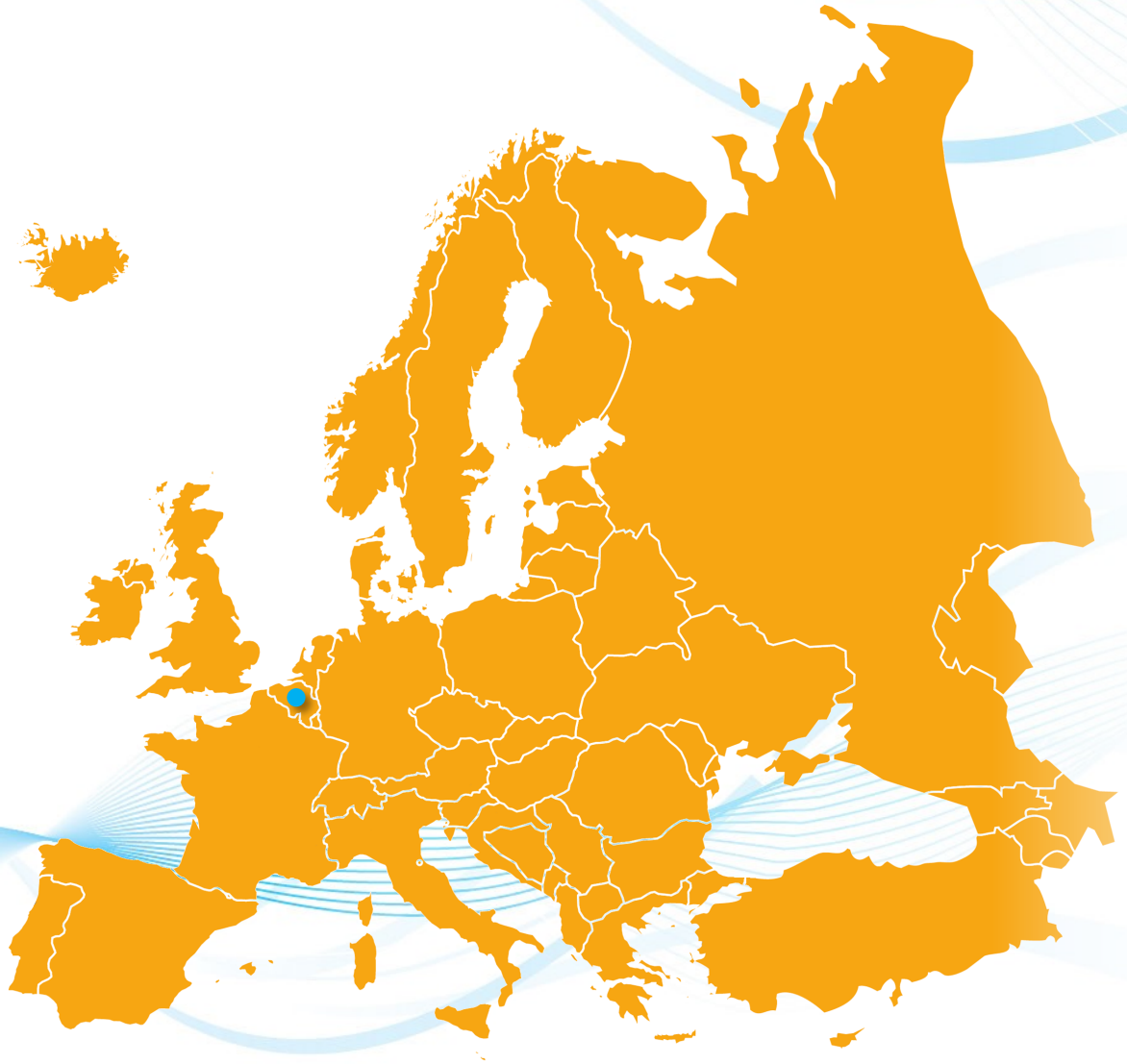
SOCIÉTÉ EUROPÉENNE POUR LA FORMATION DES INGÉNIEURS
EUROPEAN SOCIETY FOR ENGINEERING EDUCATION
EUROPÄISCHE GESELLSCHAFT FÜR INGENIEURAUSBILDUNG

Developing Graduate Engineering Skills



SEFI Position Paper

September 2015

SEFI Position Paper
on Developing Graduate Engineering Skills

Introduction

The past few years have witnessed a vibrant discussion about the skills that engineering graduates should possess to face their future roles as engineers of the 21st century. This discussion takes place all across Europe, and it varies from country to country depending on tradition, education system, make up of industry, etc. It is a complex dialogue between and among engineering education stakeholders, including legislators and governments, accreditation bodies, industry, universities, academics, and students. This SEFI Position Paper is a continuation of the dialogue that SEFI has consistently supported on engineering education.

> *"No profession unleashes the spirit of innovation like engineering. From research to real-world applications, engineers constantly discover how to improve our lives by creating bold new solutions that connect science to life in unexpected, forward-thinking ways. Few professions turn so many ideas into so many realities. Few have such a direct and positive effect on people's everyday lives. We are counting on engineers and their imaginations to help us meet the needs of the 21st century."*
>
> *National Academy of Engineering (USA)*

Engineering is not just about applying technical principles. The complexity of problems often demands a societal and systems perspective also. The argument can be made that engineers and engineering are responsible for over-promising the benefits of technology and under-delivering on a better society, and consequently that to focus only on the development and application of new technologies is insufficient to help mankind successfully address the challenges that humanity and the world faces today.

Engineering graduates will have to professionally cope with social changes, with new technologies as well as with the increasing complexity of problems, all within a global and commercial context. Hence, there is a growing need for better descriptions of additional skills which are located in the intersection of technical, methodological, personal and social competence areas.

SEFI believes that this Position Paper can link the stakeholders involved in the education of engineers in order to create both an opportunity and a space for debate and joint contributions to examine what should be the learning outcomes from an engineering education, and how they are best achieved. SEFI believes that working together with all stakeholders, and across borders, presents the best conditions to examine European engineering education and hence prepare engineering graduates for their future roles.

> *"Engineering is vital to successful, sustainable civilisation. So much rests on the shoulders of future generations of engineers that we must give them the best possible foundation to their professional lives. This means ensuring that engineering graduates can apply theoretical knowledge to industrial problems as well as exhibit theoretical understanding, creativity and innovation, team-working, technical breadth and business skills."*
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> *Royal Academy of Engineering (UK)*

This is in line with the recent 2015 European Higher Education Area ministerial statement "[w]e will therefore build on what we have in common while also enabling individual education systems to draw on their particular strengths and traditions. Diversity and the various aspects of the policy dialogue imply involvement of all levels: regional, national and institutional" (Fourth Bologna Policy Forum, Yerevan, May 2015).

SEFI would like to offer its thanks to all those who actively contributed in the creation of this Position Paper which could not exist without their assistance.

Our Position

Engineers are transforming the world. This is a profound realization and engineers, and those who educate them, should deliberate seriously on their role in this transformation. Therefore, the education of the engineer must embrace more than technical skills, but also for example reflective thinking skills that enable engineering graduates to understand their role in transforming the world. Recognising that there are regional variations in definitions, needs and priorities for engineering graduates, there are a number of key common issues within the formation and education of the engineer that SEFI supports. These are:

- Higher engineering education institutions should embrace diversity both in the students they attract, the academic staff they employ, and the inclusive programmes they deliver.
- The pace of change in the world today is greater than it has ever been, and the engineering graduate should have the skills to function and thrive in such a changing world. Consequently, engineering curricula should seek to develop innovation, entrepreneurial and social skills within the engineering graduate that gives the graduate the comfort and ability to adapt as their working world continually changes on an international scale.
- The education of the engineer should not stop after completion of the first or second cycle. Within their first cycle degree, the engineering student must learn how to learn, and that learning is for life.
- As mankind continues to try to balance technological development and growth with the consequential environmental challenges these generate, the role of the engineer in helping to address this balance is central to all of our futures. Therefore, engineering education must broaden the engineer in addition to providing deeper specialised subjects (the "T-shaped Engineer"). Critical thinking and self-reflection are necessary attributes that every engineer should possess. Engineering graduates should develop a deep understanding of ethics and sustainable development.
- Engineering graduate mobility and engineering programme comparability are important elements of the quality of engineering education, albeit they are not the only indicators of programme quality. Mobility and comparability are facilitated through international accords (e.g., the Washington Accord) and accreditation. Where national subject accreditation bodies currently do not exist, the EUR-ACE framework has had a positive impact on the development of accreditation.
- Greater attention must be paid to academic staff development and support. Just as the practice of engineering is changing rapidly, the challenge of educating the engineering students of the 21st century continues to evolve. Consequently, due consideration must be given to how our academic staff are equally evolving and supported as educators in this process.

SEFI believes that the above position on *Developing Graduate Engineering Skills* is aligned with the roles that engineering graduates must play, and is achievable with the support of stakeholders in the engineering education process. SEFI now wishes to initiate a European wide discussion about engineering skills and how the various stakeholders can contribute to their development.

A continuing discussion

SEFI invites comments and feedback on this Position Paper and a longer discussion paper which will be available at **www.sefi.be** from October. Input will be reviewed by the SEFI Working Group on Engineering Skills, chaired by Professor Kamel Hawwash. Members of SEFI interested in joining the working group are invited to contact **info@sefi.be**.

SEFI is the largest network of higher engineering education institutions (HEIs) and engineering stakeholders in Europe. As an international NGO created in 1973. SEFI contributes to the development and improvement of HEE in Europe, reinforces the position of the engineering professionals in society, promotes information about HEE and improves communication between teachers, researchers and students, reinforces the university-business cooperation and encourages the European dimension in higher engineering education. SEFI is an international Forum composed of HEIs, academic staff and teachers, students, related associations and companies in 48 countries.

Our activities: Annual Conferences, Ad hoc seminars/workshops organised by our working groups, councils and *ad hoc* committees, organisation of the European Engineering Deans Conventions, Scientific publications (including the European Journal of Engineering Education), European cooperation projects, position papers, cooperation with other major European associations and international bodies such as the European Commission, the UNESCO, the Council of Europe or the OECD. SEFI also participated in the creation of several organisations such as ENAEE, IFEES, EuroPace, IACEE, IIDEA, and of the European Engineering Deans Council that was integrated within SEFI in 2015.

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