

# The Bologna Process Implementation in EEI Engineering in Portugal

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**Abstract**—This article outline the implementation of the Bologna Process in EEI (Electrical Engineering & Informatics) Engineering in Portugal and the professional consequences of this implementation.

**Keywords**- *The Bologna Process, European Higher Education Area*

## I. INTRODUCTION

The purpose of the Bologna Process is to create the European Higher Education Area by making academic degrees and quality assurance standards more comparable and compatible throughout Europe, in particular under the Lisbon Recognition Convention. This process is named after the place where it was proposed, the University of Bologna, with the signing in 1999 of the Bologna declaration by Ministers of Education from 29 European countries. This was opened up to other countries signatory to the European Cultural Convention of the Council of Europe; further governmental meetings have been held in Prague (2001), Berlin (2003), Bergen (2005), London (2007) and Leuven (2009).

It is a common misconception that the Bologna Process is an EU initiative. The Bologna Process currently has 47 participating countries, whereas there are only 27 Member States of the EU. While the European Commission is an important contributor to the Bologna Process, the Lisbon Recognition Convention was actually prepared by the Council of Europe and members of the European Region of UNESCO.

The Bologna Process was a major reform created with the goal of providing responses to issues such as the public responsibility for higher education and research, higher education governance, the social dimension of higher education and research, and the values and roles of higher education and research in modern, globalized, and increasingly complex societies with very high demanding qualification needs.

With the Bologna Process implementation, higher education systems in European countries were organized in such a way that:

- it is easy to move from one country to another (within the European Higher Education Area) – for the purpose of further study or employment;

- the attractiveness of European higher education has increased, so that many people from non-European countries also come to study and/or work in Europe;
- the European Higher Education Area provides Europe with a broad, high-quality advanced knowledge base, and ensures the further development of Europe as a stable, peaceful and tolerant community benefiting from a cutting-edge European Research Area;
- there will also be a greater convergence between the U.S. and Europe as European higher education adopts aspects of the American system.

In much of continental Europe, the previous higher education systems were modeled after the German system, in which there is a clear difference of vocational and academic higher education. This had a strong impact on the old engineering degrees. The confluence of the two types of degrees can be counterproductive in the following cases:

- The vocational three-year degrees are not intended for further study, so those students who also want to advance to a master's degree will be at a disadvantage;
- The master's degree effectively becomes the minimum qualification for a professional engineer, rather than the bachelor's degree;
- The academic three-year degrees prepare only for continuing towards master's, so students who enter the workforce at that point will not be properly prepared. Yet they would have the same academic title as the fully trained vocationally educated engineers.

The end-result of the change is that the agreements between professional bodies will require reevaluation in some cases, according to the change of qualifications.

The European Credit Transfer and Accumulation System (ECTS) makes teaching and learning in higher education more transparent and facilitates the recognition of studies. The requirement of 60 ECTS per year assumes that 1,500-1,800 hours are available per year. However, the Bologna Process does not standardize semesters, which means that if the summer break at the university is long, the same material has to be crammed into a shorter study year.

Also, there have been accusations that the same courses have been simply redefined e.g. 1.5 times shorter when the local credits were converted to ECTS, with no change in course content or requirements. This effectively increases demands with nothing to compensate for.

Contrary to popular belief, the Bologna Process was not based on a European Union initiative. It constitutes an intergovernmental agreement, between both EU and non-EU countries. Therefore, it does not have the status of EU legislation. Also, as the Bologna Declaration is not a treaty or convention, there are no legal obligations for the signatory states. The (extent of) participation and cooperation is completely voluntary. This can be regarded both as a positive and as a negative issue. On the one hand, one could say that this “bottom-up” voluntary convergence does justice to the sovereignty of the states, which is especially important in the field of education. On the other hand, the avoidance of EU structures can be regretted for democratic reasons. The Bologna Declaration can be said to be a deal done behind closed doors by governmental officials without any participation of the European parliament. Also the involvement of the national parliaments and especially universities has been limited.

Although the Bologna Declaration was created outside and without the EU institutions, the European Commission plays an increasingly important role in the implementation of the Process. The Process will have many knock-on effects such as bilateral agreements between countries and institutions which recognize each others’ degrees. However, the Process is now moving away from a strict convergence in terms of time spent on qualifications, towards a competency-based system. The system has an undergraduate and postgraduate division, with the bachelor degree in the former and the master and doctoral in the latter.

In mainland Europe first degrees with duration of 5 years are common, with some taking up to eight years to be completed. This leads to a very high drop-out rate; many of these countries are now introducing bachelor-level qualifications, with the aim of retaining more students at least for the first degree. This situation is changing rapidly as the Bologna Process is implemented.

Depending on the country and the development of its higher education system, some introduced ECTS, discussed their degree structures and qualifications, financing and management of higher education, mobility programmes, etc. At the institutional level the reform involved higher education institutions, their faculties or departments, student and staff representatives and many other actors. The priorities varied from country to country and from institution to institution.

As far as 2009 the great majority of European countries had implemented an accreditation system based on ECTS. The situation is depicted in figure 1.

In a globally connected society where the Internet plays nowadays an important role as information provider, it is expected that a more wide agreement will be reached with the convergence of the Asian, American, Australian and European Higher Education Systems. A huge effort of cooperation with Central and South America is underway by means of the ALFA projects, which constitute joint South/Central/American and European consortiums.

## II. THE BOLOGNA PROCESS IMPLEMENTATION IN EEI ENGINEERING IN PORTUGAL

From the late 1970s Portugal has a binary Higher Education (HE) system, with Universities and Polytechnics. Up to 2006 the structure of the HE degrees in Portugal was as follows:

1. The Bachelor degree (*Bacharelato*), of a duration of 3 years of full-time study, as the core degree offered by the Polytechnics;
2. The *Licenciatura* of a duration of 5 years of full-time study for Engineering and other Professional fields (e.g. Architecture, Law,...) and 4 years for the rest (Natural Sciences, Humanities, Business and Economics, ...). Polytechnics could also award *Licenciatura* as a 2 year follow-on degree for B.Sc. holders;
3. *Mestrado* (M.Sc.), of a 2 year nominal duration, the first year with course modules and the second year dedicated to work on a dissertation;
4. The Ph.D. at the third level, of a nominal duration of 3 years, consisting exclusively of research work and writing of the thesis.

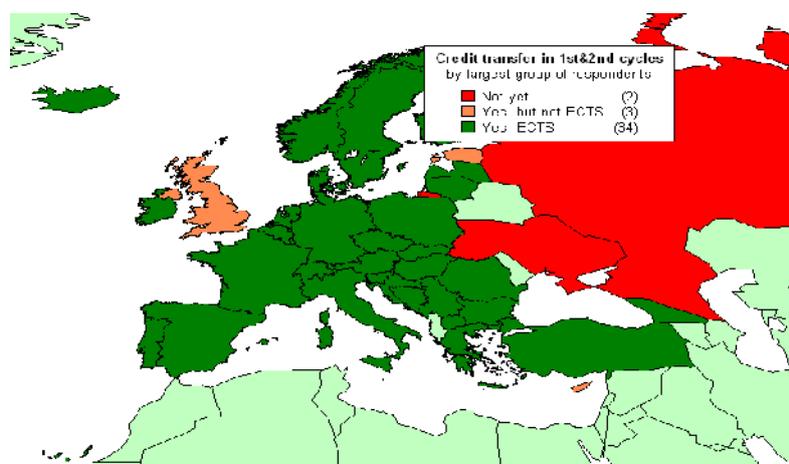


Figure 1. Implementation of ECTS Accreditation System in Europe [9]

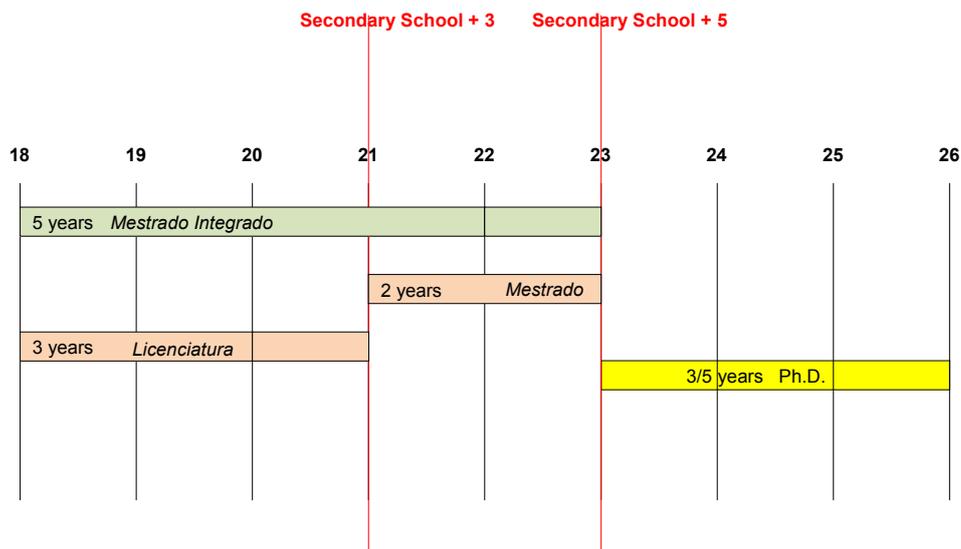


Figure 2. Higher Education System in Portugal

M.Sc. and Ph.D. studies could only be offered by the universities. It should be noted that the M.Sc. degree did not exist in the Portuguese HE system before 1980. Its introduction was inspired by the UK and USA systems where a large part of Portugal university professors had done their post-graduate studies. To register for a Ph.D. students should hold either a M.Sc. or a first class honours *Licenciatura*. Hence, following the standard path, a minimum of 7 years of university studies were required to enter a Ph.D. and a minimum of 10 years to get one. It should be noted however that average durations to get a M.Sc. or a Ph.D. were much longer.

In March 2006 the government published the long awaited law reforming the Portuguese HE degree system in accordance with the Bologna process, introducing namely the ECTS. The new three-cycle degree system is:

1. *Licenciatura* of a duration of 3 years of full-time study (180 ECTS), offered both by Universities and Polytechnics
2. *Mestrado* (M.Sc.), of a 2 year duration (120 ECTS), of which at least 35% (42 ECTS) are dedicated to work on a dissertation. The *Mestrado* can be conferred both by Universities and Polytechnics, subject to the requirement that the institutions are engaged in R&D activities in the area of speciality.
3. *Doutoramento* (Ph.D.), of which the first year can consist of course modules. The *Doutoramento* can only be conferred by Universities, subject to the requirement that the institutions have a consistent and high-quality R&D track-record in the area of speciality.

The law allows also Universities, not Polytechnics, to offer *Integrated Master* programs of 300 ECTS, in areas where, according to EU rules or to established tradition in the EU, access to a profession requires such a length of studies. That is the case in Medicine, Architecture and in the more traditional Engineering areas. Hence the well-established universities in

Portugal offer 5 year integrated master degrees in Civil, Electrical, Mechanical and Chemical Engineering.

As part of the Bologna reforms, a National Agency for the Accreditation and Evaluation of Higher Education (A3ES) has been created. The Agency started work in 2009 and is in the process of accrediting all existing programs.

Concerning Ph.D. programs it declared that it would only accredit those offered by universities with research units in the respective scientific area evaluated as *Excellent* or *Very Good* by the National Science Foundation (*Fundação para a Ciência e a Tecnologia* – FCT).

### III. THE BOLOGNA PH.D. PROGRAMS IN ENGINEERING

The new legislation specifies the scientific requirements a university must fulfil in order to offer a Ph.D. degree in a given speciality, regulates the composition of the examining board, where the majority of members should be external to the university awarding the degree, and allows for joint degrees. But, apart from establishing this overall framework, it gives freedom to each university to shape their Ph.D. programs as they see fit. For instance, it gives the option of incorporating in the programs a course component, and it does not fix the duration of the Ph.D. programs.

Following the publication of the law the universities submitted their proposals for the new Ph.D. programs, which started to admit students in 2007/2008. The most relevant innovations in doctoral education they introduce are:

1. The appearance of joint degrees of several Portuguese universities. For instance, the Universities of Aveiro, Minho and Porto, offer joint Engineering Ph.D. degrees in Informatics and in Telecommunications;
2. Double Ph.D. degrees with foreign universities. Within special programs financed by the Portuguese government, there exist several double degree programs with the Massachusetts Institute of Technology, Carnegie-Mellon University and

University of Texas at Austin and the Universities of Aveiro, Coimbra, New University of Lisbon, Porto and Technical University of Lisbon (IST). IST also offers double degrees in various engineering specialities with École Polytechnique Fédérale de Lausanne (EPFL);

3. A few Ph.D. programs specifically answering industry needs. The Ph.D. in Refining, Petrochemical and Chemical Engineering, offered by Universities of Aveiro, Porto and New University of Lisbon and financed by the industry is an illustration of that;
4. Plans by several universities to create Doctoral Schools;
5. A course component in the first year, between 30 and 60 ECTS. Although there exist programs where the first year consists exclusively of course modules, more often than not the first year includes a number of ECTS credits allocated to the preparation of the thesis work, that can be as high as 36 ECTS.

The minimum duration of the degree is either 3 or 4 years, except for the degrees in association with the US universities, where it is 5 years. At University of Coimbra and the Faculty of Engineering of University of Porto all programs are 3 years. At the other universities there are both 3 and 4 year programs, depending on the field of study.

Since the first of the new programs only started in 2007/2008, it is too early to evaluate the impact of the changes on the profile of the graduates, but it is clear that a new dynamic with an increased focus on doctoral education has been established in most universities in Portugal.

#### IV. PROFESSIONAL CONSEQUENCES OF THE BOLOGNA PROCESS

The political decision to give the title of “licenciatura” to the first three years degree in Portugal is a very serious matter, as it corresponds to the same title for a five years long degree before the implementation of the Bologna Process.

This decision is strongly criticized by the Portuguese Association of Engineers, and nowadays exists a long discussion about the competences and skills profiles achieved in the two different levels and with the new and old levels.

The European Federation of the National Engineering Association (FEANI) recognizes two main levels for the two first graduation cycles, which can make it easier to associate the proper skills with education in Engineering towards the mobility of professionals through Europe [8].

#### V. CONCLUSIONS

It was presented in short the Electrical and Information Engineering courses in Portugal, after Bologna and some aspects of the Professional consequences in the definition of competences and skills profiles achieved by the pre and post Bologna courses.

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