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European Accreditation of Engineering Education: setting up a system in the global context

by

Giuliano Augusti[1]

Abstract

Accreditation of engineering educational programmes as entry route to the engineering profession has been proved to be a powerful tool to improve at the same time academic quality and relevance for the job market.
Within Continental Europe, accreditation of engineering studies started formally in France, with a 1934 law establishing the Commission des Titres d' Ingénieur (CTI), but already in the 19th Century the Engineers' Institutions played a similar role in Great Britain. Accreditation of engineering programmes is spreading in other European countries within the present widespread trend for internationalization of QA and accreditation.
However, a generally accepted European system does not yet exist; this paper will briefly describe the EUR-ACE system that is being set up to cover this lack.
The EUR-ACE Framework Standards permit to evaluate whether an Engineering study programme – irrespective of type or profile - provides graduates with the academic qualifications necessary to enter the engineering profession at either the First Cycle or the Second Cycle level. National Agencies accredit the educational programmes, and – if they conform to the EUR-ACE Framework Standards and respect other relevant documents like the ENQA Standards & Guidelines – are authorized to add the (copyrighted) EUR-ACE label, thus giving a European dimension to the national accreditation.
This system is at present being implemented by a "core" of six Agencies, respectively in the UK, France, Germany, Portugal, Ireland and Russia, but new Agencies and countries will soon join the system. Moreover, the system is in principle open to non-European countries: agreements aimed at implementing this principle are under development.

3Introduction and Background

Accreditation of engineering educational programmes as entry route to the engineering profession has proved to be a powerful tool to improve both academic quality and relevance for the job market.

Indeed, the word "accreditation", used in the United States since the 1930s, did not find its way into European specialized literature and official documents until recently: however, historically Europe has been in the forefront.

Within Continental Europe, formal accreditation ("habilitation") started in France: a 1934 law established the Commission des Titres d' Ingénieur (CTI), in which not only academia but also employers and social stakeholders are represented on a parity basis: only graduates from an accredited programme can use the title of "ingénieur diplômé"; at present, about 700 engineering programmes are accredited in the French Schools.

In the UK a similar role has been played since the 19th Century by the Professional Institutions of the different engineering disciplines (branches): hence, accreditation was (and is) distinguished by discipline. In 1981 the overarching Engineering Council UK (ECUK) was established to coordinate and maintain the standards of the accreditation process.

Thus, although there is neither in France nor in the UK a formal obligation to register in order to practice as a professional engineer, in both countries the established standards provide a strong incentive for the accreditation of engineering degree programmes.

Engineering accreditation in UK and France is dealt with in detail in Part 2 of the full EQAF paper (Augusti et al., 2007) while, as described in several papers and reports (e.g. Augusti 2005, Augusti 2006), the situation in other countries is very varied.

[1] Professor, Università di Roma La Sapienza; President of ENAEE and coordinator, EUR-ACE IMPLEMENTATION and EUR-ACE SPREAD EU-supported projects.

For example in Germany, up to a few years ago all Higher Education programmes had to conform to strict (State or Federal) rules, which made accreditation superfluous. “Bachelor” and “Master” programmes, introduced in the 1990s, are gradually replacing the old programmes: for them formal accreditation has been prescribed, and a great number of programmes have been already accredited, especially in engineering.

In other countries, where QA assurance procedures are being introduced in the context of the Bologna process, procedures for programme accreditation are being developed in parallel, sometimes using different terminology: this is for example the case in Italy.

In Portugal (and in some other countries) accreditation of engineering programmes has preceded general Quality Assurance procedures: the “Order of Engineers” established its accreditation procedure in 1994, well before the establishment of an overall QA system of Higher Education.

It is however fair to state that the quality of European engineering programmes is in general quite high on a global standard, and on the whole continuously improving thanks not only to QA practices but also to the continuous contacts and exchanges between Engineering Faculties, facilitated since several decades by International Associations such as SEFI (Société Européenne pour la Formation des Ingénieurs) and CESAER (Conference of European Schools for Advanced Engineering Education and Research), and lately by EC-supported Thematic Networks on Engineering Education (either general: H3E, 1997-99; E4, 2000-04; TREE, 2004-2008; or branch-specific, e.g. EUCEET).

Motivation for a European system of accreditation of Engineering Education (EE)

The variety of educational situations and of degrees awarded in Europe makes trans-national recognition of academic and professional qualifications rather difficult. The Bologna process is working towards the creation of a transparent “system of easily readable and comparable degrees”, but as far as “accreditation” and recognition with professional implications, no shared project or system exists on the continental scale, while in the engineering field several international agreements for mutual recognition of degrees and/or qualifications are active (e.g. the Washington Accord). Notwithstanding the prestige of national systems and academic titles, this deficiency weakens the position of the European engineer in the global employment market.

The relevance of this problem has been felt for quite some time. Already in 1994, the European Commission issued a communication on the possible synergies between recognition of qualifications for academic and professional purposes (EC, 1994). More recently, after three “European Workshops for Accreditation of Engineering Programmes” promoted by Thematic Network H3E, a few academic and professional organizations set up in September 2000 the “European Standing Observatory for the Engineering Profession and Education” (ESOEPE).

Thus, when in March 2004 the European Commission (DG Education and Culture) issued a “Call for Proposals for Europe-wide Participation Projects contributing to the Realisation of the European Higher Education Area (Bologna Process)”, in which it was stated that “the Commission supports the setting up and testing phase of transnational evaluation and accreditation” and “would welcome ... proposals from subject specific professional organisations developing European Cooperation in Accreditation in fields like medicine or engineering”, it was quite natural for ESOEPE to promote the EUR-ACE (EURopean ACredited Engineer) project, that was launched in September 2004 and completed by 31 March 2006.

The EUR-ACE project and the EUR-ACE Framework Standards

The main purpose of the EUR-ACE project (Augusti, 2007) was to develop a set of standards and procedures for comparing the degree programmes across Europe that contributed to the formation of professional engineers. A preliminary detailed survey of the standards used by the partners in the project revealed striking similarities behind different façades, and in particular a strong preference for using standards based on outcomes, i.e. on what is achieved rather than how it is achieved. This approach has four direct advantages:

(a) it respects the many existing traditions and methods of engineering education in Europe;

(b) it can accommodate developments and innovation in teaching methods and practices;

(c) It encourages the sharing of good practice among the different traditions and methods; and

(d) it can accommodate the development of new branches of engineering.

The resulting EUR-ACE Framework Standards (EUR-ACE 2006) were developed after successive versions were commented on by the project partners and other stakeholders, both academic and non-academic, and after testing in a number of countries. They identify 21 outputs for accredited First Cycle degrees and 23 for Second Cycle Degrees, grouped under six headings:

- Knowledge and Understanding;
- Engineering Analysis;
- Engineering Design;
- Investigations;
- Engineering Practice;
- Transferable Skills.

The Framework Standards include "Guidelines" and "Procedures for Programme Assessment and Programme Accreditation" (that include the assessment, among other requirements, of the human resources and facilities available for the programme), and also a "Template for Publication of Accredited Programmes".

In order to be as flexible and comprehensive as possible, and not to exclude any "compatible" accreditation system, the Standards are framed to encompass all engineering disciplines and profiles, and distinguish only between First and Second Cycle Degrees. The Standards are also applicable to the accreditation of programmes leading directly to a degree equivalent to a Second Cycle Degree (conventionally termed 'Integrated Programmes'). Indeed, such integrated programmes are an important aspect of European engineering education, not only in the long established "Continental Schools", but also in the U.K., Ireland and other countries.

Furthermore, in some European countries engineering degrees are characterised by "profiles", in addition to the distinction between FC and SC degrees; the accreditation in some countries distinguishes between engineering branches (disciplines), and not in others. Clearly, to accommodate these differences the EUR-ACE Framework Standards must be interpreted (and if necessary completed) to reflect the specific demands of different branches, cycles and profiles. However HEIs will still retain the freedom to formulate programmes with an individual emphasis and character, including new and innovative programmes, and to prescribe conditions for entry into each programme.

The EUR-ACE Standards are consistent with the Bologna Process, and in particular with the 'Dublin Descriptors' (JQI, 2004), the 'Framework for Qualifications of the European Higher Education Area' (EQF, 2005) and the 'Standards and Guidelines for Quality Assurance in the European Higher Education Area' (ENQA, 2005). Indeed, the EUR-ACE Framework Standards address the five generic qualification dimensions of the EQF on each level by specifying and expanding them with regard to engineering.

A major difficulty in establishing programme outcomes, and of differentiating between cycles, is that of specifying an absolute standard. This is particularly so in engineering, because the standard must apply consistently to the many different and overlapping branches, and should also be applicable to new branches that will emerge because of continuing scientific and technical developments. The EUR-ACE Framework express the standard to be achieved by graduates in the three direct engineering requirements 'Engineering Analysis', 'Engineering Design', and 'Investigations' by using the phrase

'consistent with their level of knowledge and understanding'

and this "level" is described using the concept of the "forefront" of the particular branch of engineering. In the requirement "Knowledge and Understanding" the relevant phrase is for First Cycle graduates

'coherent knowledge of their branch of engineering including some at the forefront of the branch',

and for Second Cycle graduates

'a critical awareness of the forefront of their branch'.

It would be extremely difficult, if not impossible, to obtain an agreed specification of the forefront for all engineering disciplines, and, even if is could be obtained, a fixed specification would inhibit innovation in programme design and teaching methods. Nor would it be relevant or applicable to new and emerging technologies. The identification of the forefront of the branch is the responsibility of the members of the accrediting panel who are experts in that particular branch of engineering. The reasons for their decision will be reviewed and assessed by the committees responsible for the final accreditation decision.

In any case, it is worth underlining that the distinction between "First Cycle" and "Second Cycle" degrees (roughly equivalent to Bachelor and Master degrees, although the use of these terms is different in different European countries) is an essential characteristics of the EUR-ACE system, in line with the "Bologna process" approach.

The EUR-ACE accreditation system and its implementation

The "EUR-ACE Framework Standards" do not intend to substitute existing national standards, but to provide a common reference framework as the basis for the award of a common European quality label (the EUR-ACE label), devised for Europe but open to other continents.

The basic idea is, as described in a working document of the EUR-ACE project, "a bottom-up approach which involves the active participation of present and future national accreditation agencies and which should embrace a multilateral mutual recognition agreement based on agreed Standards and procedures. No supra-national Accreditation Board should be formed: accreditation should always be awarded by a national (or regional) agency which may already be in existence or may be created in the future."

This "decentralized" approach appears to be rather novel in the world-wide panorama of programme accreditation systems: a central body accredits established national agencies that already accredit (and will continue to accredit) engineering programmes (the term "*meta-accreditation*" can be used with reference to this approach) and authorizes them to add the common European EUR-ACE Quality Label to their accreditation.

To provide this central body, the ESOEPE "Observatory" has been transformed into the "European Network for Accreditation of Engineering Education" (ENAEE), an international not-for-profit association founded in February 2006 by 14 associations concerned with EE throughout Europe (three more organizations have joined ENAEE since).

ENAEE has ascertained that six Accreditation Agencies in six different countries (namely, Engineering Council-UK, Engineers Ireland; Order of Engineers, Portugal; RAEE, Russia; CTI, France; ASIIN, Germany) fulfil already the requirements set by the Framework Standards, and in November authorized them to award the EUR-ACE label for a period of two years (the six Agencies are currently being reassessed). These six countries, covering a variety of educational, political and social realities throughout Europe, constitute the initial "core" of the EUR-ACE system: approximately 100 EUR-ACE labels have been granted already in 2007, first year of operation, and a larger number is expected for 2008.

In the meantime, appropriate procedures are being set up in order able to spread the EUR-ACE system beyond the initial core. Several possible alternatives are at present envisaged:

1. Include other Agencies in the system, provided they fulfil the Framework Standards: this may soon be the case of a couple of organizations that are already members of ENAEE.
2. In countries without any accreditation system, create a new Engineering Accreditation Agency; in the meantime, programmes can be accredited by any Agency already active in the system.
3. An established "general" accreditation Agency that requires the fulfilment of specific

Standards (in our case, the EUR-ACE Framework Standards) when an accreditation implies (or is a requirement for) professional recognition, can be authorized to add the EUR-ACE label: agreements for meta-accreditations in this line are being elaborated.

4. The Agencies already participating in the system whose Statutes allow to accredit programmes outside their own country, have been authorized to award the EUR-ACE label also to such programmes. This can be indeed the simplest and quickest way, albeit not systematic, to begin spreading the EUR-ACE system: indeed, EUR-ACE labels have already been awarded to Swiss programmes.

A new EU-supported project with the self-explanatory name of EUR-ACE SPREAD is about to start (October 2008): it will primarily aim to Italy, Lithuania, Romania, Switzerland and Turkey, but other EHEA countries can be tackled by the project. Non-EHEA countries can be included in the EUR-ACE system via approach #4 and/or ad-hoc agreements between ENAEE and concerned local or regional organizations.

The global context of EUR-ACE

Apart from the "European" context, the EUR-ACE project was (and now ENAEE is) challenged to confront on a global scale with existing accreditation standards, procedures and "labels" in other parts of the world, including the standards and regulations of the US Accreditation Board for Engineering and Technology (ABET) and of the Washington, Sydney and Dublin Accords.

The Washington Accord may be compared to the EUR-ACE system: but while in the latter mutual recognition is in a "quality label" awarded by the participating Agencies on the basis of shared standards and procedures, the former relies on comparable accreditation procedures, independently applied by the participating Agencies, that only in 2005 have elaborated a common list of outcome standards, together with a typical requirement of four years of study for an engineering degree. In parallel, standards referring to the same outcome criteria have been developed for 3- and 2-years programmes, leading respectively to "engineering technology" degrees and "engineering technicians" qualifications recognised in the so called Sidney and Dublin Accords.

The rigid and formal connection of outcomes with years of study and semantic definitions of technical professions in the three-accord (W-S-D) system, causes difficulties in the mutual professional recognition for programmes defined in accord to the Bologna two-cycle system, as well as for the academic recognition of such programmes for graduates applying for admission to graduate studies. In principle such problems should not exist in an outcome approach if the achieved outcomes are equivalent.

The Bologna Process and the EQF provide a more flexible connection to the duration of study and tend to follow the European approach to separate the achievement of certified learning outcomes and gained competences from the ways of their achievement and the time it took.

Contacts have already been established between ENAEE and the International Engineering Alliance (IEA), and comparative studies of the requirements of EUR-ACE and the three W-S-D accords are being developed by both ENAEE and IEA.

Discussion and conclusions

If coupled with rigorous QA rules, as it should always be, programme accreditation assures that the educational programme is not only of high academic standard, but is also relevant for the proper role in the job market: the participation of no-academic stakeholders in the process is a guarantee to this effect. An international recognized qualification like the EUR-ACE label, added to such an accreditation, will facilitate job mobility.

Engineering has always been in the forefront of discipline-specific accreditation, that in many (if not in most) cases has preceded general QA procedures, not only in France and the Anglo-Saxon countries, but also in the quoted example of Portugal. Indeed, the "engineering" model can be (and

in some cases is) used as a pilot for other professional disciplines.

Discipline-specific accreditation is usually referred to individual educational programmes rather than Departments or HEIs, but of course does not exclude an overall system of QA of the whole educational system, authorizing only "quality" HEIs to deliver academic degrees.

If confronted with the W-S-D system of three "accords" described in the previous Section. it is fair to state that the EUR-ACE system is at the same time simpler and more flexible: it does not create a rigid barrier between "engineers" and "technologist" (against the spirit of the Bologna Process, and in many languages even not understandable) but allows national differences and appropriate distinction between the "cycles".

However, it can be expected that in order to make the EUR-ACE label fully recognized on the global scale, the relation with the Washington Accord will be a crucial point, if anything because two members of the EUR-ACE "core" are also signatories of the Washington Accord.

This will be another challenge for EUR-ACE, and at the same time will be a test of the applicability of the EQF, the Dublin Descriptors, and the EU Directive on the recognition of professional qualifications (EU, 2005).

A further challenge, that will really test the global significance of the EUR-ACE system, will be its spread outside the European Higher Education Area (EHEA).

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