

EXPORT ENGINEERING

Knud Holm Hansen
Associate Professor, Export Engineering Department

Ingeniørhøjskolen Københavns Teknikum
Engineering College of Copenhagen (University of Applied Sciences)
Lautrupvang 15, DK-2750 Ballerup, Denmark
Phone: + 45 44 97 80 88, Fax: + 45 44 66 48 62, Email: khh@cph.ih.dk

ABSTRACT

The four-and-a-half-year export engineering program at Ingeniørhøjskolen Københavns Teknikum integrates science and engineering, communication and foreign languages with economics and marketing.

The graduates are well-prepared for the present and future labour market: They are engineers with project-oriented interdisciplinary skills and with a highly international focus. At present more than 500 students are enrolled in the program and every second student is female.

BACKGROUND

The program was established in 1985 as a pilot program following a request from the Danish Ministry of Education. For two reasons the program should be targeted particularly towards students of the foreign languages program from Danish upper secondary schools (in Danish *gymnasium*):

1. To give an opportunity and to stimulate these students, especially the female students, to enroll in an engineering program
2. To cover the need in the export sector of Danish industry for employees with a high degree of communication and foreign language skills.

Furthermore the technical focus should be on electronics and mechanical engineering subjects, which were – and still are – the areas in which the Danish export was expanding.

The pilot program was developed in cooperation between IKT and the Copenhagen Business School.

As part of a general reform of Danish engineering education in 1993/94, the export engineering program was reduced from five years to four-and-a-half years. The number of hands-on workshop classes was strongly reduced.

The program was thoroughly evaluated in 1994/95 by a Steering Committee appointed by the Danish Centre for Quality Assurance and Evaluation of Higher Education after a request from the Advisory Board of Technology.

After a ten-year experimental period the program was made permanent in 1995 after the recommendation from the Steering Committee¹.

It is now a fully recognized engineering program.

OBJECTIVES

According to The Danish Ministry of Education's Order No. 681 of July 15, 1996 about engineering programs in Denmark the objectives are as follows:

The export engineering program is an integrated interdisciplinary engineering program with an international project- and product-oriented focus. The study program integrates scientific and technical subjects with foreign languages, economics, and international marketing.

Export engineers must be able to undertake the following job functions:

1. To market technical projects and products in foreign language and cultural settings and to act as consultants.
2. To apply and integrate research results in science, technology, and business and marketing for use in project and product development.
3. To enter into cooperation with people of various educational, linguistic, and cultural backgrounds, in a supervisory capacity and/or as part of a team in connection with interdisciplinary projects.
4. To communicate clearly and to negotiate in both technical and business areas in Danish, English, and at least one other foreign language.
5. To plan, carry out, and enhance technical projects (development, production, etc.) as well as account for the effects which the solution of technical problems may have on the community. These include socio-economic and cultural effects, and the effect of both the external environment and that of the workplace.

UNTRADITIONAL PROGRAM

The export engineering program, in Danish *eksportingeniøruddannelsen*, is an exception from the general structure of Danish engineering programs primarily due to the length of the program and the admission requirements. The program requires the university-entrance examination from upper secondary school, commercial school, higher preparatory school or the like with English at highest level (A) and German, French or Spanish at intermediate level (B). Students of mathematics and other students who can document good language skills similar to the previously mentioned levels are also admitted.

References 2-4 give a detailed description of the Danish educational system.

Figure 1 shows the content of the program.

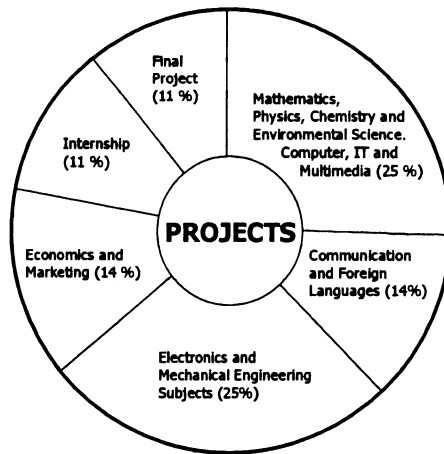


Figure 1. The content of the export engineering program.

Communication and foreign languages: Business negotiations and communication in English. German, French, or Spanish.

Electronics and mechanical engineering subjects: Mathematics and statistics, science of materials, stress and strength, mechanical elements, production, product development, quality control and management, process control, feedback systems, CAD / CAM / CIM, electronics (analog and digital), computer system engineering, data communications and computer networks, workshop courses.

Economics and marketing: National and international economics, business economics, marketing economics, logistics, international marketing, market analysis, financing and risk assessment, and international business law.

Throughout the program the student is presented with comprehensive interdisciplinary project work which make use of realistic problem statements. This gives a fundamental understanding of the fact that engineering today requires knowledge of foreign languages, communication, teamwork as well as economics and marketing plus a very thorough technical/scientific knowledge.

Interdisciplinary projects – examples

- Environmental and work-environment projects
- Integrated product development
- Electronics, microprocessor technology, and programming
- International marketing of business-to-business products
- Information technology management

Final project

A final project is carried out in cooperation with a company. The subject is based on a concrete problem statement and contains both technical and economic/business-related aspects. Typical assignments could be the technical analysis of a new product and the evaluation of its sales potential in a specific market, or an evaluation of the sales potential for an existing product in new markets. Technical development of one or more of the company's products is another possibility.

Academic Title

Export engineers are entitled to the title of B.Sc. (Bachelor of Science in Export Engineering) according to the Danish Ministry of Education's Order No. 681. Due to the fact that it is a broad-based first degree program the M.Eng. (Master of Engineering) title seems more appropriate. This title is, however, not commonly used in Denmark.

The export engineering program is approved as $4U+\frac{1}{2}T$ by the FEANI (Fédération Européenne d'Associations Nationales d'Ingénieurs - European Federation of National Engineering Associations). U represents a year of engineering education, T represents a year of training, i.e. internship. More traditional Danish engineering programs leading to a B.Sc. degree are registered as $3U+\frac{1}{2}T$.

An engineer may apply for the designation of "European Engineer", EUR ING, after a minimum of seven years, comprising $3U+2(U \text{ and/or } T \text{ and/or } E)+2E$, where E represents a year of relevant engineering experience. U, T, and E must be assessed and approved by a body accepted by FEANI.

THE PROGRAM STRUCTURE

The program is structured in accordance with the guidelines of the European Credit Transfer System, ECTS. The ECTS builds bridges between European institutions and widens the choices available to students. The ECTS system makes it easier to transfer the results of courses taken in another country.

The program is based on a structure in which the academic year is divided into two semesters of 30 ECTS credits each. A standard course of 5 ECTS credits is equivalent to a workload of 160 hours for an average student, typically with 60 hours in class. The length of a semester is approximately 19 academic weeks: 15 weeks with courses and project work and 4 weeks with an examination.

Classroom teaching alternates with interdisciplinary project work.

INTERNATIONALIZATION

Overseas studies

In the fifth semester it is possible to study abroad for six months. Every second student makes use of this opportunity. Students study at Colleges of Engineering in Austria, Chile, Finland, France, Spain, the UK, the USA, etc.

Internship

The integrated internship provides the student with insight into practical engineering problems and gives an impression of what export engineers are involved in. The intern takes part in the daily working routine of a Danish or foreign company. The intern may participate in solving ad-hoc assignments or work on project-oriented assignments. Typical assignments are market and competitor analysis, sales, product development, or technical documentation.

Every second intern does the internship abroad.

WOMEN IN EXPORT ENGINEERING

The number of students enrolled increased from 60 in 1985 to approximately 500 in the beginning of the 1990's. Five hundred and fifty students are enrolled in the program in 1998.

The program seems attractive to both men and women. Although slightly decreasing, nearly 50 per cent of the students enrolled in the program are women (Table 1).

| Table 1 | 1985 | 1990 | 1996 | 1998 |
|-------------------|-----------|------------|------------|------------|
| Students enrolled | 60 | 368 | 528 | 550 |
| - female students | 43 (72 %) | 264 (72 %) | 281 (53 %) | 274 (50 %) |
| - male students | 17 (28 %) | 104 (28 %) | 247 (47 %) | 276 (50 %) |

The high number of female students in the period 1985-90 was a consequence of the secondary educational system in Denmark, which is (very simplified) divided into two tracks: A foreign language track and a mathematics track. The foreign language track has always attracted more female students than male students. The opposite is the case for the mathematics track.

A reform of the secondary educational system in 1988-91 gave the students of the mathematics track possibilities for taking foreign languages at high levels. Since the beginning of the 1990's there has been an equal representation of male and female students in the export engineering program.

Surveys seems to indicate that both genders are attracted to the program for the following reasons:

1. It is a more general than specialised program,
2. A variety of fields are combined in the program
3. It is an international program. The possibilities for study abroad, etc. are attractive.

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EMPLOYMENT

The success of the program is confirmed by the 450 Export Engineers who graduated in the 1990-97 period. They have gained valuable experience in the business world over the years. The growing internationalization of the labour market and the increasing need for employees with an interdisciplinary appreciation of the solutions to assignments have led to a great number of export engineers being employed by the private sector.

Export engineers are qualified to play an independent role in those assignments related to the export of products and services with a considerable technological content. They also act as technological consultants. Furthermore, export engineers initiate and carry out integrated product development based on market analysis. The wide-ranging program means that graduates are able to carry out a number of different jobs. Therefore, all kinds of companies have an interest in export engineers. The export engineer is the bridge-builder between the different departments of the company.

The official unemployment rate is less than 7 per cent (March 1998) - slightly higher than for traditional engineers. Among the 450 graduates 332 (74 %) are women. Typically for the Danish labour market the unemployment rate is higher for women than men. Due to the labour market rules in Denmark a graduate may obtain financial support from the day after passing the last examination and will, in that case, be officially registered as unemployed.

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