial partners, the Centre also has successful international collaborations with China and E.U. member states. The benefits of these projects to the University and Sweden at large should also be identified.

• All partners we talked to are very pleased working with the Centre and they are closely incorporated in the research. They are involved in the projects early on and directly contribute to teaching and student training. This collaboration provides important skills to the students which could not be offered through theoretical classroom teaching.

• Several projects with successful results and applications were highlighted by the representatives of the industrial partners. These projects can be showcased with particular focus on research benefits and relevance, and advertised on the centre/university website and other platforms (similar to EU’s research success stories, articles and youtube videos). Currently, the university does not appear to effectively use the media to communicate the usefulness, impact and importance of their research to public, authorities, and decision makers. In the absence of metrics or quantitative data, this approach allows to use narratives to capture the qualitative impact of the research.

• A number of countries have developed methodologies to evaluate their research impact and their reports are available on the web. The 2010 Rand Report evaluated the Australian RQF, the UK ARC Scoring method, the US PART framework and the Dutch ERiC framework, and provides a good evaluation and comparison of different approaches. This report is available at the following link.


Overall grading of the research impact: Very good to excellent.

Comments on the Fire Protection Engineering (FPE) Program
There are very few fire engineering programs in Sweden so there is certainly potential to grow and be well-known in this area. The program is also very strongly supported by the partners and the fire department. Access to full-scale testing facilities is a very unique asset and does not have a significant cost to the university.

The partners involved are impressed with the usefulness of the research and it is clear that the research that is being carried out in the fire program is of high quality and has very important implications/benefits for the society (fire safety, risk, underground constructions, fire and rescue services, smoke behaviour, evacuations, energy effective buildings, etc.). However, there is not much to show for the high impact of the research projects that have been carried out so far. The program is understaffed and runs on the shoulders of PhD students and junior faculty. Surprisingly, this small research group has been very successful in securing substantial external funding that keeps them in operation, (See elsewhere in the report) but they are running from project to project and have not been able to publish the large amount of work that they have done. In the end, there is little to show for the academic impact of the research due to the lack of peer-reviewed journal publications. The socio-economic impacts of the research are clearly very important and can make impressive research stories if data collection and analysis are facilitated. The group indicated that their results are in fact widely used by industry (e.g., tunnel builders), authorities (policy makers, regulations, standards), and fire fighters, and these should be showcased and quantified when possible.
Since the group is operating on a project basis, they have not been able to establish a clear research direction or research strength that identifies them. They need to secure some long term government research funding to be able to do this. Currently, they are too diverse and not specialized enough. The funding situation forces them to be reactive rather than proactive.

Considering the relatively little resources they have had, and more importantly the lack of full-time senior faculty leadership and supervision in the program, the fire group has done very well but clearly cannot continue like this.

7. Quality of research

- Quality of research outputs of the FEC was measured using publications and rated according to the criteria described in the CWTS report. The results for this group was the highest of all groups in MDH (Table 4.1). Based on existing targets an average output of 1.5 - 2 per contributing researcher per year would be on par and this indicates that FEC is exceeding this by a good margin and is performing very well indeed.

- Funds obtained from external sources, was sufficient to enable and initiate research with industrial partners, but should be increased - there is a substantial potential to do this.

- Successes affecting the lives of the community, should be emphasised much more. This unique opportunity should be exploited much further. The success of the electricity plant using waste is an example of world-class standard.

- Research focuses on very relevant areas, namely energy and the environment, which is combined with waste and waste treatment, and also optimisation and control of waste treatment systems.

- Tracks rather than groups – more to guide participants in the strategically determined direction, is a ingenious approach to allocate support towards reaching common goals.

**Grading for quality of research: Excellent**

8. Renewal - Strategies and plans for development of the unit of evaluation

- To specifically focus on cutting-edge and inspiring and challenging research projects within the stated objectives of coproduction, was one of the objectives. While this has been met to some extent, this needs to be further developed and marketed.

- Junior faculty activities like small industrial companies formed in the sphere of the FEC could detract from reaching research output targets, unless it is carefully managed.

- Succession planning: Initiators of the research focus are senior staff. Provision has been made for this in the medium-term planning of the group, but should also be extended to the longer-term, providing opportunities for younger staff to gain experience and confidence with all aspects of project identification, fundraising and execution.

- The development potential is high.

- Is providing seed funding to establish start-up companies and retaining fractional ownership to generate a growing third-stream income, a feasible option?

**Grading for Renewal: Good to very good.**
9. Potential and recommendations for development

More examples of outcomes of research having a direct impact on industry & the surrounding community are needed. The project at Malarenergi is an excellent example of world-class standard, setting an example of what can be achieved when multidisciplinary skills are applied to a multi-faceted problem.

Innovative and unique research is being carried out, for example the RF-technique to monitor humidity of wood chips, the need and value of monitoring of energy and electricity usage in dwellings and the use of algae for combined waste water treatment (WWT) and biomass production for use in biogas production.

Fire Prevention Engineering

As far as Fire Prevention Engineering (FPE) is concerned, it is suggested that an analysis on sustainability be done before a decision is taken. This should involve a detailed study determining the demand for graduates in this field over an extended period of time, as well as the level of competence (B, M & PhD). Once this has been done and the outcome points towards a sustainable focus, the necessary resources i.e. manpower should be allocated.

The research focus can be integrated with that of FEC, as is currently done, provided that appointments are made in this critical area. FEC is the correct home for this.

Suggestion to define a project, sponsored via SEK300 - 400K to do a proper survey and prepare a document be prepared to do a proper, convincing survey.

10. Other issues

The following recommendations are made:

- The outputs related to research should be measured using normalised metrics (typically per SLE), which should include, but not be limited to, graduates, journal articles, patents, conference contributions, personal achievements, funds and collaborations, community/social contributions

- Targets should be set for the above, to be achieved over a planning period, e.g. 5 to 15 years. These targets should be applicable to the entire university. Performance according to the stated goals should be rewarded with allocations to improve outputs.

- Junior and mid-career faculty, and senior PhD students would strongly benefit from a career mentorship program. Some younger faculty have let the teaching and administrative duties take over their research time, which result in delayed graduation, promotion, publications etc. and hurt the program.

- They are giving away IP in return for in-kind industrial support. There are different ways to handle the IP issue, and it can be nicely worked out with the industry (other universities are doing this). The current set-up is completely at the disadvantage of the centre and MDH.
Chapter 9:
Educational Science – Report from Panel 6

Panel Members:
Pertti Kansanen, University of Helsinki, Finland (Panel Chair)
Julie Allan, University of Birmingham, UK
Maria Luiza Cestari, University of Agder, Norway
Ann Farrell, Queensland University of Technology, Australia
Sven-Erik Hansén, Åbo Akademi University, Finland
Raimondo Manca, Università di Roma La Sapienza, Italy
Blas Torrecillas, Universidad de Almería, Spain
Eva Haettner Aurelius, Lund University, Sweden
Helge Strömdahl, Linköping University, Sweden

1. General assessment
The evaluation is based on information given in an evaluation package, visits to the panel unit and discussions with the researchers. The evaluation package was received beforehand and consists of a self-evaluation document, a general bibliometric report with a complementary bibliometric analysis of the Educational Sciences (UV), and information of the researchers, their CVs and a selection of their publications.

The research conducted in the unit of Educational Sciences is heterogeneous by nature, reflecting the differences in its specialisations; there is a range of approaches from rational sciences (mathematics) to human sciences (literature), each following its own typical paradigms. This makes it difficult to use the common criteria in the evaluation; the evaluation must be differentiated according to the approaches of the different specialisations.

The focus of the research has been on national and local publications with an increasing number of international publications. In some research specialisations the majority of publications have been published mostly in international journals and have had a moderate impact value. The general trend can be considered positive, but with not insignificant variations.

The establishment of the research environments vary and some are still loosely composed and act primarily as separate sub-groups inside the research environment.
2. Research environment and infrastructure

Within the frames of the university the infrastructure in terms of physical facilities, library services, databases and technological equipment were experienced appropriate and satisfactory.

**BUSS**
Rating: Very good

BUSS has strong leadership and a clearly articulated vision. Members demonstrate commitment to the research agenda and work strategically towards shared goals. The system of recognising and remunerating scholarly publications in the workload affirms the pursuit of research excellence. There is evidence that BUSS is well supported by the information systems and library. BUSS’s geographical location makes them well placed for regular interaction and collaboration.

**MNT**
Rating: Very good/Good*

The research environment is constituted by two separate research groups with different characteristics and subject matter, one in mathematics education and the other in science and engineering education. Overall, the research is characterised by a combined interest in practice-based research and theoretical development, emphasising particular subject areas in educational research, close collaboration with schools and municipalities, and forming a research base for teacher education programmes. The staff is constituted by scholars in mathematics and science education. The mathematical group is well structured and has a strong leader. The science and engineering group is still in its early stages of development.

*Note: The rating of MNT is differentiated between the two groups. The first rating is related to the mathematics education research group and the second one to the science and engineering research group.

**SOLD**
Rating: Good

The SOLD environment is a fairly new one, being both subject-oriented and oriented towards subject didactics. The research topics are numerous: English, Comparative Literature, Swedish as a second language, German, and there are a number of seminars/forums which connect these topics to the subject didactics. The group is striving to form a unity in research and strengthen the subject didactics focus. The emphasis on teaching creates a sense of limited capacity for research. The staff are academically well qualified, particularly in socio-linguistics and literature, however, a significant number of the staff in language do not have PhDs. The research in didactics is still limited. The environment’s focus on language has been given new impetus from recent policy changes which, in turn, need to be recognized by MDH.

**SILU**
Rating: Good

This a newly structured group, divided into three subgroups and still in the phase of constituting its organisational inner structure and the new collective role. It has the potential to widen its activities within in the educational field in spite of limited resources. The group is presently focusing on projects serving and financed by local communities. The activities are closely connected to teacher education within themes like multicultural education and leadership.
MAM
Rating: Very good

Mathematics and applied mathematics (MAM) is a strong research unit, functioning at national and international levels, is appropriately sized and is very active. MAM constitutes a fundamental basis for the many programmes of the university, in particular engineering and economics. The infrastructure (libraries and computers) is adequate and the group has available all the resources they need. The environment is divided into four groups. Each group has several interesting lines of research. The groups are well balanced between senior researchers (including three professors) and less experienced ones.

3. Networks and collaborations
BUSS
Grade: Very good

BUSS has an established track record of national and international networks and collaborations focused on preschool and school contexts and agendas. Their suite of research projects and research seminars, funded by the Swedish Research Council, involves high-level collaboration with high quality academic partners. They attract international expertise through the Alva Myrdal professorship and harness such expertise in refereed publications, doctoral seminars and practitioner conferences. The EU-funded POET initiative exemplifies the international collaboration and reach for which the group is known.

MNT
Rating: Very good/Good

The coordinator of the mathematics group has strong connections with the international research community and networks as well as with national and local institutions. His strong links in this respect are promoting the group’s joint research. Additionally, the group is managing a licentiate school together with three other Swedish universities. In that vein the two groups are functioning in an independent way since the other group has more diverse and individual contacts. One of the researchers in the science and engineering group has established good international contacts in connection to research on sustainable development.

SOLD
Rating: Good

The networks, with the exception of the Eco-critical forum (literature) are national and local. Other kinds of networks were individual and informal, and we would encourage strengthening these for long term and sustainable research collaboration. The bilingualist and multicultural competence in SILU might be more profitably used within SOLD.

SILU
Rating: Good

The research environment has been active in establishing networks and collaboration with other research communities mainly with local and national institutions and universities; the close contacts in the Nordic countries is a notable strength. There would be, however, more reason to increase and deepen various kinds of collaboration by participating more in congresses and special interest groups (SIG). In the field of research there are big and active research associations (e.g., EERA, EARLI, AERA, etc.) where networking and linking with colleagues would be easy.
MAM
Rating: Excellent

MAM is a unit of research with a broad network of collaborators and with high-visibility at both national and international levels. The four research groups of MAM collaborate with the most important universities of Sweden. At international level, the collaborations are carried out with US universities (South Carolina, Illinois at Urbana-Champaign, Iowa and Florida) and European universities (Rome, Trondheim, Copenhagen, Paris-Sud, Kyiv, Haute-Alsace, Tartu, Cardiff, St Andrews and Sussex). Other universities in Canada and in Africa are also involved in these collaborations.

Results of these collaborations have been joint publications, conferences, projects, postdocs and researchers’ visits. Moreover, the group of financial mathematics obtained two Tempus projects, thus creating collaborations with universities from Ukraine and participating in Erasmus Mundus.

4. Co-production (co-creation) and external co-operation
BUSS
Grade: Very good

Joint projects with high quality partners such as municipalities and research groups, within and beyond MDH, show co-production of new knowledge that is of value to end-users. The strong links of the research group to the field of early childhood education, for example, ensure that products (such as publications and pedagogical resources) reach end-users. Joint publications, within BUSS’s two strands, demonstrate an impressive level of collaboration.

MNT
Rating: Very good/Good

Research topics mainly focus on teacher education and school development. The mathematics group is engaged in a large project financed by the Västerås municipality (16 M SEK), focusing on mathematical conceptual development, and particularly in mathematical discourses in the classroom. They have a strong collaboration and have co-produced articles with three national and seven international universities. In addition, the science and engineering group interact with the local municipality (e.g. in relation to teacher in-service education). They also participate in a Swedish national graduate school (FontD). One of the science education researchers has developed strong and important collaboration in the area of sustainable development in connection with UNESCO and UNISI in many countries including the US, Canada and some countries of Europe.

SOLD
Rating: Good

The SOLD group, in particular, the socio-linguists, have developed close cooperation with schools and other bodies in the region, and these activities have led to the co-production of new teaching practices. As emphasised previously, there is a need for stronger international networking, specifically with researchers.
SILU
Rating: Good

Much of the research is closely related to society, for example, teachers’ work, schools, science centres, politicians, municipalities, and to the Swedish National Agency for Education (Skolverket). In this respect, examples of co-production activities are presented, for instance reports together with municipalities, PhD students partly financed by municipalities and practice in schools. The conceptual difference between co-production and collaboration, however, is not yet clarified in a distinct way.

MAM
Rating: Very good

In this period, MAM has been very successful in co-producing, with companies such as Swedbank, IF-metal finance, SunGard among others as experts in finance. Many of the students are now working in such companies.

This experience has been extended to the new programme of engineering mathematics. In this way, new recent collaborations with research institute (SICS), industry (ABB, SAAB, Scania) and with other research groups of the university have been established. Moreover, MAM has been working to transfer this experience to other countries via educational programmes (Tempus and Erasmus Mundus). Furthermore, the group constructed, in cooperation with financial intermediaries, software for the evaluation of the price of financial products.

5. Productivity

BUSS
Grade: Very good

Productivity is a clear priority for BUSS, with strong evidence of high volume in publications, PhD completions and externally funded research grants. The key research foci of learning and environments (e.g., on the social language environment of preschool) and inclusion and special educational needs are strategic and collaborative, with respect to counterpart research groups within MDH and with external collaborators.

MNT
Rating: Very good/Good

The research of the mathematics group is published in well established international journals and reveals the strong academic and scientific activity of the group. Significant is the amount of publications produced by this young group of scholars. This is mirrored in the Norwegian journal list level 2 as the highest percentages (25.0%) in the sub-environment of the Sciences Educational research specialisations. The number of PhD students is considered adequate in accordance with the amount of resources. The publications of the members of the science and engineering group are mostly related to their individual doctoral theses.

SOLD
Rating: Good

The scientific productivity is significantly high in relation to single authored publications, but is low for indicators based on all publications. The normal publication pattern within the Humanities is the monograph; articles are common only in certain areas of linguistics. This explains to a
large degree the relatively low position in the bibliometric analysis. There is evidence of the presence of SOLD members at national and international conferences, and also as journal reviewers, while other kinds of listed activities are low. The number of PhD students remains low.

**SILU**  
Rating: Good

The essential part of the academic publications consists of reports written and financed by local authorities, scientific articles being in the background. Here lies a potential to elaborate reports to scientific articles and to, thus increase their number. The number of PhD and licentiate degrees awarded during the period evaluated has been very low. The overall number being produced seems, however, to be increasing.

**MAM**  
Rating: Excellent

Three members of MAM have more than 50 papers on Mathscinet (one of them with more than 100) and they have high h-indices. Other young researchers also have a very good productivity. Considering the total number of scientific outputs in relation of the number of researchers, we can say that the productivity of MAM is excellent.

Moreover, we note that, in the period 2008-2013, two full professors have been added to the group, one by promotion and another by a new appointment.

Although they only have a bachelor degree in mathematics (financial mathematics) and two masters (engineering mathematics and financial engineering) every year a PhD has been defended. Now, they have 8 doctoral students and we think that this will ensure the continuation of the large high quality productivity in the next future.

**6. Impact and relevance**

**BUSS**  
Grade: Very good

The research led by BUSS has international reach and impact. It strengthens the fields of early childhood research and research on inclusion through publications, international research exchanges and dissemination of quality research to government and non-government agencies. The research is embedded in professional relationships within the municipality and beyond and the group responds with agility to the changing policy agenda. BUSS aligns to current agendas while seeking to inform and shape thinking. Their research profile positions them well to influence policy and practice and their expertise is sought by practitioner groups, families, policymakers and politicians.

**MNT**  
Rating: Very good/Very good

The impact of the research in mathematics education is evidenced by the following indicators: publications in journals, collaboration with schools through research, support for teachers, textbook studies and political debates in the media among others. In science education there is very good collaboration with the municipalities, technological centres, in-service training for teachers in schools. They are also engaged with national and international institutions involved in sustainable development.
SOLD  
Rating: Good  
The research environment is extremely important for teacher education and teaching. There is evidence of significant impact on schools and society of the research of SOLD, for example, the research on the literacy education and learning of newly arrived children. The impact can be increased further by more targeted orientation towards language didactics.

SILU  
Rating: Good  
The research conducted in the unit does not always have evidence of immediate impact on society. However, the textbooks about multicultural education are widely used, are relevant and have an immediate impact on teacher education and schools. Student teaching, supervision and mentoring bring the latest ideas from the unit to schools. In addition, it has an impact on the school system and its organisation such as revised courses, documents and policy. There is also impact at a national level. Some colleagues are functioning as experts in reforming national school curricula and are writing expert statements for the Swedish National Agency for Education (Skolverket) in the area of their expertise.

MAM  
Rating: Very good  
The four research groups of MAM work on relevant topics, i.e. financial mathematics, stochastic process, algebra and analysis and their applications, discrete mathematics and modelling of behaviour and culture and engineering mathematics. These areas are important for the scientific world and for this university. The research activities of these groups have many relevant applications.

MAM has an important impact on society as shown by its collaboration with Riksbankens Jubileumsfond, Swedbank, IF-metal finance and SunGard (Front Arena).

Many students have been recruited by several important worldwide companies. MAM has recently begun cooperation with ABB, SAABS and Scania and laboratories of medical technology.

7. Quality of research
BUSS  
Grade: Very good  
BUSS has produced a corpus of publications, which reflects research expertise and reach in the areas of preschool education and inclusive education. Quality is attested for those works, identified on bibliometric measures and affirmed through their own benchmarking. There is evidence of high level conceptual interchange within and between the two groups and this is also seen in the quality of publications. A strategy for sustaining and, indeed, heightening, quality is the effective use of POET. Already POET is yielding joint publications of international standing. Experienced researchers mentoring emerging researchers is a model that BUSS uses to build research capacity and to ensure that a higher proportion of researchers are identified by internationally recognized bibliometric measures.
MNT
Rating: Very good/Good

The focus of the mathematics education research group is on the publication of their studies in highly ranked journals. The amount of publications mentioned earlier indicates the high quality of the work. The research is aligned to the needs of the local school communities and contributes to the advancement of the disciplinary field, for instance in connection with methodological issues. Several members of the science and engineering education group have written PhD theses as their main published work.

SOLD
Rating: Very good/Good*

The quality of research in the field of literature is very good and is of international interest, although written in Swedish. The two large projects in SOLD, funded by the Swedish Research Council, belong to the field of literature. It should be noted that funding by this agency is extremely prestigious, considering the very rigorous competition for external funding of research in the Humanities. In the field of language, the research outputs evaluated represent PhD dissertations and are of good quality. Citation levels of the group members are low. In all probability this is due to the inappropriateness of the citation methodology for this field of research.

* Note: The rating of the quality of research of SOLD is differentiated between the two different research fields literature and language. The first rating is related to the literature research group and the second one to the language research group.

SILU
Rating: Good

As emphasised earlier, the majority of the developmental and research work has been published as local reports and chapters in books, both in Swedish and in English. Several publications have been presented at congresses and published in congress proceedings with a small number of publications, produced by very few individuals, that have been peer reviewed and published in international journals of proven quality. To strengthen the quality the articles should be published in high ranked journals with impact value and this will contribute to enhancing impact.

MAM
Rating: Excellent

In this period, three important books have been published by members of MAM, two in Springer and the other in De Gruyter. These books, we think, will open new lines of research and will become necessary references for researchers working in these areas.

In general, the quality of the research of MAM is excellent and we would like to note the merit of the paper published in Science. Moreover, the group has published papers in internationally prestigious journals such as the Journal of Algebra, Journal of Functional Analysis, Journal of Mathematical Physics, Operations Research and Philosophical Transactions of the Royal Society.
8. Renewal – Strategies and plans for development of the unit of evaluation

BUSS
Grade: Very good

BUSS has a clear vision for enhancing its profile, recruitment and regeneration. Their strategy for pairing an experienced researcher with an emerging researcher stands to contribute to the skill development of new researchers and to the strengthening of research capacity.

MNT
Rating: Very good

The mathematics group is well established and is expanding in several different directions, among them, textbook analysis. As indicated above, the science and engineering group is not yet well established. One indicator of their intention in this sense can be observed, for instance focusing on research on large scale national tests (particularly in the 6th grade) and international tests such as PISA. Two Swedish universities have already been approached to engage in collaborative work.

SOLD
Rating: Good

There is a lack of strategy and of plans for achieving the ambitions to unite SOLD as a research unity, although the junior faculty activities show promise for SOLD as a research unity. The recruitment of a visiting professor in language (in reading and writing research) is commendable, as are the efforts to enhance academic strength by increasing the number of staff PhDs in language, with the support of MDH.

SILU
Rating: Good

The research environment is relatively new and the members have not yet formulated a common vision for renewal including the feasibility of realisation and prospects for future development. It is now appropriate for the group to strengthen the strategy for future research orientations and to concentrate on a few long term projects in collaboration not only with national institutions but also with wider international research communities.

MAM
Rating: Excellent

MAM consists mainly of young researchers, with the mean age of full professors low. The most active of them are also the youngest. Furthermore, the group was recently enlarged by the takeover of young high profile researchers, as it is possible to realise from the bibliometric databases (Mathscinet, Scopus and Web of Sciences).

The entry of the young high quality researchers into the group augurs well for the future development of the research of MAM. Indeed, young researchers represent a push in the continuous renewal of the research topics, whilst also addressing the new research foci in the emerging fields.
9. Potential and recommendations for development

The Panel agrees with the suggestions made by the research unit in the self-evaluation report and in the discussions during the visits and will mention here the most important suggestions for the future:

- Visiting professors
- More publications in English
- More activities in international congresses
- More sustainable international contacts
- More articles in journals with high impact factors
- Developing future cooperation with other centres, and with other academic partners
- Developing postgraduate programmes
- Developing a plan for a graduate school of its own
- Increasing the number of own PhD students
- Recruiting younger colleagues to the research team and strengthening the continuation of the research in the unit
- More activities and participation in the research associations in the field

In addition to these special recommendations we present some which are particular to certain special research environments:

**BUSS**
BUSS’s national and international positioning in early childhood and inclusion research and research leadership puts them on a trajectory for sustained impact. To achieve this, however, they will require a systematic approach to experienced researchers mentoring emerging researchers, working within writing teams and publishing in the most prestigious journals within their disciplinary fields. BUSS is encouraged to consider building methodological research capacity, particularly in the field of quantitative methods. BUSS has strong potential to be international leaders in their field.

**MNT**
MNT has scope to strengthen the scientific leadership for the educational science and engineering group (e.g., by appointing a professor). It also has scope to formulate a strong programme for the educational science and engineering research. Moreover, there is potential to strengthen the internal collaboration between the two research groups in MNT.

**SOLD**
The subjects within SOLD represent a relevant and important part of MDH’s mission and thus have potential for adopting a leading research position, particularly in ensuring the sustainability and recognition of the importance of language skills. We recommend that SOLD furthers the internal cooperation in the field of language didactics.

**SILU**
SILU has high potential to further enhance the collaboration inside the unit of Educational Science and could encourage it, for instance by offering concrete research themes to common work. A relatively small unit needs more power for funding and preparing applications for greater arenas.
MAM
The research results of the members of MAM represent a guarantee of the high potential of the group. Indeed, given the strength and the mathematical culture of the MAM members and the high scientific level of the professors in the group, the research topics that they are developing are likely to obtain very good results.

Moreover, we give suggestions for some lines of future research. First of all, they could improve the applied research in mathematical finance, in which they already work at a very high level. More precisely, the consolidated tools in this fruitful field should be exported in the actuarial field in which another random variable, i.e. the demographic evolution, should be added to the already complex evolution of financial phenomena. Furthermore, an interesting field of research, that involves results in mathematical engineering, heat transfer and mathematical finance, is the solution of multidimensional partial differential equations, both from analytical and numerical points of view.

The methods that they have developed in algebra, analysis and in discrete mathematics could find many applications in engineering.

10. Other issues
The self-evaluation report made by the personnel of UV is highly informative and features a very large volume of information. In addition, the text is critical and constructive and indicates a high awareness of the situation and circumstances as well as possibilities for research and development.

The future of some groups should be taken into consideration because of the age profile of the group. Relatively many professors are retiring in the next future and the next generation of the researchers needs special attention.
Bibliometry reports
Chapter 10: Bibliometric analyses in MER14 - introduction

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10.1 MER14
As described in chapter 3, one of the components of the research evaluation was a bibliometric study of MDH publications. A pilot study was carried out by the MDH Library during 2013 in order to give the steering group a basis for decisions regarding bibliometry. This chapter includes parts of the pilot study, as well as considerations and conclusions that led to the two bibliometric analyses presented in the next two chapters.

The overall purpose of MER14 was to evaluate the university’s research in order to identify potential areas of strength for future strategic decisions. The bibliometric analyses are therefore forward-looking in nature. Accordingly, only researchers employed at MDH in December 2013 were included in the analyses, not researchers who had left MDH during or before 2013. Also, researchers included in the analyses were encouraged to expose their full scientific production during 2008-2013, including publications completed while at other universities than MDH.

10.2 Background
The pilot study summarized which dimensions of scientific “production” could be measured or estimated through bibliometry. The shortcomings and problems associated with bibliometry when used in quality measurements were also described in some detail.

10.2.1 What can be estimated through bibliometry?
The following dimensions of scientific achievement where considered possible to estimate:

Productivity
How diligent have the MDH researchers been with regard to publications?
Quality
“What quality level is the research on?” Quality is just as difficult to measure as it is to define; instead, one often aims at something that (at least in an evaluation context) is perhaps best regarded as a surrogate for quality assessment:

Impact
Usually measured by citations, for example with the impact factor (IF). IF is a number, based on the average times articles published in a journal have been cited. IF is used as a proxy for the relative importance of a journal within its field; the higher the IF the more important the journal is considered to be. However, that peer researchers feel that a particular publication is important enough to mention does not necessarily mean that they consider the publication to be of high quality.

Prestige
Looking at the level of prominence of the channels in which researchers publish. For journals this can be approximated by the average impact (journal impact) for those titles where a research group is published. Another option is the so-called “Norwegian model”, where the reputation of the publication series and publishers are determined through a peer process. This assumes that the quality of the individual publication matches the overall quality of the channel in which it is published, which will, of course, not always be the case.

Collaboration
“To what extent and with whom are the researchers collaborating?” Measured through data on co-authorship and, where appropriate, by the disclosure of organizational affiliation.

10.2.2 Recommended sources
Based on similar analyses carried out at other Swedish universities, four different data sources were considered for the MER14 evaluation:

- The MDH institutional repository, DiVA. It has by far the highest coverage of MDH publications, but as it is mainly based on self-reporting, DiVA data is of lower quality than data from commercial databases. For instance, categorizations such as publication type or refereed/non-refereed are less consistent. Additional validation work could fix some, but not all of these problems.

- Commercial publication databases such as Web of Science and Scopus. These include citation data but no comparison data for different subject fields. Varying coverage of conference proceedings and little or no data on books, so they do not give the whole picture for research groups whose output consists to a substantial degree of such publications.

- Further processed Web of Science data, such as the CWTS Citation Index provided by Leiden University. Includes comparison data for different subject fields, but covers journal articles only.

- The Norwegian list. A register of academic journals, series, websites and book publishers, ranked according to perceived prestige. Includes monographs and chapters in anthologies published at established publishers, and articles in scholarly journals and series, and is therefore generally more inclusive than the above citation databases, both in terms of titles and publication types. However, the ranking could be considered somewhat blunt.
All of these sources were eventually used to different extents. For a more detailed discussion on the different data sources, see chapters 11 and 12. Google Scholar was suggested as a source by researchers within IT, but due to low data quality and classified algorithms it was excluded from the joint analysis. However, Google Scholar data was provided by some of the research specialisations on their local web sites and thus available to their respective panels.

10.2.3 Coverage and volume
The pilot study tried to estimate the coverage in Web of Science for the different research specialisations. Generic studies show a coverage of >90% for subjects such as chemistry and physics, but only around 10% for subjects within the social sciences and the humanities. The pilot study estimated a coverage of MDH publications in Web of Science in the range of 5-40%, with very low coverage for the IT-related specialisations. Coverage in the Norwegian list was estimated to be in the range of 15-50%.

To be able to make statistically robust analyses, a certain volume of publications is necessary. The pilot study covered the period 2008-2012 and indicated that all research specialisations except Innovation and Product Realisation had at least 50 publications indexed in Web of Science, an anticipated minimum number of publications. In the Norwegian list, all research specialisations were estimated to have at least 50 publications.

10.3 Other aspects of the bibliometric analyses
Based on the pilot study, and on further discussions with the research specialisations, it was decided that the bibliometric study should consist of two separate analyses. The first one was outsourced to Leiden University and was based on Web of Science data. The second, complementary one, was conducted by the MDH Library and was based on a range of sources, and also included the sub-environments.

In the final months of 2013, an extensive effort was carried out by individual researchers, the schools and the MDH Library. DiVA was updated with many new records, and several thousand records were supplemented with a unique author index (ORCID) to improve the quality of the following bibliometric analyses.

After the completion of the two analyses, the library arranged a series of seminars where the results were presented and discussed internally. It proved to be a valuable exercise in itself to discuss the possibilities and problems with bibliometry, the impact of bibliometry in relation to present and potential publication strategies, and as a rehearsal before presenting and discussing the bibliometric results to the evaluation panels.
Chapter 11:

Bibliometric Analysis - CWTS, Leiden University
Bibliometric analysis of Mälardalen University

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1. Introduction

The Mälardalen University (MDH) has requested the Centre for Science and Technology Studies (CWTS) of Leiden University to perform a bibliometric analysis. The goal of the project is to gain concrete and detailed insight into the bibliometric performance of the research publications of MDH and its research specialisations. The results of the analysis performed by CWTS are presented in this report.

The initial data has been provided by MDH and has been matched with the Web of Science (WoS) database, which is produced by Thomson. WoS is, along with Scopus, a major multidisciplinary bibliographic database that is available for large-scale bibliometric studies.

The project focuses on the publication output of MDH and its research specialisations during 2008-2012. The citation impact of these publications is measured during the time period 2008-2013 and is compared to worldwide reference values. The study is based on a quantitative analysis of scientific articles and reviews published in international journals covered by WoS.

The report comprises of four further sections. Section 2 describes the initial data structure and criteria for matching the initial data with our database. Furthermore, the final data for the study is presented, along with an overview of coverage, by university and research specialisations. In Section 3, we give a brief overview of the methodology employed at CWTS and of the bibliometric indicators that have been calculated in the study. Section 4 reports the main results for MDH and its research specialisations, in terms of overall performance, co-operation analysis and time trends. Concluding remarks are presented in Section 5.
2. Data collection and coverage

Data acquisition is the most crucial step in a bibliometric analysis. It entirely determines the level of analysis and meaning of the statistics that are calculated.

2.1. Initial database structure

For this project, MDH has provided the publication data to represent the university as well as its six different research specialisations. These are listed in the table below.

<table>
<thead>
<tr>
<th>Research Specialisation</th>
<th>Acronym</th>
</tr>
</thead>
<tbody>
<tr>
<td>Future Energy Center</td>
<td>FEC (MERO)</td>
</tr>
<tr>
<td>(Environment, Energy</td>
<td></td>
</tr>
<tr>
<td>and Resources Optimisation)</td>
<td></td>
</tr>
<tr>
<td>Health and Welfare</td>
<td>HV</td>
</tr>
<tr>
<td>Industrial Economics</td>
<td>IEO</td>
</tr>
<tr>
<td>and Management</td>
<td></td>
</tr>
<tr>
<td>Innovation and Product</td>
<td>IPR</td>
</tr>
<tr>
<td>Realisation</td>
<td></td>
</tr>
<tr>
<td>Embedded Systems</td>
<td>IS</td>
</tr>
<tr>
<td>Educational Science</td>
<td>UV</td>
</tr>
</tbody>
</table>

The data delivered by MDH contains bibliographic information including first author surname and initials, title and document type of each document, publication year and journal (where appropriate), publication year and the assigned DiVA code. Moreover, the research specialisation, as well as the sub-environment assigned to each document is enlisted.

The MDH data contains duplicates, mostly due to collaborations between sub-environments of the same research specialisation, but also duplicates resulted from collaborations between different research specialisations. As the present report aims a bibliometric analysis at the level of MDH and its six research specialisations, only the collaborations between specialisations will be accounted for.

There are 2990 documents with distinct DiVA codes out of the total of 3541 entries of the initial data. Table A1. in Appendix I depicts the number of distinct documents for all publication types, across all six research specialisations at MDH.
2.2. Bibliometric summary

The first step in performing the bibliometric analyses is to match the initial database with our database.

Our CWTS Citation Index (CI) system will be used for these analyses. The core of this system comprises of an enhanced version of Thomson Scientific/Institute of Scientific Information’s (ISI) citation indexes: Web of Science (WoS) version of the Science Citation Index, SCI (indexed); Social Science Citation Index, SSCI and Arts & Humanities Citation Index, AHCI.

We therefore calculate our indicators based on our in-house version of the WoS database. WoS is a bibliographic database that covers the publications of about 12,000 journals in the sciences, the social sciences, and the arts and humanities. Each journal in WoS is assigned to one or more subject categories.

We note that our in-house version of the WoS database includes a number of improvements over the original WoS database. Most importantly, our database uses a more advanced citation matching algorithm and an extensive system for address unification. Our database also supports a hierarchically organized field classification system on top of the WoS subject categories. Finally, each publication in our database has a unique publication identifier called the UT code.

Based on their DiVA code, but also on their title and first author’s name, the 2990 distinct documents in the initial database have been matched with our database and the UT code of the matched publications have been attached to the data.

Finally, 570 documents with distinct UT have been identified, which amounts in 19.06% of the initial data.

A number of 4 documents represent collaborations between different research specialisations and will therefore be included in the evaluation of the performance of each specialisation. The distribution of the distinct publications on the type of publication as well as on research specialisations, accounting for the 4 aforementioned publications, is provided in Table A2. in Appendix I. The missing document types indicate that these types are not covered by WoS.

Each publication in WoS has a document type. The most frequently occurring document types are ‘article’, ‘book review’, ‘correction’, ‘editorial material’, ‘letter’, ‘meeting abstract’, ‘news item’, and ‘review’. The classification of the matched data according to WoS document types is provided in Table A3. in Appendix I. Notice the differences in document classifications with the initial MDH dataset.

Finally, in the calculation of bibliometric indicators, we only take into account publications of the document types ‘article’ and ‘review’. In general, these two
document types cover the most significant publications. Moreover, the project focuses on publications during 2008-2012. In conclusion, our analyses aims only articles and reviews covered by WoS, published between 2008 and 2012. A number of 529 publications have fulfilled these requirements and Table 2.2. describes their distribution across document type, as assigned in WoS, and research specialisation.

Table 2.2. Final data for bibliometric analyses.

<table>
<thead>
<tr>
<th></th>
<th>FEC (MER0)</th>
<th>HV</th>
<th>IEO</th>
<th>IPR</th>
<th>IS</th>
<th>UV</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article</td>
<td>104</td>
<td>213</td>
<td>19</td>
<td>6</td>
<td>79</td>
<td>100</td>
<td>518</td>
</tr>
<tr>
<td>Review</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>TOTAL</td>
<td>108</td>
<td>215</td>
<td>20</td>
<td>6</td>
<td>82</td>
<td>101</td>
<td>529</td>
</tr>
</tbody>
</table>

This represents the final dataset that is used in all further bibliometric analyses and its publications will be further referred to as the CI publications included in the study (2008-2012).

CWTS adds a number of bibliometric data to each publication record to the publication data of MDH as collected above. These additional data are all derived from our CI-system. These data are necessary for the citation analysis and, particularly, the field-specific impact normalisation procedures. These data are the following:

1. Data of each publication citing MDH publications in the given time period;
2. Data of each publication citing all publications in the journals in which publications of MDH have been published, in the given time period;
3. Data of each publication citing all publications in the fields to which publications of MDH belong as defined according to the CI-covered journals (sub) categories, in the given time period.

The covered period is therefore 2008-2012 for publications with an extra year added for their citation period, so as to arrive at robust impact scores. The collected publication data and the above additional data constitute together the ‘Bibliometric Summary’ of the compiled oeuvre of all research specialisations of MDH.
2.3. Coverage of publications

The next step is to determine the external and internal coverage for MDH and its research specialisations.

The external coverage represents the proportion of publications included in the study from the total number of publications of the same type in the initial data. The 529 matched publications represent 54.65% of all articles and reviews reported in the initial data.

The internal WoS coverage of a research unit is defined as the proportion of the references in its oeuvre that points to publications covered by WoS. To gain insight in the CI coverage of the publications included in the study, we thus studied the references of the papers included in the present study. To this end, references in the MDH publications (2008-2012) were matched to our extended CI publication database (1980-2012). In this way we can estimate the importance of CI publications to the authors of MDH publications, by determining to what extent they themselves cite CI papers and to what extent other non-CI documents.

In conclusion, the (internal) coverage is important to determine how well CI output reflects the scholarly practice at MDH and its individual research specialisations. This represents the foundation of meaningful metrics in any bibliometric analysis.

The internal coverage at the level of the whole university and also for its six research specialisations are presented in Table 2.3.

<table>
<thead>
<tr>
<th></th>
<th>P</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDH</td>
<td>529</td>
<td>52.51%</td>
</tr>
<tr>
<td>FEC (MERO)</td>
<td>108</td>
<td>60%</td>
</tr>
<tr>
<td>HV</td>
<td>215</td>
<td>61.2%</td>
</tr>
<tr>
<td>IEO</td>
<td>20</td>
<td>49.54%</td>
</tr>
<tr>
<td>IPR</td>
<td>6</td>
<td>27.38%</td>
</tr>
<tr>
<td>IS</td>
<td>82</td>
<td>30.4%</td>
</tr>
<tr>
<td>UV</td>
<td>101</td>
<td>41.78%</td>
</tr>
</tbody>
</table>

The results indicate a low to moderate coverage for MDH, as well as for its six research specialisations. Almost half of the documents cited by the 529 articles and reviews of MDH are published in sources not covered by WoS, which can include books and book chapters, conference papers, reports, patents or even certain
journals. The low internal coverage of the IS research specialisation, for example, might indicate citation practices that cannot be traced in the CI WoS database. These practices might be characteristic to certain fields and they might imply that the impact of the publications themselves is not fully captured from the citation impact for documents covered by WoS. For IS specialisation, this is further discussed in Section 4.1. The same applies, of course, for the other two research specialisations with low coverage, IPR and UV.

3. Bibliometric indicators

In this section, we describe the methods underlying the present bibliometric analysis. Table 3.1 below provides the definition of the bibliometric indicators covered in the report.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Dimension</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>Output</td>
<td>Total number of publications.</td>
</tr>
<tr>
<td>TCS</td>
<td>Impact</td>
<td>Total number of citations.</td>
</tr>
<tr>
<td>MCS</td>
<td>Impact</td>
<td>Average number of citations.</td>
</tr>
<tr>
<td>TNCS</td>
<td>Impact</td>
<td>Total normalized number of citations.</td>
</tr>
<tr>
<td>MNCS</td>
<td>Impact</td>
<td>Average normalized number of citations.</td>
</tr>
<tr>
<td>Ptop20%</td>
<td>Impact</td>
<td>Total number of publications that belong to the top 20% of their field.</td>
</tr>
<tr>
<td>PPtop20%</td>
<td>Impact</td>
<td>Proportion of publications that belong to the top 20% of their field.</td>
</tr>
<tr>
<td>PnC</td>
<td>Impact</td>
<td>Total number of uncited publications.</td>
</tr>
<tr>
<td>PPnC</td>
<td>Impact</td>
<td>Proportion of uncited publications.</td>
</tr>
<tr>
<td>TNJS</td>
<td>Journal impact</td>
<td>Total normalized citation impact of a journal.</td>
</tr>
<tr>
<td>MNJS</td>
<td>Journal impact</td>
<td>Average normalized citation impact of a journal.</td>
</tr>
<tr>
<td>No Collaboration</td>
<td>Collaboration</td>
<td>Proportion of publications authored by a single institution.</td>
</tr>
<tr>
<td>National Collaboration</td>
<td>Collaboration</td>
<td>Proportion of publications resulted from national collaboration.</td>
</tr>
<tr>
<td>International Collaboration</td>
<td>Collaboration</td>
<td>Proportion of publications resulted from international collaboration.</td>
</tr>
</tbody>
</table>

The above indicators are grouped by dimension. More relevant information is provided in the following subsections.
3.1. Output indicator
The output indicator, denoted by \( P \), measures the total publication output of a research unit. It is calculated by counting the total number of publications covered by WoS. Once more, we stress that articles and reviews in international journals are the only publication types taken into account.

3.2. Impact indicators
A number of indicators are available for measuring the scientific impact of all publications of a research unit. All the indicators relate to the number of times the publications have been cited.

In the calculation of all our impact indicators, we disregard author self citations. We classify a citation as an author self citation if the citing publication and the cited publication have at least one author name (i.e., last name and initials) in common. In this way, we ensure that our indicators focus on measuring only the contribution and impact of the work of a researcher on the work of other members of the scientific community. Sometimes self citations can serve as a mechanism for self-promotion rather than as a mechanism for indicating relevant related work. The impact of the work of a researcher on his own work is therefore ignored.

The total number of citations (TCS) indicates the total number of citations received by all the publications of the research unit. The mean citation score indicator (MCS) is the average number of citations per publication and is obtained by dividing TCS by \( P \), the total number of publications.

Usually, a recent publication receives less citations than a publication that has appeared a number of years before. Moreover, for the same year of publication in a journal, an article in mathematics may receive less citations than an article in biology, for example. This is usually due to the different citation cultures in different fields. To account for these age and scientific field differences in citations, we use normalized citation indicators.

Each journal in WoS is assigned to one or more subject categories. These subject categories can be interpreted as scientific fields. There are about 250 subject categories in WoS. Publications in multidisciplinary journals such as *Nature*, *Proceedings of the National Academy of Sciences*, and *Science* were individually allocated, as much as possible, to subject fields on the basis of their references. The reassignment was done proportionally to the number of references pointing to a subject category. It is important to highlight that the impact indicators are calculated based on this assignment.
Our mean normalized citation score indicator, denoted by MNCS, provides a more sophisticated alternative to the MCS indicator. The MNCS indicator is similar to the MCS indicator except that it performs a normalization that aims to correct for differences in citation characteristics between publications from different scientific fields and between publications of different ages. To calculate the MNCS indicator for a unit, we first calculate the normalized citation score of each publication of the unit. The normalized citation score of a publication equals the ratio of the actual and the expected number of citations of the publication, where the expected number of citations is defined as the average number of citations of all publications of the document types article and review that belong to the same field and that have the same publication year. As mentioned beforehand, the field (or the fields) to which a publication belongs is determined by the WoS subject categories of the journal in which the publication has appeared.

The MNCS indicator is obtained by averaging the normalized citation scores of all publications of a unit. If a unit has an MNCS indicator of one, this means that on average the actual number of citations of the publications of the unit equals the expected number of citations. In other words, on average the publications of the unit have been cited equally frequently as publications that are similar in terms of field and publication year. An MNCS indicator of, for instance, two means that on average the publications of a unit have been cited twice as frequently as would be expected based on their field and publication year. We refer to Appendix II for an example of the calculation of the MNCS indicator.

Since it relies on averages, the MNCS indicator can be influenced considerably by a single highly cited publication. If a unit has one very highly cited publication, this is usually sufficient for a high score on the MNCS indicator, even if the other publications of the group have received only a small number of citations. Because of this, the MNCS indicator may sometimes seem to significantly overestimate the actual scientific impact of the publications of a research unit. Therefore, in addition to the MNCS indicator, we propose here another important impact indicator. This is PPtop 20%, the proportion of the publications of the research unit that belong to top 20% mostly cited publications.

For each publication of a research unit, this indicator determines, based on its number of citations, whether the publication belongs to the top 20% of all publications in the same field (i.e., the same WoS subject category) and the same publication year. If a research group has a PPtop 20% indicator of 20%, this means that the actual number of top 20% publications of the group equals the expected
number. A PPtop 20% indicator of, for instance, 40% means that a group has twice as many top 20% publications as expected.

Of course, the choice to focus on top 20% publications is somewhat arbitrary and has been specifically chosen for this project. Instead of the PPtop 20% indicator, CWTS usually provides PPtop10%, but can also calculate PPtop 5%, or PPtop 30% indicator. On the one hand this indicator has a clear focus on high impact publications, while on the other hand the indicator is more stable than the MNCS indicator (see Appendix II for an illustration of the calculation on the indicator). Since it relies on percentiles, the PPtop 20% indicator is much less sensitive to publications with a very large number of citations. A disadvantage of the PPtop 20% indicator is the artificial dichotomy it creates between publications that belong to the top 20% and publications that do not belong to the top 20%. A publication whose number of citations is just below the top 20% threshold is not accounted for in the PPtop 20% indicator, while a publication with one or two additional citations is accounted for.

To assess the impact of the publications of a research unit, our general recommendation is to rely on PPtop 20% indicator, as well as on MNCS indicator. Because the MNCS indicator and the PPtop 20% indicator have more or less opposite strengths and weaknesses, the indicators can be considered complementary to each other. The MCS indicator does not correct for field differences and should therefore be used only for comparisons of groups that are active in the same field.

It is important to emphasize that the correction for field differences that is performed by the MNCS and PPtop 20% indicators is only a partial correction. As already mentioned, these indicators are based on the field definitions provided by the WoS subject categories. It is clear that, unlike these subject categories, fields in reality do not have well-defined boundaries. The boundaries of fields tend to be fuzzy, fields may be partly overlapping, and fields may consist of multiple subfields that each have their own characteristics. From the point of view of citation analysis, the most important shortcoming of the WoS subject categories seems to be their heterogeneity in terms of citation characteristics. Many subject categories consist of research areas that differ substantially in their density of citations. For instance, within a single subject category, the average number of citations per publication may be 50% larger in one research area than in another.

The MNCS and PPtop 20% indicators do not correct for this within-subject-category heterogeneity. This can be a problem especially when using these indicators at lower levels of aggregation, for instance at the level of research specialisations or individuals.
We use the total and mean normalized journal score indicator, denoted by TNJS and MNJS, to measure the impact of the journals in which a research unit has published. For this, we first calculate the normalized journal score of each publication of the unit. The normalized journal score of a publication equals the ratio of on the one hand the average number of citations of all publications published in the same journal and the same year and on the other hand the average number of citations of all publications published in the same field (i.e., the same WoS subject category) and the same year. The TNJS is obtained by summing the journal scores of all publications of a research unit, while the MNJS indicator is obtained by averaging the normalized journal scores of all publications. The MNJS indicator is closely related to the MNCS indicator. The only difference is that instead of the actual number of citations of a publication, the MNJS indicator uses the average number of citations of all publications published in a particular journal. The interpretation of the MNJS indicator is analogous to the interpretation of the MNCS indicator. If a unit has an MNJS indicator of one, this means that on average the group has published in journals that are cited equally frequent as would be expected based on their field. Furthermore, an MNJS indicator of two means that, on average, a group has published in journals that are cited twice as frequently as would be expected based on their field. Finally, the indicator PnC counts all publications that receive no citation, and PPnC reports the proportion of uncited publications of all the publications of a research unit.

3.3. Indicators of scientific co-operation

Indicators of scientific collaboration are based on an analysis of the addresses listed in the publications produced by the research unit. We first identify publications authored by a single institution (‘no collaboration’). Subsequently, we identify publications that have been produced by institutions from different countries (‘international collaboration’) and publications that have been produced by institutions from the same country (i.e. ‘national collaboration’). These types of collaboration are mutually exclusive. Publications involving both national and international collaboration are classified as international collaboration.
4. Overall results

In this section, the results of the performance analysis are reported. Section 4.1. shows the overall results, whereas Section 4.2. reveals the collaboration analysis. Using bibliometric techniques, the present study analyses the publication output from 2008 to 2012 and citation impact of these publications up to 2013. The impact, as measured by citations, is compared to worldwide reference values.

4.1. Aggregated publication output and citation impact

First of all, as depicted in Table 4.1., the research specialisations of Innovation and Product Realisation (IPR) and Industrial Economics (IEO) have extremely low number of publications covered by CI WoS. Moreover, their internal coverage is rather low, being below 50%.

Usually, for small number of publications, the validity and reliability of the indicators is rather low. A very low number of publications indicates that the results are subject to very large perturbations, especially the average indicators. All in all, this might indicate that the bibliometric indicators used in this report might not be a good measure of the research performance of these research specialisations.

For these reasons, we have decided to report no field-normalized impact indicators for the research specialisations IPR and IEO. The output indicator P has been included in Table 2.3. Additionally, the basic impact indicators TCS, MCS and PnC have been reported, for a straightforward insight into the publication performance of these two specialisations.

Table 4.1. presents the output and impact indicators, based on the CI-covered publications, for MDH and its remaining four research specialisations.

<table>
<thead>
<tr>
<th></th>
<th>P</th>
<th>TCS</th>
<th>MCS</th>
<th>TNCS</th>
<th>MNCS</th>
<th>Ptop20%</th>
<th>PTop20%</th>
<th>PnC</th>
<th>MNJS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDH</td>
<td>529</td>
<td>2343</td>
<td>4.43</td>
<td>548.72</td>
<td>1.04</td>
<td>116</td>
<td>21.9%</td>
<td>26.47%</td>
<td>1.07</td>
</tr>
<tr>
<td>FEC MERO</td>
<td>108</td>
<td>993</td>
<td>9.19</td>
<td>209.2</td>
<td>1.94</td>
<td>54</td>
<td>49.62%</td>
<td>6.48%</td>
<td>1.55</td>
</tr>
<tr>
<td>HV</td>
<td>215</td>
<td>816</td>
<td>3.8</td>
<td>171.63</td>
<td>0.8</td>
<td>30</td>
<td>14%</td>
<td>23.72%</td>
<td>0.97</td>
</tr>
<tr>
<td>IEO</td>
<td>20</td>
<td>96</td>
<td>4.8</td>
<td></td>
<td></td>
<td></td>
<td>15%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IPR</td>
<td>6</td>
<td>19</td>
<td>3.17</td>
<td></td>
<td></td>
<td></td>
<td>33.33%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IS</td>
<td>82</td>
<td>148</td>
<td>1.8</td>
<td>57.3</td>
<td>0.69</td>
<td>14</td>
<td>16.87%</td>
<td>48.78%</td>
<td>0.90</td>
</tr>
<tr>
<td>UV</td>
<td>101</td>
<td>294</td>
<td>2.91</td>
<td>88.69</td>
<td>0.88</td>
<td>14</td>
<td>13.24%</td>
<td>36.63%</td>
<td>0.93</td>
</tr>
</tbody>
</table>
At the level of the whole university, it can be observed that the 529 publications have received, on average more than 4 citations in the period 2008-2013. Accounting for field and publication year differences, the citation impact is just above the world average, with MNCS of 1.04. Furthermore, 21.9% of its publications belong to the top 20% mostly cited publications, which shows that the two impact indicators MNCS and PPtop20% are consistent. With respect to the journals in which these publications appear, it can be concluded that the journals have an average impact value, since MNJS is very close to 1. Finally, more than 25% of MDH publications are uncited.

As seen from the output indicator P, the HV research specialisation has the largest number of CI-covered publications, whereas all other specialisations except FEC (MERO) have less than half of its output. It is worthwhile mentioning that the HV research specialisation does not have the largest size dependent indicators, the total number of citations received by the publications of the specialisation (TCS), as well as its normalized counterpart (TNCS). This indicates that despite the large output (P), the average (normalized) number of citations is rather low compared to FEC (MERO). Moreover, when accounting for field and publication years differences, it is noticeable that the HV specialisation performs slightly below world average, since MNCS is 0.8. In fact, with this respect, only FEC (MERO) performs well above world average, with MNCS of 1.94. Furthermore, the publications of FEC (MERO) specialisation appear in journals (MNJS) with an impact value higher than world average, whereas the publications in the HV, IS and UV research specialisations appear in journals with impact values slightly smaller than the world average. In terms of PPtop20%, Table 4.1. shows that around 50% of the publications published by current staff members of the FEC (MERO) specialisation are among the upper top 20% of most highly cited papers. Following the example in Section 3.2., it can be concluded that FEC (MERO) has more than twice as many top 20% publications as expected.

For the two research specialisations with the lowest output P, IEO and IPR, it is noticeable the relatively high number of average citations, especially for the specialisation IEO. IEO also encounters a low number of uncited documents. Nonetheless, as previously mentioned, these results are subject to large fluctuations. For example, the indicator PPnC means that 3 IEO-publications out of 20 are not cited. If a single uncited publication was added to the analysis, this would translate into PPnC of 19.05%.
Finally, the Embedded Systems (IS) research specialisation has the lowest impact indicators MCS and MNCS, and the proportion of uncited publications is around 49%. This does not necessarily indicate a lower overall performance, but more probable different output and citations practices, in terms of document types, for example. It is worthwhile mentioning the very high number of conference papers in the IS specialisation, as shown in Table A1. in Appendix I, that are not accounted for in our analysis.

4.2. Scientific co-operation

CWTS calculates for MDH and all research specialisations, a breakdown of output and impact into types of co-operation, according to the publication addresses. It should be stressed that we focus on publications from a single organization only rather than publications from MDH only. This follows from the initial dataset, but also by the focus of the study, to take into account all previous output of current staff at MDH. The same observation holds for publications with national and international collaboration.

Table 4.2. Collaboration analysis for MDH and its research specialisations.

<table>
<thead>
<tr>
<th></th>
<th>No collaboration</th>
<th>National collaboration</th>
<th>International collaboration</th>
</tr>
</thead>
<tbody>
<tr>
<td>MDH</td>
<td>26.47%</td>
<td>41.58%</td>
<td>31.95%</td>
</tr>
<tr>
<td>FEC (MERO)</td>
<td>19.45%</td>
<td>44.44%</td>
<td>36.11%</td>
</tr>
<tr>
<td>HV</td>
<td>18.14%</td>
<td>52.56%</td>
<td>29.3%</td>
</tr>
<tr>
<td>IEO</td>
<td>35%</td>
<td>30%</td>
<td>35%</td>
</tr>
<tr>
<td>IPR</td>
<td>66.67%</td>
<td>33.33%</td>
<td>0%</td>
</tr>
<tr>
<td>IS</td>
<td>50%</td>
<td>25.6%</td>
<td>24.4%</td>
</tr>
<tr>
<td>UV</td>
<td>27.12%</td>
<td>31.88%</td>
<td>41%</td>
</tr>
</tbody>
</table>

The table above quantifies the output of scientific co-operation of MDH and its research specialisations. The results indicate a moderate international collaboration for MDH, with almost 32% of its output resulting from an international collaboration. Most of the specialisations, as well as MDH itself, exhibit a national collaboration preference over the international collaboration.
Table 4.3 below describes the breakdown of impact into the three types of collaboration, at the level of MDH. The general results for MDH have been included from Table 4.1. for comparative reasons.

### Table 4.3. Performance indicators for MDH in terms of collaboration.

<table>
<thead>
<tr>
<th></th>
<th>P</th>
<th>TCS</th>
<th>MCS</th>
<th>TNCS</th>
<th>MNCS</th>
<th>Ptop20%</th>
<th>PPer20%</th>
<th>PPnC</th>
<th>MNJS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MDH</strong></td>
<td>529</td>
<td>2343</td>
<td>4.43</td>
<td>548.72</td>
<td>1.04</td>
<td>116</td>
<td>21.9%</td>
<td>26.47%</td>
<td>1.07</td>
</tr>
<tr>
<td>International</td>
<td>169</td>
<td>1026</td>
<td>6.07</td>
<td>235.94</td>
<td>1.40</td>
<td>54</td>
<td>31.8%</td>
<td>20.71%</td>
<td>1.19</td>
</tr>
<tr>
<td>Collaboration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National</td>
<td>220</td>
<td>942</td>
<td>4.28</td>
<td>203.28</td>
<td>0.92</td>
<td>41</td>
<td>18.44%</td>
<td>25%</td>
<td>1.04</td>
</tr>
<tr>
<td>Collaboration</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No Collaboration</td>
<td>140</td>
<td>375</td>
<td>2.68</td>
<td>109.51</td>
<td>0.78</td>
<td>21</td>
<td>15.3%</td>
<td>35.71%</td>
<td>0.96</td>
</tr>
</tbody>
</table>

In terms of impact, the publications with international collaboration yield the highest impact, with a PPer20% of 31.8%, followed by publications with national collaboration, with almost the same number of top 20% publications as expected, and finally the publications with no collaboration, which show an impact below expected, of 15.3%.

Figure 4.1. below summarizes the total collaboration for MDH, in terms of output and impact (MNCS).

**Figure 4.1. MDH collaboration output and impact (MNCS) per collaboration type.**
In general the pattern of higher impact of international collaborations publications is what CWTS typically finds in its bibliometric studies. Table 4.4. provides the impact indicators for the four most productive research specialisations. The output and impact indicators have been included and highlighted for comparative reasons.

Table 4.4. Performance indicators for research specialisations in terms of collaboration.

<table>
<thead>
<tr>
<th></th>
<th>P</th>
<th>TCS</th>
<th>MCS</th>
<th>TNCS</th>
<th>MNCS</th>
<th>Ptop20%</th>
<th>PPtop20%</th>
<th>PnPnC</th>
<th>MNJS</th>
</tr>
</thead>
<tbody>
<tr>
<td>FEC (MERO)</td>
<td>108</td>
<td>993</td>
<td>9.19</td>
<td>209.2</td>
<td>1.94</td>
<td>54</td>
<td>49.62%</td>
<td>6.48%</td>
<td>1.55</td>
</tr>
<tr>
<td>International Collaboration</td>
<td>39</td>
<td>499</td>
<td>12.79</td>
<td>94.32</td>
<td>2.42</td>
<td>25</td>
<td>62.42%</td>
<td>2.56%</td>
<td>1.64</td>
</tr>
<tr>
<td>National Collaboration</td>
<td>48</td>
<td>419</td>
<td>8.73</td>
<td>88.22</td>
<td>1.84</td>
<td>22</td>
<td>45.7%</td>
<td>6.25%</td>
<td>1.59</td>
</tr>
<tr>
<td>No Collaboration</td>
<td>21</td>
<td>75</td>
<td>3.57</td>
<td>26.66</td>
<td>1.27</td>
<td>7</td>
<td>34.8%</td>
<td>14.29%</td>
<td>1.32</td>
</tr>
<tr>
<td>HV</td>
<td>215</td>
<td>816</td>
<td>3.8</td>
<td>171.63</td>
<td>0.8</td>
<td>30</td>
<td>14%</td>
<td>23.72%</td>
<td>0.97</td>
</tr>
<tr>
<td>International Collaboration</td>
<td>63</td>
<td>284</td>
<td>4.51</td>
<td>63.2</td>
<td>1.01</td>
<td>15</td>
<td>21.63%</td>
<td>25.58%</td>
<td>1.02</td>
</tr>
<tr>
<td>National Collaboration</td>
<td>113</td>
<td>410</td>
<td>3.63</td>
<td>82.12</td>
<td>0.73</td>
<td>13</td>
<td>11.09%</td>
<td>29.99%</td>
<td>0.96</td>
</tr>
<tr>
<td>No Collaboration</td>
<td>39</td>
<td>122</td>
<td>3.13</td>
<td>26.31</td>
<td>0.67</td>
<td>2</td>
<td>10.04%</td>
<td>41.07%</td>
<td>0.95</td>
</tr>
<tr>
<td>IS</td>
<td>82</td>
<td>148</td>
<td>1.8</td>
<td>57.3</td>
<td>0.69</td>
<td>14</td>
<td>16.87%</td>
<td>48.78%</td>
<td>0.9</td>
</tr>
<tr>
<td>International Collaboration</td>
<td>20</td>
<td>23</td>
<td>1.15</td>
<td>9.10</td>
<td>0.45</td>
<td>3</td>
<td>16.59%</td>
<td>60%</td>
<td>0.76</td>
</tr>
<tr>
<td>National Collaboration</td>
<td>21</td>
<td>25</td>
<td>1.19</td>
<td>10.81</td>
<td>0.51</td>
<td>3</td>
<td>14.79%</td>
<td>47.62%</td>
<td>0.89</td>
</tr>
<tr>
<td>No Collaboration</td>
<td>41</td>
<td>100</td>
<td>2.44</td>
<td>37.39</td>
<td>0.91</td>
<td>8</td>
<td>18.08%</td>
<td>43.90%</td>
<td>0.97</td>
</tr>
<tr>
<td>UV</td>
<td>101</td>
<td>294</td>
<td>2.91</td>
<td>88.69</td>
<td>0.88</td>
<td>14</td>
<td>13.24%</td>
<td>36.63%</td>
<td>0.93</td>
</tr>
<tr>
<td>International Collaboration</td>
<td>41</td>
<td>176</td>
<td>4.29</td>
<td>58.37</td>
<td>1.42</td>
<td>10</td>
<td>22.66%</td>
<td>26.83%</td>
<td>1.13</td>
</tr>
<tr>
<td>National Collaboration</td>
<td>32</td>
<td>91</td>
<td>2.84</td>
<td>20.94</td>
<td>0.65</td>
<td>3</td>
<td>8.74%</td>
<td>37.5%</td>
<td>0.81</td>
</tr>
<tr>
<td>No Collaboration</td>
<td>28</td>
<td>27</td>
<td>0.96</td>
<td>9.39</td>
<td>0.34</td>
<td>1</td>
<td>4.57%</td>
<td>50%</td>
<td>0.80</td>
</tr>
</tbody>
</table>
The highest indicators are obtained by publications with international collaboration from the specialisation FEC (MERO), with MNCS of 2.42 and PPtop20% of more than 62%. These publications are also published in the most highly rated journals, as MNJS is 1.64.

A comparison between types of collaboration for MDH and its research specialisations in terms of MNCS is depicted in Figure 4.2.

**Figure 4.2. Comparison of collaboration and MNCS for MDH and its research specialisations.**

![Figure 4.2. Comparison of collaboration and MNCS for MDH and its research specialisations.](image)

### 4.3 Trend analysis

In this subsection, we discuss the time evolution of the scientific production and impact of MDH and its research specialisations. We look at all the publications of MDH and research specialisations from each year of the analysis and consider their citations until 2013.
Figure 4.3. represents the trend analysis of the output for each unit of analysis, including the research specialisations IPR and IEO.

**Figure 4.3. Trend of the output (P) for MDH and its research specialisations.**

A significant output increase can be observed for MDH and all its research specialisations in 2009. While the increase trend for MDH and most of the specialisations continue in 2010 and 2011, IEO encounters a slight decrease, as well as UV. Notice that IPR has no publications in 2011 and 2012. Apart from a slight decrease of publications in 2012 for specialisations HV and IS, all other research specialisations, including MDH exhibit a (slight) increase in the number of journal articles.

Figure 4.4. shows the trend of the impact factor PTop20%, for MDH and the most productive research specialisations.
Figure 4.4. Trend of the impact for MDH and its research specialisations. (IEO and IPR are excluded from the analysis due to the small number of publication in the analysis).

It is noticeable that all research units encounter a (slight) decreasing trend of PPTop20%, either in the beginning or towards the end of the time frame. At the level of university, MDH has a decreasing trend in 2011. FEC (MERO) is the unit with the highest scores in PPTop20% during the whole period, in all years except 2008 above 40%, although it is noticeable a decrease in this indicator in 2010 and 2011.
5. Concluding remarks

This report presents the bibliometric performance of publications by MDH, which have been identified in the WoS database and labeled as journal articles or reviews. We have found a total of 529 publications that are attributed to MDH during the period 2008-2012. These publications have received a total of 2343 citations up until 2013, excluding author self citations. This means that MDH has published on average 100 articles and reviews per year, although our trend analysis shows that the WoS-covered publication output of the MDH has increased each year from 2008, culminating with a total of 125 publications in 2012.

In terms of citation impact, the field-normalized indicators (i.e., MNCS, PPtop20% and MNJS) show that the MDH is publishing with an impact slightly above the worldwide average. For instance, almost 22% of the publications for MDH are among the top 20% most highly cited publications in their field. Apart from a slight decrease in 2011, the trend analysis shows an increasing pattern in the share of highly cited publications and in the average impact of the journals in which the MDH is publishing.

In the last year of the analysis (2012), the values are also around the worldwide average (i.e. 24.41% highly cited publications and an MNJS value of 1.11). In terms of collaboration, the MDH has published more than 30% with some degree of international collaboration, which is the type of collaboration that has resulted, on average, in the highest citation impact. Publications in collaboration with other institutions from the same country show a lower average impact than internationally collaborative publications but a higher average impact than publications authored by researchers from a single institution (MDH or a previous institution where the current MDH researcher has been affiliated). Over time, the share of international collaboration has increased, especially in 2010.

In terms of MDH six research specialisations, there are significant differences in the output and citation impact among these specialisations. As stressed in the report, different research practices or different citation cultures might yield possible explanations for these differences in terms of output and impact.

Despite the relatively low output, the research specialisation FEC (MERO) outperforms in terms of citation impact, both normalized and non-normalized. The results might show that this analysis captures very well the research activities of the FEC (MERO) specialisation. Despite the decreasing trend in 2010 and 2011, the PPtop20% shows almost twice as many highly cited publications as the worldwide
level. Lastly, the publications of FEC (MERO) resulted from an international collaboration show substantial impact compared to all other specialisations and collaboration types, although the proportion of publications with international collaboration is not the highest (see Table 4.2. and 4.4.).

As shown by the results in Table 4.1., the most productive specialisation, HV, does not have the highest impact values, but is outperformed by FEC (MERO) and UV. The normalized indicators are around the worldwide average. The trend analysis showed an increase of the most highly cited papers to almost 25% in 2010, followed by a decrease, below worldwide average, in 2011 and 2012.

It is noticeable the significant increase in the PPtop20% of the UV specialisation until 2010. Moreover, as it can be depicted from Figure 4.4, it is worthwhile mentioning that IS has more than doubled its highly cited publications from 2010 to 2012.

As final remarks, it is important to highlight the two main limitations related to the bibliometric results presented in this report. In the first place, the internal coverage of the MDH, as well as of the existing research specialisations, is low to moderate. This means, as previously observed, that the results presented have to be considered carefully. As mentioned beforehand, an internal coverage around 50% indicates that there are possibly important publications produced by these units that are not considered in this study. Also, the low coverage could imply that even some of the publications covered by WoS actually could be targeting audiences whose main research focus is not well covered by the database. Therefore, the results presented in this report must be regarded as partly related to the overall output and impact of the MDH and its specialisations.

The second limitation involves the aforementioned low numbers of output. Bibliometric indicators based on small numbers may suffer from a lower reliability due to ‘noise’ in the citation behavior of researchers. For this reason, it is very important not to take the values of the indicators as true values of impact, but only as proxies of the actual scientific impact of the publications. A more accurate interpretation would account, for example in the output in and the size-dependent indicators, for the number of (active) researchers in a certain research specialisation of MDH.

In conclusion, in this report, we have analyzed in a combined way different indicators, in order to get, as much as possible, the most complete and accurate picture of the bibliometric performance of MDH and its research specialisations. In our analysis, we have considered the number of publications involved (P), the share of top cited publications (PPtop20%), the average filed-normalized citation impact
(MNCS), as well as the average field-normalized journal impact (MNJS). By combining the information provided by these indicators, we aimed to provide the most complete and accurate picture considering the problems and limitations previously mentioned. We thus advise that taking into account multiple indicators is the best way to avoid the limitations of single-indicator driven assessments.
Appendix I. Initial data structure

Table A1. Initial data structure.

<table>
<thead>
<tr>
<th></th>
<th>FEC (MERO)</th>
<th>HV</th>
<th>IEO</th>
<th>IPR</th>
<th>IS</th>
<th>UV</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Report</td>
<td>32</td>
<td>37</td>
<td>4</td>
<td>6</td>
<td>69</td>
<td>29</td>
<td>173</td>
</tr>
<tr>
<td>Book</td>
<td>1</td>
<td>14</td>
<td>3</td>
<td>9</td>
<td>2</td>
<td>11</td>
<td>40</td>
</tr>
<tr>
<td>Manuscript (preprint)</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Conference paper</td>
<td>154</td>
<td>112</td>
<td>68</td>
<td>190</td>
<td>718</td>
<td>100</td>
<td>1312</td>
</tr>
<tr>
<td>Patent</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Doctoral thesis (monograph)</td>
<td>0</td>
<td>5</td>
<td>6</td>
<td>3</td>
<td>10</td>
<td>9</td>
<td>33</td>
</tr>
<tr>
<td>Book chapter</td>
<td>9</td>
<td>82</td>
<td>35</td>
<td>41</td>
<td>87</td>
<td>102</td>
<td>347</td>
</tr>
<tr>
<td>Article, review/survey</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Journal article</td>
<td>142</td>
<td>356</td>
<td>46</td>
<td>54</td>
<td>146</td>
<td>210</td>
<td>942</td>
</tr>
<tr>
<td>Manuscript</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Article, review</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>12</td>
<td>20</td>
</tr>
<tr>
<td>Licentiate thesis (summary)</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>22</td>
<td>2</td>
<td>37</td>
</tr>
<tr>
<td>Doctoral thesis (summary)</td>
<td>6</td>
<td>10</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>31</td>
</tr>
<tr>
<td>Licentiate thesis (monograph)</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>5</td>
<td>4</td>
<td>2</td>
<td>7</td>
<td>10</td>
<td>29</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>350</strong></td>
<td><strong>631</strong></td>
<td>173</td>
<td>323</td>
<td>1076</td>
<td>494</td>
<td><strong>2990</strong></td>
</tr>
</tbody>
</table>

Notice that in Table A1, we account for the duplicates indicating collaborations between different research specialisations. In the last column however, we exclude these duplicates. The numbers in the last column represent thus the number of distinct documents for all publication types at MDH.
Table A2 depicts the distribution of different document types in the matched data, across the 6 research specialisations of MDH. The missing document types are not covered by WoS.

### Table A2. Matched data.

<table>
<thead>
<tr>
<th></th>
<th>FEC (MERO)</th>
<th>HV</th>
<th>IEO</th>
<th>IPR</th>
<th>IS</th>
<th>UV</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article, review/survey</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Journal article</td>
<td>118</td>
<td>225</td>
<td>20</td>
<td>6</td>
<td>89</td>
<td>107</td>
<td>561</td>
</tr>
<tr>
<td>Article, review</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>119</strong></td>
<td><strong>228</strong></td>
<td><strong>23</strong></td>
<td><strong>6</strong></td>
<td><strong>89</strong></td>
<td><strong>109</strong></td>
<td><strong>570</strong></td>
</tr>
</tbody>
</table>

Table 3 presents the matched data according to WoS indexed publication types.

### Table A3. Matched data in WoS.

<table>
<thead>
<tr>
<th></th>
<th>FEC (MERO)</th>
<th>HV</th>
<th>IEO</th>
<th>IPR</th>
<th>IS</th>
<th>UV</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article</td>
<td>105</td>
<td>214</td>
<td>19</td>
<td>6</td>
<td>80</td>
<td>100</td>
<td>521</td>
</tr>
<tr>
<td>Book review</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Editorial material</td>
<td>9</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>6</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>Letter</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Meeting abstract</td>
<td>0</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>Review</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>119</strong></td>
<td><strong>228</strong></td>
<td><strong>23</strong></td>
<td><strong>6</strong></td>
<td><strong>89</strong></td>
<td><strong>109</strong></td>
<td><strong>570</strong></td>
</tr>
</tbody>
</table>
Appendix II. Calculation of field-normalized indicators

To illustrate the calculation of the MNCS indicator, we consider a hypothetical research group that has only five publications. Table A1 provides some bibliometric data for these five publications. For each publication, the table shows the scientific field to which the publication belongs, the year in which the publication appeared, and the actual and the expected number of citations of the publication. (For the moment, the last column of the table can be ignored.) As can be seen in the table, publications 1 and 2 have the same expected number of citations. This is because these two publications belong to the same field and have the same publication year. Publication 5 also belongs to the same field. However, this publication has a more recent publication year, and it therefore has a smaller expected number of citations. It can further be seen that publications 3 and 4 have the same publication year. The fact that publication 4 has a larger expected number of citations than publication 3 indicates that publication 4 belongs to a field with a higher citation density than the field in which publication 3 was published.

The MNCS indicator equals the average of the ratios of actual and expected citation scores of the five publications. Based on Table 1, we obtain

\[
MNCS = \frac{1}{5} \left( \frac{7}{6.13} + \frac{37}{6.13} + \frac{4}{5.66} + \frac{23}{9.10} + \frac{0}{1.80} \right) = 2.08
\]

Hence, on average the publications of our hypothetical research group have been cited more than twice as frequently as would be expected based on their field and publication year.
Table A2. Bibliometric data for the publications of a hypothetical research group.

<table>
<thead>
<tr>
<th>Publication</th>
<th>Field</th>
<th>Year</th>
<th>Actual Citations</th>
<th>Expected Citations</th>
<th>Top 20% threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Surgery</td>
<td>2007</td>
<td>7</td>
<td>6.13</td>
<td>15</td>
</tr>
<tr>
<td>2</td>
<td>Surgery</td>
<td>2007</td>
<td>37</td>
<td>6.13</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>Clinical neurology</td>
<td>2008</td>
<td>4</td>
<td>5.66</td>
<td>13</td>
</tr>
<tr>
<td>4</td>
<td>Hematology</td>
<td>2008</td>
<td>23</td>
<td>9.10</td>
<td>21</td>
</tr>
<tr>
<td>5</td>
<td>Surgery</td>
<td>2009</td>
<td>0</td>
<td>1.80</td>
<td>5</td>
</tr>
</tbody>
</table>

To illustrate the calculation of the PP(top 20%) indicator, we use the same example as we did for the MNCS indicator. Table A1 shows the bibliometric data for the five publications of the hypothetical research group that we consider. The last column of the table indicates for each publication the minimum number of citations needed to belong to the top 20% of all publications in the same field and the same publication year. If the number of citations of a publication is exactly equal to the top 20% threshold, the publication is partly classified as a top 20% publication and partly classified as a non-top-20% publication. This is done in order to ensure that for each combination of a field and a publication year we end up with exactly 20% top 20% publications.

In other words, top 20% publications are two times overrepresented in the set of publications of our hypothetical research group.
Chapter 12:

Complementary Bibliometric Analysis - MDH Library

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Introduction and general conditions

The bibliometric part of MER14 is an attempt to statistically assess the performance of the individual research specialisations in terms of their publication activities. This chapter acts as a complement to the *Bibliometric analysis of Mälardalen University* carried out by the Centre for Science and Technology Studies at Leiden University (CWTS, 2014), see chapter 11. As the reach of metrics based solely on articles in academic journals may be considered too limited for some subject fields, we will compile key figures from the CWTS analysis and present them alongside additional indicators based on other, more inclusive sources of bibliometric data. Thus we hope to provide the reader with complementary (and sometimes competing) perspectives on the research specialisations publications.

Keeping in line with the general outlay of MER14, the basis of this analysis are publications authored by researchers belonging to Mälardalen University’s current roster, published between 2008 and 2013. Publications by former employees are thus not included, nor are publications where the contribution of MDH researchers is solely editorial. Texts not yet published (manuscripts, preprints), oral presentations and posters are also excluded.

The analysis will focus on three dimensions of publication output: productivity, impact/prestige, and collaboration. In trying to capture each of these, we will rely on the following databases:

- **DiVA**, the Mälardalen University publication repository. Registration in DiVA is mandatory for university employees. For MER14, we’ve also asked researchers to register publications published while employed elsewhere. DiVA contains mostly scientific material (both refereed and not refereed), as well as some non-scientific publications (popular science, opinion pieces, etcetera).
- **Web of Science (WoS)**, a collection of databases provided by Thompson Reuters. For this analysis, we’ve used the five citation indexes containing citation data for both journal articles and conference proceedings.
- **Scopus**, provided by Elsevier, contains citation data for serial publications (journals, conference proceeding and book series).
- **The CWTS Citation Index (CI)**, provided by the CWTS at Leiden University. Based on data from the three main parts of WoS, it contains citation data only for the journals covered in WoS, but includes comparison data for different subject fields. All CI-based indicators in this reports is taken from CWTS (2014), which also contains an in-depth methodological discussion on how those numbers are arrived at.
- **The Norwegian list**, which is used nationally for performance based allocation of research funds in Norway (and locally by some Swedish universities). This is a register of academic journals, series, websites and book publishers, ranked according to perceived prestige, with Level 2 being the most prestigious.

The value of the bibliometric indicators will depend on how well the above data sources reflect publication traditions and norms of the subject fields in which a research specialisation is active. Because of this, we’ll begin by giving a descriptive account of the different research specialisation’s publications and their coverage in these databases.
Descriptive indicators

As DiVA contains virtually all publications by current MDH researchers from the chosen period, it’s a natural starting point for this analysis. Below we see the total number of publications in DiVA, as well as the distribution over time and the distribution of publication types.

<table>
<thead>
<tr>
<th>Year</th>
<th>HV</th>
<th>IS</th>
<th>IPR</th>
<th>IEO</th>
<th>FEC</th>
<th>UV</th>
<th>MDH</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>92</td>
<td>184</td>
<td>54</td>
<td>32</td>
<td>48</td>
<td>89</td>
<td>489</td>
</tr>
<tr>
<td>2009</td>
<td>125</td>
<td>198</td>
<td>71</td>
<td>45</td>
<td>89</td>
<td>106</td>
<td>625</td>
</tr>
<tr>
<td>2010</td>
<td>149</td>
<td>211</td>
<td>46</td>
<td>27</td>
<td>73</td>
<td>108</td>
<td>601</td>
</tr>
<tr>
<td>2011</td>
<td>120</td>
<td>239</td>
<td>73</td>
<td>39</td>
<td>54</td>
<td>102</td>
<td>618</td>
</tr>
<tr>
<td>2012</td>
<td>140</td>
<td>239</td>
<td>78</td>
<td>28</td>
<td>86</td>
<td>88</td>
<td>644</td>
</tr>
<tr>
<td>2013</td>
<td>149</td>
<td>207</td>
<td>73</td>
<td>36</td>
<td>74</td>
<td>89</td>
<td>607</td>
</tr>
<tr>
<td>Total</td>
<td>775</td>
<td>1278</td>
<td>395</td>
<td>207</td>
<td>424</td>
<td>582</td>
<td>3584</td>
</tr>
</tbody>
</table>

Table 1. Number of DiVA publications, research specialisations and MDH.

<table>
<thead>
<tr>
<th>Publication type</th>
<th>HV</th>
<th>IS</th>
<th>IPR</th>
<th>IEO</th>
<th>FEC</th>
<th>UV</th>
<th>MDH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conference paper</td>
<td>17.2%</td>
<td>66.4%</td>
<td>58.7%</td>
<td>37.7%</td>
<td>39.9%</td>
<td>20.8%</td>
<td>43.0%</td>
</tr>
<tr>
<td>Journal article</td>
<td>58.7%</td>
<td>14.3%</td>
<td>17.2%</td>
<td>29.5%</td>
<td>42.5%</td>
<td>41.9%</td>
<td>32.8%</td>
</tr>
<tr>
<td>Book chapter</td>
<td>13.0%</td>
<td>8.0%</td>
<td>12.7%</td>
<td>19.8%</td>
<td>4.7%</td>
<td>20.1%</td>
<td>11.7%</td>
</tr>
<tr>
<td>Report</td>
<td>5.4%</td>
<td>6.7%</td>
<td>1.8%</td>
<td>2.4%</td>
<td>9.0%</td>
<td>6.2%</td>
<td>5.8%</td>
</tr>
<tr>
<td>Other publication types</td>
<td>1.3%</td>
<td>0.9%</td>
<td>1.5%</td>
<td>5.3%</td>
<td>0.9%</td>
<td>5.2%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Book</td>
<td>2.2%</td>
<td>0.2%</td>
<td>2.5%</td>
<td>1.9%</td>
<td>0.2%</td>
<td>2.7%</td>
<td>1.4%</td>
</tr>
<tr>
<td>Licentiate thesis (summary)</td>
<td>0%</td>
<td>2.0%</td>
<td>3.3%</td>
<td>0%</td>
<td>1.2%</td>
<td>0.3%</td>
<td>1.3%</td>
</tr>
<tr>
<td>Doctoral thesis (summary)</td>
<td>1.4%</td>
<td>0.6%</td>
<td>1.5%</td>
<td>0%</td>
<td>1.7%</td>
<td>1.0%</td>
<td>1.1%</td>
</tr>
<tr>
<td>Doctoral thesis (monograph)</td>
<td>0.8%</td>
<td>0.9%</td>
<td>0.8%</td>
<td>3.4%</td>
<td>0%</td>
<td>1.7%</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

Table 2. Distribution of DiVA publication types; research specialisations and MDH.

Based on the publication information in DiVA, we’ve searched the other databases utilized in the bibliometric analysis. Because of citation delay, the publication year time span will be
shorter for the databases containing citation data. The table below shows the number of the research specialisation publications covered in each of these databases, as well as what percentage of the publications in DiVA that coverage represents (for corresponding publication years).\(^5\)

<table>
<thead>
<tr>
<th>Database</th>
<th>HV</th>
<th>IS</th>
<th>IPR</th>
<th>IEO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of publ.</td>
<td>Coverage</td>
<td>No. of publ.</td>
<td>Coverage</td>
</tr>
<tr>
<td>WoS (08-12)</td>
<td>231</td>
<td>36.9 %</td>
<td>269</td>
<td>25.1 %</td>
</tr>
<tr>
<td>Scopus (08-12)</td>
<td>234</td>
<td>37.4 %</td>
<td>587</td>
<td>54.8 %</td>
</tr>
<tr>
<td>CI (08-12)</td>
<td>215</td>
<td>34.3 %</td>
<td>82</td>
<td>7.7 %</td>
</tr>
<tr>
<td>Norw. list (08-13)</td>
<td>463</td>
<td>59.7 %</td>
<td>414</td>
<td>32.4 %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Database</th>
<th>FEC</th>
<th>UV</th>
<th>MDH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of publ.</td>
<td>Coverage</td>
<td>No. of publ.</td>
</tr>
<tr>
<td>WoS (08-12)</td>
<td>121</td>
<td>34.6 %</td>
<td>115</td>
</tr>
<tr>
<td>Scopus (08-12)</td>
<td>120</td>
<td>34.3 %</td>
<td>111</td>
</tr>
<tr>
<td>CI (08-12)</td>
<td>108</td>
<td>30.9 %</td>
<td>101</td>
</tr>
<tr>
<td>Norw. list (08-13)</td>
<td>170</td>
<td>40.1 %</td>
<td>266</td>
</tr>
</tbody>
</table>

*Table 3. Publication coverage; research specialisations and MDH.*

The coverage percentages presented here corresponds in principle to the “external coverage” calculated by CWTS (2014, p. 8), though while they measured only against journal articles and reviews, we use the research specialisation’s entire DiVA output as baseline. It could be argued that not all publications in DiVA are equally important, especially not when trying to assess scientific impact or prestige. And of course none of the databases above are intended to cover everything researchers publish. The Norwegian list, for instance, only contains publishers that conduct formal peer review and that do not function as an outlet primarily for a single institution (Norwegian Association of Higher Education Institutions, n.d.).\(^6\) However, not all inclusion criteria will be entirely quality based. Especially the focus on articles in English language journals in some of the databases might be problematic if a research specialisation publishes in subject field where publications in other mediums and/or languages are considered important.

To facilitate the interpretation of the bibliometric indicators, they will all be marked with the name of database on which they are based (either individually or table-wise). For indicators based on sources other than DiVA, the reader is advised to consult table 3 to put the results in perspective. As IPR have very few publications in CI, no indicators based on that source will be presented here. For IEO, some of the databases contain few publications, so indicators based on these sources may not be very stable, and might be perceived as less meaningful. Indicators based on less than 30 publications will be shaded grey.
Productivity

The sheer number of publications from a research specialisation will be largely dependent on its size and the chosen time span, so all indicators on publication productivity will be presented divided per researcher and year. We have no records of any hiatuses from research activities that may have occurred during this period, so all researchers are (probably incorrectly) assumed to have been at the disposal of the research specialisation, or their former research groups, for the entire time. As the amount of time allocated for research differs depending on staff position, we will however give a separate account of publications authored by senior staff, who generally have more time to engage in research (though for MDH as a whole, there will of course be variation within this group as well).7

Furthermore, co-authoring reduces the amount of time and work each researcher has to invest in a publication. We therefore also look at the researchers' fractionalized share of publications: If, for example, a researcher from a research specialisation co-authors a publication together with two external authors, the research specialisation is credited for a third of that publication (that is, every author is assumed to have contributed equally to the publication).

<table>
<thead>
<tr>
<th></th>
<th>HV</th>
<th>IS</th>
<th>IPR</th>
<th>IEO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per researcher and year</td>
<td>0.7</td>
<td>0.4</td>
<td>1.4</td>
<td>0.9</td>
</tr>
<tr>
<td>Per senior researcher and year</td>
<td>1.5</td>
<td>0.8</td>
<td>3.4</td>
<td>1.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>FEC</th>
<th>UV</th>
<th>MDH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Per researcher and year</td>
<td>0.9</td>
<td>0.5</td>
<td>0.6</td>
</tr>
<tr>
<td>Per senior researcher and year</td>
<td>3.6</td>
<td>1.6</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Table 4. Productivity indicators; research specialisations and MDH. Based on DiVA publications 08-13

Table 4 show that during the period of 08-13, MDH researchers (counting both senior and non-senior ones) authored an average of 0.8 publications per year. Their fractionalized share of publications was 0.5 per researcher and year. Looking only at publications authored by senior researchers, both these indicators are about twice as high for the university as a whole.

It should be noted that these figures do not take into consideration publication type. It would be reasonable to expect, for instance, that a research specialisation publishing many books would produce fewer publications per researcher than one that publishes almost exclusively journal articles. However, as this would be difficult to quantify, we have not attempted to adjust for such differences.

Impact/prestige

When trying to assess the quality of research using bibliometric methods, focus tends to be on either the impact of publications, measured by the citations they receive, or the perceived prestige of the channels that have accepted the manuscript for publication. In both cases,
measures are usually constructed to assess recognition from within the scientific community, and other aspects like societal influence falls outside the scope of analysis.

The most frequently used sources for citation data are Web of Science and Scopus. Here, we will look at the average number of citations (including self-citations) per publication and year in each of these two databases. As citation frequency varies between subject fields, this indicator should not be used for interdisciplinary comparisons, but could be useful for benchmarking against similarly oriented groups of researchers.

For a more fine-tuned measure of citation impact, we’ve asked the CWTS in Leiden to calculate the mean field-normalized citation score (MNCS). This is a relative indicator: A MNCS value of 1.2, for example, would mean that on average, the research specialisation’s articles are cited 20 % more frequently than similar articles (taking into account subject category and publication year). The percentage of articles among the 20 % most highly cited (PPTop20%) is also based on comparison of similar articles. Both also exclude self-citations.

<table>
<thead>
<tr>
<th>Impact indicators</th>
<th>HV</th>
<th>IS</th>
<th>IPR</th>
<th>IEO</th>
<th>FEC</th>
<th>UV</th>
<th>MDH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citations/publication &amp; year</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(WoS, 08-12)</td>
<td>1.1</td>
<td>0.3</td>
<td>0.2</td>
<td>1.3</td>
<td>2.9</td>
<td>1.0</td>
<td>1.1</td>
</tr>
<tr>
<td>Citations/publication &amp; year</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Scopus, 08-12)</td>
<td>1.4</td>
<td>0.6</td>
<td>0.4</td>
<td>1.3</td>
<td>3.4</td>
<td>1.0</td>
<td>1.1</td>
</tr>
<tr>
<td>MNCS (CI, 08-12)</td>
<td>0.8</td>
<td>0.69</td>
<td>-</td>
<td>1.94</td>
<td>0.88</td>
<td>1.04</td>
<td></td>
</tr>
<tr>
<td>PPTop20% (CI, 08-12)</td>
<td>14 %</td>
<td>16.9 %</td>
<td>-</td>
<td>49.6 %</td>
<td>13.2 %</td>
<td>21.9 %</td>
<td></td>
</tr>
</tbody>
</table>

Table 5. Impact indicators; research specialisations and MDH. CI data from CWTS report (2014). Grey figures = <30 publications. As IPR and IEO have few publications in CI, no indicators based on CI are presented.

Table 4 shows that MDH publications available in WoS and Scopus have received an average of 1.1 citation per year in each of these databases respectively. Furthermore, we see that MDH publications available in the CI database (i.e., articles in WoS journals) have received more citations (MNCS > 1) than other articles of the same kind. MDH articles also appear among the 20 % most cited articles more frequently than the 20 % average.

If we turn instead to the prestige of the channels in which the research specialisation publishes, we’ll first look at the mean normalized journal score (MNJS). This is calculated by the CWTS using the same principles as the MNCS, but applied to journals instead of individual publications. As journal and article impact does not always correspond, this is more an indication of publication prestige, measuring how influential the journals where the research specialisation publishes are. A MNJS value of 1.2 would mean the research specialisation publishes in journals that, on average, receive 20 % more citations than other comparable journals.

Another indicator of prestige is the percentage of publications in Norwegian Level 2 channels. These are publishers deemed leading through “an academic approval process”, set to comprise “roughly one-fifth of the publications produced by an academic or research field” (Norwegian Association of Higher Education Institutions, n.d., para. 1.5). This means that a percentage higher than twenty would indicate that the research specialisation publishes in prestigious channels more frequently than the average researcher.
Table 6. Prestige indicators; research specialisations and MDH. As IPR and IEO have few publications in CI, the MNJS-indicators based on CI are not presented.

Table 6 shows that, on the whole, MDH publishes in CI journals (i.e., WoS journals) that have an above average citation impact (MNJS close to 1). However, when publishing in channels regarded as scholarly by the Norwegian definition, MDH researcher are accepted in, or seek out, the prestigious Level 2 channels less often than others in their subject field, that is, less than 20% of the time.

Collaboration

The extent to which the research specialisation’s researchers authors publications in collaboration with others can easily be tracked in DiVA, where all authors of a publication is listed. Based on DiVA, we present the average number of authors for the research specialisation’s publications, as well as the percentage of single author publications.

Table 7. Collaboration indicators, co-authoring; research specialisations and MDH. Based on DiVA publications 08-13.

Table 7 show that the average MDH publication is authored by roughly three researchers, and that single author publications account for almost one-fourth of its output.

Information on the affiliation of co-authors is, unfortunately, largely missing in DiVA. So to be able to tell how common it is for the HV research specialisation to engage in interorganizational and international collaboration, we have once again turned to CWTS for indicators: No collaboration/single institution means that all of a publication's authors are from a single institution. National collaboration means that a publication is co-authored by researchers from two or more institutions, all within the same country. And International collaboration, subsequently, means that researchers affiliated with institutions from at least two different countries have co-authored a publication. (These categories are mutually exclusive, meaning that a publication authored in both national and international collaboration will be classified as International collaboration.)

Table 8. Collaboration indicators, affiliations; research specialisations and MDH. Based on CI publications 08-12 (CWTS, 2014). Grey figures = <30 publications. As IPR have few publications in CI, no indicators are presented.
Table 8 shows that when publishing in CI journals (i.e., WoS journals), almost three quarters of publications by MDH researchers are authored in collaboration with colleagues from other institutions. Over 30% of MDH publications are co-authored with researchers belonging to institutions in other countries.

**Collaboration maps**

The maps shows the names of organizations that appear in the address-fields in the articles in which researchers at each research specialisation have collaborated with other authors, found in WoS 2009-2013. Thus, each address that appears in the map means an organization with which researchers at each research specialisation, either have been affiliated, or with which she or he have been collaborated. Therefore, the map gives an idea of the various networks in which the actual researchers at each research specialisation historically have been involved. The size of the circles depends on the number of times the organization occurs, the thickness of the lines on the number of collaborations. Circles with same colors belong to the same cluster.
HV
The full HV collaboration network contains 252 organizations. In order to make the map more readable only organizations that occur in more than 5 articles are visible in the map. Of the 252 organizations 26 meet the threshold.

Figure 2. HV collaboration network
The table below shows the number of articles in which the names of the ten most frequently appearing organizations are found.

<table>
<thead>
<tr>
<th>Affiliation</th>
<th>Number of articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>malardalen univ</td>
<td>77</td>
</tr>
<tr>
<td>stockholm univ</td>
<td>31</td>
</tr>
<tr>
<td>lund univ</td>
<td>24</td>
</tr>
<tr>
<td>uppsala univ</td>
<td>11</td>
</tr>
<tr>
<td>jonkoping univ</td>
<td>10</td>
</tr>
<tr>
<td>univ s carolina</td>
<td>9</td>
</tr>
<tr>
<td>umea univ</td>
<td>8</td>
</tr>
<tr>
<td>univ haute alsace</td>
<td>7</td>
</tr>
<tr>
<td>univ orebro</td>
<td>5</td>
</tr>
<tr>
<td>linkoping univ</td>
<td>4</td>
</tr>
</tbody>
</table>
The full IS collaboration network contains 101 organizations. In order to make the map more readable only organizations that occur in more than 3 articles are visible in the map. Of the 101 organizations 17 meet the threshold.

Figure 3. IS collaboration network
The table below shows the number of articles in which the names of the ten most frequently appearing organizations are found.

<table>
<thead>
<tr>
<th>Affiliation</th>
<th>Number of articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>malardalen univ</td>
<td>180</td>
</tr>
<tr>
<td>univ york</td>
<td>30</td>
</tr>
<tr>
<td>madrid tech univ</td>
<td>12</td>
</tr>
<tr>
<td>ABB</td>
<td>11</td>
</tr>
<tr>
<td>blekinge inst tech</td>
<td>8</td>
</tr>
<tr>
<td>halmstad univ</td>
<td>8</td>
</tr>
<tr>
<td>eindhoven tech univ</td>
<td>7</td>
</tr>
<tr>
<td>AT&amp;T labs res</td>
<td>6</td>
</tr>
<tr>
<td>univ turku</td>
<td>5</td>
</tr>
<tr>
<td>linkoping univ</td>
<td>4</td>
</tr>
</tbody>
</table>
IPR
The full IPR collaboration network contains 11 organizations.

Figure 4. IPR collaboration network
The table below shows the number of articles in which the names of the ten most frequently appearing organizations are found.

<table>
<thead>
<tr>
<th>Affiliation</th>
<th>Number of articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>malardalen univ</td>
<td>29</td>
</tr>
<tr>
<td>univ canterbury</td>
<td>2</td>
</tr>
<tr>
<td>univ hull</td>
<td>2</td>
</tr>
<tr>
<td>univ queensland</td>
<td>2</td>
</tr>
<tr>
<td>victoria univ wellington</td>
<td>2</td>
</tr>
<tr>
<td>dalarna univ</td>
<td>2</td>
</tr>
<tr>
<td>inst environm sci &amp; res ltd</td>
<td>1</td>
</tr>
<tr>
<td>lund univ</td>
<td>1</td>
</tr>
<tr>
<td>politecn milan</td>
<td>1</td>
</tr>
<tr>
<td>stockholm inst educ</td>
<td>1</td>
</tr>
</tbody>
</table>
IEO
The full IEO collaboration network contains 30 organizations. In order to make the map more readable only organizations that occur in more than 2 articles are visible in the map. Of the 30 organizations 10 meet the threshold.

Figure 5. IEO collaboration network
The table below shows the number of articles in which the names of the ten most frequently appearing organizations are found.

<table>
<thead>
<tr>
<th>Affiliation</th>
<th>Number of articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>malardalen univ</td>
<td>9</td>
</tr>
<tr>
<td>copenhagen business sch</td>
<td>6</td>
</tr>
<tr>
<td>KTH</td>
<td>6</td>
</tr>
<tr>
<td>uppsala univ</td>
<td>5</td>
</tr>
<tr>
<td>aalto univ</td>
<td>2</td>
</tr>
<tr>
<td>ctr strateg management &amp; globalizat</td>
<td>2</td>
</tr>
<tr>
<td>Helsinki sch econ</td>
<td>2</td>
</tr>
<tr>
<td>jonkoping int business sch</td>
<td>2</td>
</tr>
<tr>
<td>stockholm sch econ</td>
<td>2</td>
</tr>
<tr>
<td>stockholm univ</td>
<td>2</td>
</tr>
</tbody>
</table>
The full FEC collaboration network contains 87 organizations. In order to make the map more readable only organizations that occur in more than 3 articles are visible in the map. Of the 87 organizations 17 meet the threshold.
The table below shows the number of articles in which the names of the ten most frequently appearing organizations are found.

<table>
<thead>
<tr>
<th>Affiliation</th>
<th>Number of articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>malardalen univ</td>
<td>138</td>
</tr>
<tr>
<td>KTH</td>
<td>70</td>
</tr>
<tr>
<td>e china unic sci &amp; technol</td>
<td>12</td>
</tr>
<tr>
<td>int inst appl syst anal</td>
<td>8</td>
</tr>
<tr>
<td>SP tech res inst sweden</td>
<td>6</td>
</tr>
<tr>
<td>swedish univ agri sci</td>
<td>6</td>
</tr>
<tr>
<td>linkoping univ</td>
<td>5</td>
</tr>
<tr>
<td>hong kong polytech univ</td>
<td>4</td>
</tr>
<tr>
<td>lulea univ technol</td>
<td>4</td>
</tr>
<tr>
<td>natl univ singapore</td>
<td>4</td>
</tr>
</tbody>
</table>
UV
The full UV collaboration network contains 72 organizations. In order to make the map more readable only organizations that occur in more than 3 articles are visible in the map. Of the 72 organizations 14 meet the threshold.

Figure 7. UV collaboration network
The table below shows the number of articles in which the names of the ten most frequently appearing organizations are found.

<table>
<thead>
<tr>
<th>Affiliation</th>
<th>Number of articles</th>
</tr>
</thead>
<tbody>
<tr>
<td>malardalen univ</td>
<td>77</td>
</tr>
<tr>
<td>stockholm univ</td>
<td>31</td>
</tr>
<tr>
<td>lund univ</td>
<td>24</td>
</tr>
<tr>
<td>uppsala univ</td>
<td>11</td>
</tr>
<tr>
<td>jonkoping univ</td>
<td>10</td>
</tr>
<tr>
<td>univ s carolina</td>
<td>9</td>
</tr>
<tr>
<td>umea univ</td>
<td>8</td>
</tr>
<tr>
<td>univ haute alsace</td>
<td>7</td>
</tr>
<tr>
<td>univ orebro</td>
<td>5</td>
</tr>
<tr>
<td>linkoping univ</td>
<td>4</td>
</tr>
</tbody>
</table>
Sub-environment indicators
The following tables present most of the above indicators at the sub-environment level. We do not have access to CI-data for sub-environments, so indicators based on that source are not included. For certain sub-environments, some indicators are based on too few publications for the result to be considered stable, so they might be perceived as less meaningful. Indicators based on less than 30 publications will be shaded grey.

The IEO research specialisation is not divided into sub-environments and will not appear in this section.

The same publication time spans are used here as above: 08-13 for DIVA and the Norwegian list, and 08-12 for WoS and Scopus. Where researchers are dividing their time between sub-environments, “per researcher”-indicators have been adjusted accordingly. Publications from these researchers will be counted once for each sub-environment, meaning that the total number of publications for the sub-environments combined may exceed that of the research specialisation.

Productivity

<table>
<thead>
<tr>
<th>Sub-environment</th>
<th>No of DIVA pub 08-13</th>
<th>DIVA pub/researcher &amp; year</th>
<th>DIVA pub, fraction/researcher &amp; year</th>
<th>DIVA pub/senior researcher &amp; year</th>
<th>DIVA pub, fraction/senior researcher &amp; year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caring Sciences</td>
<td>276</td>
<td>0.6</td>
<td>0.3</td>
<td>1.8</td>
<td>1.0</td>
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<tr>
<td>Health Care Education</td>
<td>24</td>
<td>0.5</td>
<td>0.4</td>
<td>1.7</td>
<td>1.3</td>
</tr>
<tr>
<td>Medical Science</td>
<td>7</td>
<td>0.1</td>
<td>&lt;0.1</td>
<td>0.2</td>
<td>&lt;0.1</td>
</tr>
<tr>
<td>Physiotherapy</td>
<td>65</td>
<td>0.7</td>
<td>0.3</td>
<td>1.5</td>
<td>0.6</td>
</tr>
<tr>
<td>Psychology</td>
<td>103</td>
<td>0.9</td>
<td>0.4</td>
<td>1.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Public Health Sciences</td>
<td>126</td>
<td>1.3</td>
<td>0.5</td>
<td>2.8</td>
<td>0.9</td>
</tr>
<tr>
<td>Social Work</td>
<td>125</td>
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<td>0.7</td>
<td>2.1</td>
<td>1.3</td>
</tr>
<tr>
<td>Sociology</td>
<td>72</td>
<td>0.8</td>
<td>0.6</td>
<td>1.2</td>
<td>0.9</td>
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</table>

Table 9a. HV sub-environments productivity indicators. Grey figures = <30 publications

<table>
<thead>
<tr>
<th>Sub-environment</th>
<th>No of DIVA pub 08-13</th>
<th>DIVA pub/researcher &amp; year</th>
<th>DIVA pub, fraction/researcher &amp; year</th>
<th>DIVA pub/senior researcher &amp; year</th>
<th>DIVA pub, fraction/senior researcher &amp; year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependable systems</td>
<td>234</td>
<td>2.3</td>
<td>1.0</td>
<td>5.4</td>
<td>1.9</td>
</tr>
<tr>
<td>Real-time systems</td>
<td>388</td>
<td>3.1</td>
<td>1.5</td>
<td>7.7</td>
<td>3.0</td>
</tr>
<tr>
<td>Robotics and avionics</td>
<td>204</td>
<td>2.0</td>
<td>0.8</td>
<td>4.0</td>
<td>1.4</td>
</tr>
<tr>
<td>Sensor systems and health</td>
<td>268</td>
<td>1.4</td>
<td>0.6</td>
<td>3.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Software engineering</td>
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<td>0.9</td>
<td>5.2</td>
<td>1.7</td>
</tr>
<tr>
<td>Verification and validation</td>
<td>223</td>
<td>1.9</td>
<td>0.9</td>
<td>4.3</td>
<td>1.7</td>
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</tbody>
</table>

Table 9b. IS sub-environments productivity indicators.
<table>
<thead>
<tr>
<th>Sub-environment</th>
<th>No of DiVA pub 08-13</th>
<th>DiVA pub/researcher &amp; year</th>
<th>DiVA pub, fraction./researcher &amp; year</th>
<th>DiVA pub/senior researcher &amp; year</th>
<th>DiVA pub, fraction./senior researcher &amp; year</th>
</tr>
</thead>
<tbody>
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<td>89</td>
<td>0.6</td>
<td>0.4</td>
<td>1.4</td>
<td>1.0</td>
</tr>
<tr>
<td>Innovation Management</td>
<td>170</td>
<td>1.1</td>
<td>0.7</td>
<td>2.2</td>
<td>1.5</td>
</tr>
<tr>
<td>Product Realisation</td>
<td>159</td>
<td>0.6</td>
<td>0.4</td>
<td>1.3</td>
<td>0.9</td>
</tr>
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</table>

Table 9c. IPR sub-environments productivity indicators.

<table>
<thead>
<tr>
<th>Sub-environment</th>
<th>No of DiVA pub 08-13</th>
<th>DiVA pub/researcher &amp; year</th>
<th>DiVA pub, fraction./researcher &amp; year</th>
<th>DiVA pub/senior researcher &amp; year</th>
<th>DiVA pub, fraction./senior researcher &amp; year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Safety Engineering</td>
<td>68</td>
<td>1.9</td>
<td>0.9</td>
<td>8.2</td>
<td>2.8</td>
</tr>
<tr>
<td>Future Energy</td>
<td>358</td>
<td>0.8</td>
<td>0.5</td>
<td>3.3</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Table 9d. FEC sub-environments productivity indicators.

<table>
<thead>
<tr>
<th>Sub-environment</th>
<th>No of DiVA pub 08-13</th>
<th>DiVA pub/researcher &amp; year</th>
<th>DiVA pub, fraction./researcher &amp; year</th>
<th>DiVA pub/senior researcher &amp; year</th>
<th>DiVA pub, fraction./senior researcher &amp; year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math/Applied Mathematics</td>
<td>142</td>
<td>0.8</td>
<td>0.5</td>
<td>1.8</td>
<td>1.0</td>
</tr>
<tr>
<td>BUSS</td>
<td>174</td>
<td>0.8</td>
<td>0.5</td>
<td>1.8</td>
<td>1.0</td>
</tr>
<tr>
<td>SOLD</td>
<td>111</td>
<td>0.4</td>
<td>0.4</td>
<td>0.8</td>
<td>0.7</td>
</tr>
<tr>
<td>MNT</td>
<td>72</td>
<td>0.4</td>
<td>0.2</td>
<td>1.0</td>
<td>0.6</td>
</tr>
<tr>
<td>SILU (SISU)</td>
<td>97</td>
<td>0.6</td>
<td>0.5</td>
<td>1.2</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Table 9e. UV sub-environments productivity indicators.

**BUSS** = Children and young people in school and in society  
**SOLD** = Language Studies and Comparative Literature including Subject Didactics  
**MNT** = Mathematics, Science and Engineering Education  
**SILU (SISU)** = Society, interculturalism, leadership and evaluation
## Impact/Prestige

<table>
<thead>
<tr>
<th>Sub-environment</th>
<th>No of WoS pub 08-12</th>
<th>Citations/ WoS pub &amp; year</th>
<th>No of Scopus pub 08-12</th>
<th>Citations/ Scopus pub &amp; year</th>
<th>No of Norwegian List pub 08-13</th>
<th>% Norwegian list, Level 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caring Sciences</td>
<td>104</td>
<td>0.8</td>
<td>110</td>
<td>1.1</td>
<td>193</td>
<td>21.2 %</td>
</tr>
<tr>
<td>Health Care Education</td>
<td>5</td>
<td>0.3</td>
<td>5</td>
<td>0.5</td>
<td>14</td>
<td>0 %</td>
</tr>
<tr>
<td>Medical Science</td>
<td>4</td>
<td>0.4</td>
<td>3</td>
<td>1.1</td>
<td>6</td>
<td>0 %</td>
</tr>
<tr>
<td>Physiotherapy</td>
<td>27</td>
<td>1.8</td>
<td>33</td>
<td>2.0</td>
<td>47</td>
<td>14.9 %</td>
</tr>
<tr>
<td>Psychology</td>
<td>34</td>
<td>1.1</td>
<td>33</td>
<td>1.7</td>
<td>67</td>
<td>16.4 %</td>
</tr>
<tr>
<td>Public Health Sciences</td>
<td>50</td>
<td>1.3</td>
<td>34</td>
<td>2.1</td>
<td>76</td>
<td>28.9 %</td>
</tr>
<tr>
<td>Social Work</td>
<td>15</td>
<td>0.8</td>
<td>16</td>
<td>0.8</td>
<td>46</td>
<td>17.4 %</td>
</tr>
<tr>
<td>Sociology</td>
<td>1</td>
<td>0.3</td>
<td>5</td>
<td>0.5</td>
<td>27</td>
<td>7.4 %</td>
</tr>
</tbody>
</table>

*Table 10a. HV sub-environments impact/prestige indicators. Grey figures = <30 publications*

<table>
<thead>
<tr>
<th>Sub-environment</th>
<th>No of WoS pub 08-12</th>
<th>Citations/ WoS pub &amp; year</th>
<th>No of Scopus pub 08-12</th>
<th>Citations/ Scopus pub &amp; year</th>
<th>No of Norwegian List pub 08-13</th>
<th>% Norwegian list, Level 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependable systems</td>
<td>59</td>
<td>0.2</td>
<td>123</td>
<td>0.4</td>
<td>72</td>
<td>13.9 %</td>
</tr>
<tr>
<td>Real-time systems</td>
<td>66</td>
<td>0.3</td>
<td>167</td>
<td>0.4</td>
<td>134</td>
<td>3.7 %</td>
</tr>
<tr>
<td>Robotics and avionics</td>
<td>47</td>
<td>0.4</td>
<td>83</td>
<td>0.6</td>
<td>80</td>
<td>7.5 %</td>
</tr>
<tr>
<td>Sensor systems and health</td>
<td>56</td>
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<td>101</td>
<td>0.7</td>
<td>78</td>
<td>1.3 %</td>
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<tr>
<td>Software engineering</td>
<td>95</td>
<td>0.3</td>
<td>235</td>
<td>0.6</td>
<td>162</td>
<td>11.7 %</td>
</tr>
<tr>
<td>Verification and validation</td>
<td>49</td>
<td>0.4</td>
<td>114</td>
<td>0.7</td>
<td>84</td>
<td>14.3 %</td>
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*Table 10b. IS sub-environments impact/prestige indicators.*

<table>
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<tr>
<th>Sub-environment</th>
<th>No of WoS pub 08-12</th>
<th>Citations/ WoS pub &amp; year</th>
<th>No of Scopus pub 08-12</th>
<th>Citations/ Scopus pub &amp; year</th>
<th>No of Norwegian List pub 08-13</th>
<th>% Norwegian list, Level 2</th>
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</thead>
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<tr>
<td>Design and Visualisation</td>
<td>10</td>
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<td>19</td>
<td>0.1</td>
<td>28</td>
<td>3.6 %</td>
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<tr>
<td>Innovation Management</td>
<td>6</td>
<td>0.4</td>
<td>22</td>
<td>0.6</td>
<td>41</td>
<td>4.9 %</td>
</tr>
<tr>
<td>Product Realisation</td>
<td>11</td>
<td>0.2</td>
<td>23</td>
<td>0.4</td>
<td>47</td>
<td>2.1 %</td>
</tr>
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</table>

*Table 10c. IPR sub-environments impact/prestige indicators. Grey figures = <30 publications*

<table>
<thead>
<tr>
<th>Sub-environment</th>
<th>No of WoS pub 08-12</th>
<th>Citations/ WoS pub &amp; year</th>
<th>No of Scopus pub 08-12</th>
<th>Citations/ Scopus pub &amp; year</th>
<th>No of Norwegian List pub 08-13</th>
<th>% Norwegian list, Level 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Safety Engineering</td>
<td>5</td>
<td>0.8</td>
<td>8</td>
<td>0.7</td>
<td>8</td>
<td>25.0 %</td>
</tr>
<tr>
<td>Future Energy</td>
<td>116</td>
<td>3.0</td>
<td>112</td>
<td>3.6</td>
<td>162</td>
<td>13.0 %</td>
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</tbody>
</table>

*Table 10d. FEC sub-environments impact/prestige indicators. Grey figures = <30 publications*
<table>
<thead>
<tr>
<th>Sub-environment</th>
<th>Authors/DiVA pub</th>
<th>% Single author DiVA pub</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caring Sciences</td>
<td>2.8</td>
<td>25.4 %</td>
</tr>
<tr>
<td>Health Care Education</td>
<td>1.7</td>
<td>54.2 %</td>
</tr>
<tr>
<td>Medical Science</td>
<td>4.7</td>
<td>0 %</td>
</tr>
<tr>
<td>Physiotherapy</td>
<td>4.3</td>
<td>9.2 %</td>
</tr>
<tr>
<td>Psychology</td>
<td>3.4</td>
<td>14.6 %</td>
</tr>
<tr>
<td>Public Health Sciences</td>
<td>5.0</td>
<td>6.3 %</td>
</tr>
<tr>
<td>Social Work</td>
<td>2.4</td>
<td>36.0 %</td>
</tr>
<tr>
<td>Sociology</td>
<td>1.9</td>
<td>52.8 %</td>
</tr>
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</table>

Table 11a. HV sub-environments collaboration indicators. Grey figures = <30 publications

<table>
<thead>
<tr>
<th>Sub-environment</th>
<th>Authors/DiVA pub</th>
<th>% Single author DiVA pub</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependable systems</td>
<td>3.1</td>
<td>5.6 %</td>
</tr>
<tr>
<td>Real-time systems</td>
<td>3.5</td>
<td>7.5 %</td>
</tr>
<tr>
<td>Robotics and avionics</td>
<td>3.6</td>
<td>23.0 %</td>
</tr>
<tr>
<td>Sensor systems and health</td>
<td>3.1</td>
<td>22.4 %</td>
</tr>
<tr>
<td>Software engineering</td>
<td>3.3</td>
<td>10.0 %</td>
</tr>
<tr>
<td>Verification and validation</td>
<td>3.5</td>
<td>10.3 %</td>
</tr>
</tbody>
</table>

Table 11b. IS sub-environments collaboration indicators.

<table>
<thead>
<tr>
<th>Sub-environment</th>
<th>Authors/DiVA pub</th>
<th>% Single author DiVA pub</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design and Visualisation</td>
<td>2.1</td>
<td>41.6 %</td>
</tr>
<tr>
<td>Innovation Management</td>
<td>2.1</td>
<td>39.4 %</td>
</tr>
<tr>
<td>Product Realisation</td>
<td>2.5</td>
<td>21.4 %</td>
</tr>
</tbody>
</table>

Table 11c. IPR sub-environments collaboration indicators.

<table>
<thead>
<tr>
<th>Sub-environment</th>
<th>Authors/DiVA pub</th>
<th>% Single author DiVA pub</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Safety Engineering</td>
<td>3.2</td>
<td>17.6 %</td>
</tr>
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<td>Future Energy</td>
<td>3.6</td>
<td>9.2 %</td>
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</tbody>
</table>

Table 11d. FEC sub-environments collaboration indicators.
<table>
<thead>
<tr>
<th>Sub-environment</th>
<th>Authors/DiVA pub</th>
<th>% Single author DiVA pub</th>
</tr>
</thead>
<tbody>
<tr>
<td>Math/Applied Mathematics</td>
<td>2.3</td>
<td>25.4 %</td>
</tr>
<tr>
<td>BUSS</td>
<td>2.6</td>
<td>24.1 %</td>
</tr>
<tr>
<td>SOLD</td>
<td>1.6</td>
<td>82.9 %</td>
</tr>
<tr>
<td>MNT</td>
<td>2.3</td>
<td>31.9 %</td>
</tr>
<tr>
<td>SILU (SISU)</td>
<td>1.7</td>
<td>61.9 %</td>
</tr>
</tbody>
</table>

Table 11e. UV sub-environments collaboration indicators.

*BUSS = Children and young people in school and in society*

*SOLD = Language Studies and Comparative Literature including Subject Didactics*

*MNT = Mathematics, Science and Engineering Education*

*SILU (SISU) = Society, interculturalism, leadership and evaluation*
Notes

1 Publications authored in collaboration between research specialisations will be counted once for each unit involved. When presenting results for MDH as a whole they will, however, only be counted one single time, so the total number of publications for MDH might be smaller than the number of publications from all research specialisations combined.

2 The WoS databases used here are: Science Citation Index Expanded, Social Sciences Citation Index, Arts & Humanities Citation Index, Conference Proceedings Citation Index- Science, and Conference Proceedings Citation Index- Social Science & Humanities

3 The CI database contains data from Science Citation Index Expanded, Social Sciences Citation Index, and Arts & Humanities Citation Index

4 For a complete list of publication types occurring in the DiVA data, see CWTS (2014, p. 25). Note that the category “Other publication types” presented here may include, but is not limited to, the DiVA category “Other”.

5 The Norwegian list can be searched here: https://dbh.nsd.uib.no/publiseringskanaler/Forside?request_locale=en. A list of which sources are included in the different parts of WoS and in Scopus can be found here: http://www.kth.se/kthb/publicering/bibliometri/faq-biblimetrics/faq/which-journals-and-conference-proceedings-are-covered-by-web-of-science-and-scopus-1.378647

6 The Norwegian model for funding allocation also require that individual publications “present new insight” and are “presented in a form that allows the research findings to be verified and/or used in new research activity” for them to be regarded as academic (Norwegian Association of Higher Education Institutions, n.d., para. 3.2). This categorization is not easily applicable to DiVA data, as MDH publications obviously haven’t been registered with the Norwegian definition of scholarliness in mind. For this analysis, only publications registered in DiVA as having “Refereed” or “Other scientific” content have been considered for the Norwegian list indicators.

7 The division between senior and non-senior staff used here may not correspond entirely with which researchers were considered senior in the research specialisations’ self-evaluations, as we’ve based it solely on staff categories. For the bibliometric analysis, the following were categorized as senior: Professors (Professors, promoted senior lecturers); Adjunct professors; Visiting professors; Manager; Senior lecturers (Senior lecturers, promoted lecturers); Adjunct senior lecturers; Researchers; Research engineers; Associate senior lecturers

References


Appendices
Appendix 1:
Vice-Chancellor’s Decision (in Swedish)
Externt utvärdering av forskningen vid Mälardalens högskola

Beslut


Rektor beslutar att tillsätta en styrgrupp med upprådet att utgöra strategisk ledning av utvärderingen och stöd till projektledare och biträdande projektledare. Styrgruppen ska bestå av prorektor (ordförande), dekanus och prodekaner, bibliotekschef, chef för utbildnings- och forskningssektionen och en doktorandrepresentant. Eventuellt nyutnämnde dekan och prodekaner till kommande fakultetsnämndperiod med start 1 januari 2014 adderas till styrgruppen.

Rektor beslutar att uppråda till förvaltningschefen att tillhandahålla administrativt stöd för utvärderingens genomförande.

Rektor uppdrar till akademicheferna att inom ordinarie budget avsätta de personella resurser inom akademien som krävs för genomförande av utvärderingen.

Rektor beslutar att avsätta ett rambudget om 5 miljoner kronor för projektet, för att finansiera projektledning och extern utvärdering. Styrgruppen uppdras att fastställa detaljerad budget för projektet i samråd med ekonomichef.

Rektor beslutar att högskolans forskning ska utvärderas utifrån en modell bestående av självvärdering, extern bedömning av internationellt sammansatta paneler och bibliometrisk analys. Samtliga forskning vid högskolan ska ingå i utvärderingen och styrgruppen uppdras att fastställa utvärderingseheter och göra övriga avvägningar vad gäller genomförandet både inför och under utvärderingen, inklusive fastställande av detaljerad tidplan för utvärderingen.
Bakgrund

MDH:s målbild är att vara det ledande lärosätet i Sverige för excellent samproduktion med olika samhällsaktörer, både internationellt och nationellt. I forsknings- och utbildningsstrategin för perioden 2013-2016 anges att en extern utvärdering ska genomföras av högskolans samtliga forskningsinriktningar. Det övergripande syftet är att utvärdera högskolans forskning för att därigenom identifiera tänkbara styrkeområden inför ställningstaganden i kommande forsknings- och utbildningsstrategi. Mer detaljerat avser utvärderingen att uppfylla följande syften:

1. **För en forskargrupp** (inkl. den enskilde forskaren)
   - Ge stöd i förbättringsarbetet genom att beskriva forskningsverksamheten, visioner för dess utveckling och diskutera dessa med en internationell panel
   - Ge vägledning kring lämpliga framtida allianser och samarbeten, internt och externt
   - Ge underlag för prioriteringar vid ansökningar om extern finansiering

2. **För en akademi**
   - Erbjuda akademinivån stöd i dess arbete med att formulera forskningsplaner, göra prioriteringar etc.
   - Främja förnyelse genom att upptäcka spirande och möjliga nya inriktningar för forskningen, även akademiöverskridande

3. **För högskolan**
   - Identifiera och ge en gemensam bild av var högskolan har sina starka forskningsmiljöer och framgångsrika grupperingar, både befintliga och potentiella
   - Erbjuda ett externt framtaget bakgrundsmaterial som stöd för strategiska beslut för att stärka kvaliteten i forskningen
   - Få fram ett av flera underlag för ställningstaganden inför den kommande forsknings- och utbildningsstrategin 2017-2020
   - Genom att göra en egeninitierad utvärdering förbereda högskolan för de kommande nationella forskningsutvärderingar som regeringen aviserat

I genomförandet av utvärderingen av forskningen kommer högskolan att utgå från det upplägg Uppsala universitet utvecklat och genomfört vid två tillfällen. Utvärderingen består av tre delar: självvärdering, bibliometrisk analys och extern bedömning av internationellt sammansatta paneler.

Rektor beslutar i närvaro av högskoledirektör Marie Eriksson och efter föredragning av chef för utbildnings- och forskningssektionen Malin Gunnarsson.

Karin Röding
Rektor

Malin Gunnarsson
Föredragande
Appendix 2:

Panel member requirements
Guidelines for external evaluation panels
(30 August 2013)

1. Introduction

The Vice-Chancellor has decided to launch MER14, an external evaluation of research activities at Mälardalen University, in accordance with the objectives defined in the MDH research and education strategy for 2013-2016. External evaluation panels play a crucial role in the selected evaluation model, and this document formulates guidelines for the set-up and operation of these panels. Six panels will be appointed, one for each established research specialisation, with eight external experts making up each panel. The number of experts in a panel can be adjusted if necessary. The panels will have an international focus and the experts may be appointed in one of the following roles: chairperson (Swedish or international), international panelist and Swedish panelist. The panels should be set up with an even gender distribution in mind – at least three panelists of either gender should be included in each panel.

2. The process for nomination and appointment of panelists

The nomination of experts for the panels is done as follows:

A. The research managers for each research specialisation coordinate the internal compilation of a list including 20-25 panelists in order of priority. This process requires cooperating closely with professors and senior researchers within the specialisation. Nominations can be generated in different ways:

- From the different research teams
- Following recommendations from external fellow researchers
- From lists of (proposed) participants in other Swedish evaluations of higher education institutions
  - From the MER14 project group
- Other

B. No later than 15 September 2013, each manager is expected to present a list to the MER14 project group for examination before a decision is reached in the steering group. The list must specify the following in order to achieve transparency and facilitate quality assessment by the panels:

- The name, title, organisation, contact information and webpage of the nominated expert, as well as the proposed role – chairperson, international panelist, or Swedish panelist
- The expert’s qualifications and the way in which they match the research specialisation which will be evaluated, and its sub-environments
- Previous cooperation and contact with MDH, if applicable
- How the nomination has come about – who has contributed each name on the list

C. The chairpersons of the six panels will be appointed early and offered the opportunity to comment on “their” panels before invitations are sent. This means that the process of identifying candidates for the chairperson position will be swift and handled directly

1 MER14 = MDH:s Evaluation for improved Research quality
2 Se decree from 28 May 2013 (MDH 1.1.4-295/13)
by the Deans of the Schools and research managers who will consult the professors in each specialisation.

D. The MER14 steering group will reach a decision about the nominations of chairpersons and other panelists at the steering group meetings on 13 September 2013 and 10 October 2013, respectively.

E. The MER14 project group is responsible for inviting the experts and for making sure the composition of panels is adequate – depending on who accepts and who declines, the make-up of a panel should reflect the research activities of the established research specialisation in a satisfactory way. The invitation of panelists will be done in writing and signed by the Vice-Chancellor. The aim is for all panels to be filled no later than 20 December 2013.

IMPORTANT NOTICE:
No communication (informal inquiries etc.) whatsoever must be instigated directly with panel experts! Challengeability and conflicts of interest, especially in relation to project cooperation and co-publication with MDH researchers, will be monitored centrally before invitations are sent via the Vice-Chancellor.

3. Criteria for panel experts (panelists)
For all panelists, challengeability regulations will be observed in relation to economic or research-related connections/dependencies between the panelist and the evaluation unit in question. All sub-areas of an evaluation unit must be represented adequately in the corresponding panel. A balanced gender distribution will be pursued for each panel. The panel as a whole should be made up of a satisfactory combination of generalists and specialists.

Panel chairperson
- Generalist within the research specialisation in question
- A renowned researcher with strong qualifications and a high level of integrity
- Experience of international evaluation projects
- Appropriate qualities and abilities for leading the work of the panel
- If possible, working outside Sweden (but can be Swedish)

International panelist
- Preferably working outside Sweden – primarily within Europe (including the Nordic countries) and as a secondary alternative outside Europe
- Can be employed outside the academic world, for instance in institutions or industry, but is expected to have a background in or be actively engaged in relevant research specialisations
- A renowned researcher within one of the sub-environments of the evaluation unit

Swedish panelist – at least one per panel
- Must be engaged at another Swedish institution of higher learning within the research specialisation in question
- Should be highly knowledgeable of Swedish university research and "the Swedish system"
- A renowned researcher within one of the sub-environments of the evaluation unit
4. Specification of the panelists’ assignment

On the basis of MDH documentation that is made available to the experts, the panels will assess and evaluate research and research activities as well as offer conclusions and recommendations in an evaluation/panel report. The documentation which will underpin the work of the panels, their assessment and formulation of conclusions and recommendations comprises the following:

- A self-evaluation (in English) for each established research specialisation with sub-environments
- Various indicators and ratios for staff, economy, and so on, furnished centrally at MDH
- A bibliometric analysis which is made available before the panel visit
- Presentations and discussions that occur when the panels visit MDH week 21 (19-23 May 2014)
- Supplementary information that the panels/panelists find on their own initiative, for instance publications by MDH researchers or information from the MDH websites

The chairperson will lead the work of the panel and be responsible for the compilation and delivery of the final panel report. The chairperson will also be offered the opportunity to take part in the election of panelists, the planning of the panel visit at MDH and certain other preparatory arrangements. All chairpersons will also participate in a synthesis project in connection with the panel visit. In order for this to be practically possible, all panels will visit MDH at the same time, week 21 2014.

The panels are encouraged and expected to work as a unified group with preparations, the MDH visit, and the writing of the report. At the panel visit, there will not be a division into small groups, so the entire panel will receive the same information and hear the same presentations, and will write the report together on a consensus basis.

Specification of the panel chairperson’s assignment

- Take part in certain preliminary activities, including the selection of panel experts
- Lead the evaluation work of the panel
- Assess and document the activities of the evaluation unit in terms of quality
- Be responsible for the final report of the panel
- Offer suggestions for measures that will improve quality and promote progress
- Participate in follow-up work for a general analysis pertaining to MDH as a whole

The tasks of international panelists

- Partake with integrity in the evaluation work of the panel
- Assess and document the activities of the evaluation unit in terms of quality
- Offer suggestions for measures that will improve quality and promote progress

The tasks of Swedish panelists

- Partake with integrity in the evaluation work of the panel
- Assist the panel with insight into the conditions and limitations of the Swedish system of higher education, and, based on this knowledge, make sure that the panel maintains its focus on the objectives, methods, and criteria of the evaluation project
• Assess and document the activities of the evaluation unit in terms of quality
• Offer suggestions for measures that will improve quality and promote progress

No contact must be initiated, or documents sent, from MDH associates on their own initiative to panels or panelists. Panelists may themselves ask for supplementary material or information, but any such requests must be channeled via the MER14 project group.

5. Clarification concerning challengeability and conflicts of interest

In the nomination process and the selection of panelists, great care must be taken to avoid challengeability and conflicts of interest which may affect the result or legitimacy of the evaluation project. The challengeability-related recommendations of the Swedish Research Council provide a guide, especially those parts which touch upon bias: “Bias covers any situation when other grounds for challengeability are not applicable. The rule should not be applied routinely every time no other ground for challengeability is formally applicable. There must be a concrete reason for it to be applied. Examples of bias in the operations of the Swedish Research Council:

• Close professional cooperation [shared research, publication, education and so on]
• Obvious friendship or antagonism
• Relations of dependence in economic terms
• Manager/employee relation
• If someone is engaged in an issue in such a way that suspicions may arise that the conditions for an impartial assessment are not fulfilled
• Each situation must be analysed separately in terms of both the kind and scope of such circumstances, as well as the temporal aspect.”
• For instance, a waiting period of at least five years for co-publications between MDH researchers and panelists will be verified before invitations are distributed. Panelists who participate in the project will also produce and sign a Declaration of Conflict of Interest in relation to the issue of challengeability.

3  http://vr.se/download/18.aad30c310abc973578000259/1145954938609/Javsregler_Vr.pdf
Appendix 3:
Panel members
Panel 1 – Health and Welfare

Arja Rimpelä (Chair)
Professor of Public Health, University of Tampere, Finland.
Research interests include school-age and adolescent health and health behaviors, socioeconomic health differences as well as school health and tobacco policy.

Ravinder Barn
Professor of Social Policy, Royal Holloway, University of London, UK. PhD in Race and Ethnic Relations from the University of Warwick.
Her research interest is multi-disciplinary and spans social policy, sociology, social work, and criminology. Professor Barn is a mixed-methods researcher with a particular interest in child and family welfare, gender and crime, youth justice, and the sociology of technology.

Philip Darbyshire
Professor of Nursing, Monash University and Flinders University, Australia. PhD from Edinburgh University.
He is internationally recognized as a leader in nursing and health care research and service development.

Hanneke de Haes
Professor of Medical Psychology, University of Amsterdam Academic Medical Centre, Netherlands. PhD from Leiden University.
Research interests include quality of life, (cost-)effectiveness of medical interventions, medical decision making, communication, patient satisfaction, palliative care, behaviour change counseling, and the assessment of medical students’ attitudes and communicative behaviour.

Östen Wahlbeck
Senior Lecturer in Sociology, University of Helsinki, Finland. PhD in Ethnic Relations from the University of Warwick, UK.
His research interests include immigration, ethnic relations, diasporas, and economic sociology. On-going research projects include neo-assimilationist political discourses and integration policies, Kurdish migration and diaspora, and transnational practices in migration.

Paul Watson
Emeritus Professor of Pain Management and Rehabilitation, University of Leicester, UK. He was appointed as the UK’s first Consultant Physiotherapist in Pain Management in 2002.
His interests are in the management of chronic pain, particularly musculoskeletal pain, and on the prediction of poor outcome from physiotherapy treatment.

Andrew Watterson
Professor of Health Effectiveness, University of Stirling, Scotland, UK. He is Director of the Centre for Public Health and Population Health Research at the University of Stirling.
He is an occupational and environmental health policy researcher on chemical hazards including pesticides, participatory research and environmental health, and the precautionary principle.
Lena von Koch
Professor of Health Service Research, Karolinska Institutet, Sweden. She is a licensed physiotherapist and received her PhD from Karolinska Institutet.

In her research she focuses on people living with chronic illness, their needs of health services and how these needs can be met by the health system.

Panel 2 – Embedded Systems

Wilhelm Schäfer (Chair)
Professor in Software Engineering, University of Paderborn, Germany. PhD from the University of Osnabrück, Germany, in the area of software engineering and tools.

His research interests are in adaptive re-engineering processes, techniques for the model-based specification and verification of distributed real-time embedded systems, as well as associated development processes.

Antonia Bertolino
Research Director of CNR in the Software Engineering & Dependable Computing (SEDC) Research Laboratory at ISTI - Istituto di Scienza e Tecnologie dell’Informazione “A.Faedo” in Pisa, Italy.

Her research interests span over software and services engineering. She investigates approaches for software and services validation, testing, and monitoring, in particular the challenges posed by the collaborative and high dynamic approaches of online software development processes.

Tiziana Margaria
Professor in Service and Software Engineering, Institute of Informatics, University of Potsdam, Germany. PhD in Computer and Systems Engineering, Politecnico di Torino, Italy.

Her current research focuses on advanced service engineering techniques supporting reliability and compliance through a model-driven version of service-oriented development, and the embedding of selected formal methods in the development platform.

Françoise Simonot-Lion
Professor of Computer Science, Nancy Université, France. She is the scientific leader of Real Time and InterOperability (TRIO), an INRIA research team at LORIA laboratory in Nancy.

Her main research topics are modelling and verification techniques for the design of optimized real time distributed applications under safety constraints and specification of embedded services ensuring a real time Quality of Service.

Herbert F. Voigt
Professor of Biomedical Engineering, Boston University, USA. PhD from Johns Hopkins University.

Research interests include auditory neuroscience, auditory nerve and cochlear nucleus physiology, correlation of physiological response properties with anatomical properties of neurons, encoding of complex signals and transformations of these encoded signals by the neuronal circuitry of the cochlear nucleus, and mathematical modeling of the neuronal circuitry of the cochlear nucleus.
Kazuya Yoshida
Professor of Aerospace Engineering, Tohoku University, Japan. PhD from Tokyo Institute of Technology.

His research activities cover dynamics and control of space robotic systems ranging from orbital free-flying robots to planetary exploration rovers. Research activities also include the development of university-based micro satellites and the terrestrial applications of space technology, such as robotic remote exploration for search and rescue missions.

Bertil Svensson
Professor of Computer Systems Engineering, Halmstad University, Sweden. PhD from Lund University.

His research interests include all levels of computer systems engineering; from applications and algorithms, programming models and architecture, to digital system construction and circuit technology. Demanding applications and algorithms have been obtained from areas such as image analysis and self-learning systems.

Åke Öberg
Emeritus Professor of Biomedical Engineering, Linköping University, Sweden. PhD from Uppsala University.

Research interests are in circulatory physiology, bio-optics, biomedical instrumentation, sensors and clinical engineering. He has published over 400 scientific papers and books in these areas.

Panel 3 – Innovation and Product Realisation

Chris McMahon (Chair)
Professor of Mechanical Engineering, University of Bristol, UK.

His research interests are in engineering design, especially concerning the application of computers to the management of information and uncertainty in design, and to design automation.

Alain Bernard
Professor at Ecole Centrale de Nantes, France, and Director of Research, Laboratoire IRCCyN.

Main research topics are reverse engineering, rapid product development, knowledge-management and knowledge-based systems, product/process/organization modeling, simulation and performance evaluation.

Neil Mansfield
Professor of Human Factors Engineering, Loughborough University, UK. PhD from University of Southampton on human vibration biomechanics.

Research interests include human response to vibration and noise, physical ergonomics, and human factors design and ergonomics, with a particular focus on vehicle applications. He is currently working with global automotive companies and suppliers.

Janet McDonnell
Professor of Design Studies, Central Saint Martins, University of the Arts London, UK.

Research interests include design, design processes, and creative collaboration. The focus of work is on means of bringing practices to notice, making practices ‘visible’, the decision-making behaviour, how ideas get introduced and established, the informational bases that individuals and groups rely on, and the influences of assumptions and norms.
Helinä Melkas
Professor, Lahti School of Innovation, Lappeenranta University of Technology, Finland. PhD from Helsinki University of Technology.

Research interests include innovation processes and policy, service innovation, creativity, and social entrepreneurship.

Hendrik Van Brussel
Professor in Mechatronics and Automation, Katholieke Universiteit Leuven, Belgium.

Present research interest is shifting towards holonic manufacturing systems, behaviour based robots with applications in service and medical robotics, and micro and precision engineering.

Mike Danilovic
Professor of Industrial Organisation with a focus on innovation and technology management, Halmstad University, Sweden.

Research interests involve innovation and innovation-processes, particularly in regard to high-tech companies and products such as mobile phones, cars and aircraft and the collaboration between academia and industry.

Panel 4 – Industrial Economics and Organisation

Thorvaldur Gylfason (Chair)
Professor of Economics, University of Iceland. PhD from Princeton University, USA.

His current research is mostly in the field of economic reforms, constitutions, natural resources, trade, and growth. In recent years, he has been a frequent consultant to the International Monetary Fund and also to the World Bank, the European Commission, and the European Free Trade Association.

Silvia Gherardi
Professor of Sociology of Work, University of Trento, Italy.

Research interests include the exploration of different “soft” aspects of knowing at work and in organizations, with a particular emphasis on communicative, emotional, symbolic, and linguistic aspects of organizational process.

Damian Hodgson
Senior lecturer in Organisational Analysis at Manchester Business School, University of Manchester, UK. PhD from the University of Leeds, UK.

His research centers on issues of power, knowledge, identity and control in complex organisations and the management of experts/professionals. Dr. Hodgson has devoted much of his efforts to the study of innovative forms of control over knowledge workers and professionals, across various sectors.

Edward Page
Associate Professor in Politics and Political Theory, Warwick University, UK.

Research interests cover a range of topics in political theory, normative ethics, and international environmental politics. One project includes equity, politics, and policy in connection to the Kyoto Protocol as global climate change raises a number of important issues for political scientists and theorists.
Jan-Åke Törnroos
Professor of International Marketing, Åbo Akademi University (ÅA), in Turku, Finland.
Research is closely related to international industrial marketing using an interaction and net-
work approach. Other areas include corporate internationalization and globalization, intercul-
tural marketing management, the time-dimension in firms and organizations, qualitative meth-
ods, and process-based studies in marketing.

Charlie Karlsson
Professor of Industrial Organization at Blekinge Institute of Technology, Sweden. PhD in Econom-
ics from Umeå University, Sweden.
In his research he has focused on infrastructure economics, urban economics, the economics
of technological change, regional economics, spatial industrial dynamics, entrepreneurship and
small business economics, and the economics of R&D and higher education.

Jan-Erik Vahlne
Professor in Management and Organization, University of Gothenburg, Sweden. PhD from Upps-
ala University.
Current research areas include testing of the hypothesis that previous cooperation will increase
probability of success of mergers and acquisitions, studying the role of commitments in pro-
cesses of strategic change and internationalization, and management under uncertainty.

Panel 5 – Future Energy Center

Philip de Vaal (Chair)
Professor at the University of Pretoria, South Africa.
Research interests include modelling and control, plantwide control performance monitoring
and quantification, control of chemical processes with difficult-to-measure characteristics, con-
trol of batch processes, abnormal situation management, process identification and process mod-
eling, tribology, and use of laboratory techniques related to performance characteristics of fuels
and lubricants.

Bogdan Dlugogorski
Professor at Murdoch University, Australia. PhD in Chemical Engineering from University of
Montreal, Canada.
His research focuses on problems relating to process safety, especially fire and explosion chemis-
try, and formation and mitigation of pollutants, including large scale storage of carbon dioxide.
He has introduced new means to improve the performance of fire-fighting foams.

Deng Shiming
Professor at the Hong Kong Polytechnic University, Hong Kong. PhD in Air Conditioning and
Refrigeration Engineering from South Bank Polytechnic, London, UK.
Research interests include direct expansion (DX) air conditioning and refrigeration system simu-
lation and control strategies development, applying air conditioning and thermal comfort in
sleeping environment in tropics or subtropics, and building energy use performance analysis
including building energy audit and benchmarking.
**Ruiqin Zhang**  
Professor at the College of Chemistry and Molecular Engineering, Zhengzhou University (ZZU) in Henan Province, China. Graduated from Peking University.

She leads the provincial Environment and Energy Research Group, focusing on biomass thermal conversion technology, energy efficiency, and atmospheric environment pollution and control.

**Banu Örmeci**  
Associate Professor and Canada Research Chair in Wastewater and Public Health Engineering, Carleton University, Canada. PhD in Civil and Environmental Engineering from Duke University, USA.

Research interests include water and wastewater disinfection, fate and survival of microorganisms through treatment processes, removal of chemical contaminants from water, and sludge treatment processes.

**Thore Berntsson**  
Professor at the Division of Heat and Power Technology, Chalmers University of Technology, Sweden.

His research projects have included advanced biorefinery concepts; carbon capture; strategic energy efficiency measures; process integration and energy system studies; and in general the development in different energy systems and technologies.

**Panel 6 – Educational Science**

**Pertti Kansanen (Chair)**  
Professor Emeritus of Education, University of Helsinki, Finland.

His main research interests are in ethics of education, teachers’ pedagogical thinking, research on teaching and teacher education, and the German Didaktik and American research on teaching (a comparative point of view).

**Julie Allan**  
Professor of Equity and Inclusion, School of Education, University of Birmingham, UK.

Her work encompasses inclusive education, disability studies and children’s rights and is both empirical and theoretical. She has a particular interest in educational theory and the insights offered through poststructural and social capital analyses.

**Maria Luiza Cestari**  
Professor at the Department of Mathematical Sciences, University of Agder, Norway. PhD in Mathematics Education from University of Oslo, Norway.

Research interests include cognitive and educational psychology and mathematics education, communication in mathematics in classrooms, mathematics knowledge for teachers, difficulties in mathematics, multicultural classrooms, and collaborative working groups.
Ann Farrell
Professor of Early Childhood and Head of the School of Early Childhood, Queensland University of Technology, Australia. PhD from the University of Queensland.

Her research and teaching expertise is in research ethics, children’s rights to protection and participation, childhood and families’ studies, and children in the legal and criminal justice systems. Her teaching expertise spans undergraduate and postgraduate programs as well as in-service programs.

Sven-Erik Hansén
Professor Emeritus of Education, Åbo Akademi University, Finland. PhD from the University of Vaasa, Finland.

Research projects have included theory and practice in teacher education; organizing curriculum change; teachers’ professional development; and support for new teachers.

Raimondo Manca
Professor of Mathematical methods applied to economics, finance and actuarial science at University of Rome “La Sapienza”, Italy. PhD from the University of Naples, Italy.

His main research interests are multidimensional linear algebra, computational probability, application of stochastic processes to economics, finance and insurance and simulation models.

Blas Torrecillas
Professor of Algebra at the Department of Mathematics, University of Almeria, Spain. PhD from University of Granada, Spain.

Research interests include mathematics, history of mathematics, algebra, algebraic geometry, category theory, commutative algebra, non-commutative geometry, and algebra & algebraic topology.

Eva Haettner Aurelius
Professor of Comparative Literature at Lund University, Sweden.

Research interests include pre-20th century women’s literature, primarily in the form of autobiographies and letters, the work of Swedish author Birger Sjöberg, and performance aspects of literature.

Helge Strömdahl
Professor Emeritus of Science Education at Linköping University, Sweden. PhD in Science Education (chemistry) from Gothenburg University, Sweden.

He has a special research interest in conceptual change. Previously Director of studies, Swedish National Agency for Education, and Director of the Swedish National Graduate School in Science and Technology Education.
Appendix 4:
Self-Evaluation Template
Self-Evaluation -
Research evaluation at MDH/Mälardalen University 2014 (MER14)

The present document is meant to form a concise but informative background material for the expert panels to aid their work in carrying out the evaluation. The self-evaluation, in combination with a separate bibliometric analysis, forms an important basis but it should be pointed out that during the panel visit (week 21) ample time will be reserved for meetings between panels and the different research groups and also other informative activities that will amplify and clarify the written documents.

The self-evaluation is divided into three parts. The first part (A1-A9) is a written description of research activities to be completed by the primary unit of evaluation. The second part (B1-B5) is a quantitative summary of certain research-related activities, also to be completed by the primary unit of evaluation, and the third part (C) presents data as extracted from common databases. It is also possible to provide relevant web addresses, under A10, in order to offer additional means of obtaining information about the research activities.

Besides a Web of Science analysis, the complete set of publications contained in DiVA will be used for the bibliometric analysis. All researchers must, before the end of 2013, check that their publications are registered in DiVA and update the register if necessary. Detailed information about this, and other issues relating to the evaluation, is available - see http://www.mdh.se/internt/forskning/mer14.

For publications included in the two different lists of papers to be selected (A7 and A8), and which are not available electronically (e.g. books), the unit of evaluation should be prepared to make at least two copies available by 1 March, 2014. Individual panelists could ask for such material to be sent to them before the site visit, and all selected publications should also be available in print to the panel during the site visit.

Some terms in the questions at issue, such as “interdisciplinary” (in A1.iii), cannot be defined exactly as they might have different meanings in different research areas. You must therefore interpret these terms, and answer the different questions, based on the prerequisites within your own research field.

Please note that a maximum of 16 pages is available for answering questions A1-A4.i. Beyond this, an additional 6 pages might be used for case descriptions under question A4.ii.

MDH, 1 November 2013

Prof. Roland Svensson
Project Manager, MER14

1 Primary unit of evaluation=established research specialisation [etablerad forskningsinriktning], but the self-evaluation should also cover and describe the sub-environments (sub groups) as they are defined in relation to MER14
Self-evaluation document, MER14

To be completed (in English) by the primary unit of evaluation and submitted/uploaded by Friday 28 February, 2014 at the latest. Use the template below and submit one aggregated document per primary unit of evaluation [=established research specialisation, etablerad forskningsinriktning], including sub-environments (sub groups) as they are defined in relation to MER14.

The evaluation document will be available, in the way it has been submitted, to the external expert panels immediately after this.

The final document consists of three sections:
A. A written description of research activities etc., to be completed by the primary unit of evaluation – see below
B. A quantitative summary of certain research related activities, to be completed by the primary unit of evaluation – see below
C. Certain basic data extracted from the common databases, possibly with comments

Please note that a maximum of 16 pages is available for answering questions A1-A4.i. Beyond this, an additional 6 pages might be used for case descriptions under question A4.ii.

Part A: Strategic aspects on research

Name of the primary unit of evaluation: ............................

A1.  
   i) Give a summary of the current research. Define missions and goals as well as possible.
   ii) List actions that would improve the quality of the research, and obstacles that hinder improvement.
   iii) Describe interdisciplinary activities and networks, give information on joint publications and funding, and provide statements on the suitability of the present organisational placement within Mälardalen University.

| Clarification: The research profiles of the primary unit of evaluation and its sub-environments should be clear from this summary. |
| Limitation: The primary units of evaluation are allowed to submit a maximum of **16 (sixteen) A4-pages in total** for Questions A1-A4.i. |
| (In the response use text font Times New Roman, size 12, left-aligned text, margins 2.5 cm top/bottom/left/right, normal character spacing – use MS Word or compatible software and do not submit pdf-files). |

Response…
A2.
i) Describe current, particularly successful, research.
ii) List institutions or groups, national and international, which are considered suitable for benchmarking (in relation to activities selected under A2.i), and state the view of the primary unit of evaluation on its own standing in comparison to these.

Limitation: The primary units of evaluation are allowed to submit a maximum of 16 (sixteen) A4-pages in total for Questions A1-A4.i.

(In the response use text font Times New Roman, size 12, left-aligned text, margins 2.5 cm top/bottom/left/right, normal character spacing – use MS Word or compatible software and do not submit pdf-files).

Response…

A3.
i) Describe the most promising research directions for the primary unit of evaluation (and sub-environments) in a perspective of 5-10 years.
ii) Give an account of how the successful accomplishment of these research directions would be attained, e.g. in terms of present or anticipated future resources and available research staff. Describe plans for development with respect to the recruitment of researchers and PhD students over the next 5 years.

Limitation: Each primary unit of evaluation is allowed to submit a maximum of 16 (sixteen) A4-pages in total for Questions A1-A4.i.

(In the response use text font Times New Roman, size 12, left-aligned text, margins 2.5 cm top/bottom/left/right, normal character spacing – use MS Word or compatible software and do not submit pdf-files).

Response…
A4.
i) Describe how the primary unit of evaluation (and sub-environments) is working with co-production, and how it plans to develop ways of working with co-production.

ii) If applicable, present at most three cases where the implementation and results of co-production are apparent. The case descriptions should not exceed two pages each (examples of what may be included in each description: a summary of the results achieved, how the co-production was carried out, impact, positive effects, continuing plans, partners involved and economic conditions).

Limitation: Each primary unit of evaluation is allowed to submit a maximum of 16 (sixteen) A4-pages in total for Questions A1-A4.i. Beyond this, an additional 6 pages might be used for case descriptions under question A4.ii.

Under Question B4 you can find examples of indicators that can be described in more detail under Question A4.i.

(In the response use text font Times New Roman, size 12, left-aligned text, margins 2.5 cm top/bottom/left/right, normal character spacing – use MS Word or compatible software and do not submit pdf-files).

Response…

A5. Present a list of important regional, national and international collaborators including focus and scope of cooperation.

Clarification: You can include different types of cooperation/collaborators, also web cooperation (where no physical meetings take place), cooperation with NGOs etc. The list may include cooperation and activities since 2008. You can include links to websites with more detailed information.

(In the response use text font Times New Roman, size 12, left-aligned text, margins 2.5 cm top/bottom/left/right, normal character spacing – use MS Word or compatible software and do not submit pdf-files).

Limitation: Maximum two pages for Question A5.

List…

A6. Present a list of the most important external funders and levels of funding.

Clarification: This question presents an opportunity to describe external research funding; funders, amounts, time periods etc. – as a complement to the total numbers presented under Question B2. The list may include funding since 2008.

(In the response use text font Times New Roman, size 12, left-aligned text, margins 2.5 cm top/bottom/left/right, normal character spacing – use MS Word or compatible software and do not submit pdf-files).

Limitation: Maximum one page for Question A6.

List…
A7. Select and present a list of publications – or other research outputs – representing the research activity at the primary unit of evaluation (and sub-environments).

| Clarification: | Selected publications can be from any year and could be written in English, or other language which is commonly used in the research field in question. If the publication is electronically available, include a link. For publications that are not available electronically (e.g. books), the primary unit of evaluation is asked to be prepared to provide at least two copies for the panel members, if so requested. All selected publications should also be available in print during the expert panel visit. Research outputs other than publications can be patents, products, methods, computer programs, data bases etc. Limitation: Each primary unit of evaluation is allowed to list a maximum of 20 publications/outputs under A7. |

List…

A8. Select and present a list of publications – or other research outputs – representing the renewal of research activity at the primary unit of evaluation (and sub-environments).

| Clarification: | Selected publications can be from any year and could be written in English, or other language which is commonly used in the research field in question. Publications in press could also be included. If the publication is electronically available, include a link. For publications that are not available electronically (e.g. books), the primary unit of evaluation is asked to be prepared to provide at least two copies for the panel members, if so requested. All selected publications should also be available in print during the expert panel visit. Research outputs other than publications can be patents, products, methods, computer programs, data bases etc. Limitation: Each primary unit of evaluation is allowed to list a maximum of 10 publications/outputs under A8. Alternatively – if no publications can be identified and listed under A8 – a total of 25 publications/outputs can be listed under A7. |

List…
### A9. Present a list of significant prizes and awards.

<table>
<thead>
<tr>
<th>Clarification: List the person, age (when receiving the award), sex, year and award. Include prizes/awards presented to individual researchers or to groups/primary unit of evaluation since 2008. Only significant regional, national or international prizes/awards should be listed.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limitation: Maximum one page for Question A9.</td>
</tr>
</tbody>
</table>

List...

### A10. Additional sources of information.

<table>
<thead>
<tr>
<th>Clarification: In order for the external experts to get a complete and correct picture of the primary unit of evaluation, please list additional sources of information, such as website addresses for the primary unit of evaluation and research/research groups (if applicable). If information is only available in Swedish, clearly state this after the address in question.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limitation: Maximum one page for Question A10.</td>
</tr>
</tbody>
</table>

List…
Part B: Quantitative summary of research activities

Clarification: In B1-B3 total numbers for the primary unit of evaluation should be presented (not detailed lists). In B4-B5 total numbers or frequency should be presented (not detailed lists). Since the expert panels during the site visit might ask for more detailed explanations regarding the numbers presented you should keep, and be prepared to present, underlying data.

B1. Engagement and involvement in the scientific community (since January 2008)

<table>
<thead>
<tr>
<th>Total number</th>
<th>Number of individuals contributing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

... Please select relevant indicators below, or define similar relevant indicators, transfer them to the table above and fill in the corresponding numbers:

- Plenary or keynote talks at international conferences
- Plenary or keynote talks at national conferences
- Invited talks at international conferences
- Invited talks at national conferences
- Assignment in research councils and foundations
- Assignment as expert in evaluations for professor and lecturer positions (international)
- Assignment as expert in evaluations for professor and lecturer positions (national)
- Assignment as faculty opponent or grading committee for PhD defenses
- Assignment as editor or member of editorial boards
- Guest editor, special issue editor etc.
- Assignment as journal reviewer
- Member of academies and learned societies
- Member of international scientific councils and committees
- Member of EU/Research Council/Vinnova (etc.) evaluation panels [berednings-grupper]
- Organised international conferences (i.e. roles as conference organiser, local chair, general chair, or PC-chair)
- Organised national conferences (i.e. roles as conference organiser, local chair, general chair, or PC-chair)
- Program committee (PC) membership

Comments: For the indicators chosen, please make a short qualitative explanation and analysis under the table (maximum ½ page in total). This analysis could relate to the size, context or maturity of the group; etc.
B2. **Actions for renewal** (since January 2008)

<table>
<thead>
<tr>
<th></th>
<th>Total number</th>
</tr>
</thead>
<tbody>
<tr>
<td>External recruitments - with doctoral exam from another university</td>
<td></td>
</tr>
<tr>
<td>Internal recruitments - with doctoral exam from Mälardalen University</td>
<td></td>
</tr>
<tr>
<td>Number of granted external funds for new projects (see also Question A6)</td>
<td></td>
</tr>
<tr>
<td>Total amount of granted external funds, SEK (see also Question A6)</td>
<td></td>
</tr>
<tr>
<td>Other relevant indicator, specify:</td>
<td></td>
</tr>
</tbody>
</table>

**Comments:** For the indicators chosen, please make a short qualitative explanation and analysis under the table (maximum ½ page in total). This analysis could relate to the size, context or maturity of the group; etc.

B3. **International collaboration** (since January 2008)

<table>
<thead>
<tr>
<th></th>
<th>Total number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research visits abroad (1 week – 1 month duration)</td>
<td></td>
</tr>
<tr>
<td>Research visits abroad (more than 1 month duration)</td>
<td></td>
</tr>
<tr>
<td>Visiting researchers from abroad (1 week – 1 month duration)</td>
<td></td>
</tr>
<tr>
<td>Visiting researchers from abroad (more than 1 month duration)</td>
<td></td>
</tr>
<tr>
<td>Number of cooperating international institutions with joint publications</td>
<td></td>
</tr>
<tr>
<td>Number of joint publications with the above</td>
<td></td>
</tr>
<tr>
<td>Other relevant indicator, specify:</td>
<td></td>
</tr>
</tbody>
</table>

**Comments:** For the indicators chosen, please make a short qualitative explanation and analysis under the table (maximum ½ page in total). This analysis could relate to the size, context or maturity of the group; etc.
**B4. Co-production aspects** (since January 2008)

<table>
<thead>
<tr>
<th>Total number or “frequency”²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Please select relevant indicators below, or define similar relevant indicators, transfer them to the table above and fill in the corresponding numbers:

- Number of border crosser *[gränsgångare]* – experts moving between academia and the surrounding community
- Affiliated researchers and adjunct scientists from industry, public sector etc.
- External [PhD] supervisors from industry, public sector etc.
- Number of industry PhD:s
- Number of municipality PhD:s *[kommundoktorander]*
- Number of county council PhD:s *[landstingsdoktorander]*
- Number of co-production PhD:s (other than above)
- Number of spin-off commercial companies
- Number of spin-ins, or other productification of research results
- Models and concepts for packaging and distribution of research results to industry or public sector
- Number of companies with joint activities
- Number of cooperating industries with joint publications
- Number of joint publications with industry
- Seminars in cooperation with industry, public sector etc.
- Conferences with participants from industry, public sector etc.
- Contract research, volumes
- Projects with at least 50 % co-financing from the private or public sector (number of projects, funding per year, co-financing in relation to faculty funding etc.)

**Comments:** The indicators can be explained more in detail under Question A4.i. if applicable. **For the indicators chosen, please make a short qualitative explanation and analysis under the table (maximum ½ page in total). This analysis could relate to the size, context or maturity of the group; etc.**

² Please clarify what the presented numbers refer to (total number, per year [average], often, continuously etc.) according to the most relevant way to present it. Be prepared to present underlying data if the panel requests it.
B5. Other engagement and interaction with society (since January 2008)

<table>
<thead>
<tr>
<th>Total number or “frequency”³</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Please select relevant indicators below, or define similar relevant indicators, transfer them to the table above and fill in the corresponding numbers:

- Adjunct professorships
- Textbooks
- Popular science papers/books
- Popular science presentations
- Patents
- Governmental/societal assignments
- Place of employment for PhDs (graduated 2008-2013) – a list of PhDs can be included under the table, including present employer and position/assignment

Comments: For the indicators chosen, please make a short qualitative explanation and analysis under the table (maximum ½ page in total). This analysis could relate to the size, context or maturity of the group; etc.

³ Please clarify what the presented numbers refer to (total number, per year [average], often, continuously etc.) according to the most relevant way to present it. Be prepared to present underlying data if the panel requests it.
Part C: Data extracted from common databases

Note! Part C will be distributed to the primary units of evaluation no later than 15 February 2014 from the MER14-project. Comments, if motivated, should be returned to the MER14-project no later than 27 February.

Data (Part C), and comments upon it, will be made available to the external experts on 1 March, 2014, together with Self-Evaluation parts A and B.

Part C will include data regarding:

- Personnel
  1. Professor
  2. (Docent)
  3. Lektor/Senior Lecturer
  …etc.
- Examinations from postgraduate studies, lic./PhD
- Economy

C1. If motivated, comment upon the extracted data (data distributed to the primary units of evaluation no later than 15 February 2014)

Clarification: Since the data regarding personnel, exams and economy is submitted according to university-wide (or national) standards and regulations the actual figures are fixed. However, due to the selection of data, you might want to comment upon circumstances in your specific research field, or if you have research staff with external funding, industrial PhDs etc. (thus not present in the internal databases). The clarifications must not exceed two pages in total and will be included in the material presented to the panel.

Remember that the assessment does not compare different units within Mälardalen University. It should rather reflect the standing of each unit compared to that of other universities and units (involved in the same research field).

NOTE! The bibliometric analysis will not be completed until the end of April 2014 and units will not be able to comment upon this analysis in the self-evaluation. You can comment upon the bibliometrics, if necessary, during the panel visit in May 2014. The units of evaluation will, as the expert panels, have access to this analysis before the site visit.

Limitation: Maximum two pages for Question C1.

Text (optional, if you have specific comments on data in part C)…
Appendix 5:

Terms of Reference
The present document describes the Terms of Reference to be used by the panels engaged in the research evaluation MER14 at Mälardalen University (MDH).

1. Terms of Reference for the expert panels

1.1. Objectives of the evaluation

The present evaluation was initiated by the Vice-Chancellor and it includes all research activities at MDH. MER14 is the first comprehensive evaluation of research at MDH. The overall objective is to identify strong areas of research and successful research constellations as a basis for future research and education strategies. The evaluation will provide means to strengthen the quality of the scientific activities at the university by offering background material for future decision-making processes. It will also offer the schools and research groups’ support in planning and implementing future research.

The evaluation is not aimed at highlighting individual scientists but rather at assessing the performance and prospects of entire research specialisations and their sub-environments. The evaluation should probe the standing of MDH research activities in an international perspective and does not aim at comparing different disciplines within the university.

1.2. Method of evaluation

The evaluation will be carried out in part with the help of six panels of international experts that evaluate the research of MDH activities based on a five-day site visit, together with information provided beforehand. Each panel has an international Chair and a group of experts who together cover the different research areas. Each panel also has at least one representative from another Swedish university, who can assist in matters that require insight into for instance the university system and research funding practices in Sweden.

The primary unit of evaluation is a research specialisation, with a varying number of sub-environments (sub-groups). Each panel will cover one of the research specialisations:
The panel should work as a group to attain collective assessments, at the same time making use of the various areas of expertise among the members. The panels are asked to summarise their conclusions and recommendations in a panel report, covering both the primary unit of evaluation and its sub-environments. However, the researchers are not to be evaluated as individuals.

The panel members receive background material in advance. The material consists of panel-wise self-evaluations where for instance research activities, networks and collaborations, and views on future research directions and renewal of research are described [part A]. It also includes a number of quality indicators [part B] and facts and figures regarding the personnel, finances and research examinations of each unit [part C]. This material will be available to the panels in early March.

Part A also includes a list of a limited number of selected publications. Complete lists of all publications from the last 10 years, or more, can be found and filtered through the university digital publication archive DiVA: \[http://mdh.diva-portal.org/smash/searchad.jsf\]

The written self-evaluations and oral presentations given during the site visit will constitute the basis for the evaluation.

Two different bibliometric analyses will also be conducted and these will be available to the panels in mid-April. The first analysis will be based on Web of Science-indexed publications from the 5-year period 2008-2012, with citations until 2013, in order to obtain a field-normalised picture of the international impact of the research. The second analysis will be based on MDH’s publication archive DiVA (2008-2013) and be of particular interest for certain research areas where Web of Science has limited applicability for bibliometric analysis.

1.3. Working arrangements of expert panels

The site visits all take place in one week, 19-23 May 2014. On the first day of the visit an introduction will be given and time allocated to plan the work of the panels. The panel Chair coordinates the work of the panel and is also responsible for coordinating the writing of the report. A template for the report is provided and time will be given to work on the report during the visit. The final panel report shall be submitted to MDH by June 13.

At the end of the visit week the Chair/panel shall give a brief account; an exit interview, of the main conclusions of the panel. On Friday afternoon there will also be a meeting of all panel Chairs in order to review matters of cross-disciplinary character and to discuss certain points of interest arising in the evaluation process.

1.4. Final evaluation report

A final evaluation report will be edited by the project management. It will describe the procedure for the evaluation, and include the individual panel reports. Furthermore, it will present the results of the bibliometric studies.
1.5. Confidentiality and trust

The panel members accept not to misuse non-public information that is disclosed to them through the evaluation. In accordance with Swedish legislation, the panel reports will be public once they have been submitted in their final form.

The panel members are required to declare any conflict of interest with respect to the subjects of the evaluation.

1.6. Evaluation criteria and panel report template

The expert panels are asked to 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 for the aspects under heading 1.6.2-1.6.8 below. 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**  Attracts national attention and has international potential

**Insufficient**  The research is insufficient in terms of quality or does not receive national and international attention

The table “Grading scale” (see below) suggests criteria for the different grades; however, the criteria listed should be considered as suggestions. If the panel feels that the criteria need to be modified for a specific research field, such modifications are welcomed as long as they are documented in the report.

The quality ratings apply to the research presented to the panels, which should include all activities. Since there may be a spectrum of quality levels associated with a particular research field pursued, the panels are asked to qualify their assessments by stating to what extent a research activity meets a particular quality standard.

In the following headlines are provided under which the panels are asked to provide comments, conclusions and recommendations. These should be made both for the primary unit of evaluation (=research specialisation) and, whenever possible, for the sub-environments/sub-groups as they are defined in relation to MER14.

1.6.1. General assessment

Give a brief account of the overall impression of the research conducted in the unit of evaluation. Comment also on the maturity of the primary unit of evaluation and the sub-environments and its standing in a lifecycle perspective.
1.6.2. **Research environment and infrastructure**

Comment on the research environment; its organisation, its resources, the constitution of staff and their activities. Comment on the infrastructure, for instance 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, demography, gender profile and leadership.

The infrastructure of a research environment can be distributed, that is collaborators may provide key infrastructure. If this is the case, please comment on this and the ability of the research environment to make use of these external resources.

1.6.3. **Networks and collaborations**

Comment on the degree and quality of national and international collaborations in academic networks. To what degree is academic partners integrated and contribute with their competence to joint research?

1.6.4. **Co-production (co-creation) and external co-operation**

Comment on the degree and quality of networks and collaborations outside of academia; for instance industry, NGOs, public bodies and society at large. To what degree are non-academic partners integrated and contribute with their competence to joint research? Does the co-production and co-operation improve the conditions for and the quality of the research at MDH?

1.6.5. **Productivity**

State conclusions regarding the scientific productivity and outcome of research. Productivity relates to the total volume of scientific production; reports and other output, and should be judged in relation to resources available; for instance number of staff and their time allocated for research, and funding.

The quantification of production is evaluated by means of bibliometric indicators, the number of licentiate and PhD degrees awarded, and promotions of docents/reader and professors.

1.6.6. **Impact and relevance**

State conclusions regarding the relevance of research activities and the impact of the research on society. Specifically comment on the significance, the reach and the benefits of the impact cases presented by the unit of evaluation.

Relevance is a criterion which includes the scientific, technological, social, cultural or socioeconomic significance of scientific work. Relevance can be expressed in terms of impact and the extent to which the research is a prerequisite for other research areas, undergraduate or graduate studies, public or commercial benefit, etc.
1.6.7. Quality of research

State conclusions regarding the overall quality of research activities. Quality of research is to be understood as a measure of excellence (in originality of ideas, methods chosen, networks and collaborations, etc.) and of the attention received by the unit and its research.

Quality of research includes the degree of international interest (reach), the impact on 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 should be assessed on the basis of the ability of the unit to achieve and present clear-cut scientific analyses and results. The assessment should reflect the position of the unit in relation to frontiers of research in the field or discipline, which is best judged through peer review. In the assessment, the panel members are expected to rely on their own expertise and knowledge of the field.

1.6.8. Renewal - Strategies and plans for development of the unit of evaluation

Comment on presented visions for renewal and emerging science, including the presumed feasibility of realisation and prospect for success. Comment on impressions of junior faculty activities. Comment on the development potential of the unit of evaluation.

1.6.9. Potential and recommendations for development

State conclusions and recommendations for further improvement of any aspect of the unit of evaluation, that is relevant for the quality of research. If possible, identify specific areas of high and realisable potential. In particular, comment on whether synergies between different environments and networks are being developed to their full potential.

1.6.10. Other issues

Comment on other issues or possible actions for improvement. Comments can also be made regarding MDH in general or the Swedish university system in general.

1.7. Grading the research

The evaluation is done for different subject areas with possibly different views on what constitutes appropriate criteria for these levels. The criteria listed below should therefore be considered as suggestions. If the panel feels that the criteria need to be modified for a specific research field, such modifications are welcomed as long as they are documented in the report.

Quality grading should relate to the actual or deserved influence of the research conducted. In some cases, research of very high quality may not have been published outside a national context due to traditions in the research field or within the research group. If the panel sees examples of such research that should have been made available to the international research community, then please comment on this.
The quality rating for on-going research activities is primarily expressed in terms of international standing. However, it is recognised that there may be certain fields that are special and not directly assessable on an international scale, although they may be of high quality. It may sometimes still be possible to make internationally comparative assessments regarding tools and methods used. The panels are asked to comment specifically in such cases.

### Grading Scale

<table>
<thead>
<tr>
<th>Environment/Infrastructure</th>
<th>Networks and collaborations</th>
<th>Co-production</th>
<th>Productivity</th>
<th>Impact and relevance</th>
<th>Quality of research</th>
<th>Renewal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Excellent</strong></td>
<td>Leadership, constitution of staff, activity, and ability to attract external funding is excellent in all aspects</td>
<td>The national and international collaboration is wide and relevant with very high quality academic partners that contribute to the research</td>
<td>The collaboration with very high quality partners is wide and relevant regarding partner contribution to joint research. The research has a high value with strategic importance for the external partners</td>
<td>Very high number of publications, PhDs, etc. in relation to unit of evaluation resources</td>
<td>The research has international reach of high significance and relevance to society</td>
<td>Wide international attention, most prominent channels, internationally leading research</td>
</tr>
<tr>
<td><strong>Very Good</strong></td>
<td>Leadership, constitution of staff, activity, and ability to attract external funding is very good in most aspects</td>
<td>The national and international collaboration is wide and relevant with high quality academic partners that contribute to the research</td>
<td>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</td>
<td>Above average number of publications, PhDs, etc. in relation to unit of evaluation resources</td>
<td>The research has international reach of significance and relevance to society</td>
<td>International attention, recognised channels, nationally leading research</td>
</tr>
<tr>
<td><strong>Good</strong></td>
<td>Leadership, constitution of staff, activity, and ability to attract external funding is satisfactory in all aspects</td>
<td>The collaboration is wide and relevant with academic partners that contribute to some extent to the research</td>
<td>Relevant collaboration partners. Non-academic partners contribute to the research. The research has value for the external partners</td>
<td>Average number of publications, PhDs, etc. in relation to unit of evaluation resources</td>
<td>The research has national reach of some significance and relevance to society</td>
<td>National attention, recognised channels, near the research front</td>
</tr>
<tr>
<td><strong>Insufficient</strong></td>
<td>Leadership, constitution of staff, activity, and ability to attract external funding is clearly unsatisfactory in several aspects</td>
<td>The academic collaboration is insufficiently developed</td>
<td>The collaboration with non-academic partners is insufficiently developed</td>
<td>Clearly below average number of publications, PhDs, etc. in relation to unit of evaluation resources</td>
<td>Lack of reach, or minor significance and relevance of research to society</td>
<td>The research is insufficient and reports have not gained wide circulation or do not receive national and international attention</td>
</tr>
</tbody>
</table>
Appendix 6:

Site visit programme
MER14 – Site visit programme
(Approved 8 May 2014 by the steering group)

Programme, Sunday 18 May

Eskilstuna

<table>
<thead>
<tr>
<th>Time</th>
<th>Venue</th>
<th>Activity</th>
<th>Panelists</th>
<th>From MDH</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>18:00</td>
<td>Elite Stadshotellet Hamngatan 11</td>
<td>Informal &quot;Get-Together&quot; Buffet</td>
<td>Panel 1 (HV), Panel 3 (IPR)</td>
<td>By invitation</td>
<td></td>
</tr>
</tbody>
</table>

Västerås

<table>
<thead>
<tr>
<th>Time</th>
<th>Venue</th>
<th>Activity</th>
<th>Panelists</th>
<th>From MDH</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>18:00</td>
<td>Elite Stadshotellet Stora torget</td>
<td>Informal &quot;Get-Together&quot; Buffet</td>
<td>Panel 2 (IS), Panel 4 (IEO), Panel 5 (FEC), Panel 6 (UV)</td>
<td>By invitation</td>
<td></td>
</tr>
</tbody>
</table>

Programme, Monday 19 May

Eskilstuna/Västerås

<table>
<thead>
<tr>
<th>Time</th>
<th>Venue</th>
<th>Activity</th>
<th>Panelists</th>
<th>From MDH</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:30</td>
<td>Stadshotellet Eskilstuna</td>
<td>Bus depart to MDH Västerås (-09:15)</td>
<td>Panel 1 (HV), Panel 3 (IPR)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>08:45</td>
<td>Stadshotellet Västerås</td>
<td>Short walk till MDH (-09:00)</td>
<td>Panel 2 (IS), Panel 4 (IEO), Panel 5 (FEC), Panel 6 (UV)</td>
<td>-</td>
<td>Follow guide</td>
</tr>
<tr>
<td>09:00</td>
<td>MDH Västerås</td>
<td>&quot;Check-in&quot; for panelists</td>
<td>All</td>
<td>-</td>
<td>Registration open 08-14</td>
</tr>
<tr>
<td>10:00</td>
<td>MDH, Alfa</td>
<td>Vice-Chancellor: Welcome Introduction MDH Swedish univ. system</td>
<td>All</td>
<td>By invitation</td>
<td></td>
</tr>
<tr>
<td>10:50</td>
<td>Outside Alfa</td>
<td>Short break</td>
<td></td>
<td>Coffee available</td>
<td></td>
</tr>
<tr>
<td>11:10</td>
<td>MDH, Alfa</td>
<td>Pro-Vice-Chancellor: On MER14</td>
<td>All</td>
<td>By invitation</td>
<td></td>
</tr>
<tr>
<td>12:00</td>
<td>MDH, Ypsilon</td>
<td>Separate Panel Chair meeting (Own time)</td>
<td>Panel Chairs Rest of panel</td>
<td>By invitation</td>
<td></td>
</tr>
<tr>
<td>12:50</td>
<td>By the main entrance</td>
<td>Photo session</td>
<td>All</td>
<td>By invitation</td>
<td></td>
</tr>
<tr>
<td>13:00</td>
<td>MDH, Rosenhill</td>
<td>Lunch</td>
<td>All</td>
<td>By invitation</td>
<td></td>
</tr>
<tr>
<td>14:00</td>
<td></td>
<td>Introduction from Schools</td>
<td>Panel: 1, 2+3, 4+5, 6 Deans of School Res. Directors</td>
<td>Four tracks</td>
<td></td>
</tr>
<tr>
<td>15:00</td>
<td></td>
<td>Panels, own time</td>
<td>Panel-wise</td>
<td>Six tracks</td>
<td></td>
</tr>
<tr>
<td>17:00</td>
<td>Vice-Chancellor</td>
<td>Reception</td>
<td>All</td>
<td>By invitation</td>
<td></td>
</tr>
<tr>
<td>18:30</td>
<td></td>
<td>Bus depart for Eskilstuna-panels</td>
<td>Panel 1 (HV), Panel 3 (IPR)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Programme, Tuesday 20 May

#### Eskilstuna

<table>
<thead>
<tr>
<th>Time</th>
<th>Venue</th>
<th>Activity</th>
<th>Panelists</th>
<th>From MDH</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:30</td>
<td>Stadshotellet, Hamngatan 11</td>
<td>Short walk to MDH Eskilstuna (-08:45)</td>
<td>Panel 1 (HV) Panel 3 (IPR)</td>
<td></td>
<td>Follow guide</td>
</tr>
<tr>
<td>09:00-</td>
<td>MDH Eskilstuna</td>
<td>According to panel program</td>
<td></td>
<td></td>
<td>See panel program</td>
</tr>
<tr>
<td>15:00-</td>
<td>Stadshotellet, Hamngatan 11</td>
<td>Internal panel work</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>alt. MDH E</td>
<td></td>
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</tr>
<tr>
<td>18:00</td>
<td>Stadshotellet, Hamngatan 11</td>
<td>Bus to Sundbyholm</td>
<td>Panel 1 (HV) Panel 3 (IPR)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19:00</td>
<td>Sundbyholm castle</td>
<td>Vice-Chancellor’s Dinner</td>
<td>All</td>
<td></td>
<td>By invitation</td>
</tr>
<tr>
<td>22:00</td>
<td>Sundbyholm castle</td>
<td>Bus to Stadshotellet, Eskilstuna</td>
<td>Panel 1 (HV) Panel 3 (IPR)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Programme, Tuesday 20 May

#### Västerås

<table>
<thead>
<tr>
<th>Time</th>
<th>Venue</th>
<th>Activity</th>
<th>Panelists</th>
<th>From MDH</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:30</td>
<td>Stadshotellet, Stora torget</td>
<td>Short walk to MDH Västerås (-08:45)</td>
<td>Panel 2 (IS) Panel 4 (IEO) Panel 5 (FEC) Panel 6 (UV)</td>
<td></td>
<td>Follow guide</td>
</tr>
<tr>
<td>09:00-</td>
<td>MDH Västerås</td>
<td>According to panel program</td>
<td></td>
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<td>See panel program</td>
</tr>
<tr>
<td></td>
<td>Lunch</td>
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</tr>
<tr>
<td>15:00-</td>
<td>Stadshotellet, Stora torget</td>
<td>Internal panel work</td>
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<td></td>
<td>alt. MDH V</td>
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</tr>
<tr>
<td>17:00</td>
<td>Stadshotellet, Stora torget</td>
<td>Short walk to harbour Boat to Sundbyholm</td>
<td>Panel 2 (IS) Panel 4 (IEO) Panel 5 (FEC) Panel 6 (UV)</td>
<td></td>
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</tr>
<tr>
<td>19:00</td>
<td>Sundbyholm castle</td>
<td>Vice-Chancellor’s Dinner</td>
<td>All</td>
<td></td>
<td>By invitation</td>
</tr>
<tr>
<td>22:00</td>
<td>Sundbyholm castle</td>
<td>Bus to Stadshotellet, Västerås</td>
<td>Panel 2 (IS) Panel 4 (IEO) Panel 5 (FEC) Panel 6 (UV)</td>
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Programme, Wednesday 21 May

**Eskilstuna**

<table>
<thead>
<tr>
<th>Time</th>
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<th>Panelists</th>
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<th>Note</th>
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<tr>
<td>08:15</td>
<td>Stadshotellet</td>
<td>Bus to Västerås</td>
<td>Panel 1 (HV)</td>
<td>Res. Director</td>
<td>Panel 1 to Västerås</td>
</tr>
<tr>
<td>08:30</td>
<td>Hamngatan 11</td>
<td>Short walk to MDH</td>
<td>Panel 3 (IPR)</td>
<td></td>
<td>Follow guide</td>
</tr>
<tr>
<td>09:00-</td>
<td>MDH V (P 1) MDH E (P 3)</td>
<td>According to panel program</td>
<td>&quot;-&quot;</td>
<td>See panel program</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lunch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15:00</td>
<td>MDH V (P 1) MDH E (P 3)</td>
<td>According to panel program</td>
<td>&quot;-&quot;</td>
<td>See panel program</td>
<td></td>
</tr>
<tr>
<td>16:00</td>
<td>MDH V</td>
<td>Bus to Eskilstuna (panel 1)</td>
<td>Panel 1 (HV)</td>
<td>Res. Director</td>
<td>Stadshotellet Eskilstuna</td>
</tr>
<tr>
<td>18:00</td>
<td>Stadshotellet</td>
<td>Internal panel work</td>
<td>Panel 1 (HV) Panel 3 (IPR)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Hamngatan 11</td>
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<td></td>
<td>alt. MDH E</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>18:00</td>
<td>Stadshotellet</td>
<td>Dinner at hotel</td>
<td>&quot;-&quot;</td>
<td></td>
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<tr>
<td></td>
<td>Hamngatan 11</td>
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<td>19:00-</td>
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<td>&quot;-&quot;</td>
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<td></td>
<td>Hamngatan 11</td>
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Programme, Wednesday 21 May

**Västerås**

<table>
<thead>
<tr>
<th>Time</th>
<th>Venue</th>
<th>Activity</th>
<th>Panelists</th>
<th>From MDH</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:30</td>
<td>Stadshotellet</td>
<td>Short walk to MDH Västerås (-08:45)</td>
<td>Panel 2 (IS) Panel 4 (IEO) Panel 5 (FEC) Panel 6 (UV)</td>
<td></td>
<td>Follow guide</td>
</tr>
<tr>
<td>09:00-</td>
<td>MDH Västerås</td>
<td>According to panel program</td>
<td>&quot;-&quot;</td>
<td>See panel program</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lunch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15:00</td>
<td>MDH Västerås</td>
<td>According to panel program</td>
<td>&quot;-&quot;</td>
<td>See panel program</td>
<td></td>
</tr>
<tr>
<td>15:00-</td>
<td>Stadshotellet</td>
<td>Internal panel work</td>
<td>&quot;-&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stora torget</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>alt. MDH V</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>18:00</td>
<td>Stadshotellet</td>
<td>Dinner at hotel</td>
<td>&quot;-&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stora torget</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>19:00-</td>
<td>Stadshotellet</td>
<td>Internal panel work</td>
<td>&quot;-&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stora torget</td>
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### Programme, Thursday 22 May

#### Eskilstuna

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<th>Panelists</th>
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<tbody>
<tr>
<td>08:30</td>
<td>Stadshotellet Hamngatan 11</td>
<td>Short walk to MDH E-tuna (-08:45)</td>
<td>Panel 1 (HV)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Panel 3 (IPR)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>09:00-</td>
<td>MDH Eskilstuna</td>
<td>According to panel program</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>-15:00</td>
<td>MDH Eskilstuna</td>
<td>Lunch</td>
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</tr>
<tr>
<td>15:00-</td>
<td>Stadshotellet Hamngatan 11</td>
<td>Internal panel work</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>alt. MDH E</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>18:00</td>
<td>Stadshotellet Hamngatan 11</td>
<td>Dinner at hotel</td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>19:00-</td>
<td>Stadshotellet Hamngatan 11</td>
<td>Internal panel work</td>
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<td></td>
<td>-</td>
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#### Västerås

<table>
<thead>
<tr>
<th>Time</th>
<th>Venue</th>
<th>Activity</th>
<th>Panelists</th>
<th>From MDH</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:30</td>
<td>Stadshotellet Stora torget</td>
<td>Short walk to MDH Västerås (-08:45)</td>
<td>Panel 2 (IS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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<td>Panel 4 (IEO)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Panel 5 (FEC)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Panel 6 (UV)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>09:00-</td>
<td>MDH Västerås</td>
<td>According to panel program</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-15:00</td>
<td>MDH Västerås</td>
<td>Lunch</td>
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<td>15:00-</td>
<td>Stadshotellet Stora torget</td>
<td>Internal panel work</td>
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<td></td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>alt. MDH V</td>
<td></td>
<td></td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>18:00</td>
<td>Stadshotellet Stora torget</td>
<td>Dinner at hotel</td>
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<td></td>
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</tr>
<tr>
<td>19:00-</td>
<td>Stadshotellet Stora torget</td>
<td>Internal panel work</td>
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Programme, Friday 23 May

### Eskilstuna

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<th>Panelists</th>
<th>From MDH</th>
<th>Note</th>
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<tbody>
<tr>
<td>08:00-10:00</td>
<td>Elite Stadshotellet Hamngatan 11</td>
<td>Internal panel work</td>
<td>Panel 1 (HV) Panel 3 (IPR)</td>
<td></td>
<td>Two rooms</td>
</tr>
<tr>
<td>10:00</td>
<td>Elite Stadshotellet Hamngatan 11</td>
<td>Exit interview (parallel, panel-wise)</td>
<td>-</td>
<td>By invitation</td>
<td>Two rooms. 5-10 repr. from MDH/panel</td>
</tr>
<tr>
<td>11:15</td>
<td>Elite Stadshotellet Hamngatan 11</td>
<td>End of site visit</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11:30 ca</td>
<td>Elite Stadshotellet Hamngatan 11</td>
<td>Lunch</td>
<td>Optional</td>
<td>By invitation</td>
<td>Complementary transports to airports etc.</td>
</tr>
<tr>
<td>12:15</td>
<td></td>
<td>Two panel chairs to Stadshotellet</td>
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### Västerås

<table>
<thead>
<tr>
<th>Time</th>
<th>Venue</th>
<th>Activity</th>
<th>Panelists</th>
<th>From MDH</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:00-10:00</td>
<td>Elite Stadshotellet Stora torget</td>
<td>Internal panel work</td>
<td>Panel 2 (I) Panel 4 (IEO) Panel 5 (FEC) Panel 6 (UV)</td>
<td></td>
<td>Four rooms</td>
</tr>
<tr>
<td>10:00</td>
<td>Elite Stadshotellet Stora torget</td>
<td>Exit interview (parallel, panel-wise)</td>
<td>-</td>
<td>By invitation</td>
<td>Four rooms. 5-10 repr. from MDH/panel</td>
</tr>
<tr>
<td>11:15</td>
<td>Elite Stadshotellet Stora torget</td>
<td>End of site visit</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11:30 ca</td>
<td>Elite Stadshotellet Stora torget</td>
<td>Lunch</td>
<td>Optional</td>
<td>By invitation</td>
<td>Complementary transports to airports etc.</td>
</tr>
<tr>
<td>13:00 -16:00</td>
<td>Elite Stadshotellet Stora torget</td>
<td>Chair meeting</td>
<td>Panel Chairs</td>
<td>By invitation</td>
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</table>
**Questionnaire**

At the end of the site visit all panellists received a short questionnaire. One part was a voluntary free response section and responses are summarized below. 41 of the 45 panellists answered the questionnaire. Similar opinions expressed by several persons are in bold letters.

**Free response section, summary**

**Things you liked MOST at/with MER14:**
- The panel colleagues (excellent competence and insight within the group), the meeting also the other panels, this was as well a fine enrichment. The short trip on the lake. The excellent organisation and of course the discussion with the panel colleagues and representatives. The meeting with the funding agencies was very useful and gave a lot of clarification and insight. The time the vice-chancellor took…
- The friendly atmosphere. The hospitality. The opportunity to meet and discuss with researchers and PhD students
- **Very constructive, open-minded environment at MDH but also within the panel**
- Taken seriously by staff
- Collegiality, “Can do”-attitude
- The group was great – very productive
- **Perfect organisation. Strong involvement of the members of the faculty. Friendly atmosphere easing fruitful discussions**
- Exemplary organisation and attention to detail: IT support; proximity of hotel to university; vice-chancellors presentation and engagement; researcher presentations were informative and refreshingly open/honest
- Willingness to assist in all aspects
- **International composition of the panels. This helped to provide many insights**
- I also appreciated the engagement of the vice-chancellor
- The preparation of the documentation was clear and concise
- Weather

**Things you liked LEAST at/with MER14:**
- **The magnitude of issues to cover in a short period – but this is the reality of any evaluation**
- Not enough time for preparation of written report
- It was difficult to understand the relationship between the research areas and the academic organisation
- Heterogeneity of presentations from groups – more uniform structure would have been better
- Slightly too long presentations by the staff and discussions with the panel not always in focus (the panel also to be blamed)
- **Only six members in the panel, two fewer than planned (panel 5)**
- The noisy hotel (Eskilstuna)
Make SPECIFIC proposals or remarks - for us to be able to improve future site visits:

- Perhaps less presentations and more questions/answer-time
- **Maybe a bit more time to discuss with PhD students and researchers more in detail on their scientific topics and research projects**
- More time for internal panel discussions
- Extended presentations shortened the time for discussions. Research information could be better organised, it took some time to figure out the details; distribution of academic positions, etc.
- Explain better the Swedish system of position levels in academia and conditions for different levels
- Provide an organization chart(s) of people in the various organizational units, departments, etc.
- **It would be helpful to have “satisfactory” between good and insufficient in the review scale**
- There should be cross-panel meetings to look e.g. for possible synergies. There should be meetings with the top-management team of the university
- Activities could start later on Monday to avoid panellists having to travel on weekend

Additional comments or questions:

- Wonderful initiative (10/10 MDH)
- It was appreciated that we could change the timetable according to our needs
- The atmosphere and support for visit (all aspects) was warm and appreciated. Thank you for giving me the opportunity to assist in your review process
- It was very nicely organised and people were open to discuss and receive feedback
- MDH did an excellent job! The information provided by the university and all arrangements were very well organised and thought through

The second part was a fixed response section and the responses are summarized below. 41 of the 45 panellists (91%) completed this section, though some panellists did not respond to each statement.
## Fixed response section, summary

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly agree</th>
<th>Agree</th>
<th>Neither</th>
<th>Disagree</th>
<th>Strongly disagree</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information before the site visit (website, e-mail etc.) was satisfactory</td>
<td>78%</td>
<td>20%</td>
<td>2%</td>
<td>0%</td>
<td>0%</td>
<td>4.76</td>
</tr>
<tr>
<td>Answers to your requests (by e-mail etc.) were satisfactory</td>
<td>85%</td>
<td>15%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>4.85</td>
</tr>
<tr>
<td>The self-evaluation covered the research activities reasonably well</td>
<td>29%</td>
<td>61%</td>
<td>3%</td>
<td>5%</td>
<td>3%</td>
<td>4.08</td>
</tr>
<tr>
<td>The bibliometric analyses provided valuable information about the research specializations publication activities</td>
<td>24%</td>
<td>56%</td>
<td>10%</td>
<td>7%</td>
<td>2%</td>
<td>3.93</td>
</tr>
<tr>
<td>Your panel had the necessary competencies needed for the review</td>
<td>80%</td>
<td>18%</td>
<td>0%</td>
<td>3%</td>
<td>0%</td>
<td>4.75</td>
</tr>
<tr>
<td>You had enough time to cover and assess the research on-site</td>
<td>56%</td>
<td>29%</td>
<td>7%</td>
<td>7%</td>
<td>0%</td>
<td>4.34</td>
</tr>
<tr>
<td>The presentations (Tuesday-Thursday) were according to your need</td>
<td>40%</td>
<td>50%</td>
<td>8%</td>
<td>3%</td>
<td>0%</td>
<td>4.28</td>
</tr>
<tr>
<td>The time schedules (Tuesday-Thursday) were kept</td>
<td>66%</td>
<td>34%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>4.66</td>
</tr>
<tr>
<td>There was sufficient time available for discussion</td>
<td>54%</td>
<td>37%</td>
<td>2%</td>
<td>7%</td>
<td>0%</td>
<td>4.37</td>
</tr>
<tr>
<td>Information provided during the site visit was satisfactory</td>
<td>60%</td>
<td>38%</td>
<td>3%</td>
<td>0%</td>
<td>0%</td>
<td>4.58</td>
</tr>
<tr>
<td>The arrangements (Tue-Thu) were satisfactory (rooms, lunches etc.)</td>
<td>78%</td>
<td>20%</td>
<td>0%</td>
<td>3%</td>
<td>0%</td>
<td>4.73</td>
</tr>
<tr>
<td>To participate in the evaluation was valuable to yourself</td>
<td>80%</td>
<td>20%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>4.80</td>
</tr>
<tr>
<td>The feedback and report from your panel will be of great value to Mälardalen University</td>
<td>72%</td>
<td>28%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>4.72</td>
</tr>
<tr>
<td>The report template was useful</td>
<td>49%</td>
<td>41%</td>
<td>10%</td>
<td>0%</td>
<td>0%</td>
<td>4.39</td>
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</table>
Appendix 8:
Photos from the site visit
Photos from the visit to Sundbyholm castle, 20 May 2014 (Photo: Emil Atak)