

# SOCRATES THEMATIC NETWORKS: Contributions to mutual knowledge and recognition of Engineering Education in Europe

Claudio Borri<sup>1</sup>, Elisa Guberti<sup>2</sup> and Francesco Maffioli<sup>3</sup>

**Abstract** - Accreditation of the degree programmes in Engineering is surely an argument which stimulates a great interest not only in the Italian level but above all in the European perspective. It appears strategic that Europe is equipped with a system which permits to compare the degree programmes in Engineering offered by various universities in Europe also in view of a major competition in the area of higher education in the European Union, in comparison with third countries. This appears the principal basis of different actions financed by the European Commission, which have among their own objectives also the study of an accreditation system of the degree programmes in Engineering in Europe. In this article 3 SOCRATES Thematic Networks are presented, which, one after the other, starting from 1998, have been operational in the European panorama. Among their objectives there is a recurrent motive: accreditation of the degree programmes in Engineering in Europe.

*Index Terms* - Thematic Network, Engineering, Mutual recognition, Accreditation of studies, Quality certification.

## 1. THE FRAMEWORK: THE EUROPEAN FOUNDED PROJECTS

Every year, hundreds of thousands of people in Europe take the opportunity to study abroad or work on European projects supported by the SOCRATES Programme. ERASMUS is the higher education Action of SOCRATES II programme, as well as of the Lifelong Learning Programme as it is denominated for the next period (2007-2013) [1]. It seeks to enhance the quality and reinforce the European dimension of higher education by encouraging transnational cooperation between universities, boosting European mobility and improving the transparency and full academic recognition of studies and qualifications throughout the Union.

## 2. SOCRATES-ERASMUS THEMATIC NETWORKS

In this framework Thematic Networks (TN for short from now on) can be considered one of the main innovations of

the Socrates-Erasmus programme. They were created to promote forward-looking, strategic reflection on the scientific, educational and institutional issues in the main fields of higher education. Generally speaking, a Thematic Network is a co-operation between departments of higher education institutions and other partners (e.g. academic organisations or professional bodies) [2] [3].

The main aim of a TN is to identify how to enhance quality and to define and develop a European dimension within a given academic discipline or study area. Alternatively, it can take up a topic of an inter- or multidisciplinary nature, or other matters of common interest, such as university management or quality assurance. Co-operation within Thematic Networks is expected to lead to outcomes which will have a lasting and widespread impact on universities across Europe in the field concerned.

All the Thematic Networks have taken European integration on board and have had a very pronounced European dimension. In that sense, European co-operation has been envisaged at two levels: firstly, as a policy issue, where higher education has been called upon to contribute to the cultural, economic and technical construction of the Union. Secondly, Thematic Networks have been a means in itself to stimulate and, where necessary, adapt higher education, improving its quality and effectiveness.

## 3. SOME EXAMPLES OF SUCCESSFUL THEMATIC NETWORKS AND THEIR CONTRIBUTION TOWARDS A EUROPEAN ACCREDITATION SYSTEM

It appears pertinent here to bring some examples of best practice in the field of European Thematic Networks and in particular to give some information about the following projects: H3E (Higher Engineering Education for Europe [www.tkk.fi/Misc/H3E/](http://www.tkk.fi/Misc/H3E/)), E4 (Enhancing Engineering Education in Europe [www.unifi.it/tne4](http://www.unifi.it/tne4)), TREE (Teaching and Research in Engineering in Europe [www.unifi.it/tree](http://www.unifi.it/tree)).

### 3.1 H3E THEMATIC NETWORK (HIGHER ENGINEERING EDUCATION IN EUROPE) 1998-2000

<sup>1</sup> Prof. Claudio Borri – Vice Dean for International Relations and Full Professor of Computational Mechanics of Structures - Facoltà di Ingegneria, Università di Firenze - President of SEFI 2005-07 and President of IFEEES 2006-08 – President of Thematic Networks E4 and TREE (cborri@dicea.unifi.it).

<sup>2</sup> Dr. Elisa Guberti – Head of the International Relations Office - Facoltà di Ingegneria, Università di Firenze – Project Manager of Thematic Networks E4 and TREE (intreling@unifi.it).

<sup>3</sup> Prof. Francesco Maffioli – Full Professor of Operational Research at the Politecnico di Milano and Coordinator of Thematic Networks E4 and TREE (maffioli@elet.polimi.it).

The aim of H3E, a Thematic Network active in the period 1998-2000, has been that of contributing to the development of a European Dimension within Higher Engineering Education through reflections and actions. This work has been carried out in co-operation among Engineering Education Institutions' and Students' associations in order to:

- a) Put forward the common elements that existed across European Higher Engineering Education Systems in the following six main areas:

- Motivation for Higher Engineering Studies
- Types & Forms of Higher Engineering Education and Core Curricula
- Quality Assurance and Mutual Recognition
- Internationalisation
- Educational Methods to foster Life-long learning
- Continuing Education

- b) Act in favour of a co-ordinated approach in facing the above mentioned challenges.

- c) Support the following specific case studies likely to bring added value and enrich the work carried out in connection with points above.

- JEEP Teams - Joint European Engineering Project Teams
- Pie - Plastics in Engineering
- Protect - ProTecT Consortium: Technical Textiles.

As far as the "Quality Assurance and Mutual Recognition" working group is concerned (see point a. above), it is well known that there is a wide range of types and forms of Engineering Education in Europe. This is so both within any individual nation and between the various European countries. Moreover, practices on quality assurance and on the recognition of qualifications also vary greatly between countries.

The Working Group of H3E on "Quality Assurance and Mutual Recognition" investigated how far it is possible to classify, into a relatively small number of basic types, the various curricula and schemes of postgraduate professional training. The aim was that of facilitating mutual recognition more than what was usual at that moment. In this the Group was fully mindful of the many bodies which already have interests in this area; the H3E project sought to catalyse their interaction, to the benefit of all.

The ultimate result of the work of this Group has been a proposals for a system of accreditation and suggestions on how it could be implemented in practice.

### **3.2 E4 THEMATIC NETWORK (ENHANCING ENGINEERING EDUCATION IN EUROPE) 2000-2004**

Given the interest of the European Engineering Education Community in the topics approached by H3E, it was considered strategic to go on with a new Thematic Network which was active in the period 2000-2004. The new project, partially financed by the European Commission, has been named E4 (Enhancing Engineering Education in Europe) and has been managed from its very beginning by an Executive Bureau formed by the authors of this paper.

Among all TN projects approved and running under SOCRATES II, E4 offered a wide perspective over all Engineering/Technology education fields covering relevant

and transversal issues, deliberately chosen to be not branch specific. Innovative contributions to international dimension and curriculum development, high standards, quality insurance and accreditation, use of ICT tools were the main subjects of the five Thematic Network activities, denominated as follows:

- 1) Employability through innovative curricula;
- 2) Quality assessment and transparency for enhanced mobility and trans-European recognition;
- 3) Engineering professional development for Europe;
- 4) Enhancing the European dimension;
- 5) Innovative learning and teaching methods.

In particular Activity 2 (Quality Assessment & Transparency for Enhanced Mobility & trans-European Recognition - A2) was targeted to a key issue, essential for the development of the European dimension of engineering education, from the point of view of all stakeholders (academia, enterprises, students, Society): namely, the way and means to enhance recognition throughout Europe, with the main aim to facilitate employability and (physical and virtual) mobility of engineers.

In order to let the great diversity of educational systems throughout Europe to be an asset for, and not an obstacle to recognition, the stress was shifted from requirements on the curriculum to requirements on the "competences" of the graduates. As a prerequisite, each educational institution had to complete information on itself and strive for the maximum transparency. In many European countries this is already ensured by Quality Assurance procedures, suggested (or imposed) to engineering education institutions in order to validate the learning opportunities they offer; and supported by Quality Assessment bodies, managed by the competent Ministry and/or by professional associations

The development of lists of "Qualification Attributes" to measure the competencies of each "type" of engineer, and the generalization of "Quality Assurance" procedures will make the issue of Trans-European recognition of courses and degrees, also for professional purposes, much simpler to tackle.

In parallel, the development of an European permanent "Observatory" of these assessment bodies (ESOEPE: European Standing Observatory for the Engineering Profession and Education) helped to provide a path to a smooth form of "accreditation" through mutual trust and bilateral agreements.

As already anticipated, Activity 2 of E4 TN relied and capitalised on the work already done by Working Group 2 of H3E, trying to move gradually towards a more experimental phase.

The first commitment of A2 was that one of being actively present in ESOEPE ([www.feani.org/ESOEPE](http://www.feani.org/ESOEPE)), the Standing Observatory, which resulted from the contacts established by WG2 of H3E also outside the Academic world through the two European Workshops on Assessment of Engineering Programmes (EWAEP1: The Hague, 3-5 December 1998; EWAEP2: Paris, 17-19 June 1999).

The other immediate commitment of A2 was that of updating and extending the state-of-the-art Report of WG2 of H3E. The three Chapters of the volume of E4 dedicated to

A2, constitute three independent (albeit correlated) documents.

These three documents (and all other E4 documents) needed to rely on a Glossary of the most important terms in higher education, to clarify and standardise their use by E4. The A2 group was very active in the preparation of such a tool. As matter of fact the E4 Glossary has become a well known reference document for the engineering education community in Europe and is presently being revised within the successor of E4: TREE Thematic Network.

### 3.3. TREE THEMATIC NETWORK (TEACHING AND RESEARCH ENGINEERING IN EUROPE)

Thanks to the success of E4, the University of Florence was invited by the European Commission to continue to manage this important activity with a follow-on project considering in particular the synergies between education and research in faculties of engineering in Europe. In September 2004, the TN TREE (Teaching and Research in Engineering in Europe) was launched with a substantial partnership of some 115 engineering schools.

The four main activities within TREE are:

- 1) Line A: *Tuning*. Fine-tuning new curricula for the two-tier structure of higher education; developing tools for quality assessment, assurance, and accreditation; extending ECTS;
- 2) Line B: *Education and Research*. Monitoring the status and promotion of doctoral studies; promoting the role of research activity in engineering education; endorsing the value of research-oriented project work;
- 3) Line C: *Enhancing the attractiveness of EEE*. Attracting young people, especially women, to engineering education also with initiatives such as joint/double degrees;
- 4) Line D: *Sustainability*. Sustaining engineering education institutions by developing continuing education, open, and distant learning opportunities; studying ways to make valuable tools, identified during the TN.

The transition from E4 to TREE suggested the necessity to prepare real "instruments" to reinforce the European dimension of the studies in engineering, without however diminishing the importance of continuing with study activities about various key issues. We have to keep in mind indeed the dynamics of the situation favored by so called Process of Bologna, of a major mobility of the students thanks to Erasmus, etc. The potential beneficiaries of the TREE activity, which foresees to make available its rich set of results by the end of 2007, will not only be the faculties of Engineering in Europe, students and professors, but also the academic associations, the enterprises, the national and international agencies for accreditation, and all other stakeholders.

### 3.4. TECHNO TN ARCHIPELAGO

The Thematic Network "Archipelagos", grouping TNs working in neighbouring orientations, was initiated by TNs in science and Engineering oriented fields and a European Expert Forum was organised on February 2004 in Brussels

by some 10 such TNs, with the participation of Representatives of the European Commission, of EUA (European University Association), SEFI (European Society for Engineering Education), BEST (Board of European Students of Technology), CESAER (Conference of European Schools for Advanced Engineering Education and Research, EAN (European Access Network). EULLearN (European University Lifelong Learning Network) was also involved in the organisation of the event. Among the conclusions of the February 2004 Expert Forum in Brussels was the maintaining of the TechnoTN structure, including the Webpage, and to amplify the process by organising in 2005 an extended European TechnoTN Expert Forum, where in addition of the TNs experts, were invited the professions, the decision makers and all relevant actors.

The TN Archipelago ([www.upv.es/TechnoTN/](http://www.upv.es/TechnoTN/)), is aimed at making the organisation of such European TechnoTN Expert Forum possible. The Archipelago is made up by a consortium of leading university institutions co-ordinating European ERASMUS Thematic Networks. Through these Thematic Networks some 850 European Higher Education institutions are involved, and considering their links with professional organisations, students, local, regional and national authorities and decision-makers, social partners, etc., this Archipelago represents a real European dimension in education and will have a lasting and widespread impact across a large range of institutions.

### 4. TUNING EDUCATIONAL STRUCTURES IN EUROPE

The project Tuning Educational Structures in Europe (<http://www.unideusto.org/tuning/>) is at the heart of the Bologna - Prague - Berlin - Bergen process. It is one of the few projects in Europe that actually links the political objectives set in the Bologna Declaration of 1999 to the higher education sector. "Tuning" is a project developed by and meant for all areas of higher education.

The Tuning project focuses not on educational systems, but on structures of studies. Whereas educational systems are primarily the responsibility of governments, educational structures and content are that of higher education institutions. As a result of the Bologna Declaration, the educational systems in all European countries are in continuous evolution. This is the direct effect of the political decision to harmonise different national systems of higher education in Europe. For Higher Education institutions these reforms mean the actual starting point for another discussion: the comparability of curricula in terms of structures, programmes and learning methodology. In this reform process the required academic and professional profiles and needs of Society play an important role.

The main aim and objective of the project is to contribute significantly to the elaboration of a framework of comparable and compatible qualifications in each of the (potential) signatory countries of the Bologna process, which should be described in terms of workload, level, learning outcomes, competences and profile. The Tuning project has developed a methodology and a common language, reflected in the Berlin Communiqué (19 September 2003) [4], which can serve as a common basis, and will make it possible to develop an overarching European framework of

qualifications [5].

In the third phase (2005-2006), three major tasks are foreseen. The first task is to validate and to consolidate the outcomes of the Tuning pilot project, phases 1 and 2. This will be done by assisting existing and new Socrates-Erasmus networks in the use of the Tuning methodology and its related tools and products. Other networks of subject areas will be identified to which the Tuning outcomes are of relevance. As many subject areas as possible will be invited to define reference points as well as cycle level descriptors for their disciplines. To strengthen and improve the foundation of the Tuning approach, main stakeholders, operating on an international market and in international organisations, will be asked to reflect on its methodology of defining programmes of study on the notions of social needs, available resources, professional and academic profiles and learning outcomes and competences. The second major task is to disseminate and to implement the Tuning material developed so far. This requires the setting up of an information campaign, as well as the organisation of structures to facilitate the actual use of the Tuning approach. The third task is to evaluate, to monitor and to adjust the outcomes of the pilot project and develop these further against the background of generalization of the use of the Tuning approach in the European Higher Education Area. Related to this task is the making of the Tuning reference points and cycle level descriptors suitable for recognition purposes. Also the implementation of additional research on selected issues related to the use of competences will be part of this task and the development of quality at programme level.

The activities of the E4 Thematic Network (see point 3.2) were strictly connected with the “Tuning” activities. The promoters of the five Activities and the Coordinator of the TN E4 have been part of the Engineering Synergy Group (SG) of the Tuning project. The Engineering SG has been formed with the declared goal of taking advantage of the experience being obtained within the TN E4 and within other TN’s in the field of Engineering Education such as H3E and EUCEET (European Civil Engineering Education and Training, 1998-2001). It is through these links to Thematic Networks in the engineering field that the representativeness of the Engineering SG was ensured together with the active role that engineering education societies such as SEFI and CESAER, and professional organisations such as FEANI, played within E4 [6].

## 5. CONCLUSIONS

The activities carried out by European Founded Project and more specifically by the SOCRATES Thematic Networks, gave a great contribution towards the creation of a European accreditation system and new initiatives to reach this goal are actually still taking place.

A rather novel way of international accreditation of engineering degree programmes has been elaborated by the EUR-ACE (Accreditation of European Engineering Programmes and Graduates) Project.

This Project was supported by the European Commission through the Socrates and Tempus programmes in the period

Sept. 2004 – March 2006. (EUR-ACE section on [www.feani.org](http://www.feani.org)).

The rich experiences accumulated in decades by national bodies like the French “Commission des Titres d’Ingénieur” and the British Chartered Engineering Institute are capitalised and exploited to create a consistent accreditation system of engineering education at the continental scale. Indeed, while international accreditation systems exist or are being established in other areas and continents, European engineering still lacks one: and on the global job market this puts the European engineer in an objectively weaker position. As a concluding remark it can be stated that the success of the EUR-ACE project has shown that there is a great interest towards accreditation procedures in the engineering field and also a need for a European accreditation system. The authors are confident that the project results will be implemented and a coordinated accreditation system will be established covering most European countries. The Thematic Networks, with the support of the General Directorate of Education and the Culture of the European Commission, have contributed during all these years in many aspects of general interest for the university education: harmonising the studies (the Tuning Project in general, the other projects in engineering education), the development of life-long learning, use of ICT, appraisal of the quality, accreditation, innovation of the learning methods, and last but not least, the birth of a network of institutions in continuous contact and trusting each other.

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## REFERENCES

- [1] DECISION No 1720/2006/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 November 2006 establishing an action programme in the field of lifelong learning, Official Journal of the European Union, L 327/45
- [2] (2006): Borri C., Guberti E., Maffioli F. “Erasmus Thematic Networks and the European Dimension of Engineering Education”. EJEE Special Issue on E4 outcomes
- [3] (2003): Borri C., Maffioli F. “Thematic Network E4: an effective tool to improve EE in Europe”. European Journal of Engineering Education 28 n. 4 December 2003
- [4] European Commission, DG EAC, « Réaliser l’Espace Européen de l’Enseignement Supérieur » 19.09.2003 [http://www.bologna-bergen2005.no/Docs/France/030919\\_Berlin\\_Communique-Fr.pdf](http://www.bologna-bergen2005.no/Docs/France/030919_Berlin_Communique-Fr.pdf).
- [5] (2005): Communication from the Commission, COM (2005) 152 final “Mobilising the brainpower of Europe: enabling universities to make their full contribution to the Lisbon Strategy” SEC (2005) 518
- [6] (2003): Borri C., Maffioli F. eds (2004): “E4 Thematic Network: Enhancing Engineering Education in Europe”, voll. I-VI, Firenze University Press, 2003.