

*Coping with diversity within a common framework  
for accreditation of engineering education*

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***Hacer frente a la diversidad dentro de un marco  
común para la acreditación de la educación en  
ingeniería***

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**Abstract**

The ENAEE (European Network for Accreditation of Engineering Education) is a non-profit international association based in Brussels. It aims at building a pan-European framework for the accreditation of engineering education programmes, in order to enhance the quality of engineering graduates, to facilitate the mobility of professional engineers and to promote quality and innovation in engineering education. Its main activities include the definition and management of the EUR-ACE label, that may be awarded to Engineering programmes at Master or Bachelor level, that are compliant with common standards and guidelines – the EAFSG, EUR-ACE Framework Standards and Guidelines. However the aim is not uniformity but trust building among all stakeholders of engineering education. This paper discusses how ENAEE copes with the diversity of accreditation practices and with the diversity of the legal implications of accreditation in different countries.

## 1. Introduction

The ENAEE (European Network for Accreditation of Engineering Education) is a non-profit international association created in 2006 and based in Brussels. It aims at building a pan-European framework for the accreditation of engineering education programmes, in order to enhance the quality of engineering graduates, to facilitate the mobility of professional engineers and to promote quality and innovation in engineering education. Its main activities include the definition and management of the EUR-ACE label, that may be awarded to Engineering programmes at Master or Bachelor level, that are compliant with common standards and guidelines – the EAFSG, EUR-ACE Framework Standards and Guidelines. The labels are awarded by Agencies that are authorized by ENAEE upon successful completion of a review of their operations. After 10 years of operation, more than 1500 labels awarded in more than 20 countries by 13 authorized agencies, after the signature of a mutual recognition agreement – the EUR-ACE accord ENAEE has gathered a valuable experience and is addressing a series of issues, in particular:

- Coping with the diversity of practices across the authorized agencies while ensuring consistency of decisions to award the label.
- Coping with the diversity of the legal implications of accreditation in different countries.
- Partnering with international organizations involved in Engineering education in particular the International Engineering Alliance.

This paper will deal with the first two issues.

## 2. What is programme accreditation?

Programme accreditation is a decision taken after a review process that assures the educational quality and the job relevance of an engineering degree programme against a set of standards. It helps people make important decisions about engineering education including:

- Authorities recognizing the degree awarded
- Students choosing an educational programme
- Institutions seeking to improve the education provided by their programme
- Employers recruiting well-prepared graduates
- Industry seeking to voice educational needs to institutions The EUR-ACE® system incorporates the views and perspectives of all stakeholders: students, higher educa-

tion institutions, employers, professional organisations and accreditation agencies, governments.

In Higher education programme accreditation is distinct from Institutional accreditation, a process by which a Higher Education Institution – HEI - is assessed and is granted by a public authority the authorization to operate and/or to deliver degrees that are recognized in a specific jurisdiction.

In some countries both programme accreditation and institutional accreditation are regularly performed. In some countries Quality Assurance is mandatory only at institutional level and Programme accreditation is an option. The main argument supporting the view that programme accreditation is not needed is that the HEI's should have the full responsibility of the quality of the degrees they deliver.

However, professions such as engineering, medicine, architecture and others carry out work which directly affects the lives of the public.

In order to assure the public that these actions and decisions are carried out safely and ethically, graduates must possess specific competences.

To ensure that engineering education programmes produce graduates who can demonstrate satisfactory achievement of these competences, they are subject to accreditation by their professional body or another accreditation agency which carries out programme-based accreditation.

### **3. How does this work?**

An organization or agency that – possibly along with other activities - accredits engineering degree programmes applies to ENAEE for the authority to grant the EUR-ACE® Label to the degree programmes it accredits at Master and Bachelor degree level. If ENAEE is satisfied that the procedures and policies of the agency meet the standards set out in EUR-ACE® Framework Standards and Guidelines (EAFSG), then that agency is authorized to award the EUR-ACE® Label to the programmes it accredits.

### **4. The competencies expected from Engineering graduates**

The competencies expected from engineering graduates of EUR-ACE® Labelled accredited engineering degree programmes are listed under six categories of programme outcomes:

- Knowledge and Understanding
- Engineering Analysis
- Engineering Design
- Investigations

- Engineering Practice
- Transferable Skills: to be successful in the workplace, engineers are required to have not only technical and problem-solving expertise upon completion of their engineering degree programme, but also transferable skills. Transferable skills are those which are required to work across disciplines and teams, and include the ability to communicate effectively in the workplace.

## **5. The EUR-ACE® label is relevant to all European engineering degree programmes**

The “Bologna” process, regularly reaffirmed in the successive ministerial conferences, was a powerful incentive to develop common systems of reference for higher education.

From its onset, the EUR-ACE® label was conceived as a tool relevant across all European countries, despite the diversity in educational traditions and in legal contexts in the continent. However it was very early decided not to establish a common uniform model for higher education in engineering but to preserve diversity. The objective is not uniformity but mutual trust in the quality of graduates trained in different HEIs, in different countries, by different pedagogical methods, in different branches of Engineering. Therefore the EUR-ACE standards are the result of a constantly revisited bottom up process involving all the stakeholders of Engineering education. They offer a consistent framework to measure the effectiveness of an engineering degree programme in providing its’ graduates with the knowledge, skills and attitudes required at the Bachelor and Master level (and consequently the EUR-ACE® label distinguishes between EUR-ACE® Bachelors and EUR-ACE® Masters).

Due to the way they are structured, they can accommodate innovation in teaching methods, as well as encourage the sharing of best practice and they can incorporate the development of new engineering disciplines.

Each Higher Education Institution (HEI) that has a EUR-ACE® labelled engineering degree programme must undergo regular evaluation of the quality and relevance of its engineering education degree programmes, by one of the authorized agencies.

## **6. The diversity of practices**

In the governance system of ENAEE, the Label Committee is the body in charge of carrying out the process leading to the authorization of agencies to deliver the EUR-ACE label. It is composed of one member per authorized agency. In auditing the agencies the ENAEE auditing panels – called Review Teams - analyze the documentation presented by the agencies but also observe on site how the agencies themselves audit the engineering programmes in the HEIs, and how they make the accreditation decisions. In the period 2012-2015, 14 agencies were audited and newly authorized or reauthorized. This broad experience made it possible to document and compare the diversity of accreditation practices across the agencies. In May 2015 the Label Committee launched a systematic investigation on this diversity of practices.

The existence of differences in practices did not come out as a surprise and is in itself fully acceptable to a certain extent, provided the ultimate goal of mutual trust is preserved. Further investigations and discussions are in process to decide which practices should be avoided, which "differing" practices may be kept or which practices should become generalized and mandatory in the future.

Here are some examples of such differences:

- Inclusion of students in audit panels: some agencies include students, some do not. It was noted that the agencies that do not include students are often organizations of professional engineers, "orders of engineers" or closely linked to such organizations. In the UK the "generalist" Quality Assurance Agency in higher education, QAA – that is not EUR-ACE authorized agency - does include students in its panels whereas the Engineering Council, a professional organization, does not. Of course, as a EUR-ACE authorized agency, the Engineering Council, in granting the EUR-ACE label to a programme, verifies that the running of the programme duly reflects the students' perspective, as required by the EAFSG. This difference may be considered as non-substantial. It is interesting to compare the practices of some accreditation agencies with the ESG Standards and Guidelines for Quality Assurance in the European Higher Education Area, version 2015, which indicate as a standard for external quality assurance: "External quality assurance should be carried out by groups of external experts that include (a) student member(s)". Some of the EUR-ACE authorized agencies are full ENQA members and comply with the ESG. For the authorized agencies that are not ENQA members and do not include students in the audit panels the rationale is that accreditation is not the same as quality assurance.
- Meetings with employers during site visits: all agencies but ASIIN include systematically a meeting with employers of the graduates of the programme being audited and with alumni. ASIIN does include such meetings rarely e.g. for sandwich type programmes. The discussion about this difference will take into consideration the ways and means that the agency will use, in auditing a particular programme, to assess the appreciation of the quality of the programmes by these two categories of stakeholders, alumni and employers.
- Publication of audit reports: most agencies do not publish the full audit reports; many however publish a kind of "executive summary". It was overall considered that the full report should not be published. In some countries it would go against very strong traditional practices and even be not lawful, because the full reports contain sensitive personal or institutional data and the publication would harm the quality of the recommendations.
- Publication of decisions: all agencies publish positive decisions. The French CTI publishes the decisions even if negative. Here again, it is interesting to quote the ESG: "full reports by the experts should be published, clear and accessible to the academic community, external partners and other interested individuals. If the agency takes any formal decision based on the reports, the decision should be published together with the report".

Other differences occur because the level of achievement, by the graduates, of some of the declared programme outcomes are intrinsically difficult to assess for the HEIs. Correlatively it is difficult for Agencies auditing programmes to ascertain that students do possess the corresponding skills upon completion of the programme. Here are some of the skills listed in the EAFSG for which experience shows that they are not easy to assess or at least there are no commonly accepted ways of assessing them:

- Ability to engage in independent life-long learning
- Ability to manage complex technical or professional activities or projects that can require new strategic approaches, taking responsibility for decision making
- Leadership

There are ways however – which are beyond the scope of this paper- to improve the reliability of the assessment practices: instructional designers and assessors, from HEI's and companies, should be trained in assessment techniques and have at least a basic knowledge of Bloom's taxonomy, and of learning theories: behaviorism, cognitivism, constructivism, etc... Also, as the assessment of individual competencies of employees is commonly practiced in industry, sharing assessment methods used in industry and in higher education should be promoted and supported.

It is also important to develop methods to assess specific competences acquired by individual students in pedagogical activities such that Groups, Projects, Distance Learning, MOOCs etc...and to discuss critically the new opportunities offered by learning analytics, by the increased use of new interactions between teachers and learners, and of self and peer assessment.

ENAAE promotes of course investigations and discussions on these issues and in particular on the challenges posed to accreditation bodies by the welcome continuing change in the contents of engineering disciplines, the upcoming of new engineering branches and in the pedagogical innovation.

## **7. The diversity of the legal implications of accreditation in different countries**

### **7.1 Legal status of accreditation**

In most countries there is a system in place to assess and authorize higher education programmes leading to an officially recognized degree. Sometimes an official agency or a ministry is in charge of the authorization process, that is very similar to an accreditation process but may be based solely or mostly on academic criteria. In most countries, engineering degrees are concerned by this general national authorization system for academic degrees but there are no mandatory specific requirements for them. In this situation a specific accreditation of engineering degrees is optional: this is the case in the UK, in Spain or in Italy for instance. However in some countries agreements are in place or in discussion between the body in charge of the "national" accreditation and the local EUR-ACE authorized agency, by which a programme obtaining the label will

“more easily” or even automatically obtain the national accreditation. In France, Engineering degrees are legally subject to an accreditation by the official accreditation agency CTI, which is also authorized to deliver the EUR-ACE label. In Germany an accreditation system is in place, it is carried out but “recognized” accreditation agencies; one of them, ASIIN is authorized to deliver the EUR-ACE label, but there is no legal requirement for an Engineering degree to be accredited by this particular agency. Moreover the general framework of accreditation is being debated and may be modified.

## **7.2 Access to the engineering profession:**

In some countries the engineering profession is “regulated”, totally or partially. This is the case in Spain, Portugal, the UK, Italy, for instance. This means that the access to the engineering profession is restricted to the individuals who are registered as members of an “Order” of Engineers. Only registered engineers can sign certain technical documents. In some of these countries the engineers working for a company - as opposed to engineers engaged in independent practice - are not requested to be “registered” but in some others all engineers must be “registered”.

In some other countries the access to the engineering profession is not regulated at all. This is the case in France. However, in France the academic title “ingénieur diplômé” is protected and restricted to individuals that graduated from one of the programmes accredited by the CTI. But the access to the engineering profession is not legally restricted to those graduates. It is the responsibility of the company hiring an engineer and assigning to him or her a specific mission to check that the individual possesses the competences needed for this mission. Likewise a client – in particular a public authority – assigning a mission to an individual or to a company will check the competences of the individuals carrying out the mission.

This very short and sketchy description of various legal contexts shows sufficiently the great diversity prevailing in the EHEA, European Higher Education Area. No wonder that there is no easy description of the privileges granted in another country to graduates of a EUR-ACE labelled engineering degree in one country, be it for pursuing further studies, e.g. doctoral studies, or for accessing the engineering profession.

ENAE is working at making these privileges more evident for the stakeholders, in particular for the graduates. By the aforementioned EUR-ACE accord, a mutual recognition agreement, the authorized agencies accept each other’s accreditation decisions in respect of Bachelor and Master Degree programmes which they accredit. They have also agreed to make every reasonable effort to ensure that the bodies responsible for recognizing engineering qualifications and/or for registering or licensing professional engineers to practice in their country or jurisdiction, accept the comparability of EUR-ACE® labelled programmes accredited by authorized agencies. It is expected that this agreement will further facilitate the implementation of the EU Directive on Recognition of Professional Qualifications throughout the European Union.

Recently, in April 2016, the ECEC, European Council of Engineers Chambers started an EU funded project aiming at establishing Common Training Principles for Engineers. In the last project team meeting it was decided to refer to the EUR-ACE Framework

Standards and Guidelines (EAFSG) Programme Outcomes for Bachelor – respectively Master - Degree as an orientation of the required contents of the programmes leading to a degree in engineering.

## **8. Conclusion**

Coping with diversity in the EHEA is likely to remain a work in progress and ENAEE will continue its endeavor to work at it with all the stakeholders. Elements of diversity that impair the free movement of students, graduates and professionals must be discussed and procedures to simplify these exchanges should be streamlined. Some people suggest to introduce automated testing of graduates in this perspective. Why not. However all members of ENAEE share the view that assessment and accreditation are social processes; since their aim is trust building the actual direct involvement of peers and stakeholders is as important and valuable as the accreditation decisions themselves.