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The Bologna Declaration and Engineering Education – a Discussion Paper

Contents

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Introduction

The Bologna Declaration is important for European Engineering Education, but it is far from obvious how the Declaration is being implemented and how it should be implemented.

The purpose of this present discussion paper is to facilitate and stimulate discussion by providing information on the Declaration and its background and on previous positions taken by SEFI.

Short personal accounts given by SEFI's national representatives[1] form an important foundation for this discussion. The final section is an attempt at a synthesis and analysis of the result of this survey.

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Background

On May 25th 1998, on the occasion of the 800th anniversary of the Sorbonne University, Ministers of education from France, Italy, Germany and Great-Britain, signed a common Declaration that aimed to "harmonise the architecture of the European higher education system".

Which were the reasons behind this initiative? In spite of the opening of the European frontiers in terms of employment, it seemed indeed that the level of mobility between the different EU member states was still too low. This situation also did not correspond to an optimal use of the European citizens competencies. This had of course a negative impact on the European competitiveness in the world. Europe must also be a Europe of skills and knowledge and in this context the European universities have a central role to play.

The celebration of the Sorbonne Anniversary was the ideal moment for such a political reflection. Universities indeed were born in Europe and at the medieval time, students and teachers freely studied and circulated throughout Europe using their skills and knowledge within the whole continent.

It also appeared to the Ministers who signed the Declaration that, even if efforts already had been made, in particular in the framework of the mutual recognition of higher education degrees in the professional context, and through specific European directives, it was necessary to go further.

In the Sorbonne Declaration, Ministers committed themselves to "encourage the emergence of the common frame of reference, aiming at improving readability of the degrees, to facilitate the students' mobility and employability". Other Members States and other European countries were therefore invited to join the four signatories and the European universities were invited to contribute to the reinforcement of the place of Europe in the world by improving and updating the education offered to European citizens.

[1] See attachment 3

In France, at the same period (May 1998), a discussion was held relating to the access paths to higher education in the so-called Rapport Attali: "Pour un modèle européen d'enseignement supérieur" (*Towards a Higher Education European Model*). The report suggested to put together the educational perspectives offered by the Grandes Ecoles and the universities, emphasising their main mission to "serve the students, give all of them, despite their social origins, all the chances/opportunities to choose their area of excellence, to prepare themselves for the professions of tomorrow and to ensure the development of the knowledge".

The advocated European model was the one of a convergent system of diplomas and curricula for all the higher education institutions. In addition to a brief overview of the different higher education systems in Europe, the Attali report proposed to the Grandes Ecoles and to the universities a common architecture of the apprenticeship structures and this in term of three steps, leading from the basic qualifications to specialised studies through an intermediary level. This is what is known as the famous 3-5-8 system. This chronology of the Attali report created some confusion and gave rise to misunderstandings as many were lead to believe that the 3-5-8 system was advocated by the Sorbonne Declaration.

The talk about harmonisation of the European higher education architecture was also a source of misunderstanding as it sometimes was interpreted as a calling for unified curricula throughout the continent. But, when they called for an open space for higher education in Europe, the ministers actually pleaded for the respect of the European diversity and the respect of the differences.

The fact that the Sorbonne initiative had been taken by the large EU Member States was not well received by the smaller countries, not having been consulted beforehand. Consequently, this first attempt encountered an important resistance and led to numerous discussions at all possible levels.

Nevertheless, the Sorbonne Declaration represented the starting point for a new European approach in encouraging a reflection relating to the European space for higher education as a key factor for the European citizens mobility. Different European countries started a similar reflection and agreed to commit themselves to implement the contents of the Sorbonne Declaration. The developments of the different higher education reforms realised in the same time in Europe, also encouraged several European governments to act.

The European Commission, the CRE and the Confederation of the European Rectors conferences initiated a study emphasising the different trends of the higher education structures in the EU and in the Central and Eastern European countries associated to the SOCRATES programme. A working group was established and in June 1999, the University of Bologna, in cooperation with the CRE and the Confederation of the European Rectors Conferences, organised a major event that lead on 19 June 1999, to the signature of Bologna Declaration by 30 European Ministers of education (29 countries).

In March 2001, at the initiative of the CRE and of the Confederation of European Rectors Conferences, the European universities met in Salamanca[2]. The objective of the Salamanca Convention was to define a position common to the European universities and to the academic associations regarding the Bologna Declaration. This was undertaken in order to produce a document to be communicated to the European Ministers of education before the Prague Conference planned for May 2001.

The text produced – "Shaping the European Higher Education Area" – was sent to the Ministers who met in Prague in order to review the progress and to define the priorities of the process for the coming years. In the text, the European universities re-affirmed their support to the Declaration of Bologna principles as well as to the creation of a European area for higher education before the end of the decade. Before the Prague Conference, SEFI, CESAER and CLUSTER, sent a letter to the Ministers (see Attachment 2) presenting their common position as far as the specific situation of higher engineering education was concerned.

The Prague Summit (May 17) did not lead to a new declaration but it led to a Communiqué – available at *www.sefi.be*. Three new countries joined therefore the process: Cyprus, Turkey and Croatia. Ministers also stressed the important role to be played by the students within the university decision process.

Coming back to the Bologna Declaration itself, we can say that it is a unique and remarkable document. It is not a classical international convention or a simple declaration of intention. It contains an action plan, a follow-up and an implementation process. Ministers commit themselves, and engage their relevant countries, to introduce fundamental changes within their higher education system. The Declaration deals with central questions and it will have a considerable influence about the European universities in the coming years. It will lead to a harmonisation of the degrees structure, at least in certain fields, and each country will be forced to overcome the obstacles towards the mobility.

Ministers do not define in detail what they understand by "European Area of Higher Education", but it is obvious that **mobility, transparency, compatibility and comparability**, are its key words. Ministers seem very much concerned by the fact that the position of continental Europe gets weaker in comparison with the international market that is constituted by all the higher education students.

The consequences of the Declarations also depend of the reactions of the universities. But the universities and the academic associations – and in particular the engineering schools and the universities of technology – have not been sufficiently involved in the process and in the preparation of the Declarations. The Salamanca Convention constituted a step in the good direction but it seems that the governments and the European Union have take the initiative back in Prague.

The objectives to reach are defined in the Bologna Declaration as follows:

[2] On this occasion, the two associations merged within a new entity called "EUA – European University Association".

- **Adoption of a system of easily readable and comparable degrees**, also through the implementation of the Diploma Supplement, in order to promote European citizens' employability and the international competitiveness of the European higher education system.

- **Adoption of a system essentially based on two main cycles,** undergraduate and graduate. Access to the second cycle shall require successful completion of first cycle studies, lasting a minimum of three years. The degree awarded after the first cycle shall also be relevant to the European labour market as an appropriate level of qualification. The second cycle should lead to the master and/or doctorate degree as in many European countries.

- **Establishment of the system of credits** – such as ECTS system – as a proper means of promoting the most widespread student mobility. Credits could also be acquired in non-higher education contexts, including lifelong learning, provided they are recognised by receiving Universities concerned.

- **Promotion of mobility** by overcoming obstacles to the effective exercise of free movement with particular attention to:
  - for students, access to study and training opportunities and to related services;
  - for teachers, researchers and administrative staff, recognition and valorisation of periods spent in European contest researching, teaching and training, without prejudicing their statutory rights.

- **Promotion of European co-operation in quality assurance** with a view to develop comparable criteria and methodologies.

- **Promotion of the necessary European dimension** in higher education, particularly with regards to curricular development, inter-institutional co-operation, mobility schemes and integrated programmes of study, training and research.

All these elements were considered and confirmed by the Ministers of Education in Prague in May 2001. Furthermore, they emphasised the following points:

- The crucial role of lifelong learning, notably to improve social cohesion, equal opportunities and the quality of life, insisting also on the importance of the new technologies.

- The involvement of higher education institutions and of students as competent, active and constructive partners in the establishment and shaping of the European higher education Area. Ministers affirmed that students should participate in and influence the organisation and contents of education at universities. They also emphasised the need, evoked by the students, of the social dimension within the Bologna process.

- The importance of enhancing the attractiveness of the European higher education for the students of Europe and of the rest of the world, Europe having to promote the quality of its higher education and research. To make the European diplomas more easily readable and comparable, it is important to develop a common framework of qualifications as well as

coherent quality assurance and accreditation/certifications mechanisms and to increase information efforts.

The ministers committed themselves to continue their cooperation in the implementation of the Bologna Declaration objectives, building on the similarities and benefiting from the differences between their cultures, languages and national systems, while developing the dialogue between the universities and their associative representatives, the students organisations and the Community programmes.

A new ministerial conference should take place in Berlin during the second semester of 2003 in order to review progress and set directions and priorities for the next stages of the process. A follow up group has been designated in view of this conference, and associations such as EUA, ESIB[3] or EURASHE[4] (Non-university higher education sector) will be consulted in the follow-up work. In order to take the process further, ministers encouraged the follow-up group to arrange seminars to explore the following areas: cooperation concerning accreditation and quality assurance, recognition issues and the use of credits in the Bologna process, the development of joint degrees, the social dimension with specific attention to obstacles to mobility, the lifelong learning…).

SEFI's position

SEFI made its position on the Declaration public in December 2000 through a position paper (Attachment 1) distributed to all ministers concerned and to the SEFI members. The paper was based on a discussion at the General Assembly in Paris in September 2000. A draft was circulated among all members and it was finally approved by SEFI's Administrative Council on Dec 2, 2000. The paper is also available on *www.sefi.be*.

Later SEFI together with CESAER[5] and CLUSTER[6] sent a letter to the ministers before the Prague meeting in May 2001. The letter is included as Attachment 2.

Comments on the Declaration

It is easy to agree upon most of what the ministers committed themselves to in Bologna. Nobody should really be against the "A Europe of Knowledge" and "The European Higher Education Area". The value of easily comparable degrees is obvious. A credit system like the ECTS will provide a system for recognition and transfer and will no doubt promote mobility. Mobility of students, teachers, researchers and administrative staff should of course be promoted. "European cooperation in quality assurance with a view to developing comparable criteria and methodologies" is certainly worthwhile.

[3] National Union of Students in Europe
[4] European Association of Institutions in Higher Education
[5] Conference of European Schools for Advanced Engineering Education and Research.
[6] Consortium Linking Universities of Science and Technology for Education and Research

There is however a, maybe significant, omission under point 4. It is stated that *"Credits could also be acquired in non-higher education contexts, including lifelong learning, provided they are recognised by the receiving Universities"*. It does *not* state that receiving Universities have the right to decide whether credits acquired in a normal higher education context should be recognised or not. This point must be clarified and universities must watch this carefully and defend their responsibility for the degrees they confer.

The crucial point, and the one who has attracted the attention of most observers, is point 2; the "*adoption of a system essentially based on two cycles, undergraduate and graduate*" with a first degree that should "be relevant to the European labour market as an appropriate level of qualification". Most people assume that what is aimed at is a so-called 3-5-8 system; a Bachelor's degree after three years, a Master's after 2 additional years and finally a PhD after 3 more years. This scheme is however not specified in the Declaration; it only says that the first cycle should last at least 3 years.

A two-tier system - a Bachelor/Master system, often referred to as the "Anglo-Saxon or "Anglo-American" system" - would certainly facilitate mobility during the studies, introduce a certain flexibility and make it easier for students to follow their individual strategy choosing between specialities. Another argument is that Europe has to meet mounting challenges from abroad and that most countries in the world except mainland Europe use such a model. Some think that a two-tier model is needed for (continental) Europe to be attractive for students from outside Europe, in particular for students coming for a Master's programme.

A first observation is that the particular conditions for Engineering education do not seem to have been taken into account. You may even ask whether engineering education should be concerned by the Declaration at all. It is in any case obvious that those who wrote the text primarily had the general, non-professional, university education in mind and not Engineering education or any other professionally oriented education like for instance medical education.

An objection against this particular part of the Bologna Declaration is that we already have a European model for Engineering Education that is compatible with the idea of a "European Area of Higher Education"The reasons given for replacing this European model by a 3+2 Bachelor/Master system are not sufficient.

Many people believe and repeat that there is a large difference between education systems and degrees in the various European countries. This may be true in some fields but in Engineering Education there is already a high degree of similarity between the various national engineering education systems. The long, integrated and coherent 5-year curricula typical for countries like Spain, Sweden, Switzerland, Italy and Germany have a long tradition and are well established. It is important that this classical Engineering Education is preserved.

The main reason why are people so convinced that there are large differences between various national systems is probably that the roads leading to the national degrees often look different. Other reasons are simply lack of information and differences in terminology. There are of course still some national differences, but the introduction of a 3+2 system would not make these dis-

appear. Such a reform would not solve all problems of lack of transparency and readability of degrees and qualifications. More important is to provide and improve information, through diploma supplements and otherwise, to develop and perhaps change terminology and to work on national and European procedures for quality assurance and accreditation.

A completely different matter is that Master's programmes in engineering given by continental universities could be attractive for overseas students, especially if those programmes were given in English or maybe in some other international languages such as Spanish or French. But these could be given independently of and in parallel to the integrated 5-year curricula.

A second observation is that European ministers of Education immediately look across the Atlantic and import what is supposed to be an "Anglo-Saxon model when they want to create a *European* Space for Higher Education. Unfortunately there also seems to be a misunderstanding: The normal North American engineering degree is not a two-tier Bachelor/Master, it is a 4 year Bachelor. This is what ABET accredits and this is the normal academic background, the first professional degree, for a North American professional engineer.

A third observation concerns the shorter and more application oriented engineering education in many, if not most, European countries. Most continental European countries have two main types of engineering education, one longer programme and one shorter. The aims and objectives of the 3-year and the 5-year education are different. The essential technical as well as non-technical elements of the two types of education are the same, but in different proportions, with a different ratio of theoretical work to practical problems. Our society and our industry need both types, but the shorter and more application oriented education, is too often wrongly considered being inferior and less prestigious.

It would not be too difficult to reorganise the normal 5-year curriculum and introduce an intermediate degree after three years. But what would the consequence be for the application oriented short-cycle programmes typical for many countries? There is in many countries a tendency for this education to become more "academic" and theoretical, an "academic drift". An introduction of a new Bachelor's degree as a normal intermediate step towards the professional degree might strengthen this tendency.

It may also become difficult to explain to students and employers the difference between the two degrees, between the new Bachelor and the existing 3-year application-oriented degree. There is a risk that they would converge to something that neither suits those who want to pursue their studies or those who want to go directly into the labour market. However, all experiments are of value as they might help to find ways to reduce of the real length of studies and the high drop out rates at universities.

The Present European Situation

SEFI has asked its national correspondents to provide information on the situation in their respective countries. The result of this survey is presented as Attachment 3. SEFI does not pre-

tend this to be the complete and final description of the situation; it reflects opinions and observations of the ongoing process by SEFI's national representatives.

It is obvious from the result of the survey and from other available information that the picture varies drastically from country to country. It is therefore not yet possible to talk about a European trend or a new European system

It is furthermore a part of the picture that the movement towards a two-tier degree system is driven from above and that many universities and educators only are moderately interested, even in countries where the reform is taking place.

Another general observation is that many of the smaller and of the Eastern and Central European countries seem to pay more attention to what has been signed in Bologna than the bigger ones, Italy being a remarkable exception

The two-tier system

The first observation concerns the "big four", the four largest members of the European Union, who also happen to be those who signed the original Sorbonne Declaration. Each of these countries has chosen their own solution, at least for the time being. Their different approaches perfectly illustrate the various available options.

- The Italian authorities have obviously taken the lead and Italy has already made drastic reforms rapidly introducing a two-tier system in full accordance with Bologna. The new degree system will replace the older.

- Britain seems to be satisfied with its present system and nothing indicates any reforms that can be traced to the Declaration. (The same holds also for Ireland, although changes are under discussion.)

- Germany has also introduced a two-tier system, although this reform process was initiated well before the Declaration. The two-tier system will also exist in parallel with the old one. The German picture is also complicated by the Fachhochschule/Technical University dichotomy.

- France does not for the moment seem to consider any reforms of its classical 2+3 system - 2 years of "classes préparatoires" followed by 3 years of Grandes Ecoles.

Some countries have already had a two-tier system for some years, quite independently of the Bologna Declaration. United Kingdom and Ireland belong to this group and also Poland[7], Spain[8], Russia[9], Slovakia, Estonia and Lithuania[10].

[7] The Polish system of Engineering Education has gradually changed into two-tier system since 1997 and locally even earlier.
[8] The Spanish 3+2 system for engineering education consists of a first cycle leading to a *Ingeniero Tecnico* degree and a second leading to a *Ingeniero Superior* degree.
[9] The new Russian two-tier system was introduced in 1992.

Other European countries can, with regard to long cycle engineering education, be grouped into three main categories;

1. Countries were the governmental authorities have decided to introduce or probably will decide in the near future to introduce a 3+2 system. In this group we find Denmark, Norway, Iceland, the Netherlands, Belgium (Flemish Community)

2. Countries where the decision is left to the Universities. To this category belong Austria, Switzerland, Slovakia, the Czech Republic and Portugal.

3. Countries were no decision has been taken and were the existing system can be expected to prevail for the time being. This category contains countries such as France, Finland, Hungary, Romania and Sweden.

Parallel systems

The countries where the introduction of a 3+2 system has been decided or is likely to be decided follow different patterns. Some of them have more or less clearly indicated that the two-tier system should replace the classical five-year one. To this group belong countries such as Belgium, Iceland, Italy and Lithuania.

In other countries the two systems will remain side by side even if the long range might be to have only one model. To this group belong Germany, Norway, Spain, Russia, Switzerland and Denmark.

Austria and Switzerland will allow both models, but for any given curriculum in a university only one system may persist.

"Relevant for the Job Market" or a Pivot Point?

In most countries, where an intermediate degree 3-year is introduced, this degree will primarily be something that facilitates for the student to move, either to a new university, to a new country or to a new line of study. The employers may of course also accept the degree, but it cannot really be seen to fulfil the Bologna requirement of being in itself “relevant for the European job market”. Degrees introduced or being introduced in Switzerland, Denmark, the Netherlands Belgium (both French and Flemish Communities)[11], Iceland seem to fit this description of a “Pivot Point”.

Application-oriented curricula

The question of the more application-oriented education is crucial. How these should fit into the Bologna scheme and how these can survive side by side with new intermediate "Bachelor's" degrees is far from obvious. Different countries have different solutions, each based on the his-

[10] Lithuania has a two-tier (4+2) system since 1990. There are now discussions about a possible change to a 3/3.5+1/1.5 system.
[11] If a 3+2 system is introduced.

tory, industrial and social structure and established traditions of each individual country. Much work has to be done before we can talk about anything like a European harmonisation of these curricula and degrees. This work is important for many reasons, one being the fact that in most countries the number of graduates from these programmes exceeds the number of graduates from the long cycle education. The main challenge is to agree on certain minimum standards and to create a system to describe, in a commonly understood way, the various competencies for professional and academic use. The work done by the Thematic Network E4[12], run by University of Florence in cooperation with SEFI and other organisations, is of interest in this context.

Accreditation

Accreditation has been put on the agenda although it is not explicitly mentioned in the Bologna Declaration. The ministers committed themselves however to the "Promotion of criteria and methodologies for quality assessment" and accreditation is often mentioned in the following phases of the Bologna process.

Not long ago very few educators in Europe (with the notable exceptions of France, UK and Ireland) thought much about accreditation of Engineering programmes. It was essentially something that went on in the US. Accreditation did not fit into our existing structures and our established patterns. Germany and Sweden are typical examples; the government simply gave the right to confer the *Dipl.-Ing.* or *civilingenjör* degree to a certain number of universities and produced a set of rules that should be respected.

The situation has changed and the word "accreditation" is often used and heard. But not only Bologna has brought up this issue. European universities are also part of broad and general movement towards new ways to manage and control public organisations. Key words are decentralisation, autonomy and self-regulation, management by objectives and accountability. This leads naturally to an increased interest in evaluations and accreditation.

In addition providers of education become more numerous and more diversified as a consequence of this deregulation and of an increasing number of institutions. Accreditation is seen as a possible tool for "consumer protection".

Accreditation of Engineering degrees now not only exists in France, Britain and Ireland; it also exists in Portugal and it has been introduced in Germany for the new Bachelor's and Master's degrees. The Netherlands decided to create accreditation agencies a few months ago. Discussion is also taking place in Italy. Many East and Central European countries have it. In most of these countries the accreditation process is either completely "owned" by the professional organisations or performed in such a way that these organisations are deeply involved.

European accreditation of Engineering Education

European accreditation of Higher Education has been discussed for some time but the special circumstances of Engineering Education are not always sufficiently considered in this general discussion.

[12] Enhancing Engineering Education in Europe www.ing.unifi.it/tne4.

- Mobility is often discussed in the Bologna context but mostly taken to mean mobility of students and teachers whereas for Engineering the crucial issue is the mobility of graduated engineers.

- Many non-engineering educators or administrators seem to forget or neglect that accreditation of engineering programmes is well established in several European countries since the 1930s..

- The existence of strong and active professional bodies, already involved in accreditation is an important factor.

- The aims and objectives of the Engineering Education are based on international frames of reference and on the needs of the profession, whereas in many other cases the aims, objectives and frames of reference are national.

The role of professional organisations in accreditation is crucial. There is a risk that we get two non-related parallel discussions on European accreditation with little overlap and interaction. One is a part of this Bologna process, based upon various public authorities with the recently created ENQA[13] in a central position. The other discussion includes the professional organisations for engineers with the British Engineering Council, ABET[14], CTI[15] and ASII[16] as typical examples.

Universities are however already overloaded by various evaluations etc. These two ongoing processes must therefore merge so that a future European accreditation of engineering education programmes can rely upon professional organisations, national authorities, universities, organisations of students, teachers and employers and European organisations for Engineering Education.

The creation of a European agency similar to ABET is not realistic. The only real possibility is a cooperation of accrediting bodies in Europe in a network of agencies. An ultimate goal could be a mutual recognition of accreditation and a certain convergence of criteria. Such an accreditation network must build on the existing and active accreditation agencies, primarily the British, Irish, French, Portuguese, German and the new Italian ones and actively involve the professional organisations.

Any European accreditation network for Engineering Education has, in some way or another, to take the well-known Washington Accord[17] into consideration. The Accord is not only an important agreement; it also provides a working and existing model for a European network.

Some European national agencies have already taken important steps towards a deeper cooperation. The German ASII, the French CTI, the British Engineering Council, the Italian deans, the

[13] The European Network for Quality Assurance in Higher Education.
[14] The Accreditation Board for Engineering and Technology (USA).
[15] Commission des Titres d'Ingénieur (France).
[16] Akkrediterungsagentur für Studiengänge der Ingenieurwissenschaften und der Informatik (Germany).
[17] Signed in 1998 by accrediting agencies in a number of English-speaking countries, including two members of the European Union, United Kingdom and Ireland.

Portuguese Ordem dos Engenheiros, the thematic network E4[12] and SEFI, together with CESAER, BEST[18] and FEANI, have created a body called ESOEPE - the European Standing Observatory of the Engineering Profession and Education.

Other aspects of the Bologna declaration

European Credit Transfer System (ECTS)

The system is gradually gaining ground. This is a major reform in those countries, such as France, which previously did not rely upon a credit system. In many other countries the introduction is trivial.

Readability

The use of the Diploma supplement is slowly increasing.

Mobility

Obstacles are most certainly gradually being removed and mobility is encouraged.

"International" Master's Programmes

There is obviously a growing interest and many countries, but not all, already offer or plan to offer various special Master courses primarily aimed at foreign students and often given in English. To this group of countries belong Ireland, France, Belgium (Flemish Community), Germany, the Czech republic, Poland, Lithuania, Sweden, Belgium, and Switzerland. The typical entry requirement is a first 3-year academic degree (Bachelor).

A possible future standard model

At least some countries have opted for the following model, which might become a standard pattern, namely:

- Let the new 3+2 system and the classical system exist in parallel;
- Consider the intermediate degree primarily as a point of mobility;
- Make a clear distinction between this "Bachelor's degree" and the Applied Engineering 3 year degree;
- Introduce more Master's programmes primarily intended for students from abroad with a first university degree.
- Develop a national system for accreditation of Engineering Education Programmes.

We may also get a system being a mixture of the British and the continental system with a first degree at two levels; a 3-year Bachelor essentially being a point for mobility and a 4-year Bachelor with more incorporated professional elements, comparable to a British MEng or an American BSc(Eng).

[18] Board of European Students of Technology.

ATTACHMENTS

Attachment 1

Brussels, 4th December 2000

SEFI's Opinion on the Joint Declaration by the European Ministers of Education, signed in Bologna

SEFI welcomes the important initiative taken by the European ministers of Education in signing the Joint Declaration in Bologna in June last year. SEFI strongly supports the idea of the creation of a European Higher Education Area.

SEFI wishes to make the following general comments:

- SEFI shares the opinion of the Ministers concerning the need for a system of easily readable and comparable degrees, through a Diploma Supplement or otherwise,

- SEFI supports a wider use of the ECTS system as a proper means to promote student mobility,

- SEFI is convinced of the importance of increased mobility for students, teachers, researchers and administrative staff and it does in many ways promote such mobility,

- SEFI is already, by its statutes, committed to the idea of developing the European dimension in Education. It does so primarily by serving as a network of engineering educators and a forum for discussion and information exchange, as well as through the activities of its Working Groups, for instance, in curriculum development,

- SEFI shares the opinion of the European Ministers concerning the importance of European cooperation in quality assurance and accreditation. In certain countries in Europe, Engineering Education programmes are already accredited by competent bodies. SEFI welcomes any initiative leading to a common reflection, aiming at a deeper understanding and cooperation between these agencies. SEFI is fully prepared to pursue its action in this area, in cooperation with these accreditation agencies and other organisations.

The Ministers also commit themselves to the adoption of an education system based on two main cycles, where the first cycle shall in itself be relevant to the labour market and where the second should lead to a Master's degree.

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The introduction of a larger number of Master's degree programmes, building on Bachelor's degrees, will no doubt make European Engineering Education more attractive for non-European students, especially if the programmes are run entirely or partly in English. It will also facilitate student mobility within Europe. SEFI therefore welcomes a large-scale introduction of separate 1-2 year Master's Programmes in Engineering.

The particular conditions and circumstances of Engineering Education must, however, be taken into consideration. It is often said that the educational systems across Europe are very different. This may be true in some fields but in Engineering Education the systems are already similar in many respects. There are many reasons behind this. One reason is the international character of the engineering profession. Another is the influence that the classical 19th century German technical university has had in the past as a model for other countries, particularly in Northern, Eastern and Central Europe. SEFI and other organisations have also contributed to a convergence of ideas.

In many European countries, two distinct types of engineering curricula are offered, one more scientifically oriented and one more application-oriented. Both of these have been developed to respond to the particular needs of industry and graduates of both types of curricula are well received by the job market.

There is today a high degree of consensus that the professional engineering degree should take about five years following secondary school. An exception has always been the United Kingdom, which has traditionally accepted the three-year honours degree as an adequate university education for the professional engineer, but its system of separate professional recognition adds further years of practical training to the qualification requirements. Recently, Britain has moved in the direction of its European partners by making the four-year MEng degree the minimum academic requirement for professional recognition as a Chartered Engineer.

Most European countries also have various forms of shorter Engineering Education. The length and character of these curricula may vary slightly from country to country but they have normally two factors in common; they are more vocationally oriented, or application-oriented, than the longer programmes and, although bridges normally exist, they are not primarily designed as a first part of a two-tier system. Graduates of these programmes play an important role, particularly in small and medium-sized enterprises.

SEFI is convinced that this existing European system for Engineering Education has much merit, that the system is quite compatible with the vision of a European Higher Education Area and that it should not be sacrificed. The cultural diversity of Europe is also a source of richness and changes in the architecture of Engineering Education must not be allowed to destroy this richness.

This does not, of course, exclude the creation of a two-tier Bachelor/Master system also in Engineering Education, whenever this is judged appropriate. The Master's degree should, in such cases, be equivalent to the existing 5-year degrees.

It is also essential that changes in the organisation of engineering studies take into account the ongoing evolution in the transfer of knowledge and the emergence of virtual universities, flexible learning and distance education.

SEFI's view is thus that:

- any reform of the structure of European Engineering Education must take the particular conditions of this field of education into account,
- the existing European integrated 5-year curricula in Engineering are compatible with the idea of a European Education area,
- the existing European system of longer integrated curricula leading straight to a Master's Degree in Engineering should be maintained, possibly in parallel with a two-tier Bachelor/Master system,
- the longer, as well as the shorter, more application-oriented, curricula, correspond to a clear need and graduates from both types of programme have a good position on the job market,
- the specific qualities of the present, existing, application-oriented Engineering degrees should be recognised and safe-guarded,
- the creation of new 1-2 year Master's programmes in Engineering should be encouraged.

Attachment 2

Letter addressed by CESAER, CLUSTER and SEFI to the European Ministers of Education on the occasion of the Prague Conference

Dear Madame/Sir,

We are writing you on behalf of CESAER, SEFI and CLUSTER, the main organisations for universities of technology, faculties of engineering and other higher engineering education institutions in Europe.

Our organisations have given a longstanding contribution to cross-European cooperation in our field and we have actively participated in the Convention recently held in Salamanca where the attached documents were presented. These describe the complete background of our common positions regarding the Bologna process, which we strongly support.

Most of our views have been retained in the Conclusions of Salamanca. However, some important points have only been included in an implicit or general form. We have thus felt the need to provide you and all other European Ministers of Education with a more precise input from universities of technology and other engineering education institutions before the European summit in Prague on May 17-18.

CESAER, SEFI and CLUSTER fully support the following points, which we consider crucial in the creation of a European Higher Education Area as far as engineering education is concerned:

1. Highly qualified engineers, able to contribute to the technological progress through their leadership in research and development activities, are of vital importance for the economic competitiveness of Europe. Therefore scientifically oriented curricula leading to the Master's level, i.e. the 2nd Cycle level in the Bologna formulation, are necessary.

2. The society also needs graduates from application oriented engineering studies lasting three/four years. Their specific qualities should be appropriately recognised.

3. The option of 5-year integrated programmes (exceptionally 4-year) spanning the 1st and 2nd Cycles and leading straight to a Masters Degree in Engineering, without the mandatory award of an intermediate professional degree at the end of the 1st Cycle, should be maintained in addition to the two-cycle structure envisaged in the Bologna Declaration

4. The creation of new 1-2 year Masters programmes should also be encouraged.

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5. The general employability should be distinguished from professional employability. The Bachelor's level does not necessarily have to qualify for professional employability.

6. The Bachelor's level should not only give employability; it should also be a pivot point for cross-European and international mobility and an entry point to the Master's level.

7. Universities should be allowed to set their own admission criteria for entry to the 2nd Cycle.

8. The organisations for engineering education and the professional engineers in Europe should play a formal role in the development of accreditation, quality assurance and recognition at a European level

We thank you for your attention and trust that these considerations will be taken into account in the summit of the European Ministers of Education to be held in Prague.

If you have any questions or doubts about the above, please do not hesitate to contact us.

Prof. Jaume Pagès	Prof Torbjörn Hedberg	Prof Dominique de Werra
President of CESAER	President of SEFI	President of Cluster

Attachment 3

SEFI National Correspondents

Country	Representative	Institution
Austria	Dr. Franz Reichl	Vienna University of Technology
Belgium (French)	Prof. Auguste Laloux	Université Catholique de Louvain
Belgium (Flemish)	Prof. Rob Gobin	Katholieke Universiteit Leuven
Czech Republic	Prof. Ladislav Musílek	Czech Technical University of Prague
Denmark	Prof. Ole Vinther	Engineering College Copenhagen – IPN Network
Estonia	Prof. Andres Keevallik	Tallinn Technical University
France	Prof. Jean Michel	Ecole Nationale des Ponts et Chaussées Paris
France	Prof. J-M. Alaverdov	Ecole des Mines d'Albi
Finland	Prof. Eero Suosara	Jyväskylä Polytechnic
Germany	Prof. Steffen Bohrmann	Fachhochschule Mannheim
Germany	Prof. Günter Heitmann	Technische Universität Berlin
Hungary	Mrs.Zsuzsanna Sárközi Zágoni	Technical University of Budapest
Hungary	Dr. Angela Sz. Varadi	University of Miskolc
Iceland	Prof. Gudbrandur Steinthorsson	Tækniskóli Íslands
Ireland	Dr. Ivan Gibson	National University of Ireland
Italy	Prof. Bruno di Maio	Università degli studi di Palermo
Liechtenstein	Dr. Dieter Gunz	Fachhochschule Liechtenstein
Lithuania	Prof. Algirdas Valiulis	Vilnius Gediminas Technical University (VTU)
The Netherlands	Dr. Paquita Pérez Salgado	Open University of the Netherlands
Norway	Prof. Kjell Erling Malvig	Norwegian University of Science and Technology
Poland	Prof. Andrzej Filipkowski	Warsaw University of Technology
Portugal	Dr Alfredo Soeiro	University of Porto

Romania	Prof. Iacint Manoliu	Technical University of Civil Engineering of Bucharest
Russia	Prof. Nikolay Fomin	Moscow Technical University of Communications and Informatics
Slovakia	Prof. Maros Finka	Slovak University of Technology in Bratislava
Spain	Prof. Marinela García Fernández	Universidad Politécnica de Madrid
Sweden	Prof. Torbjörn Hedberg	Luleå University of Technology
Switzerland	Prof. Gaston Wolf	Zurich University of Applied Sciences at Winterthur
Turkey	Prof. Dr. Okyay Kaynak	Bogazici University
United Kingdom	Mr. John Whitwell	Institution of Civil Engineers
Ukraine	Prof. Gennadiy Pivnyak	National Mining University of Ukraine