

Business development and entrepreneurship: Combining engineering with the social sciences

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ABSTRACT

Demand in the business sector for highly skilled and multitalented new graduates is ever increasing. Engineers are more and more expected to not only to be familiar with the technical aspects of their work but also with financial, marketing and legal aspects as well as being skilled in leadership and communication. In this paper we describe the bachelors program, *Business development and entrepreneurship in the building sector (the AE programme)*. The program aims at providing the housing- and construction sector with graduates who possess a broad view of the issues and tasks that face the sector. The programme is highly adapted to the needs of the business sector and is planned and carried out in close collaboration with the industry. The program combines studies in engineering with cross disciplinary mix of among others economics and finance, marketing, business development, project management, leadership and the behavioural sciences. The program is also open to students without a traditional educational background in the natural sciences or engineering so as broadening the recruitment base with the purpose of attracting more diverse talent into the area of engineering and business development.

KEYWORDS

Engineering education, social sciences, business development, cross disciplinary education

INTRODUCTION

Traditionally, engineering skills and skills in social sciences have been homed at separately. Engineering being taught at technical universities while social sciences such as economics an management being taught at business schools. While it's not uncommon that engineering graduates also pursue a degree in management or economics, combining engineering and social science skills to such extent that is done in a bachelors program such as the AE-program is to our knowledge relatively novel. There is however a need, both within the academic sphere as well as in the business sector, of combining these skills. For instance, technical solutions, say to environmental problems, will not be successful if individuals/customers do not see or understand the value with implementing them [1] [2]. This stresses the importance of understanding the marketing and behavioural aspects of successful adaptation and implementation of new technology. In research regarding the

abatement of environmental problems there is an increasing emphasis on multi-disciplinary research, with input from engineering, psychology, law, sociology, political science etc. An understanding of the multi faceted nature of today's problems and issues that will confront engineers is therefore vital [3].

Understanding what constitutes effective leadership and project management is yet another skill that is becoming increasingly important. In the management literature there has long been an emphasis on the "soft skills" relating to management. These include for instance leadership skills, motivation, and decision making skills. Leadership for one is an area that is attracting an ever increasing attention within construction management research [4]. It has furthermore been claimed that an understanding of social sciences gives engineers to go beyond the pure technical aspects of a project and thus tap into the decision making processes within projects [5]. Thus, having a combination of strong management and engineering skills provides students with the possibility to take on roles both in engineering as well as in management and act as links between the two areas within industrial organizations.

Being exposed to social sciences studies also gives students a better appreciation and understanding of how engineering fits into a larger societal context [6]. An understanding that is crucial especially with respect to the sustainability issues touched upon above.

Another important issue concerns making engineering education more attractive to prospective students. In Sweden there has over a period of time been a decline in the attractiveness of engineering and science studies. By increasing the amount of social sciences content, students who would have otherwise chose to pursue a business or economics education may be inclined to pursue an engineering exam [7].

In the next sections we will outline the AE-program describing its background and history, the students, the market for the program, and where the students go after graduation.

BACKGROUND

The bachelor programme in building and civil engineering at Chalmers was a very traditional engineering programme with almost 90% engineering and mathematics and with small elements of for instance economy. This was the normal structure for bachelor programmes in engineering at Chalmers and at other Swedish universities.

After graduating, the new engineers started a career that after rather short time gave them a position as managers. In the construction industry, a new engineer starts as an assistant manager and after some time he/she can be responsible for a site with a project worth several millions SEK. Those who went to different consultants started as members in a project group, but often became responsible for the group after a few years. All of them have had good knowledge in engineering and have been well prepared for the technical part of the work. Similar for all of them was that they lacked experience of leadership and related issues. Leadership was often seen as something that was better learned when in the working situation.

Some different things happening at the same time started the thoughts of doing something new. There had for a long time been discussions about giving leadership courses or not, but the meanings differed. The main meaning had been that this was more efficient taught when in the management situation, but at that time the demand was growing. There was also a change in the construction industry. Some of the companies had started with a more total approach, developing projects themselves. They looked for older buildings ore some land, and worked with the possibilities to develop it, to give it a higher value, then build, rent out

and sell to some real estate company that is better at the property management. In this way they could take advantage of the increasing value from the total process.

There were also discussions about the future lack of students with a background from natural science in secondary school. Some smaller universities had already big problems recruiting students, and the number of students with natural science studies was decreasing because of reduced interest for studies in that area. The engineering programmes also had to compete with medicine and other popular programmes.

The decision was to try to do something new, which could be an alternative to the traditional programme, and which could meet the changing demands of construction industry as well as attracting students not traditionally inclined to pursue an engineering education. A mix of students with different backgrounds could give new values to the group, as they join the group with different experiences. But the ambitions were to keep the traditional programme parallel to the new one, and give the students a choice.

THE AE PROGRAMME

The BSC programme Business development and entrepreneurship for the construction industry was created. The new ideas in the construction industry were taken as a starting point. There was a need for persons that could act as “a spider in the net” and be able to discuss with all involved experts. They should be able to manage the project and get it to a successful completion. Without being able to do the detailed structural design themselves, they should get the right language and an understanding and be able to discuss the solutions with the experts.

Comparing to the traditional programme, the amount of mathematics and structural design was reduced. The engineering parts were also concentrated on buildings instead of covering the whole construction area. This gave free space for the softer parts of the programme, but the concentration gave still enough deep in the engineering parts that were studied. This was the important change that made it possible to recruit students without the background from natural science, as mentioned before.

There is a strand of social sciences through the three years. It starts already the first semester with Behavioural science. This is a basic course that gives the ground for the following studies. It is an important background (but uncommon) also for some of the engineering studies, such as building and urban planning and for the decisions when designing an apartment or a city area. It is followed by project management studies in the second year and leadership and management studies in the third year.

Economy is also as a strand from the first semester, with more commercial and financial aspects during the second and third year. They are accompanied by Business law, Construction contracts and Marketing. Then the necessary knowledge for an entrepreneur is formed, and the different parts are integrated in the course Business development in the last year, where the students have to work with a business idea of their own, and an idea for which they already have researched the market in the marketing course.

The fourth semester starts with Project and commercial management, where the students for the first time have to combine the knowledge from almost all earlier studies in a feasibility project. They have to propose a solution of a building demand and decide what to do, how to do it, how to finance it, calculate the risks and present the results. This has to be conducted in rather large groups, so they have to practise what they have learnt about working in groups. One example of a project is to give a solution for a new office building, which could be the new entrance to the university from the east side.

As important as the different courses that form the programme is the way of working. The students work in project groups in many of the courses. There is always at least one project running in every period through the three years. The projects are more and more complex as the students become more experienced. The students found it frustrating in the beginning of the first project, to realise that the necessary information wasn't available within university. They had to find industry contacts to be able to solve the problem. This has then been the normal of working and it shows that they work with questions that are actual and relevant for their future career.

The programme emphasises the communication abilities in both Swedish and English, and to support this there are two courses in language and communication through the three years, with their own credits to make them visible in the certificate. But the different lecturers cooperate, so that the assessment in the engineering course is at the same time an assessment in the parallel communication course. The lecturer in the engineering subject and the lecturer in language and communication often meet the students together, present the projects together and tutor the students together as well as assess them together.

THE STUDENTS

The programme is attractive, and high grades are necessary in order to gain admission. There is a good mix of students with different background and different experiences. Many of them have worked a few years or done other things for one or two years, experiences that are good to relate to in the project work. Discussions with the students have shown that most of them applied for the programme because of the mix of engineering and social sciences and the comprehensive view. It was rather clear that many of them shouldn't have applied for a traditional engineering programme. As a group, they are open-minded, communicative and supportive. The percentage of female student is also rather uncommon for an engineering programme. It has been steadily growing and in 2008 female students were in a majority.

THE MARKET

When the ideas were outlined, some key companies were visited. These were contractors, consultants and real estate companies. The planned program was presented for high ranking executives within the companies. Almost all of them were positive to the plan. One big company was against, but have since come aboard when seeing the qualifications of the graduates, and now they also employ a larger number of AE students.

Only the student representatives were against, when the proposal for a new programme was discussed in the board at the university. The reason for the opposition is not altogether clear. However, one can suspect that students in the traditional civil engineering programs thought the AE programme to be somewhat alien to Chalmers. As a result the students in the programme had problems with their membership in the student union during the first two years.

WORK AFTER GRADUATING

For the first years, the students had problems with finding a job. The main reason for that was that the programme was too unknown. This has changed now, and the graduates are rather attractive. It is interesting that they have become attractive as site managers, this was not anticipated. The skills they get are seen as important for that role. It is obvious that the reduction of engineering skills is well balanced by the social sciences approach. The interest in the management role is increasing during the three years of study, and being a site manager is a complex role. It is like being responsible for a rather big manufacturing company, when you compare to budget, number of employees etc. But you can also find them as project managers in business development roles in real estate companies or

construction companies. Another interesting observation is that the smaller or medium sized companies were faster in adopting the new type of engineers. This is probably a result of the smaller companies need for people with an overall knowledge, and the helicopter view, while the bigger companies work with more specialised staff.

CONCLUSIONS

In this paper we have outlined the rationale behind and the content of the AE-programme. The concept being combining behavioural science, economics, marketing, management and as such providing the students with a solid as well as diverse education thus enabling them to face a changing and developing construction industry. By seeking input from the construction and housing sector from the outset of the programme, as well as maintaining a close cooperation with the sector the programme manages to keep up with changing demands. The programme, with its strong emphasis on the social sciences, also attract substantial numbers of engineering students from other programs who wishes to enrol its social science courses,

The value of an education based on a truly cross-disciplinary basis is extensive. Not only does it provide students with a diverse array of knowledge giving them the tools to work in cross disciplinary business environments, but also provides them with an understanding of the multi-facetted nature of the issues facing today's society, one being the challenge of creating sustainable environments. This being an area in where the construction industry will meet major challenges in the near future.

Finally, we also strongly believe in the value of an early exposure of the social sciences within engineering educations in that it enables them to better integrate this knowledge. As noted above, the students in the AE-programme enrol in a behavioural science class in their first semester of study. Doing so, we believe the programme provides the students with a better possibility to integrating knowledge from the social sciences with traditional engineering subjects as well foster a proficiency in communication skills.

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