

Proceedings

*Enhancement of the Global Perspective for
Engineering Students by Providing an
International Experience*

Engineering Conferences International

Year 2003

Enhancement of the Global Perspective
for Engineering Students by Providing an
International Experience: An Academic
View - Europe

Claudio Borri
University of Florence

Elisa Guberti
University of Florence

ENHANCEMENT OF THE GLOBAL PERSPECTIVE FOR ENGINEERING STUDENTS BY PROVIDING AN INTERNATIONAL EXPERIENCE: AN ACADEMIC VIEW - EUROPE

**CLAUDIO BORRI¹
ELISA GUBERTI²**

Abstract

After a short presentation of the educational programmes within the European Commission, the paper introduces the initiatives focused on the cooperation with third countries. In this frame the new proposal ERASMUS World is presented. The intention of the Commission is that one to promote the EU as a centre of excellence in learning around the world, mainly via the creation of inter-university European Master Courses.

With regard to already well-established measures the SOSCRATES programme is also presented. In particular its action devoted to HE³ is taken into account in order to introduce Thematic Networks programmes.

Finally the activity of E4 Thematic Network is briefly described.

1. Introduction: the EU Educational Programmes

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. Moreover, the TEMPUS Programme is developing cooperation to upgrade higher education from North Africa to Mongolia. And from now on, the EU will be opening up to countries around the world, confident that a European education is an international asset both at home and abroad.

Education in Europe has both deep roots and great diversity. In 1976, education ministers first decided to set up an information network, as the basis for better understanding of educational policies and structures in the European Community. This reflected the principle that the particular character of education systems in the Member States should be fully respected, while coordinated interaction between education, training and employment systems should be improved. EURYDICE, the information network on education in Europe, was formally launched in 1980.

Ever since, the comparison of ideas and good practice on the basis of solid fact-finding and first-hand experience has been a central component of European cooperation in

¹ Dpt. of Civil Engineering, School of Engineering, University of Florence, Italy. Deputy Rector for European Educational Programmes and President and Legal Representative for E4 TN. E.mail: cborri@dicea.unifi.it

² International Relations Office, School of Engineering, University of Florence, Italy. E4 Thematic Network Project Manager. E.mail: e4@ing.unifi.it

education. This approach has developed in many ways, from academic networks, study visits and partnerships of numerous kinds, to the EU's policy-making role today in such central issues as defining quality indicators and the future objectives of education and training systems.

In 1986, attention turned from information exchanges to student and teachers exchanges with the launch of the ERASMUS programme, often cited as one of the most successful initiatives of a European Community that had just expanded to 12 countries: since then more than 1 Million students moved in the past 15 years. Yet it was not until 1992 and the creation of the single European market that education became formally recognised, in the Treaty on European Union signed in Maastricht, as a legitimate area of EU responsibility in its own right.

The experience has been consolidated and developed into the SOCRATES programme, covering all areas of education at all ages and levels of ability, launched in 1995 together with the LEONARDO DA VINCI and the Youth programmes. With the European Union now preparing for its greatest enlargement, a new generation of these programmes, opened to 31 countries, is in operation for the period 2000-2006.

To facilitate the introduction of European studies in universities, the European Commission is also supporting the Jean Monnet project, offering start-up subsidies for the establishment of Jean Monnet Chairs, permanent courses, modules in European law, European economy, political studies of European construction, and the history of European integration. The project also supports the creation of Jean Monnet Centres of Excellence.

In parallel with these action programmes, the Directorate-General for Education and Culture is responsible for a number of European initiatives in education-related fields.

The paper reports, in the following, on some of most important programmes and namely:

- Cooperative programmes with the third countries (section 2);
- ERASMUS World, for EU Master Courses (section 3);
- SOCRATES/ERASMUS (section 4) ;
- Thematic Networks (TN) within ERASMUS (section 5);
- The E4 TN project, relevant to the Engineering HE area (section 6).

2. Cooperation with third countries

Many countries around the world are seeking multilateral cooperation with universities and training centres in the European Union. The Commission supports these links with third countries through a range of programmes :

- Agreements with the USA and Canada, which were renewed at the start of 2001 for five years
- The TEMPUS programme, which covers the countries of the former Soviet Union, the western Balkans and Mongolia, and which was extended in June 2002 to the EU's Mediterranean partners.

- The ALFA and Alban programmes for Latin America
- AsiaLink, which involves many countries in Asia
- Pilot projects with Australia and Japan.

Transnational education is becoming increasingly common in Europe. Many EU Member States have already developed bilateral relations with other countries in the area of higher education, and there are a number of transnational higher education initiatives within the European Union. However, the Commission believes more should be done if European universities and learning centres are to derive the full benefits of internationalisation in education.

European education ministers stated in the Bologna Declaration: "The vitality and efficiency of any civilisation can be measured by the appeal that its culture has for other countries. We need to ensure that the European higher education system acquires a world-wide degree of attraction equal to our extraordinary cultural and scientific traditions" (June 1999).

At Lisbon (March 2000) and Prague (May 2001) European government ministers further emphasised the need to promote European higher education and to encourage international collaboration. Co-operation with third countries outside the EU is an important element of this. In July 2001, the European Parliament and Council received a Communication by the Commission on strengthening EU-third country co-operation in higher education.

3. ERASMUS World

Following the positive reception of the Communication by the European Parliament and Council, the Commission adopted a new proposal, ERASMUS World, in July 2002. The new initiative would promote the EU as a centre of excellence in learning around the world, by supporting the creation of inter-university European Union Masters Courses. It would also provide EU-funded scholarships and fellowships for third country nationals participating in these European postgraduate programmes. The Commission's proposal for ERASMUS World, with a planned budget of 200 million Euros (2004-2008), is currently under consideration by the Parliament and Council.

The purpose of this new proposal is mainly that one of enhancing quality in European higher education and of promoting intercultural understanding through co-operation with third countries in higher education. This proposal was adopted on July 17, 2002, on the initiative of the Commissioner for Education and Culture, Viviane Reding, supported by Commission President Romano Prodi. The ERASMUS World proposal follows the Commission's earlier release of a Communication on reinforcing co-operation with third countries in the field of higher education in July.

The ERASMUS World scheme is intended to strengthen international links in higher education, by enabling students and visiting scholars from around the world to engage in postgraduate study at European universities, as well as by encouraging the mobility of European students and scholars. The basic features of the programme include a global scholarship scheme for third country nationals, linked to the creation of

«European Union Masters Courses» at European universities. These postgraduate courses would involve study at several higher education institutions in different Member States and be distinguished by their European label. The programme foresees the creation of around 90 inter-university networks to provide 250 EU Masters Courses by 2008. Partnerships between EU Masters Courses and third country institutions would also be encouraged. The planned budget for the ERASMUS World project is 200 million euros for the period 2004-2008.

The ERASMUS World proposal confirms the Commission's desire to encourage opening up European higher education to the rest of the world. It complements the EU's existing regional programmes in higher education with third countries. The proposal was adopted less than a month after the Council's Decision to extend the TEMPUS programme to the Meda countries (June 27, 2002). Regional programmes, such as TEMPUS, ALFA and Asia-Link, will continue to foster international co-operation in higher education between the EU and its partners.

ERASMUS World however is a new global scheme, which aims to provide a distinctly European offer in higher education. It seeks primarily to enhance the quality and attractiveness of higher education within Europe. The development of European Union Masters Courses and scholarships will provide a framework to promote valuable exchanges and dialogue between cultures. By supporting the international mobility of scholars and students, ERASMUS World intends to prepare its participants from the European Union and its partner countries for life in a global, knowledge-based society.

3.1. Description of the Programme

The programme's overall aim is to contribute to quality education in the European Union, in particular by fostering co-operation with third countries. The long-term impact sought by the present proposal is, firstly, to better prepare citizens in Europe, but also in partner third countries, to live and work in a global, knowledge-based society. The proposal seeks, secondly, to ensure Europe's position as a pole of excellence in higher education and, therefore, to ensure that higher education in Europe becomes an increasingly more attractive destination world-wide. Thirdly, through people-to-people exchanges and structural cooperation concentrating on young people with a potential for future leadership roles within the economy and society, the proposal seeks to improve mutual understanding between peoples and cultures, thus contributing to world peace and stability, and to Europe's legitimate aspirations as a major player on the international scene. In pursuing these objectives the Community will also seek to improve links between higher education institutions and industry.

3.1.2. Specific objectives

In order to achieve these general objectives, the direct and short-term effects sought by the programme can be grouped as follows:

- the emergence of a distinctly European offer in higher education which would**
-
-
-

- be attractive both within the European Union and beyond its borders;
- a higher profile for, visibility of and improved accessibility to European education;
- a greater world-wide interest in and more concrete possibilities for acquiring European qualifications and/or experience among highly-qualified graduates and scholars from all over the world;
- more structured co-operation between European Community and third country institutions and greater outgoing European Union mobility as part of European study programmes.

3.1.3. Operational objectives

The Community, through calls for proposals launched in the framework of the programme, will provide financial support with a view to generating:

- European Union Masters Courses (selected for a five-year period, subject to a lightweight annual renewal procedure based on progress reporting), involving at least three higher education institutions from three different Member States and leading to double/multiple degrees.

Concentrating on the post-graduate level is a deliberate operational choice that can be justified for the following main reasons:

- a) factors such as, *inter alia*, the structure of degrees, complexity of curricula and the use of language; undergraduate studies would allow much less flexibility than post-graduate level courses for developing European “flagship” products, i.e., European joint programmes leading to double degrees;
- b) the Community could not support significant numbers of third country students

for a three to six year period of undergraduate study, whereas the duration of study at Masters level does allow the development of a strong international projection including Community-sponsored student mobility;

c) the value-added of Community intervention could be maximal at post-graduate level (Masters) since it would contribute to the development of the degree structure favored by the Bologna/Prague process, a key element of which is the establishment of a first degree, Masters degree, and doctorate cycle;

d) international mobility is proportionately higher at postgraduate (Masters) level than at undergraduate level;

e) in practical terms, working with students at post-graduate level provides an insurance against failure as the student has proved during undergraduate study his or her abilities.

- Scholarships for third country graduate students selected to enroll for a full study period (on average fifteen months) in European Union Masters Courses.
- Scholarships for third country visiting scholars for teaching and scholarly assignments (average three months) connected with European Union Masters Courses;
 - Partnerships (up to three years) between European Union Masters Courses and third country higher education universities, including European Union student and staff outgoing mobility.

– Studies, conferences, seminars, publications, joint development of marketing actions, joint development of web-based and other tools to support international education and student mobility.

The programme's overall and specific objectives would be achieved through the following actions:

- A. European Union masters courses
- B. Scholarships
- C. partnerships with third country higher education institutions
- D. enhancing attractiveness
- E. support measures

The programme must be seen as an internal policy instrument and therefore the actions above will be funded from Chapter Three of the Community Budget.

4. The SOCRATES Programme

In a world of relentless change, it is increasingly important to build up knowledge in order to acquire useful skills, to get a job, or simply for personal fulfilment. Education today is more and more a lifelong process. Learning and training no longer means only what goes on in school or university, but also in less formal environments and at any time of life.

A key feature of Europe, which is often mentioned, is its diversity. This is particularly true in the area of education, where systems and practices vary enormously from one country to another. This diversity is a source of enrichment for everyone and offers fertile ground for innovation and the quest for quality. Together we can be stronger and more creative.

SOCRATES is Europe's mobility programme and involves around 30 European countries. Its main objective is precisely to build up a Europe of knowledge and thus provide a better response to the major challenges of this new century: to promote lifelong learning, encourage access to education for everybody, and help people acquire recognised qualifications and skills. In more specific terms, SOCRATES seeks to promote language learning, and to encourage mobility and innovation.

SOCRATES advocates European cooperation in all areas of education. This cooperation takes different forms: mobility (moving around Europe), organising joint projects, setting up European networks (disseminating ideas and good practice), and conducting studies and comparative analyses.

In practice, SOCRATES offers people grants to study, teach, undertake a placement or follow a training course in another country. It provides support for educational establishments to organise teaching projects and to exchange experiences. It helps associations and NGOs in organising activities on educational topics, etc. One golden rule must be respected: only activities which have a European dimension based on transnational cooperation may receive financial assistance.

SOCRATES targets all forums of learning irrespective of level, ranging from nursery school to university. This includes adult education, which often involves more informal pathways.

Educational establishments cannot fulfil their mission behind close doors and must open up to new ideas and practices, e.g. by building up partnerships with establishments in other countries or working with the various players of civil society.

SOCRATES targets all the members of the education community, and this truly means everybody:

- pupils during compulsory schooling, students, people, the young and the not so young alike, wishing to return to learning;**
- teachers being trained or in service; ancillary, administrative and managerial staff involved in education;**
- educational establishments of all types;**
- but also all external interested parties: civil servants and decision makers; local and regional authorities; parents' associations; the social partners; the business sector;**
- associations and NGOs.**

Whatever the target groups and whatever the type of project, SOCRATES sets out to stress the multi-cultural character of Europe as one of the cornerstones of active citizenship. It supports the education of the least advantaged groups of people. It endeavours to counter social exclusion and under-achievement at school. It promotes equal opportunities for women and men irrespective of circumstances. It sets great store by the new information communication technologies (ICT). It encourages the learning of the different European languages, and innovation in education.

SOCRATES comprises eight separate actions:

- COMENIUS: school education**
- ERASMUS: higher education**
- GRUNDTVIG: adult education and other education pathways**
- LINGUA: learning European languages**
- MINERVA: information and communication technologies (ICT) in education**
- Observation and innovation of education systems and policies**
- Joint actions with other European programmes**
- Supplementary measures**

4.1 SOCRATES Chapt. 1: ERASMUS

Chapter 1 of SOCRATES is entirely dedicated to HE, as a follower of the previous ERASMUS Programme. Main actions supported are: student and teacher exchanges ; joint development of study programmes; dissemination and implementation of results of CD projects; thematic networks between departments/faculties across Europe; language courses and intensive programmes; European credit transfer system (ECTS).

Covering the period 2000-2006, SOCRATES/ERASMUS aims at improving the quality and the "European dimension" of higher education, including both universities and « extra-university » institutions. The participating countries are the 15 Member States of the European Union, the 3 countries of the European Economic Area (Iceland, Liechtenstein and Norway) and all the Associated Countries in Central and Eastern Europe, as well as Cyprus and Malta.

4.1.1 Background

The SOCRATES II programme supports European cooperation in eight areas, from school to higher education, from new technologies to adult learners.

The higher education section of SOCRATES II (ERASMUS) continues and extends the European Community Action Scheme for the Mobility of University Students (the "ERASMUS programme"), established in 1987. It is named after the philosopher, theologian and humanist Erasmus of Rotterdam (1465-1536). An untiring adversary of dogmatic thought in all fields of human endeavour, Erasmus lived and worked in several parts of Europe, in quest of the knowledge, experience and insights which only such contacts with other countries could bring.

4.1.2 Objectives

Higher education plays a crucial role in producing high quality human resources, disseminating scientific discovery and advanced knowledge through teaching, adapting to the constantly emerging needs for new competences and qualifications, and educating future generations of citizens in a European context. All such functions are of vital importance to the long-term development of Europe.

The increasing speed at which existing knowledge becomes obsolete, and the rapid changes in the means by which it is delivered and renewed, will require the higher education sector to adopt new methods and commit itself wholeheartedly to the provision of lifelong learning.

Against this background, ERASMUS contains a wide range of measures designed to support the European activities of higher education institutions and to promote the mobility and exchange of their teaching staff and students.

4.1.3 Participating countries

Adopted on 24 January 2000 and spanning the period until the end of 2006, SOCRATES and its ERASMUS action are now open to the participation of 30 countries: the 15 Member States of the European Union; the three EEA countries (Iceland, Liechtenstein and Norway) and twelve associated countries: Hungary, Romania, the Czech Republic, the Slovak Republic, Poland, Bulgaria, Estonia, Latvia, Lithuania, Slovenia, Malta and Cyprus.

4.1.4 Key features

As in the past, ERASMUS is open to all types of higher education institutions (for

which the term "universities" is generally used), all academic disciplines and all levels of higher education study up to and including the doctorate.

While the promotion of 'physical mobility', mainly of students, constituted the main thrust of ERASMUS Phase I and II, the higher education Chapter of SOCRATES seeks to integrate such mobility into a wider framework of cooperation activities which aim at developing a "European Dimension" within the entire range of a university's academic programmes. "Bringing students to Europe, bringing Europe to all students" is the new spirit of ERASMUS: while student mobility retains a position of central importance within the programme, stronger incentives are now available to encourage universities to add a European perspective to the courses followed by students who do not participate directly in mobility.

More emphasis is consequently placed on teaching staff exchanges, transnational curriculum development and pan-European thematic networks. Wider dissemination of and participation in the results of this work are sought through specific support. ERASMUS also encourages universities to associate other public and private bodies from their surrounding regions with their transnational cooperation activities, thereby enhancing opportunities for inter-regional cooperation between the participating countries.

From 1987/88 to 1999/2000, about 750,000 University students have spent an ERASMUS period abroad and more than 1,800 Universities (or other Higher Education institutions) are presently participating in the programme.

The EU budget of SOCRATES/ERASMUS for 2000-2006 amounts to around 950 Mio Euros (of which approximately 750 Mio Euros for students grants). Additional funds are provided in each country by public authorities, by the universities themselves and by other organisations.

5. ERASMUS Thematic Networks

Thematic Networks are one of the main innovations of the SOCRATES-ERASMUS programme. They were created to deal with 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). Normally, all countries participating in the SOCRATES-ERASMUS programmes (EU, EFTA and Candidate Countries) should be represented in a Thematic Network. The main aim of the programme is 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.

6. E4 Thematic Network

6.1 Introduction

Among all TN projects approved and running under SOCRATES II, E4 offers the widest perspective over all Engineering/Technology education fields covering relevant and transversal issues, which are definitely not branch specific. The paper first introduces the general aim of the project, underlining the meaning of the European Dimension of EE⁴, to facilitate greater mobility of skilled personnel and ensuring integration of the different systems throughout the continent. Innovative contributions to international dimension and curriculum development, high standards, quality insurance and accreditation, use of ICT tools are the main subjects of the Network activities: these are described in details in section 2, which is followed by the strategic approach and principal outcomes (section 3 and 4 respectively). Organisation and dissemination are also key aspects of the project, dealt by 3 Transversal Actions, common to all activities and supporting the working groups outcomes, enhancing visibility.

6.2 Rationale and background

Entered in its third year of activity by October 1st 2002, E4 can be surely considered as a successful example of networking and gathering together expertise in EE. As an evidence of this, the project has been selected by the EC – TN managers as an example of good practice to be presented to the Co-ordinators of newly approved TNs proposals for the 2003-2006 term. This paper describes the aim and tasks, the academic approach, the involvement of students, professionals/industrial partners, the main expected/achieved outcomes and dissemination activities. Some 110 Institutions of Higher Education have signed the bilateral agreement with the Università di Firenze (referred to, for the sake of simplicity, as Univ. of Florence in the following) declaring their interest in participating actively to the TN. Three internationally recognised associations, BEST (Board of European Students of Technology), CESAER (Conference of European Schools for Advanced Engineering Education and Research) and SEFI (Société Européenne pour la Formations des Ingénieurs), strongly support this TN (as they did for the TN “Higher Engineering Education for Europe” (H3E for short) under SOCRATES I): it is mainly through them that a strong active participation is ensured as well as an effective dissemination of the results.

E4 aims at influencing EE in Europe at various levels. The most important and numerous comprise all EE Institutions (students and teachers) and the many stakeholders (e.g. industries, public administrations, etc.): this level is reached mainly through the members of the associations mentioned above; the top level is constituted by the people actively involved in the project (the conference of Active Members of E4 convened each Year). A comprehensive and continuously updated description of the

E4 TN can be found in its web site <http://www.ing.unifi.it/tne4>. E4 is structured into five *Activities*.

6.2.1 Activity 1: Employability through innovative curricula

Innovation is one of the key factors not only for enhancing employability, but also for the competitiveness of European industry. This need is multifaceted: forming innovative minds must be high in the list of goals of any EE institution and many aspects contribute to the satisfaction of this need. One is the explicit outcome orientation and the continuous updating of the curricula for EE in their various aspects: basic science courses; the fundamentals of engineering; more recently introduced topics, like management and information technology; new teaching and learning arrangements promoting active learning and the acquisition of core competences and transferable skills. All these aspects are thoroughly considered and their respective value assessed, also comparing the degree in which different institutions have taken them into account, in particular having in mind the consequences of the Bologna Declaration. Indeed a great challenge and innovation for the curricula will be the development and implementation of the two-tier system, especially the design of undergraduate curricula and a first degree guaranteeing high quality, employability and international professional and academic recognition. The development of a diversified system of post-graduate studies in Europe, the implementation of modularised structures, and extending the use of ECTS are considered. In due course the changing needs of the different traditional and emerging branches will be reflected including the links of EE and the promotion of entrepreneurship.

6.2.2 Activity 2: Quality assessment and transparency for enhanced mobility and trans-European recognition

A primary issue for all stakeholders of EE (Academia, enterprises, students, Society) is to enhance recognition throughout Europe, in order to ensure employability and (physical and virtual) mobility of engineers: how to foster the generalisation of “Quality Assurance” procedures, and how to improve the tools for measuring (and comparing) the competencies of each “type” of engineer. In many European countries, Quality Assurance procedures are already suggested (or imposed) to EE institutions in order to validate the learning opportunities they offer; these are supported by Quality Assessment bodies, managed by the competent Ministry and/or by professional associations. Further development is however essential. On the other hand, in order to facilitate Trans-European recognition of courses and degrees, E4 was among the first promoters of the development of the "European Standing Observatory for the Engineering Profession and Education" (ESOEPE), established in the very first days of activity of E4 with the participation of assessment and accreditation bodies of six European countries and now being enlarged: E4 feels that this “Observatory” may help to provide a path to a smooth form of “accreditation” through mutual trust and bilateral agreements.

6.2.3 Activity 3: Engineering professional development for Europe

This Activity is aimed to promote continuing education and professional development of Engineers in Europe. For this purpose A3 mainly focuses on:

- monitoring actions already established within European projects, as well as in individual universities, professional associations, companies and other organisations;
- collecting examples of good practice in the development of continuing education opportunities for engineers;
- assessing the role of research as a component of continuing engineering education;
- producing guidelines for the development of good continuing professional development initiatives in Engineering faculties;
- helping to develop a learning culture in industry.

6.2.4 Activity 4: Enhancing the European dimension

Despite the great success of ERASMUS Programme in increasing the mobility of students in Europe, the awareness of the necessity of introducing a European dimension for all Engineering students is not yet as widely accepted and understood as it should be. Among other aspects, it is felt that this need can be satisfied only introducing elements of internationalisation culture into the formation one receives *at home*. Hence this Activity has two sides: one devoted to identify these elements and how to incorporate them into an already crowded curriculum, the other devoted to design actions to facilitate students mobility, trying to remove hindrances on it and proposing initiatives to stimulate it, like the so-called *JEEP⁵ Teams*.

6.2.5 Activity 5: Innovative learning and teaching methods

New Information and Communication Technologies (ICT) continue to create new opportunities also in the learning environment. The application of ICT in education and training can help to make the learning process more effective and closer to the needs of students. However the application of ICT does not automatically lead to better education. In an Engineering environment the technology itself is usually less of a problem, but achieving the shift from teacher-driven to learner-centred education involves a complex, and inevitably slow, process of re-adaptation of minds and structures in Institutions. There is a lot of experience in applying ICT to EE across Europe, but too little of this experience has been successfully disseminated, so that positive as well as negative aspects need to be thoroughly discussed.

Four themes were established and four people appointed to be the theme co-ordinators (http://virtual.hut.fi/E4_Action5/themes.htm for additional details).

6.3. Aims and objectives

The structure and the dissemination tools of the project needed for achieving its objectives has been implemented during the first year (Bureau, Management Committee, International Advisory Board, Headquarters, WEB manager, electronic newsletter and web site: www.ing.unifi.it/tne4).

Each Activity has its specialised set of aims and objectives, which we summarise below and which have sometimes suggested to articulate each Activity Working Group into a number of *Special Interest Groups* (SIG).

6.4. Innovative aspects and target beneficiary groups

One of the most significant aspect is the shift from a teacher centred towards a learner centred approach. This means that a student can, to some extent, choose the time and space of his/her learning activity. This approach needs also new types of tutoring and mentoring as well as strong co-operation among teachers even in different faculties and fields of study. The important pedagogical approach is also the connection between theory and practice, in a way that the link between the authentic problems and theories studied at the university will be clear to the students. Also the social aspects have to be taken into account so that different kind of teamwork and group work will be part of studies in every level. These considerations are relevant to all Activities of the E4 project, from curriculum development to recognition, from continuing education to internationalisation and the use of new learning tools.

Another innovative aspect is implied by the attempt to follow and study an educational field in condition of rapid evolution. In particular this TN emphasises the need for stronger communication between the two populations of students and teachers. Several events, some being proposed during the fourth (dissemination) year of E4, offer occasions of capitalising on the experience so far.

The foreseeable (more or less direct) beneficiaries of E4 activities are:

- EE Institutions
- Academic associations
- The EUA
- National Rector Conferences
- Policy makers in EE
- Professional bodies and associations
- European enterprises

6.5. Outputs

As far as the “Curriculum Development “ (*Activity 1*) is concerned, besides the updating of the state-of-the-art documentation on EE systems and curriculum development in Europe, the second and third years focused on the development of EE curricula in a two tier European Higher Education structure including concepts of modularisation and the implementation of ECTS which also form the basis for contribution of the Synergy Group of the TN “Tuning Higher Education Structures in Europe” (TUNING). In addition the third year will result in contributions concerning the role of output standards and the definition of common cores for the development of innovative curricula.

Based on these documents, other outputs are also being elaborated during the final year of the project:

- guidelines for the development of innovative EE curricula with special focus on the enhancement of the European dimension;

- a collection of good practice examples including the promotion and practical experimentation of innovative curricula at least in Universities participating actively to the E4 TN;
- a report on motivations for EE and how innovative curricula can contribute to elevate the attractiveness of EE in Europe for different groups of students, in particular female students.

With regards to intensified reflection and the dissemination of outcomes, A1 will continue to seek the involvement of SEFI Working Group on Curriculum Development, but also of those on Mathematics, Physics, Environmental Engineering, Ethics, Women in Engineering and the newly formed WG on Synergies between Engineering Education and Research. The role of BEST is also relevant, because of the obvious connection with motivating to EE studies (a topic which has seen a strong involvement of BEST as co-ordinating association of WG1 of H3E during SOCRATES I). FEANI and CLAIU participation will be crucial in improving the awareness of the different perspectives needed in the various branches of the engineering profession.

In the field of “Quality Assessment and Accreditation” (*Activity 2*) the main outcomes envisaged are:

- a collection of examples of good practice on qualification profiles, quality assessment and trans-national accreditation; possibly also design of pilot projects on these themes;
- the three documents listed and described in Section 2.2: these will be put on the E4 web site, continuously updated up to the end of the E4 third year;
- an active involvement of ESOEPE, including in particular exchanges of information (mainly through the web site) and the organisation of Workshops.

The preliminary results and conclusions of the “Continuing Education of Life-Long Learning” (*Activity 3*) the Seminars of A3 have been published separately on its web site (www.cfp.upv.es/e4/).

These results include:

- a taxonomy of business models for Continuing Engineering Education (CEE) in Europe;
- survey of business models for CEE;
- case studies of successful practice;
- marketing strategies for CEE, relationship marketing and case studies of marketing continuing professional development.

These preliminary results with conclusions and recommendations are currently being elaborated and prepared for final publication during this third year.

A seminar for all active members of the A3 working group has already been organised. In addition dissemination events, in conjunction with overall dissemination events of E4 and separately are planned and scheduled yet.

“Internationalisation” activities (*Activity 4*) will lead to:

- design of a “code of good practice” for enhancing European dimension in HEE;

- produce registers of some of the more obvious activities in internationalisation, such as courses given in foreign languages and courses leading to double diplomas;
- design of an effective organisation for experiences like JEEP Teams and pilot projects experimenting with this tool;
- report on European work environment and its needs of internationally formed engineers.

Students as well as academics are aware of the problem and rank it high among those needing an innovative approach for arriving at a satisfactory solution. SEFI has had a Working Group on Internationalisation of EE for quite a time, recently merged with the Curriculum Development Working Group. The effort of Swansea University in developing JEEP Teams will be capitalised, in particular concerning the analysis of the difficulties they have encountered.

Innovative Learning and Teaching Methods (*Activity 5*, http://virtual.hut.fi/E4_Action5/) aims to investigate and disseminate good practices and initiatives in the field of learning and teaching engineering. By the end of March 2003 Activity 5 has the following outputs: ETH Zurich has carried out a survey of virtual campuses in Europe which provides an overview of the developments in Europe in the field. Bauhaus-Universität Weimar has also prepared a short overview of German virtual university initiatives. TU Ilmenau has collected information on existing new learning and teaching methods by means of a questionnaire sent to the institutions of E4 network. HUT has co-operated with other Finnish Universities in organising the course Information and Communication Technologies in Teaching and Learning.

6.6 Dissemination

The leadership and the whole E4 team have undertaken huge information efforts (brochures, website, reports). Yet they have at least for the first year concentrated more on the process itself than on its expected outcomes. Although the building of the identity of the Project has continued, following goals and activities have been focused in the subsequent years:

- definition of specific role and links with established Engineering Education institutions and networks;
- role of E4 with respect to the Bologna process and the role of the TUNING project therein;
- role of E4 with respect to clarifying the terminology in use;
- other specific macro and micro measures in order to help enhancing EE in Europe.

Furthermore, the activation and motivation of every partner is obtained by means of convening meetings and special sessions devoted to E4 at any of the major conferences (like the annual conf. of SEFI, the ASEE-SEFI, the ECI meetings and some CESAER events). It is already put in practice to repeatedly communicate with all partners, keeping them informed (electronic newsletter, circular mails, periodic information by the Headquarter).

The first results to be reached have been:

- **important networking and strengthening of the large partnership (more than 100 engineering schools) focused on the burning issues of the engineering education, like internationalisation, quality insurance/assessment/accreditation, mobility, tuning of educational systems, etc.;**
- **initiating of some good practices, like the continuous support given to ESOEPE, grouping some 7 (and hopefully more in the future) different national accreditation bodies for Engineering Curricula;**
- **linking and bridging to other transversal projects, such as EUCEET, TUNING, etc., ensuring information exchange and mutual cross-fertilisation;**
- **intermediate assessment based on the IAB report.**

Dissemination is achieved in E4 through the following Transversal Actions:

- **Transversal Action 1 (Web site conception & management)**
- **Transversal Action 2 (Electronic Bulletin, Publications of E4, Glossary)**
- **Transversal Action 3 (General Conferences)**

7. Concluding remarks

European integration is preceding towards the target of creating a common HE area within 2010. This ambitious goal has received the largest and most beneficial impulse by several actions undertaken by the EC, starting late 80s. The impact of the wider mobility schemes under ERASMUS COMETT (first), which becomes SOCRATES/ERASMUS and LEONARDO DA VINCI (after 1996) has been enormously beneficial and has accelerated the integration process very significantly. Nowadays, the competitiveness with international Educational system is increased with the launch of new tools which shall allow Europe to be attractive to the best non-European post-graduate students for a longer period of studies.

8. Acknowledgments

The authors gratefully acknowledge the financial support of the EC, DG Education and Culture, to the E4 TN project, which allowed the issuing of the present report. The tireless advice and cooperation of Prof. Francesco Maffioli, E4 Scientific Co-ordinator, is also acknowledged.