

QUALITY ASSESSMENT IN ENGINEERING EDUCATION IN SPAIN: TOWARDS A NEW ACCREDITATION AGENCY

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EXTENDED ABSTRACT

Engineering programs have special characteristics within the university systems in many European countries, mainly because the close relationship between their academic programs and university degrees, and their increasingly demanding careers. This has become more important following the adoption of the Bologna Process, in which university education is now organized in two levels, bachelor and master. In addition, the social changes associated with a switch from an industrial to a knowledge economy is also a factor, as in the increasingly role of technology in society.

Quality in higher education is a complex matter and it gets more complicated when education and accreditation systems depend on Governments. In these circumstances, even if the entities responsible for quality assurance try to work independently, their decisions may collide with the interests of the governmental entity responsible for the global education system. Within higher education, the accreditation entities and the regulatory administration may have conflicting perspectives, causing problems for the functioning of the education system. Experience shows that in these cases the entities responsible for the quality of university systems must give valid answers to all the different academic fields involved through general processes and mechanisms in which all the particularities are included. Furthermore, this dependence on Governments prevents the accreditation entities from signing international agreements for multilateral recognition with other prestigious organizations.

Engineering programs in Spain are facing some contradictions despite their reputation, in particular, insufficient academic and professional recognition. Accordingly, some Spanish universities are now seeking ABET accreditation for their engineering programs, which may involve additional costs, internal imbalance, competition between centers and availability of specific study programs. In this paper some thought is given to the possibility of creating an accreditation agency for engineering programs in Spain within the EURO-ACE framework. Its compatibility with the Spanish legislation, its acceptance and possible integration with university and professional systems are analyzed. This is carried out within the European ENAEE network that has not been introduced in Spain yet, maybe due to the particular Spanish structure of the quality and accreditation system with regional agencies.

KEYWORDS

Quality Assessment, Academic and Professional Recognition and Accreditation, Evaluation and Accreditation Agencies

1. INTRODUCTION

Guaranteeing quality in higher education is a matter of great importance, particularly when meeting the international standards of the university systems in the competitive global market. In order to be competitive in this new environment, which can sometimes be unfair in relation to both the access to higher education and suitable use of economic resources, it is necessary to have quality assurance procedures to certify the level and scope of the skills acquired by the students during the training process.

The different scientific, technical, humanistic, social and artistic studies are considered individually as particularities in the university systems, mainly because of the different ties established in each between students training and later activities in their different career fields. Key people and renowned institutions claim that academic skills, knowledge, capacities and abilities, although necessary, are not sufficient to develop the necessary skills that a professional needs in the different work fields. Attitude, in other words, the way individuals approach work and apply their knowledge and skills, is a very important matter that shapes people's differentiated and particular professional attributes.

All this occurs to a greater or lesser extent in all fields of study and makes it tremendously hard to try to design a single mechanism to guarantee quality. This is a paradox because university systems, national education administration authorities and/or other recognized international organizations tend to set up evaluation and/or accreditation agencies which take into consideration universal objectives. Engineering programs are a good example of this, and many countries have their own national accreditation systems which consider both the academic and the professional aspects of an Engineer's formation. This is very important because accreditation involves academic and, above all, international professional recognition.

In this paper we analyze the situation of the quality systems of engineering programs in some reference countries as a starting point and consider the feasibility of creating a specific accreditation agency for engineering programs in Spain. In addition, we also consider compatibility with the Spanish legislation, its acceptance and possible integration within the university and professional sectors. Furthermore, different organizing formulas to achieve some reasonable results are also analyzed.

2. SOME INTERNATIONAL REFERENCES OF ENGINEERING PROGRAMS ACCREDITATION

There are two clear ways to achieve the status of professional engineer. In countries where the state regulates the programs and is responsible for academic and professional training, the academic degree granted to students is a professional qualification that allows them to work with full responsibility right from the start. In these cases, there are non-governmental engineering associations or institutions, specific in every field of study and professional activity, which control the process through the accreditation of programs and sometimes examinations or professional internship.

The trend throughout the world nowadays is that, whatever the legal academic and professional framework, the accreditation of university study programs must play an important role both to guarantee the quality of the education and to develop professional careers for graduating students. This objective duality explains the boom in accreditation organizations in the world although the consequences in each case depend on their founding principles, structure and organization of the different agencies or committees. In principle, the accreditation organizations should be independent, even if their functional, structural and government models depend directly or indirectly on public organizations adding more operational complexity.

There are two major accreditation systems or entity models. The first deals with the needs arising from civil society and the demands of various social sectors, while the second arise as a result of public policies enforced by law. In this context, the most representative organization of the first model is the *Accreditation Board for Engineering and Technology* (ABET, USA) and of the second is the *Commission des Titres d'Ingénieur* (CTI, France). Both organizations were born and developed at the same time although in different cultural, academic and professional backgrounds.

In USA the programs accreditation was started officially in 1932 by the foundation of the Engineer's Council for Professional Development (ECPD) and the first study programs were accredited in 1936. A few decades later it changed its name to Accreditation Board for Engineering and Technology (ABET, Inc.), which is currently a federation of technical and professional societies that gathered to promote quality in engineering, technology and applied sciences. Although ABET is a private entity, its accreditation activities and quality assurance of engineering studies are widely recognized by the North American official education organizations such as the Council on Higher Education Accreditation (CHEA), and internationally. ABET is currently carrying out the accreditation of engineering programs in hundreds of institutions, mainly in Asia and Latin America, and is a reference for some European systems that are creating accreditation organisms with very similar structure and functioning standards.

France established by law the Commission des Titres d'Ingénieur in 1934, to evaluate and provide accreditation to higher education institutions in Engineering, Informatics, Applied Mathematics and Project Management. It was also responsible for quality control, planning and follow-up activities in higher education. Moreover, French law empowered the CTI to evaluate and analyze engineering studies in Germany, Switzerland, Bulgaria, or Viet-Nam. Other countries such as China, India and Belgium are under the accreditation process. Engineering in France has some peculiarities as is regulated and protected only by a higher education institution accredited by the CTI, which as mentioned before, is an autonomous official commission but financed by the French National Ministry of Education.

Since then, many accreditation institutions and entities have emerged throughout the world, some of them are very important or at least have the same category as the reference institutions mentioned in the previous section. For example, the Quality Assurance Agency (QAA) or the Engineering Council (EC) in the United Kingdom, the Canadian Engineering Accreditation Board (CEAB) in Canada, the Higher Education and Training Awards Council (HETAC) in Ireland, the Japanese Accreditation Board for Engineering Education (JABEE) in Japan, the Accreditation Board for Engineering Education of Korea (ABEEK) in South Korea, the Engineers Australia Accreditation Board in Australia, the Institution of Professional Engineers in New Zealand, the Engineering Council of South Africa (ECSA) in South Africa, la Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) in Brazil, the Consejo de Acreditación para la Enseñanza de la Ingeniería (CACEI) in Mexico or the Agencia Nacional de Evaluación de la Calidad y la Acreditación (ANECA) in Spain. This is a large group of institutions, very similar in many aspects, but also very different in others, which have achieved a diverse reputation within a complex cultural context of academic and/or professional accreditation.

3. GLOBALIZATION, INTERNATIONALIZATION, RECOGNITION AND ACCREDITATION

Globalization is perhaps the economic and social phenomenon that best characterizes modern times. Among many other things, globalization means the internationalization of

the activities in all areas. Relentlessly, this fact demands a greater mobility of ideas, people and things. This is not new for engineers, since many claim that engineering has always been a global, transnational and multinational professional career increasingly subjected to international competition. Therefore, engineering programs play an important role in generation and transfer of scientific knowledge to wealth generation. This is essential for the development of the knowledge economy and is the key element in globalization.

As mobility increases, countries need to establish new technology quality mechanisms. Markets take care of the quality of ideas and things and state of the quality of people and employers with their global policies and strategies. In any case, the recognition of people capacities or that of any other economic, professional or social entity is not based on acts of goodwill but in quality objective policies. This is where academic and professional accreditation in education and more particularly, in higher education, play a leading role. It is true that the economy is the dynamic factor of these policies, but it is also true that there are agents leading the economic and social development of their countries who, will finally define or propose the quality and knowledge evaluation mechanisms.

The need to create mechanisms not only to harmonize professional mobility but to help quality assurance in the professional services rendered by engineers abroad, led some countries to set up some agreements and organizations to guarantee the quality of education and engineering professional services. For example, in 1989 the representatives of the accreditation organizations of the engineering programs in Australia, Canada, United States, Ireland, New Zealand and United Kingdom signed the so called Washington Agreement for the professional recognition of the accreditation of the engineering programs. Later eight more countries, China, Taipei, Korea, Hong Kong, Japan, Malaysia, Singapore, South Africa and Turkey joined the list of the promoting countries of the agreement and six more accreditation organizations (Bangladesh, Germany, Russia, Pakistan, Sri Lanka) have applied for membership.

The Washington Agreement (WA) was signed in 1989 for the recognition of the professional engineering qualifications (in Spain these are identified as the long cycle engineering programs). It was complemented some years later, in 2001, with the Sydney Agreement (SA) for the technologists professional qualifications recognition (in Spain this concerns higher professional education) and finally in 2002 the Dublin Agreement (DA) was signed for the recognition of professional technicians (in Spain, this relates to technical engineering) and although all the different agreements were not signed by all the promoting members of the WA, a great number of them did so. An important aspect of all these agreements is that they were signed by the institutions responsible for the accreditation of the engineering programs of the different countries and not by the Governments. This is very important because the legal status of the institutions responsible for the accreditation enables them to establish international agreements with other renowned institutions with similar objectives or to sign multilateral education agreements. Finally, this allows programs, students, and accredited engineering professionals that have been evaluated by these institutions to have a greater international visibility and study programs recognition in the different continents, with a previous accreditation in their countries of origin.

Something similar is happening in Europe with the *European Accredited Engineering Programs* (EUR-ACE, 2006) the objective of which is to complement national accreditations by giving them a more international scope even for agencies from a non-European Higher Education member country. The EUR-ACE seal of quality is promoted by the *European Network for Accreditation of Engineering Education* (ENAE, 2006) constituted by various economic and social agents from all fields of engineering. The network manages the EUR-ACE seal of quality and accepts the integration under certain

conditions. It also manages the seal of quality of general national quality agencies or more specific engineering agencies.

EUROPEAN FEDERATION OF NATIONAL ENGINEERING ASSOCIATIONS	ENGINEERING COUNCIL
COMMISSION DES TITRES D'INGENIEUR	ACCREDITATION AGENCY SPECIALIZED IN ACCREDITING DEGREE PROGRAMS IN ENGINEERING, INFORMATICS, NATURAL SCIENCES AND MATHEMATICS
ENGINEERS IRELAND	ORDEM DOS ENGENHEIROS
CONFERENZA DEI PRESIDI DELLE FACOLTA DI INGEGNERIA ITALIANE	SOCIETE EUROPEENNE POUR LA FORMATION D'INGENIEURS
RUSSIAN ASSOCIATION FOR ENGINEERING EDUCATION	EUROCADRES: CONSEIL DES CADRES EUROPEENS
UNIVERSITA DEGLI STUDI DI FIRENZA	DANISH SOCIETY OF ENGINEERS
BUNDESAMT FÜR BERUFSBILDUNG UND TECHNOLOGIE	ASSOCIATION FOR EVALUATION AND ACCREDITATION OF ENGINEERING PROGRAMS
INTERNATIONAL SOCIETY FOR ENGINEERING EDUCATION	INSTITUTO DE LA INGENIERÍA DE ESPAÑA
ROMANIAN AGENCY FOR QUALITY ASSURANCE IN HIGHER EDUCATION	FINNISH ASSOCIATION OF GRADUATE ENGINEERS

Table 1: ENAEE full members

It is interesting to point out that the only institutions participating simultaneously in two of the mentioned initiatives are the Engineering Council of the United Kingdom and the ASIIN (Accreditation Agency Specialized in Accrediting Degree Programs in Engineering, Informatics, Natural Sciences and Mathematics) in Germany. This latter is a relatively new agency founded in 1999 but has developed intensively during the last years. Both agencies have the specific objective of carrying out the accreditation of study programs. Additionally, both institutions, considered as ABET and CTI references, are lined up with each of the alternative options.

4. A PROPOSAL FOR AN ACCREDITATION AGENCY SPECIALIZING IN ENGINEERING PROGRAMS IN SPAIN

Spanish education, professional and accreditation systems are governed by law by the Accreditation National Evaluation Agency (ANECA) and a group of (11) regional agencies established as for the decentralized higher education system transferred to 17 the autonomous communities.

According to the Spanish legislation, only those full members of the *European Association for Quality Assurance in Higher Education (ENQA)* are entitled to accredit university degree programs which are valid in Spain (there are currently 5 agencies: ACSUG, AQU, ACSUCYL, UCUA AND ANECA). In any case, 5 or 12 Spanish agencies are for general purpose and comply with the same or similar evaluation objectives and criteria established by the education authorities responsible for education policies. The same thing happens during the accreditation phase, except for the five accredited agencies by the European ENQA network that play a relevant role in this task.

AGENCIA NACIONAL DE EVALUACIÓN DE LA CALIDAD Y DE LA ACREDITACIÓN (ANECA)
AXENCIA PARA A CALIDADE DO SISTEMA UNIVERSITARIO DE GALICIA (ACSUG)
AGÈNCIA PER A LA QUALITAT DEL SISTEMA UNIVERSITARI DE CATALUNYA (AQU)
AGENCIA PARA LA CALIDAD DEL SISTEMA UNIVERSITARIO DE CASTILLA Y LEÓN (ACSUCYL)
AGÈNCIA DE QUALITAT UNIVERSITÀRIA DE LES ILLES BALEARS (AQUIB)
AGENCIA CANARIA DE EVALUACIÓN DE LA CALIDAD Y ACREDITACIÓN UNIVERSITARIA (ACECAU)
UNIDAD PARA LA CALIDAD DE LAS UNIVERSIDADES ANDALUZAS (UCUA)
AGENCIA DE CALIDAD, ACREDITACIÓN Y PROSPECTIVA DE LAS UNIVERSIDADES DE MADRID (ACAP)
COMISIÓN VALENCIANA DE ACREDITACIÓN Y EVALUACIÓN DE LA CALIDAD EN EL SISTEMA UNIVERSITARIO VALENCIANO (CVAEC)
AGENCIA DE CALIDAD Y PROSPECTIVA UNIVERSITARIA DE ARAGÓN (ACPUA)
AGENCIA DE EVALUACIÓN Y ACREDITACIÓN DE LA CALIDAD DEL SISTEMA UNIVERSITARIO DEL PAÍS VASCO (UNIBASQ)
AGENCIA DE CALIDAD UNIVERSITARIA DE CASTILLA-LA MANCHA (ACUCM)

Table 2: Evaluation and Accreditation Agencies in Spain

This matter will not be discussed further here; however, it cannot be disregarded since the real situation has an influence on any reflection about these matters. In a first approximation, it could be considered and proposed that since there are 5 quality evaluation agencies accredited by the European institutions and that there are 5 big and well defined areas of knowledge in Spain (Legal and Social Sciences, Experimental Sciences, Health Sciences, Art and Humanities, and Engineering and Architecture), each one of these agencies, besides providing general services to their communities or reference education administration, could specialize in the evaluation and accreditation of university degrees in one of the previously mentioned knowledge areas.

Therefore, each regional agency would become a national agency (this is not a contradiction, because the current accredited agencies already have the dual role), and could establish more appropriate agreements at national and international level. Also, and more importantly, it could assess the characteristics of each field of study and its professional consequences. It won't be particularly difficult for any of the five (5) currently accredited agencies to establish agreements with the Spanish Institute of Engineering (IIE, ENAEE member) nor to adopt the quality methodology and procedures required by the EUR-ACE seal. In any event, all this would demand great efforts and a national agreement, which cannot be anticipated at least in the short term.

It will be then necessary to think about an external solution to the current partial system, as far as the engineering accreditation is concerned. As mentioned before, there are two alternatives:

- a) Finding alliances with any of the full members of the Washington Agreement.

- b) Becoming part of the ENAEE network through a new agency created specifically for the engineering accreditation in compliance with the EUR-ACE quality seal criteria standards.

In the first case, the members or partners could be the ABET agencies in USA, due to its unquestioned leadership and international reputation, or any of the European promoting agencies of the Washington Agreement such as the Engineering Council in the United Kingdom, the Higher Education and Training Awards Council in Ireland or the Agency Specialized in Accrediting Degree Programs in Engineering, Informatics, Natural Sciences and Mathematics in Germany (this latter after obtaining full membership). This approach would not be hard to follow, and above all, to implement in an independent agency. For example, a franchise or something similar would involve a previous agreement to avoid competition with the services provided by the home institution.

A more comprehensive proposal with more chances of success would be to reproduce in Spain the steps made by the German agency ASIIN. In other words, to create a specific accreditation agency for engineering within the European ENAEE network, in compliance with the rules and procedures established by the EUR-ACE quality seal and request afterwards its integration to the Washington Agreement. Hence, to implement this proposal the new agency should rely on the support and commitment of the Spanish university systems and professionals, including the Spanish Institute of Engineers (IIE), as well as other economic, social agents interested and involved in these matters such as recruitment, businesses and scientific organizations. This would enhance considerably the reputation of Spanish engineering, not only in Europe but, and above all, in the rest of the world.

5. CONCLUSION

The quality evaluation and accreditation system in Spain is very complex, far-reaching and good; however, it cannot provide the appropriate framework for academic and professional recognition internationally. The governmental nature and regulation of the various evaluating agencies and education systems do not allow them to become full members of the international agreements for the academic and professional recognition except for regional agreements.

The integration of the Spanish university system into the European Space of Higher Education is causing engineering problems with some academic activities at undergraduate and graduate levels as well as with engineering degrees recognition. This worries professional engineers and it gets worse when analyzing other group's demands for a greater liberalization of degree programs, which in practice would entail a dramatic change in professional careers and disappearance of the current reservations.

A specific agency for engineering accreditation in Spain would lead to help tackle both these issues, particularly the legal regime that would allow it to become part of the key international agreements without losing its European ties. This would lead to a better international recognition and integration of the various social agents involved in the definition and development of the new economic and productive model and thus professionals that a modern country needs to be competitive in a globalized world.

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