



Mads Nygård
Henrik I. Christensen
Dietrich R.T. Zahn

INTERNATIONAL EVALUATION:
DOCTORAL SCHOOL OF ENGINEERING AND SCIENCE &
TECHNICAL DOCTORAL SCHOOL OF IT AND DESIGN

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AAU – TECHNICAL PHD SCHOOLS – EVALUATION 2018

INTERNATIONAL EVALUATION: DOCTORAL SCHOOL OF ENGINEERING AND SCIENCE & TECHNICAL DOCTORAL SCHOOL OF IT AND DESIGN (2013-2017)

SITE VISIT: 23rd-24th of August 2018
EVALUATION REPORT: 12th of October 2018

EVALUATION COMMITTEE

The university had appointed an international board consisting of the following members:

- Mads Nygård – Dean of Engineering Education, Norwegian University of Science and Technology, Trondheim, Norway (Chairman of the committee)
- Henrik I. Christensen – Director of Institute of Contextual Robotics, University of California San Diego, USA
- Dietrich R.T. Zahn – Head of Department, Semiconductor Physics, Chemnitz University of Technology, Germany

DOCUMENTS PROVIDED

The evaluation committee received the following materials beforehand:

- Terms of reference for this international evaluation
- Program for the corresponding site visit
- Self-evaluation of the two doctoral schools to be evaluated (for the period 2013-2017)
- Report from the international evaluation of the Doctoral School of Engineering and Science & the Doctoral School in Medicine, Biomedical Science and Technology, AAU (the former evaluation: for the period 2008-2012)
- Self-evaluation of the Doctoral School of Engineering and Science & the Doctoral School in Medicine, Biomedical Science and Technology, AAU (the former evaluation: for the period 2008-2012)
- PhD Handbook - The Doctoral School of Engineering and Science (from the former evaluation)
- Draft of implementation plan based on the former international evaluation
- Comments on implementation plan based on the former international evaluation

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EXECUTIVE SUMMARY

Based on the documents provided, the interviews, and discussions on site, the committee would like to stress the following important findings:

- AAU has created a strong eco-system in Northern Jutland with educational, research, and economic impact. However, there is a limited mobility of students and candidates that could be a challenge in the years ahead.
- AAU has flagged a high ambition with respect to the two doctoral schools. They have a lot of potential given that the ambition is fully implemented in the future.
- AAU has over a long period of time established a strong cooperation with industry. This does not seem to stem from strategic initiatives this far, so the cooperation has potential for further improvement.
- There are some more specific recommendations which should be taken into consideration – grouped as follows:
 - Organization
 - Operations
 - Recruitment and Enrolment
 - Supervisors and Supervision
 - PhD Courses
 - Quality Monitoring and Outcome
 - Mining the Alumni Network
 - Career Planning
 - Research Culture
 - Systemic Issues

The committee would further like to stress the vital multidisciplinary aspect, which concerns several of the groups mentioned above:

- It is widely recognized that much of the new innovation opportunities are expected to be at the boundary of topical research. Consequently, it is important that the students have a broader awareness / knowledge of the fields they are engaged with. In addition, most of the courses / programs offered are small as they are highly targeted. By adopting a more multidisciplinary approach there are opportunities to increase class sizes and also give the students a broader perspective on how techniques are used across different domains.

The committee would finally like to stress two important procedural aspects:

- There is a need to carefully consider if and how to implement both the former and present recommendations, and it is desirable to leverage these in future evaluations. If one decides not to implement a specific recommendation, the reasons for this should be made clear.
- In future evaluations, it will be desirable to have separate interviews also with current (and former) PhD students – as was the case with the supervisors this time. The assumption is that PhD students will speak more freely when interviewed alone and not together with their supervisors / leaders.

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ORGANIZATION

AAU as an organization seems to be in flux. There have been several structural changes over the last years, wrt. both splitting and merging of departments etc. This opens up opportunities, but it also represents challenges if not handled well.

There are several “inconsistencies” within the organization, which may stem from this flux. These “inconsistencies” represent different ways of both viewing and doing things within AAU. Some examples of these are:

- Some employees / students feel there are several inherent internal challenges – while others only point to lack of enough funding and recruitment of good PhD students
- Some find that there are/is too many rules / too much regulation – while others seem this is just fine
- Some employees / students find the study plan too rigid a tool – while others find it an excellent one
- Some say AAU’s PhD study is, of course, also problem based – while others say it per definition can’t be
- Some employees / students think the organization only accepts PhD theses as paper collections – while others feel that to go for monograph PhD theses is a good idea

There are also “challenges” that are of a more structural type on all levels, which again may lead to inherent conflicts within groups, departments, faculties etc. Some important ones are:

- Few PhD programs are interdisciplinary per se, and the trend away from interdisciplinary PhD programs seems to be increasing
- Most PhD programs belong to a single department, and the trend away from multidepartmental PhD programs seems to be increasing
- Some PhD programs are of a size which may turn critical, if some unexpected events should happen
- There are not many arenas for sharing best practices / exchanging experiences, which both several employees and several students could see the benefit of
- There is a lot of freedom wrt. how to organize and conduct the/a PhD study, which may lead to unwanted consequences if it becomes too large

The committee therefore recommends the following actions:

1. *AAU ought to create more interdisciplinary PhD programs*
2. *AAU ought to create more multidepartmental PhD programs*
3. *AAU ought to cluster groups across all levels to secure critical mass on all levels*
4. *AAU ought to carefully consider the match between academic units, programs, and schools*
5. *AAU ought to create more arenas for sharing best practices / exchanging experiences*
6. *AAU ought to secure a more unified view across the organization wrt. how things are carried out*

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OPERATIONS

The committee noted a certain lack of “proactiveness” across the organization when faced with negative trends – e.g. wrt. a decreasing no of PhD students enrolled and wrt. a very high no of deregistrations of PhD students. The discussions with the AAU management showed that these numbers are not as alarming as first considered, but the feeling of a lack of genuine “proactiveness” still prevails.

The committee further noted that the AAU management felt that the university with its PhD schools and programs is selling itself, and hence does not need extra profiling or marketing. This may have been the case – and may still be the case, but this may change in the future.

The committee also noted that AAU has PhD program chairs that have had the post for very long periods. This job is a very challenging one, as the chair has to be able to operate in a “carrot only” environment – i.e. without the “stick also” option.

The committee even noted that the time effectively to do research for the PhD thesis is limited in the allotted PhD period – as courses have to be taken (30 ECTS), teaching has to be done (for most PhD students) and a stay away from AAU is expected (with the corresponding time-consuming logistics).

The committee finally noted that strategic plans only exist on the top level – with the below levels only having more work-type-of-plans to implement the top-level strategic plans. This may limit the options to grow economic opportunities on all levels.

The committee therefore recommends the following actions:

7. *AAU ought to install a proactive attitude wrt. negative trends on all levels*
8. *AAU ought to profile, market, and sell the PhD schools and programs in an active way*
9. *AAU ought to consider having PhD program chairs serving for a limited time period only*
10. *AAU ought to consider allowing PhD students more time for their research work*
11. *AAU ought to establish strategic plans on all levels - to focus on both the right kind of funding (externally) and the right kind of prioritization (internally)*

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RECRUITMENT AND ENROLMENT

The committee noticed a significant decline in applications in multiple programs and that recruitment procedures across the Schools are not uniform. Different procedures are applied when interviewing and recruiting potential PhD candidates across the Schools. Comments were received regarding difficulties to assess international PhD applicants and their qualifications. Moreover, the focus in recruiting PhD students was more on quantity than quality.

An improvement in the hiring and recruiting processes of PhD students thus seems necessary. There is an opportunity to be more strategic about hiring of PhD students using mandatory interviews and multi-advisor engagement in the recruiting process. Training courses for those who are involved in the recruitment procedure may be considered, e.g. in interviewing techniques.

Furthermore, a more proactive recruitment as well as improved advertisement for PhD positions are needed.

The committee therefore recommends the following actions:

- 12. AAU ought to clarify the rules that apply for the recruiting process and ensure an efficient and reliable selection procedure*
- 13. AAU ought to define the means of selecting the best-suited candidates in detail*
- 14. AAU ought to clearly focus the recruitment process on quality of PhD students rather than quantity*

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SUPERVISORS AND SUPERVISION

The committee noticed a lack of consistency in expectations between PhD students and their supervisors, in some cases even resulting in poor collaboration, whereas the quality of PhD studies clearly depends on the quality of the PhD supervision. It was mentioned in the discussions that in some cases there even seems to be a lack of the supervisor's scientific focus as well as lack of time spent between PhD students and supervisors. Moreover, insufficient attention is paid to cultural differences among international PhD students. Apparently there seems to be a need for mentoring / training program for PhD supervisors (supervise the supervisors!). This may require channelling of funding into the supervisor training. While an involvement of more younger researchers in the supervision of PhD students is wanted, these younger researchers would particularly benefit from a mentoring program.

The committee also observed that there are different ideas about what the study plan is. While the study plan is partially seen as a key element, which leads to an increase in quality, a more pragmatic use of study plans is also wanted, for instance to reduce the bureaucracy involved.

The committee therefore recommends the following actions:

- 15. AAU ought to establish mentoring/training courses for supervisors*
- 16. AAU ought to build incentives for supervisors to take required mentoring/training courses*
- 17. AAU ought to encourage PhD supervisors to meet regularly and share/discuss best practice in supervising*
- 18. AAU ought to ensure that the PhD supervisors make PhD students aware of career planning, e.g. using the Career Center at AAU*
- 19. AAU ought to improve supervisors' awareness of the cultural differences among PhD students*
- 20. AAU ought to allow more pragmatic uses of study plans*

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PHD COURSES

The committee noticed that there are considerably different views wrt. the usefulness of PhD courses. Courses are assessed as either too general or too specific. There is a need for courses in the “middle”. In particular, specific courses should not be too narrow. Moreover, courses should become a more active part of the research by e.g. making them problem based and research relevant (as an example, a course on vibrations that are relevant in various areas of the research involved was mentioned in the discussions). Innovative courses and the involvement of PhD students suggesting topics for courses are welcome.

More interdisciplinary colloquia for PhD students with participation of international experts in the research fields involved as well as courses on the philosophy of science would be beneficial. On the other hand, the committee is concerned about the possibly too high a load for PhD students imposed by the PhD courses (and their teaching) that may not leave enough time to do sufficient research within the 3-year PhD period.

The committee therefore recommends the following actions:

- 21. AAU ought to evaluate the PhD course program with respect to content and suitability*
- 22. AAU ought to introduce more interdisciplinary courses as well as interdisciplinary colloquia for PhD students*
- 23. AAU ought to consider the workload imposed by PhD courses wrt. time available for research*

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QUALITY MONITORING AND OUTCOME

The committee noticed that the statistics provided are not complete and better statistics are needed to find the root of problems like the high number of de-registrations in a considerable number of PhD programs. Further, the committee observed in general a lack of exchange of best practices / experiences across programs. Moreover, in order to ensure a high quality of the research performed in PhD projects the committee feels that quality monitoring of the research ideas behind proposed PhD projects could be beneficial.

The committee therefore recommends the following actions:

- 24. AAU ought to improve the collecting of data of present PhD students and alumni and provide improved statistics*
- 25. AAU ought to consider the introduction of peer reviewing the research ideas before turning them into PhD project*

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MINING THE ALUMNI NETWORK

The graduate programs have been active for an extended period of time. There are thus a significant number of alumni that have graduated from the program. The committee noted that it is not apparent that there is a formal alumni network. Neither is it clear that the network is used in an active or passive form.

AAU has a strong tradition of doing research that has strong ties to industry. The alumni network offers a unique opportunity to engage with a broad set of companies and alumni to strengthen the ties to industry. It appears that national funding for research and certainly for AAU has been declining. The committee strongly feels that the alumni network should be leveraged to build diversity in engaging with external parties.

The committee is also convinced that we will see a change in university education models. There will be a need for life-long education through course programs, joint projects, and similar mechanisms. The alumni network is an obvious model for AAU to strengthen ties to former students and offer them such services.

The committee therefore recommends the following actions:

- 26. AAU ought to set up a more organized approach to management of the alumni network*
- 27. AAU ought to engage the alumni network to diversify its funding portfolio*
- 28. AAU ought to consider the alumni network as a way to explore translation of R&D results*
- 29. AAU ought to use the alumni network for organization of recruiting events*
- 30. AAU ought to leverage the alumni network to understand the needs / opportunities for continuing education*

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CAREER PLANNING

The world is ever changing. Almost all the sectors that the two graduate programs are engaged in see exponential growth, which also implies that the areas are changing. How does one provide knowledge about first principles and at the same time prepare students for a career where many of them will be employed by industry and not in academia?

In almost all cases the graduate courses are very good. It is, however, not clear that the programs are designed to produce world-class researchers to industry as well as academia. The students were not all aware of the broad range of career opportunities available to them. Not everyone engaged in the graduate education will become a professor!

AAU has a Career Center for graduate students. When the committee asked graduate students if they had leveraged the Center, half of them had not even heard of the office. There is clearly a need for the students to be more proactive, but also for program management to provide stronger guidance to the students.

The committee therefore recommends the following actions:

- 31. AAU ought to consider stronger engagement for career planning with students as their studies progress to prepare them for a life after graduation*
- 32. AAU ought to promote its Career Center better to its students*

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RESEARCH CULTURE

The committee noted that there are multiple strong research groups within the graduate programs. These groups provide a broad range of opportunities to the participating students. The distribution of students across groups has fat tails, which implies that many of the students are not in those big research groups - but in groups run by a single professor.

The committee considers it important that all PhD students have a broad perspective of the field they are doing research in. It was not evident from discussions with students, postdocs, and faculty that there are such broader mechanisms in place to provide the students with broader exposure to - ideas, ways to do research, lectures by senior researcher in the field, opportunities to promote research to a broader audience etc.

There are many possible ways to encourage a broader research culture that promotes a wider perspective, diversity, critical thinking, etc. There are many possible ways this can be achieved - from an annual research day over program wide lecture series – a research showcase to stakeholders and still a teachable moment for the students, to broader literature study groups. An obvious question is - how you do create the AAU culture of problem driven research or a similar hallmark for AAU?

The committee therefore recommends the following actions:

- 33. AAU ought to build up a stronger research culture that is broader than single research groups*
- 34. AAU ought to have an annual research day where students provide posters presenting their research to the broader faculty and potentially to external partners*

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SYSTEMIC ISSUES

The committee was generally impressed by the research that it was exposed to. The research is of high quality and well presented. However, the committee did notice a number of more systemic issues.

Several members of the faculty expressed their frustration with the reduction in funding support from National Research Agencies and the difficulty in securing new EU funds. This correlated well with the general reduction in admission of new PhD students to the programs. Some programs have grown, but in the overall admissions are going down. It was surprising to the committee that the faculty did not see this as an opportunity to explore the option to diversify. AAU has a strong record of collaborating with industry in the undergraduate program, and clearly there is an opportunity to build strategic alliances with companies in Denmark and elsewhere to pursue a strategy of becoming a key partner for their long-term research. Given the track record of excellent industry links for applied development projects as part of the undergraduate program, this ought to be a relatively easy task to undertake – not at least for the Rector.

The committee also noted that multiple professors expressed a desire to reduce the number of PhD students and focus more on hiring Post-Docs. According to these faculty members the cost of a Post-Doc is comparable to a PhD student especially if the course burden is taken into account. The PhD students are in most cases the foundation of basic research and the first step in the research pipeline. If you significantly reduce the PhD production, it is likely to impact future hiring. Today hiring of international researchers is non-trivial. It is felt that the Rector ought to engage in a broader discussion about the comparative costs of PhD students vs Post-Docs.

The committee therefore recommends the following actions:

35. *The Rector of AAU ought to actively engage in a discussion about strategies for more diversified research funding and especially consider a broader engagement with industry*
36. *The Rector of AAU ought to engage in a broader discussion with Denmark's Department of Education on the comparative costs of PhD students vs Post-Docs to ensure a balanced portfolio of researchers across different ranks*