ENHANCING INTERACTION WITH EXTERNAL STAKEHOLDERS IN PROGRAM MANAGEMENT

Svante Gunnarsson, Anna Fahlgren

Linköping University, Sweden

Per Fagrell

KTH, Sweden

ABSTRACT

Interaction with the surrounding society and external stakeholders is an important component when developing and managing high quality and relevant education programs. This paper presents some of the outcomes of the project MERUT which was carried out during 2018 – 2020 with support from the Swedish innovation agency Vinnova. The key outcome is a toolbox offering a structured way to describe and handle methods and tools for stakeholder interaction. The methods of interaction are organized in three categories, denoted A, B, and C, where category A includes methods for external stakeholders to influence the management and development of the education program. Category B consists of means for external stakeholders to have an active role in course modules, and category C contains methods and tools to evaluate the quality and relevance of the education from, for example, alumni or employer perspective. Examples from the different categories are presented, including the CDIO Syllabus Survey, alumni surveys, and reflection documents.

KEYWORDS

Stakeholder interaction, Syllabus survey, program evaluation, Standards: 2, 3, 4, 5, 12

INTRODUCTION

Interaction with the surrounding society and external stakeholders is an important component when developing and managing high quality education programs. The interaction can be done in many ways, but the overall aim is to develop and ensure the quality and relevance of the program. Interaction with various stakeholders is also a vital component of the CDIO framework, and there are obvious connections to several of the items in the CDIO Standards. See (CDIO Standards, 2022). For example, Standard 2 about Learning outcomes says *Specific, detailed learning outcomes for personal and interpersonal skills, as well as disciplinary knowledge, consistent with program goals and validated by program stakeholders.* Also, Standard 12 about Program evaluation says *A system that evaluates programs against these twelve standards, and provides feedback to students, faculty, and other stakeholders for the purpose of continuous improvement.* In several cases, the criteria for the highest level in

the rubrics used for self-evaluation based on the CDIO Standards refer explicitly to stakeholders.

There are numerous ways and methods for interaction with external stakeholders when developing, re-designing, maintaining, and running education programs, and the aim of this paper is to propose a structured way of describing such methods and their purpose. The main messages of the paper are:

- A toolbox for methods and tools for stakeholder interaction arranged in three different categories depending on the role and purpose of the interaction.
- Examples of tools and methods in each category, where some tools are new or applied in new contexts and some methods are established, but now placed in the proposed framework.

Stakeholder interaction in higher education has been studied from many different perspectives, and there are many publications in the field. Comprehensive overviews of the field, with extensive lists of references, are given in (Fagrell, 2020) and (Fagrell, Fahlgren, & Gunnarsson, 2020). Among the references one can mention (Thune, 2011) and (Anderson, 2001) discussing various aspects of the interaction between universities and industry.

The paper is organized as follows. The first section gives a short description of the MERUT project, in which the toolbox and some of the tools were developed, and in the following section the toolbox itself is presented. In the next section the similarities and differences between quality and relevance are discussed, and in the three following sections the different categories of tools and methods are discussed. For each category some examples of methods and ways for interaction with external stakeholders are discussed. Finally, the paper ends with a summary and conclusions.

THE MERUT PROJECT

During 2018 – 2020 the Swedish funding agency Vinnova sponsored 18 projects dealing with various aspects of the interaction between Higher education institutions (HEIs) and external stakeholders. On the national level the collection of projects was called the K3-initiative (K3 for the knowledge triangle), and each project involved several HEIs, and had its own project leader, steering group, etc. See (K3, 2022). The various projects worked independently, but with some overall national coordination and cross-contacts where the scope of the individual projects had some overlap. The overall aim of the K3-initiative was to enhance the ability and capacity of the HEIs to interact with external stakeholders to strengthen the quality of the education and research at the HEIs and the mechanisms to transfer and utilize the knowledge from the HEIs in industry, public sector, and civil society. The topics of the individual projects ranged from ways to include the interaction with external stakeholders in the quality assurance system of the HEI, how the interaction with external stakeholders can be made more structured via strategic collaboration agreements, to ways to include the ability for interaction with external stakeholders in the regulations for recruitment and promotion.

One of the K3-projects was named MERUT (Swe: Metoder för relevansbedömning av utbildning), and it included seven HEIs, representing a variety of disciplines (engineering, medicine, humanities, etc). See (MERUT, 2022). The project management was located at Royal Institute of Technology (KTH) in Stockholm, and the overall aim was to study various aspects of how the relevance and quality of education programs can be improved via various

forms of interaction with external stakeholders. The project included several sub-projects and it resulted in several useful outcomes. In addition to the toolbox for ways and methods for stakeholder interaction, which is the key message of this paper, the re-design of the Bachelor's program in biomedicine at Linköping University using the CDIO framework was one important outcome. See Fahlgren, et al. (2018) for further information about this re-design.

THE TOOLBOX

The outcome of the MERUT project that is the focus of this paper is summarized in the graphical illustration in Fig 1., where different methods and tools for interacting with external stakeholders are structured in a systematic way. The dark blue boxes represent the conditions and regulations that are formulated on national and governmental level. The boxes within the shaded green area represent internal structures and processes that the HEI to a large extent can form itself, given the conditions stated in the dark blue boxes. The light blue boxes represent external stakeholders of different types, including alumni, employers, representatives in various boards or groups related to the education program. The arrows from the light blue boxes to boxes within the green shaded area represent flow of information between the external stakeholder and program management as well as course modules. This information flow can be either formal and structured or informal.

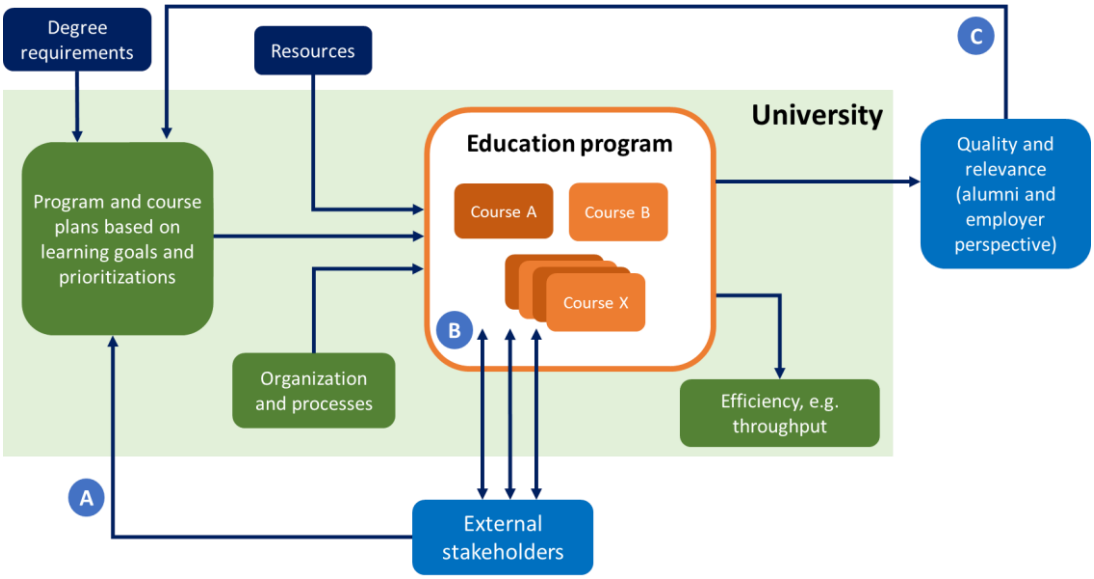

Figure 1. Graphical illustration of how the interaction with external stakeholders can be structured. The dark blue boxes represent the conditions and regulations that are formulated on national and governmental level. The boxes within the shaded green area represent internal structures and processes that the HEI to a large extent can form itself, given the conditions stated in the dark blue boxes. The light blue boxes represent external stakeholders of different types, including alumni, employers, representatives in various boards or groups related to the education program.

It should be stressed that this is not the first time the mechanisms around an education program is described schematically using a block diagram including feedback loops. Fig 4.1 in Crawley, et al. (2014) is one example. Also, feedback mechanisms are natural components of quality systems, which is illustrated in, for example, Fig 9.3 in Crawley, et al. (2014).

Using Fig 1 the methods and tools of interaction are organized in three categories, denoted A, B, and C in the figure, and the categories have the following meaning:

A. Methods for external stakeholders to influence the management and development of the education program. This includes having representatives from external stakeholder in e.g., program or advisory boards, but also the use of systematic tools such as the CDIO Syllabus Survey to collect opinions and expectations from future employers and other stakeholders concerning the expected knowledge and skills of the graduates.

B. Means for external stakeholders to have an active role in course modules. This includes e.g., learning activities which are, partly or in total, carried out in close collaboration with an external stakeholder, in the form of a project course, internship etc. The category also includes the use of adjunct teachers in the education program, i.e., persons employed externally but with a part time position at the university.

C. Tools and methods to evaluate the quality and relevance of the education from e.g. alumni or employer perspective. This includes alumni surveys of various type, but also surveys and reflections carried out by the students at the very end of the education.

The sections below present examples of methods and tools from each of the categories.

QUALITY AND RELEVANCE

Before discussing examples from the different categories there will be some reflections on the concepts of quality and relevance in higher education, and some findings from (Fagrell, Fahlgren, & Gunnarsson, 2021) will be presented. Quality is a crucial aspect in higher education, and it has received extensive attention by many researchers. See for example (Green, 1994) and Schindler, et al. (2015). The meaning and importance of the word relevance has however not been studied to the same extent. In the preparation of the paper (Fagrell, Fahlgren, & Gunnarsson, 2020) a simple survey was carried out with the aim to get some clarification of the concepts. The survey was handed out to some of the participants at the national conference Forskning om högre utbildning in 2018 and some of the Swedish participants at the CDIO conference in Japan 2018. The survey consisted of a small set of open questions about the similarities and differences between the quality and relevance. In total 23 persons answered the survey, and a common view from the participants, from both HEIs and external stakeholders, is that relevance is related to aspects outside the HEI, like, for example, the needs from society, industry, and the labor market in general. Representatives from external stakeholders stressed the connections between relevance and the knowledge and skills needed for the professional career. A general conclusion is that relevance has many similarities with quality, but it needs to be related to something or someone. In many cases quality and relevance are seen as subsets of each other and complementing each other rather than being opposites. Furthermore, there is a strong connection between relevance and the job market, but that this connection is not as strong for quality. Further details can be found in (Fagrell, Fahlgren, & Gunnarsson, 2020, 2021).

CATEGORY A

This category includes various ways of involving external stakeholders in the management of education programs, and two examples from this category are given. Based on an interview study with representatives from external stakeholders a checklist has been developed. The second example is an adaption and application of the CDIO Syllabus Survey to biomedicine.

External stakeholders in program management

The involvement of external stakeholders in higher education takes various forms and modes and is often not firmly institutionalized (Thune, 2011). This is also a main conclusion from the study within the project MERUT about how external stakeholders are involved in program management at seven higher education institutions in Sweden (Fagrell, Fahlgren & Gunnarsson, 2020). Despite a variation of the cases (engineering or non-engineering, vocational qualification, or general qualification), the expectations, comments and arguments from the external stakeholders were similar. The external stakeholders want to send messages to higher education institutions about changes in their business sectors, and about the subsequent changes in knowledge and skills in the labor required, to encourage the higher education institutions to adjust and develop their programs. However, the external stakeholders do not expect immediate changes because of their comments, neither do they see themselves as a part of a quality assurance scheme at the higher education institution.

Checklist

One of the main observations in (Fagrell, Fahlgren, & Gunnarsson, 2020) is that mutual expectations is a key factor when involving external stakeholders in program management. In several of the interviews that form the basis for the findings in the paper this is brought up as a subject for development. This involves questions about the role of the group in which the external representative participates, various feedback mechanisms, etc. To support the involved persons and provide some clarifications a simple checklist has been proposed, and the checklist is presented in Fig 2. The intention is to support both program management and the representatives from external stakeholders. In addition, the checklist is divided into questions related to *Structure,* which for example encompasses the role of the group in the internal organization of the HEI and *Contents*, which involves questions around the role of the external representative.

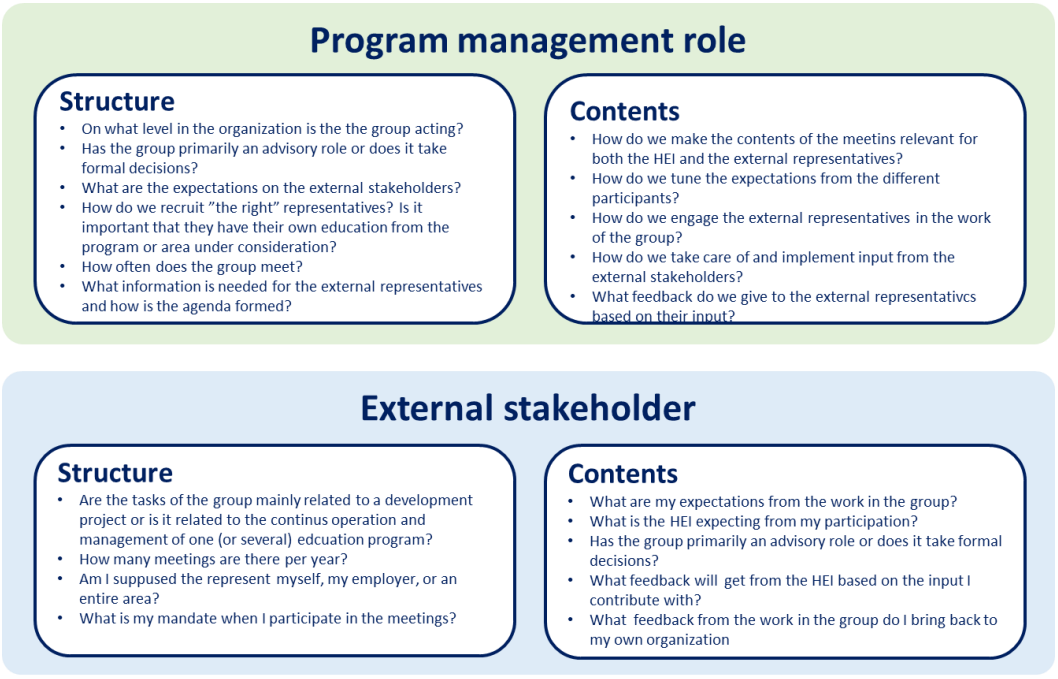

Figure 2. Checklist when involving external stakeholders in program management.

The checklist was presented and discussed during a roundtable discussion at a national conference about engineering education (*Den 8:e Utvecklingskonferensen för Sveriges Ingenjörsutbildningar*) in November 2021. The document was received very positively and was judged to be very useful in the process of involving external stakeholders in the management of education programs.

CDIO Syllabus Survey

The CDIO Syllabus Survey is a systematic tool for collecting the views and opinions of external stakeholders concerning the expected knowledge and skills of the graduates from an education program. The CDIO Syllabus itself was first presented in (Crawley, 2001), and it is one of the two fundamental documents of the CDIO framework. The document, together with revised and translated versions of it, can be found via the CDIO web site, the (CDIO Initiative, 2022). The CDIO Syllabus consist of four main sections with corresponding sub-sections and sub-sub-sections.

I - Disciplinary knowledge and reasoning.
II - Personal and professional skills and attributes
III - Interpersonal skills: Teamwork and communication.
IV - Conceiving, designing, implementing, and operating systems in the enterprise, societal, and environmental context – The innovation process.

In addition to introducing the CDIO Syllabus, (Crawley, 2001) presents the first examples of application of the Syllabus survey. This was later followed by, for example, Bankel, et al. (2003), which presents the outcome of the Syllabus survey from the four original collaborating universities in the CDIO Initiative. A thorough description of how the survey is designed is given in Crawley, et al. (2014). In the survey a selected set of stakeholders are asked to, from their perspective, rate the expected levels of proficiency of the graduates in the CDIO Syllabus

knowledge and skills, according to a proposed scale. As in e.g (Crawley, 2001) and Bankel, et al. (2003) the focus has been on Sections 2, 3, and 4 of the CDIO Syllabus. There are numerous other examples of applications of the survey, and further examples can be found via the link Knowledge library of the CDIO web site. The usefulness of the CDIO Syllabus is illustrated in in Fahlgren et al., (2019), where it is presented how the CDIO Syllabus was adapted to the biomedicine field, and how the Syllabus Survey was designed based on the adapted version. The cited paper presents how the survey was carried out, and observations between different groups of stakeholders are discussed. In addition, similarities and differences when comparing with the engineering field are presented. These findings support that the CDIO Syllabus Survey is a very useful tool in Category A of the toolbox.

CATEGORY B

Category B involves a multitude of modes for interaction between course modules and external stakeholders, and they can roughly be divided into two different sub-categories. The first sub-category is when the students temporarily leave the HEI and spend a shorter or longer time with a company or some other external stakeholder. This sub-category includes activities ranging from study visits for a few hours to internships or a Master's thesis carried out in industry over a whole semester. In the second sub-category one finds ways of interaction where the "outside world" visits the HEI and contributes to the activities in a course module. Examples from this category encompass, for example, guest lectures, persons from industry having adjunct positions teaching in course modules, and project tasks proposed by external stakeholder. Within the CDIO Initiatives several examples of project-based learning activities based on tasks from external stakeholders have been reported over the year. A related case is challenge-based learning (CBL) which has received considerable attention during the recent years. In CBL a key component is that the student teams should work on a challenge provided by an external stakeholder. Some reflections about the connections between CBL and the CDIO framework are given in Kohn Rådberg, et al. (2020) and (Gunnarsson & Swartz, 2021).

CATEGORY C

This category, which is closely related to CDIO Standard 12 (Program evaluation), is about methods for "measuring" the quality of the education provided by an education program. Ideally one would like to have some simple indicators showing this quality, but this isn't realistic, and instead some indirect indicators are used. Various mechanisms for national evaluations or accreditations can also be placed in this category.

Alumni surveys

Alumni surveys is a common tool for collecting information about the quality of an education program. Several such studies have been reported over the years, and from the CDIO community one can mention (Bisagni, Ghiringhelli, & Ricci, 2010) and (Wiklund, Lindblad, & Gunnarsson, 2005). One phenomenon that has been observed during the last decade is that it has become more and more difficult to reach high enough response rates to make the results useful.

Reflection documents

As pointed out above, the risk of getting a low response rate is a key challenge when using alumni surveys to capture the quality and relevance of an education program. An alternative could be to use a survey at the very end of the program, and this was one of the key ideas behind the introduction of *reflection documents* as a part of the examination of the Master's theses within the engineering education programs at Linköping University. Of course, the students have not yet started their professional career, but since the big majority carry out the Master's thesis externally at a company, they will get a good insight into the life as an engineer in industry. Therefore, it will be possible to do some reflections on to which extent the education program has given them the necessary knowledge and skills. Another reason for introducing the reflection documents is that it is a good habit to summarize the "lessons learned" at the end of all larger projects. The introduction of the reflection documents was inspired by the same document from the LIPS project model, which was developed during the early years of the CDIO Initiative to support several of the project courses which were introduced in different programs, see (Svensson & Gunnarsson, 2012). The first generation of reflection documents was introduced in 2011, and some initial findings were presented in (Kindgren, Nilsson, & Wiklund, 2012). Some revisions of the structure of the document and the issues to reflect upon led to the second generation. Up to now the documents have been handled manually as pdf documents sent back and forth between student, examiner, and the program board. Recently a project has been initiated, where the aim is to create a web-based system for writing, assessing, and storing the documents.

DISCUSSION AND CONCLUSIONS

A toolbox for methods and tools for interaction with external stakeholders has been proposed, and examples of tools in the different categories (as presented in Fig. 1.) have been presented. For simplicity and clarity each method is only placed in one category, although some of the methods in the toolbox can possibly be placed in more than one category.

The toolbox has been developed in the Swedish context with some inspiration from the organization and processes at the home universities of the authors, and there can of course be variations in the applicability depending on national and local contexts.

It should also be stressed that the examples that are presented in the different categories are just examples, and that there are numerous other tools and methods that can be placed in the different categories. The key message of the paper is the toolbox itself.

The toolbox is one of the main outcomes of the MERUT project and main message of this paper. Some of the tools and methods presented above are also outcomes of the MERUT project, while some are existing tools developed in other contexts. The main contributions in the paper concerning the new or adapted tools are:

- The survey about similarities and differences between quality and relevance
- The interview study with representatives from externa stakeholders
- The checklist when involving external stakeholders in program management
- The adaptation and application of the CDIO Syllabus Survey to the Bachelor's program in biomedicine.

Finally, it should be stressed that the toolbox and the tools within it are just tools. The overarching aim is always to design, manage, and run education programs that enable for the students to obtain the knowledge and skills needed for the professional career. In that work the interaction with external stakeholder is an indispensable component.

FINANCIAL SUPPORT ACKNOWLEDGEMENTS

The work was partially supported by the project Metoder för relevansbedömning av utbildningar (MERUT) funded by the Swedish innovation agency Vinnova.

REFERENCES

Andersson M. S. (2001). The complex relation between the academy and industry; Views from the literature. *The journal of Higher Education*, Vol 72, No 2.

Bankel J., Berggren K. F., Blom K., Crawley E.C., Wiklund I., & Östlund S. (2003*).* The CDIO Syllabus: a comparative study of expected student proficiency. *European Journal of Engineering Education*. Vol 28, No. 3.

Bisagni C., Ghiringhelli G. L, & Ricci S. (2010). Survey for program evaluation of aerospace engineering at Politecnico Di Milano. *6th International CDIO Conference*, Montreal, Canada.

CDIO Initiative. (2022, April 1). Retrieved from http://www.cdio.org/

CDIO Standards. (2022, April 1). Retrieved from http://www.cdio.org/

Crawley E., (2001). The CDIO Syllabus. *A statement of goals for undergraduate engineering education.* Springer. MIT Report.

Crawley E., Malmqvist J., Östlund S., Brodeur D., & Edström K. (2014). *Rethinking Engineering Education*. *The CDIO Approach*. Springer. 2nd edition.

Fagrell P., Fahlgren A., & Gunnarsson S. (2020). Curriculum development and quality work in higher education in Sweden: The external stakeholder perspective, *Journal of Praxis in Higher Education,* Vol 2, Issue 1.

Fagrell P. (2020). *Change and inertia in the development of Swedish engineering education: The industrial stakeholder perspective.* Doctoral dissertation, KTH Royal Institute of Technology.

Fagrell P., Fahlgren A., & Gunnarsson S. (2021). Relevans i högre utbildning. *Forskning i Högre Unbildning, FHU2021,* Örebro, Sweden.

Fahlgren A., Thorsell A., Kågedal K., Lindahl M., & Gunnarsson S. (2018). Adapting the CDIO framework to biomedicine education. *14th International CDIO Conference*, Kanazawa Japan.

Fahlgren A., Larsson M, Lindahl M., Thorsell A., Kågedal K., Lindahl M., & Gunnarsson S. (2019). Design and outcome of a CDIO Syllabus survey for a biomedicine program. *15th International CDIO Conference*, Aarhus, Denmark.

Green, D. (1994). *What is Quality in Higher Education?* (D. Green, Ed.). SRHE & Open University Press.

Gunnarsson S. and Swartz M. (2021). Applying the CDIO framework when developing the ECIU University. *17th International CDIO Conference*, Bangkok, Thailand.

Kindgren A., Nilsson U., & Wiklund I. (2012). Using students' reflections on program goals after master's thesis as a tool for program evaluation. *8th International CDIO Conference*, Brisbane, Australia.

Kohn Rådberg K., Lundqvist U., Malmqvist J., & Hagvall Svensson O. (2020). From CDIO to challenge-based learning experiences – expanding student learning as well as societal impact? *European Journal of Engineering Education,* Vol. 45, No. 1.

K3 (2022, April 1). *K3-projekten*. Retrieved from https://k3-projekten.se

MERUT (2022, April 1). *MERUT-projektet*. Retrieved from https://k3-projekten.se/project/merut

Schindler, L., Puls-Elvidge, S., Welzant, H., & Crawford, L. (2015). Definitions of quality in higher education: A synthesis of the literature. *Higher Learning Research Communications, 5*(3), 3-13.

Svensson T. & Gunnarsson S. (2012). A Design-Build-Test course in electronics based on the CDIO framework for engineering education. *International Journal of Electrical Engineering Education*, Volume 49, Number 4.

Thune, T. (2011). Success Factors in Higher Education–Industry Collaboration: A case study of collaboration in the engineering field. *Tertiary Education and Management*, 17(1), 31-50.

Wiklund I., Lindblad E, & Gunnarsson S. (2005). Using an Alumni Survey as a Tool for Program Evaluation. *1st International CDIO Conference*, Kingston, Canada.

BIOGRAPHICAL INFORMATION

Svante Gunnarsson is Professor in Automatic Control at Linköping University, Sweden. His main research interests are modelling, system identification, and control in robotics. He is also the CDIO coordinator within the Faculty of Engineering and Science at Linköping University. He served as Chair of the Organizing Committee of the 2nd International CDIO Conference 2006.

Anna Fahlgren is Professor in Regenerative Medicine at Linköping University. Her main research interest is mechanical induced bone degradation. She has also been program manager for the new BSc program in Industrial and Experimental Biomedicine.

Per Fagrell is Director Strategic Partnerships and affiliated researcher in the research group HEOS (Higher Education Organization Studies) at KTH Royal Institute of Technology, Sweden. His main research interest is engineering education development and educational collaboration.

Corresponding author

Svante Gunnarsson
Department of Electrical Engineering
Linköping University
58183 Linköping, Sweden
svante.gunnarsson@liu.se