

EUGENE: AN LLP ACADEMIC NETWORK FOR ENGINEERING EDUCATION

A. AVDELAS

Department of Civil Engineering, Faculty of Engineering
Aristotle University of Thessaloniki, GR-541 24 Thessaloniki, Greece
e-mail: avdelas@civil.auth.gr

EXTENDED ABSTRACT

Engineering and Engineering Education (EE) play an important role in the development of Europe. The opening of European EE to the world is a challenge for engineering academic institutions all over Europe. Yet, there are a lot of issues to be addressed. Among them are competitiveness, innovation and attractiveness of engineering education and especially of PhD training. These issues are closely linked with the emerging field of engineering education research and with the mobility, both within Europe and in a global scale of engineering students, graduates and professionals but also with lifelong learning and continuing engineering education. All the above issues demand close cooperation between European engineering academic institutions involving also industrial stakeholders. The Lifelong Learning Programme (LLP) Academic Network in the field of Engineering Education "EUGENE-EUropean and Global ENgineering Education" (October 2009 to September 2012) is an attempt to study all the above subjects. This is done through the five Activity Lines and the three Transversal Activities of the project: **Line A**-Structure and Bologna follow-up in the competitiveness issues of PhD studies, **Line B**-Promoting EE in Europe as a true research field, **Line C**-Improving transnational mobility of engineering students, graduates and professionals, **Line D**-Life Long Learning & continuing education as a tool to improve competitiveness and innovation of European engineers, **Line E**-Increase attractiveness of studies in science and engineering and to the European Higher Education Area, **TA 1**-Direct involvement of industrial stakeholders, **TA 2**-Promote the establishment of the standing European Engineering Deans Council, **TA 3**-Identify and put in practice sustainability tools beyond the 3 years of life of the project.

The 78 partners of EUGENE come from 32 countries. In addition, there are 6 associate partners from 4 other countries. Partners are not only higher education institutions but also engineering societies and associations like IFEES, SEFI, CESAER, EUCEET and APE, quality assurance institutions like ASIIN, ENAEE and CTI and companies like Dassault Systèmes and Hewlett-Packard.

KEYWORDS

LLP ERASMUS Academic Network, Engineering Education, European Higher Education Area, EUGENE

1. INTRODUCTION

In the last decade Engineering Education (EE) in Europe has been changing. Economic globalization, the Bologna Process, and many other factors have created an environment of continuous evolution. The introduction of the three-cycle structure has made engineering study programmes more accessible and more understandable, also to non-European students. Furthermore, the introduction of English in many Second Cycle and PhD programmes have helped European universities to attract more international students, teachers and researchers and to prepare their own graduates for a truly global environment.

Socio-economic growth and competitiveness are "technology driven" and EE plays a central role in supporting key factors such as innovation and entrepreneurship. This is particularly true for Europe because of its historic heritage and its worldwide role. On the other hand, after many years of cooperation within Europe, it is time for European EE to discuss and analyze its position in a global context. The opening of the European educational borders to the world makes mandatory the analysis of the strengths and weaknesses of European Higher Education (HE), especially if one takes into account the impressive figures of emerging HE areas in the world. This is more true for EE. The Lifelong Learning Program (LLP) Academic Network EUGENE-EUropean and Global ENgineering Education, being a large network representing all European countries, constitutes a truly pan-European project that will contribute to many key European policies related to EE at the highest level.

After its lifetime as a European supported project, EUGENE is expected to take the form of a permanent observatory flanking SEFI, possibly at the occasion of regular meetings, and work on, at least some of, its main activities. Thus, EUGENE is expected to offer a permanent service to the EE community in Europe.

2. THE COMPOSITION OF EUGENE

EUGENE started running in October 2009, the third in a series of successful Academic Networks related to EE: Enhancing European Engineering Education-E4, Teaching and Research in Engineering in Europe-TREE and TREEdiss [1]. Its overall aim was stated as: Setting up a top level discussion and action forum to follow the continuous evolution of Engineering Education (EE) in Europe and enhance its competitive profile worldwide.

Because of the many and complex tasks of EUGENE, 5 Activity Lines and 3 Transversal Activities have been created. Each Activity Line and Transversal Activity is coordinated by one or two active academic or non-academic members [2]:

Activity Line A-PhD STUDIES: Structure and Bologna follow-up in the competitiveness issues (main question: are PhD studies in Engineering and Technology in Europe effective/innovative/competitive enough?)

In recent years in many universities in Europe doctoral schools have been established and doctoral programs are offered. In the past PhD consisted exclusively of individual research, under the supervision of a promoter/ advisor. Now, (advanced) courses are offered to doctoral students, trainings are organized; doctoral students participate in projects with industry etc. The proportion of these activities with respect to the individual research effort varies. Most of us are convinced that individual research should remain the backbone and the main constituent of PhD work. In many places we have already some experience with the doctoral programs and activities of doctoral schools. It would be most interesting to find out how effective these new activities are: are the PhD theses better? Are the PhDs better engineers? Are they better innovators or entrepreneurs? The

purpose of this Activity Line will be to collect information on the experience with different doctoral programmes and formulate recommendations for the future. Activity Line A will build on previous work by Academic Networks TREE [3] and European University Civil Engineering Education and Training (EUCEET) [4]. Expected outcomes:

- Guidelines for the introduction of a common set of excellence standards and principles in Engineering PhD programs.

In this context, a number of interviews have been set up and questionnaires sent to staff responsible for doctoral schools, doctoral students in the end phase of the PhD-who went through a doctoral program, employed in industry doctorate holders-who went through a doctoral program and employers of doctors (with and without PhD training). Among the preliminary conclusions the following can be listed [5]: The doctoral program should support and facilitate the PhD work and not be an extra burden. Because of big differences in the background (2nd cycle) of PhD candidates, in their character and talent, in the subjects, in research groups, in advisers, in aspiration for the future career etc, PhD programmes should be individualised: the different components should be offered, but the candidate himself should be free to make his own choice (with the help of his adviser) according to his own preferences, needs and aspirations (career perspectives). Further, a list of indicators aiming at Quality Measurement has been prepared in the form of a questionnaire and distributed to the members of Line A in order to be tested anonymously. The similarity of the answers showed the validity and strength of the relevant indicators [5]. The questionnaire can be accessed through the EUGENE web site, in the Documents area reserved for Line A [2].

Activity Line B-Promote EE in Europe as a true research field, with comparison to worldwide developments in Engineering Education Research (EER): a true and innovative research area to improve entrepreneurship, innovation and competitiveness

The second Activity Line is targeted to promote the recognition in Europe, as it already happens in other regions of the world, of EE as a true research area. In fact in order to develop the potential of European Higher Education institutions it is of paramount importance to identify aspects of the learning process where innovation is needed, putting in place the required research activities. These will require the contribution of researchers from the EE community as well as from other fields, as for instance social sciences and psychology, when possible already active in the study of the learning processes in science and engineering. A substantial part of this research activity will be devoted to measure the effectiveness of some of the suggestions contained in a frequently updated "repository" of guidelines for the enhancement of European Engineering Education. For doing this, the obvious tool is the diffusion of questionnaires, but other measuring tools must be designed, such as for instance experiments of small groups of institutions, so that this part of the Academic Network activity can qualify as true research in (engineering) education. Expected outcomes:

- Reports on: the current position and future trends for EER in Europe, European Taxonomy of EER, European EER methodologies accessible for EE staff and other interested;
- Series of Journal articles;
- Workshops on: existing research groups and research methods, working on taxonomy and research methodologies for engineering education research in Europe, impact of educational research and up-scaling of projects;
- European Summit on EER that will take place in K.U. Leuven on 28-29 of October 2011.

Activity Line C-Improve trans-national mobility of engineering students, graduates and professionals

This Line will involve two main aspects: (a) within the European Higher Education Area (EHEA), that is checking and improving the applicability and consistency (in the

Engineering field) of the European Qualifications Framework, the EU Directive on Recognition of Professional Qualifications, Accreditation Standards and other relevant "European" documents and (b) on the global scale which will imply the comparison of the "European" documents with other documents and agreements (Washington and other Accords in the international education area, but also regional and national Standards in other parts of the world: e.g. North Africa, S.E. Asia, Latin America); tentative agreements for mutual recognition. Both aspects should involve not only the "academic" side, but also the "professional training" (and "Vocational education and training"). Expected outcomes:

- Round Table Discussion "Towards a globally shared Glossary of terms in engineering programme accreditation and quality assurance: a preliminary public presentation and discussion";
- High Level European Qualifications Frameworks and Engineering Standards: a critical comparative review and suggestions for improving applicability and consistency;
- Comparison of the EUR-ACE Standards and the requirements of the Washington and Sydney accords;
- Glossary-A tentative towards a globally shared Glossary of terms in engineering programme accreditation and quality assurance;
- Engineering Standards worldwide: a comparative collection;
- Proposals for Mutual recognition of engineering degrees and qualifications.

Activity Line D-Life Long Learning (LLL) and Continuing Education (CE) as a tool to improve competitiveness and innovation of European engineers

European universities are facing enormous challenges in developing their LLL practices and processes to help European working life to meet the requirements of fast change towards the new business logic of global industrial value networking. A practical consequence of this is that the necessary competence development of knowledge professionals and other academic level experts is becoming more complex. Requirements for systemic lifelong professional development are increasing. The latest research results need to be integrated to the CE programmes and these to be transformed to become facilitated work-based learning practices, where innovation and effective use of Information and Communication Technologies (ICT) are the most critical success factors. Productivity and innovative use of ICT are prerequisites for competence development and through that for empowerment and social well-being. Universities' knowledge based on research is, however, not well utilized in societal interaction. The purpose of this Activity Line is by the help of benchmarking good practices and analysing the latest university research results in this focus area to conceptualize the needed actions in the university-industry collaboration. Special focus is on the modern use of ICT and the orchestration of the activities to increase synergy between and through that societal impact of research, teaching and the third mission operations. The major outcomes within Line D will be conceptualized core processes with benchmarked good practices and implementation manual. By the help of these universities can develop their LLL and CE activities as a powerful tool for employability and competitiveness of European engineering graduates. Expected outcomes:

- Concepts and tools for: increasing university's societal impacts, university's own innovativeness, improving university's own productivity.

Activity Line E-Increase attractiveness of studies in science and engineering and to the EHEA: involve students in organisations (Erasmus Mundus Network, TEMPUS Mediterranean, as follow-up) and promote awareness outside the EU of EE evolution and opportunities

The main aim of the activities of this working group will be to identify examples of good practice enhancing the attractiveness of engineering as a career both to traditional and non-traditional groups. The focus will be on attracting students of the right quality to both Bachelor and Master's degrees. Expected outcomes:

- Examples of good practice
- Reports outlining: the attributes that increase prospects of employability, the issues and potential barriers

Three Transversal Activities (TA) are supporting the Network:

TA1-Direct involvement of industrial stakeholders (European corporations with global dimensions) in all above Activity Lines A to E, with an active contribution. Expected outcomes:

- Professional Development Workshop;
- Handbook of practices.

TA2-Promote the establishment of the standing European Engineering Deans Council (as an interlocutory body with the newly established Global Engineering Deans Council-GEDC by the International Federation of Engineering Education Societies-IFEES). Expected outcomes:

- Joint GEDC/EUGENE forum;
- Establishment of the European Engineering Deans Council. The Kick-off meeting took place in Lisbon on September 27, 2011.

TA3-Identify and put in practice sustainability tools beyond the 3 years of life of the Academic Network, by means of: 1) ensuring visibility through an interactive web-site (informatic portal), 2) set-up a frequently updated "repository" of guidelines for the enhancement of European EE visibility world-wide, 3) foster the creation of a "Florence EE Group/Network" (an Academic Network like the Utrecht, or Coimbra ones, grouping Universities to work exclusively on EE items and future projects/initiatives).

International Advisory Board (IAB): The activities of the project are monitored by a three-member IAB. In order to ensure the independency of the experts the members of the IAB work on a subcontract basis and are not affiliated to any of the project partners. The members of the IAB have been nominated by the Management Committee on the basis of their solid experience in the field of Engineering Education and quality assurance issues. The IAB is delivering evaluation reports on the progress of EUGENE.

3. CONCLUDING REMARKS

EUGENE has now arrived at a crucial milestone: the last year of the project. The structure is set, the partners are actively involved, the web site is running and the activities are fully operating. It is therefore time for real actions to take place in order to demonstrate that such large cooperation projects are not a waste of time and public money but a concrete tool for the enhancement of the attractiveness of the European Higher Education Area, contributing to the global dimension of Engineering Education.

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