

AC 2008-1198: SEVERAL WAYS OF PREPARING EXPORT ENGINEERING STUDENTS FOR INTERNATIONAL PRACTICE

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Several Ways of Preparing Export Engineering Students for International Practice

Abstract

Export engineers work in many different kinds of Danish and foreign companies where they market projects and products with substantial contents of engineering knowledge – in a highly international environment.

Besides giving an overview of the study program, including objectives and structure, this paper describes the different ways to prepare the students for international practice. Successes, problems and challenges will briefly be outlined as well.

Export Engineering

For more than two decades Copenhagen University College of Engineering (CUCE – in Danish: Ingeniørhøjskolen i København, IHK – <http://www.ihk.dk>) has offered a four-and-a-half years export engineering study program leading to a bachelor of engineering degree.

The program includes a six months work placement.

It is a unique study program, combining engineering subjects, mathematics, science, business economics, international marketing, and foreign languages.

Besides 12 years of primary and secondary education, students must meet requirements of high levels in English (first foreign language) and German, French, or Spanish (second foreign language) before enrollment.

Export engineering is sometimes also named global business engineering.

Bridgwood et al.¹ give a detailed description of Danish engineering education, while Woolston and Dickey² present the Danish educational system in general. Krogh³ explains the different aspects of internationalisation of CUCE.

Objectives of the study program

Quotation from the curriculum:

“The purpose of the program for a degree in export engineering is to qualify students to carry out national and international business functions in which they will:

1. Convert and combine technical and commercial research and scientific, technical, and commercial knowledge into practical applications in development projects by resolving technical and/or commercial problems
2. Critically adopt new knowledge in relevant areas of engineering, commerce, and language/culture, and understand and include intercultural issues
3. Independently carry out export engineering assignments that arise from integrating technical disciplines with finance and international marketing
4. Plan, realise, and manage projects, technical and technological plants and be able to include social, financial, environmental, and health and safety consequences in the resolution of technical problems

5. Enter into co-operation and management functions and contexts at a qualified level with people who have a different educational, language, and cultural background
6. Give advice, promote, negotiate, and communicate in technical and commercial areas of work in Danish, English, and at least one other foreign language and consider differences in culture and background.

In addition, the program shall qualify the students to continue to the graduate level or to another program of continuing education. [sic]”

Structure of the study program

Figure 1 gives a brief overview of the structure of the study program.

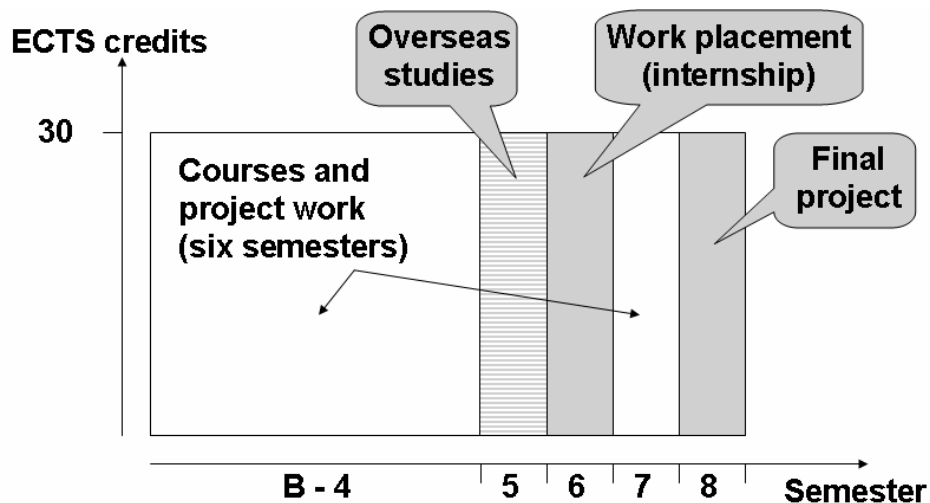


Figure 1: Structure of the export engineering study program. According to the European Credit Transfer and accumulation System⁴, the workload of one academic year is 60 ECTS credits for the student.

The program is based on a structure in which the academic year is divided into two semesters of 30 ECTS credits each. 5 ECTS credits is equivalent to a workload of 140 hours for an average student, typically with 50-60 hours in class. Classroom teaching alternates with interdisciplinary project work.

Semester B (foundation courses) meets the requirements in mathematics, physics, chemistry for entrance to the classic engineering programs. Some students may – more or less – skip this semester.

	<i>Title</i>	<i>ECTS credits</i>
<i>Courses:</i>	Mathematics	22.5
	Basic science	7.5

Semesters 1 & 2 give the basic qualifications in mathematics, physics, chemistry, economics and marketing. Spoken and written English and a second foreign language are included as well.

	<i>Title</i>	<i>ECTS credits</i>
<i>Courses:</i>	Managerial economics	5
	Marketing economics	5
	English 1	5
	English 2	2.5
	Society & culture 1 (German, French, or Spanish)	7.5
	Mathematics & science 1	5
	Mathematics & science 2	15
<i>Interdisciplinary project with course activity:</i>	Project 1 (Sustainable products)	15

Semester 3 & 4 specialize in international marketing on the business-to-business market, product development, and IT-systems.

	<i>Title</i>	<i>ECTS credits</i>
<i>Courses:</i>	Materials science, strength of materials, mechanical engineering	7.5
	Programming	7.5
	English 3	2.5
	English 4	5
	Society & culture 2 (German, French, or Spanish)	5
	Marketing (German, French, or Spanish)	2.5
<i>Interdisciplinary projects with course activity:</i>	Project 3 (Integrated product development)	15
	Project 4 (International marketing of it-network based systems)	15

All elective courses are located in semester 5.

The list below is limited to courses offered by the export engineering department at CUCE.

These courses are all taught in English.

Two 30 ECTS credits course packages are specifically designed for incoming exchange students and export engineering students who are not going abroad (see below).

	<i>Title</i>	<i>ECTS credits</i>
<i>Courses:</i>	Innovation and entrepreneurship	7.5
	From local to global business	7.5
	Multimedia	7.5
	Life cycle assessment (e-learning)	5
	Manufacturing technologies (e-learning)	5
	Study group	2.5-7.5
	Multidisciplinary project	2.5-15
<i>Course packages:</i>	European Project Semester	30
	Innovation & Entrepreneurship Semester	30

The student might, however, pick courses from other institutions as well. This gives the student the obvious possibility of studying abroad for a semester.

Semester 6 is work placement in a company – in Denmark or abroad (30 ECTS credits).

Semester 7 is about business concept innovation and change management, and linking the student's practical experiences and previous semesters.

	<i>Title</i>	<i>ECTS credits</i>
<i>Courses:</i>	Marketing across cultures	7.5
	English 7	2.5
	Export technology (German, French, or Spanish)	5
<i>Interdisciplinary project with course activity:</i>	Project 7 (Change management and business concept innovation)	15

Semester 8 is for the final project (30 ECTS credits).

After graduation

Export engineers typically work as export managers, sales and marketing managers, international key account managers, or project managers in product development. A large number of export engineers are employed in information technology and telecommunication companies.

Companies in the areas of food processing, health care, and wind industry, as well as producers of for example electronics and pharmaceuticals also employ export engineers.

Furthermore export engineers are well qualified for enrollment in master programs in Denmark or abroad. Some examples are: Master of Science in International Technology Management at Aalborg University, Denmark, Master of Science in Business, Language and Culture at Copenhagen Business School, Denmark, Mastère Ingénieur d'Affaires Européen at École Nationale Supérieure des Télécommunications de Bretagne, Rennes, France (see below).

According to a survey⁵ (among export engineers graduated 1990-2005), 26 % of all graduated export engineers from CUCE have chosen to continue their education in some way.

Approximately 1,200 export engineers have graduated from CUCE.

A study program which is also attractive to female students

Figure 2 shows the number of students who have been enrolled in the study program the last four calendar years.

As indicated by the numbers, the study programs attract female and male students at a ratio close to 1:1.

Year	2004	2005	2006	2007
Total	68	76	61	83
- Female	32 (47 %)	40 (53 %)	21 (34 %)	41 (49 %)
- Male	36 (53 %)	36 (47 %)	40 (66 %)	42 (51 %)

Figure 2: Enrollment of students to the full study program.

Well prepared for international practice

To secure that the student gain vital international experience, several paths have been set up which give the student the following options:

Research international markets

Based on the student's choice of foreign languages, research is often done on foreign markets. This is for example done by collecting primary data (field research) or secondary data (desk research) in connection with the 4th semester's 15 ECTS credits course "International marketing of it-network based systems", which also includes an interdisciplinary study project. The overall objectives are to give the student a basic understanding of the challenges, changes in methods, etc., the company faces when planning to enter the export market. The course focuses on methods to assess opportunities on the international market and select a strategy of internationalisation that make the student able to select appropriate choices concerning market, distribution, management, competitiveness, use of relationship marketing, and possible protection policies.

A student who has fully met these objectives has learned to

- Identify and analyze a need on a foreign market
- Set up and argue for a possible technical solution and a marketing plan and also make a financial budget based on the proposal(s)
- Bring the results in perspective according to alternative solutions
- Structure and write an interdisciplinary report in English
- Present methods and results orally
- Formulate relevant problem statements on a professional level
- Choose and use appropriate methods
- Assess and conclude on the collected data and results
- Collect relevant information for use in the project

Furthermore, the student has learned to

- Plan and complete a project together with other students
- Communicate and cooperate in an interdisciplinary context.

Connected with the above is a 2.5 ECTS credit course in "Marketing - German, French or Spanish" which focuses on marketing on markets in which the language is spoken. Not only will the student improve his or her skills in the respective language, but (s)he will also receive valuable knowledge about this society and business culture and how to do business on this market.

A semester studying abroad – possibly in combination with e-learning

One semester (the fifth) is solely for elective courses. This gives the student an excellent opportunity to spend a semester at a university outside Denmark. The semester studying abroad might, however, be combined with a few web-based courses offered at CUCE.

CUCE has about 100 exchange agreements with universities all over the world where the export engineering students can study.

Almost every second student goes abroad. Students benefit tremendously from a semester abroad, both from a personal and a professional point of view. It also brings perspective and motivation to the student which seems valuable in further studies.

Furthermore, CUCE can benchmark the contents and level of the export engineering study program in study programs at universities in other countries.

The keyword for making this option possible is “flexibility”. There are very few restrictions for selecting elective courses. They must, however, be at an appropriate academic level and altogether relevant in an export engineering context.

An internship in a company abroad

It is mandatory to spend a semester in a company in Denmark or abroad.

Ideally, the company must have an environment relevant to the export engineering curriculum. This could be a manufacturing company, including goods as well as services. A company with its own independent product development is desirable, although not a requirement.

The company can be located in or outside of Denmark (for example a subsidiary of a Danish company).

The internship can take place in a single department or - following a plan - more than one department. If a department in a company has a relatively narrow working scope, it can be beneficial to work in several departments.

The work assignments must, on the whole, be typical engineering tasks. The intern can work on specific projects or on developing tasks. The intern can work independently or as an assistant to one or more employees.

The relevant departments could be sales, product development, production planning, marketing, and the like.

Experience shows that interns, companies, and work assignments vary enormously. It is not, therefore, possible to provide an all-inclusive profile of an intern’s work assignments.

Write a final project in a company abroad

The final project (30 ECTS credits) in the export engineering study program

- is an individual project
- must be carried out in cooperation with a company (in Denmark or abroad)
- contains both technical and business-related problem formulations
- must be written in English

The final project demonstrates the interdisciplinary nature of the program and reflects the three main disciplines of the program, which are engineering, economics, marketing (business studies) and foreign languages. The final project will often only treat one of the technical areas. The project must solve one or more essential problems for the company in question, with all parts of the project contributing to the solution of these problem(s).

Evaluation of the final project takes place within the following three areas: business studies, engineering, and foreign languages.

Attend double degree programs with institutions abroad

A number of double degree programs have been set up with partner institutions in Germany, France, and Spain which make it possible for the student to receive a degree from both CUCE and the partner without extending the duration of study (unless the student wants a masters degree).

Example 1

A double degree possibility has been set up together with University of Applied Sciences Constance (UAS Constance, see <http://www.fh-konstanz.de/>), Germany. According to this an export engineering student who wants to get the double degree has to study two semesters at the UAS Constance (i.e. fifth and seventh semester) and write the final project with supervisors from both institutions. Students from Constance have the same opportunities at CUCE as well.

Example 2

A student who wants to get a European Business Engineer degree may apply for the Mastère d'Ingénieur d'Affaires Européen at Ecole Nationale Supérieure des Télécommunications de Bretagne in Rennes, France (see <http://international.telecom-bretagne.eu/welcome/studies/masteres/>).

The student must study French and have passed the seventh semester before continuing in Rennes. By extending the length of study with six months the student will receive both degrees.

Example 3

Selected export engineering students who have validated six semesters at CUCE can switch to the business school for technology ESIEE-Management in Paris, France, to follow the complete program for a Master of Science in Management of Technology Information Systems (M.Sc. MOTIS, see <http://www.istm.fr/english/istm/welcome.php>).

This means three semesters of academic work followed by a six month internship in a French or foreign enterprise.

At the end of this period, they would receive both their CUCE degree and the M.Sc. MOTIS.

Setting up double degrees is hard work. The benefits for the students are, however, many and considerable. A major challenge is to keep track of all the different updates of the curricula.

Attend elective courses and course-packages in an international environment at CUCE

For export engineering students who do not want to - or do not have the possibility of going abroad – and also to balance the number of out-going students on an exchange basis, CUCE has set up a number of elective courses and course packages taught entirely in English.

Most successful is the European Project Semester⁶ (EPS). A 30 ECTS credits package where students work in international teams on joint projects. Every semester CUCE attracts 50-60 students from EU-countries, USA, etc. to the EPS-program, which in general creates a very international atmosphere at CUCE.

Since 2007 CUCE has also offered an Innovation and Entrepreneurship Semester (IES, 30 ECTS credits).

Conclusion

Export engineering is, of course, about export. Not all graduates are, however, directly involved in exporting goods and services to other countries. Export engineers, in fact, work in a very broad spectrum of companies and in many different areas.

Nevertheless, the graduates are expected to be well prepared for international practice.

According to the earlier mentioned survey, it is confirmed that graduates are qualified to carry out national and international business functions according to the objectives for the study program.

It is therefore strongly believed that the many and different ways set up to secure that students gain international experience are working well.

It is also believed that because the students are used to working/studying at different places they achieve qualifications and a flexibility which is invaluable in their future careers.

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