

Communication CESAER/SEFI  
**“Engineering Education and Research and the Bologna Process –  
On the Road to Bergen 2005”**  
(March 2005)

## **Introduction**

The Bologna process was initiated by politicians and signed by the ministers of European countries. The process aims at the harmonization of the structure of university education in Europe in order to facilitate mobility. A meeting of EUA (European University Association) was convened in Salamanca in 2001, which provided a forum for a discussion of the central issues of the Bologna process on a broad basis. The results obtained by several working groups were presented to the meeting of the ministers of education in Prague in 2001. The same procedure was used for the meeting in Berlin in 2003 and the EUA prepared the input at a meeting in Graz. The next monitoring of the ministers will take place in Bergen in 2005 and the universities are planning to prepare their statements at a meeting in Glasgow.

The Bologna process brings about specific problems in the field of studies of science and engineering. Therefore CESAER (Conference of European Schools for Advanced Engineering Education and Research) and SEFI (Société Européenne pour la Formation des Ingénieurs) tried to develop a common view on the most important issues of the Bologna process. This was done prior to the Salamanca meeting, and for the Graz meeting a position paper was formulated in a workshop in Helsinki, in February 2003, which was open to the whole engineering community. In order to be prepared for the next meetings in Glasgow and Bergen the two societies convened a seminar on the Bologna process, which took place on June 4, 2004 in Madrid. This seminar was organized in five working groups on selected topics of the Bologna process. The aim was to disseminate the results in the engineering world in order to trigger off a broad discussion and to formulate a position paper of the two societies. This position paper reflects the conclusions of the Madrid seminar.

## **1. PhD in Engineering**

1.1. PhD activities of doctoral candidates are the main source of innovation and new knowledge through research in the engineering sector. They also play an important role in the relationship between academia and industry. This level of training has a large diversity of format and content among universities. This variety should be maintained to ensure future development of research programmes. Nevertheless, primary emphasis should be given to the research work of candidates in all PhD programmes.

1.2. Any form of uniform requirements is likely to be counterproductive. However, some institutional norms concerning the quality management of doctoral programmes may enhance the organization of these programmes. Such norms should include the duration of the studies –normally 3 to 5 years of research-, its scope, additional education required and a schedule.

1.3. The outcome of the doctoral cycle should be PhD graduates who are capable of creating technological innovation, developing new disciplines and building bridges between the world of academic research and the world of innovations in business, industries and government. The PhD thesis should contain original research and should be prepared in close cooperation between candidate and adviser.

1.4. Each university should be responsible for the selection of its own PhD candidates. Universities could offer joint degrees to face the complexity of doctoral programmes. The universities can also cooperate as networks at European level. Association with industrial programmes is also a possibility to ensure development of engineering scientists.

1.5. Doctoral candidates should be considered as researchers and should be recognized as professionals who make a key contribution to the creation of new knowledge through research.

## **2. Bachelor/Master Studies in Science and Engineering**

2.1. The 3+2 model has become a standard reference in engineering. This should not exclude other possible paths towards the second-level degree, such as an integrated 5 years curriculum or a 4+2 scheme or a 4+1 model.

2.2. Engineering needs at least two types of first-level degrees, each with clearly-defined aims and objectives. First cycle degrees should be a gateway to a wide choice of second cycle programmes. The receiving institutions have the freedom to define criteria and procedures for the selection of students for the second level degree courses.

2.3. Obstacles for mobility at the end of the two cycles within the European Union should be eliminated at the academic and at the professional levels. The competition between universities created by the two cycles is a positive factor and should be welcomed.

2.4. Mutual and unconditional recognition of the learning outcomes of study programmes between two or more institutes might have a more profound impact on mobility of students than the simple accumulation of ECTS credits. Some examples of this recognition already exist on the national and international level.

## **3. Double and Joint Degree Programs**

3.1. Trans-national recognition of engineering degrees, academically and professionally, is a primary goal within the context of the Bologna process. Double and joint degrees seem particularly appropriate to facilitate this recognition.

3.2. There is a need for the identification and compliance requirements of legal and of financial procedures to make these joint degrees possible. The importance of the diploma supplement to promote this type of degree is high and may be indispensable for the implementation.

## **4. Further Development of ECTS**

4.1. The disciplines that compose the engineering degrees should be defined primarily in terms of learning outcomes. This definition tries to reflect the paradigm change from input (workload) to output (competences).

4.2. The ECTS credits are primarily a workload measure and a planning tool. The number of ECTS credits awarded for achieved learning outcomes depends on many factors, such as programme design, teaching methods, student abilities and motivation. The credit system needs further development to include other type of indicators.

4.3. In Engineering the whole set of competences acquired in an integrated programme does not represent the mere addition of the ECTS credits of the modules. The outcome is a result of an integrated education and care should be taken to ensure a proper curriculum. Also, the use of the ECTS in Engineering cannot be used to standardize the degrees in Europe.

4.4. ECTS credits should not necessarily be applied to the PhD since an essentially curriculum based PhD-programme cannot fulfil requirements concerning the personal independence, the research experience and alike.

## **5. Quality Management – Accreditation – Autonomy**

5.1. In Engineering education programmes the quality assessment and accreditation procedures must be based on learning outcomes. These outcomes should be classified in three areas: competences, skills and knowledge. To make the process transparent there is a need for the operational definitions of quality criteria for these learning outcomes.

5.2. It is recommended that the quality management and quality assurance systems are as decentralized as possible. A primary concern is that these systems do not become an extra burden for the academic staff and for the administration.

5.3. There is a need to increase the co-operation and the dialogue between academic recognition actors and professional accreditation organizations. Since academic recognition and professional accreditation are two different issues there must be a coordination to simplify procedures.

5.4. The academic recognition in Engineering of the programmes in Europe must have some characteristic features in common. Some of these elements may be a self-evaluation procedure, quality guidelines defined by an external body and an academic recognition body from the engineering community.

5.5. It is recommended that a European organization for academic recognition and professional accreditation be established. The tasks of this organization are to develop a framework of European guidelines and to co-operate, as well as to complement, the national bodies.

### **The role of CESAER and SEFI**

CESAER - The Conference of European Schools for Advanced Engineering Education and Research – founded in 1991, is a multinational association of some 55 leading European universities and schools specialised in academic engineering education and research. These institutions exert a powerful influence on technological growth and workforce development, and ultimately on the viability of the European economy.

SEFI - The European Society for Engineering Education -, founded in 1973, is an international non-profit organization linking together 480 members amongst which ones 250 European universities and institutions of higher engineering education (38 countries). Through its network and its numerous activities and services offered to its members, SEFI has a serious expertise relating to the situation of higher engineering education in Europe. SEFI contributes to the development and improvement of HEE, to the improvement of exchanges between teachers, researchers and students, and of industry with the academics.

CESAER and SEFI both have wide representational roles in the field of European Engineering Education. They have been engaged in and have supported the Bologna Process since its inception. In addition, they have been very active in organising debate and investigations into the future of European engineering education. They remain committed to playing a constructive role in the creation of the European Higher Education Area and the European Research AREA. They have produced this communication in order to present to the wider Higher Education community and to political decision-makers their views on particular issues in the debate on the Bologna Process.

### **Members of the CESAER/SEFI Bologna Working Group**

Prof. Hans Kaiser (chair)  
Prof. Marinela Garcia  
Prof. Torbjörn Hedberg  
Prof. Günter Heitmann  
Prof. Gareth Jones  
Prof. Konrad Osterwalder  
Prof. Alfredo Soeiro (SEFI president)  
Prof. Tor-Ulf Weck  
Prof. Jan Wörner (CESAER president)  
Mrs. Françoise Côme  
Mr. Jan Graafmans

### **CESAER contact information**

Jan Graafmans, Secretary General  
[jan.graafmans@cesaer.org](mailto:jan.graafmans@cesaer.org)  
Tel.: +32 16 32 13 60  
Fax.: +32 16 32 85 91  
Mobile: +32 497 481 660

CESAER  
Kasteelpark Arenberg 1  
B-3001 Heverlee (Leuven), Belgium  
[info@cesaer.org](mailto:info@cesaer.org)  
[www.cesaer.org](http://www.cesaer.org)

**SEFI contact information**

Françoise Côme, Secretary General  
[francoise.come@sefi.be](mailto:francoise.come@sefi.be)  
Tel. : +32 2 502 36 09  
Fax. : +32 2 502 96 11  
Mobile : +32 475 935 614

SEFI  
119, rue de Stassart  
B-1050 Brussels, Belgium  
[info@sefi.be](mailto:info@sefi.be)  
[www.sefi.be](http://www.sefi.be)