QUALIFICATIONS AND PROFESSIONAL COMPETENCIES OF THE CONSTRUCTION MANAGER IN PORTUGAL: THE IMPACT OF THE BOLOGNA PROCESS

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Abstract

The legal framework concerning the construction industry is closely related with the industry's specificities in each country. With the increasing globalisation of the economy, particularly in the European Union, there is a trend for a normalisation of the legal framework related to construction practices.

In terms of professional practice in construction in Portugal, the graduate professionals are architects, civil engineers and technical civil engineers. In order to legally practise in the field, architects must be registered in the Order of Architects, civil engineers with the Order of Engineers and technical civil engineers with the Professional Association of Technical Engineers. The legal framework for the activity of these different professions has long been established by the Decree Law 73/1973. As regards the construction management profession, these professionals are not obliged by law to fulfil any specific educational requirements nor are they subject to any legal regime regulating their activities. However, it is generally recognised that the Institutions of Higher Education in Portugal do not provide the competencies required for an efficient practice in the area of construction management.

The Bologna Model establishes that the definition of the objectives of the course subjects be centred in terms of the learning outcomes. It appears that with the new curricula structure, which emphasises competencies to be acquired, the institutions of higher education are better prepared to mach their educational activities with the needs of business community.

Keywords: Bologna process, Construction management, Competencies, Qualifications, Civil engineering, Portugal.

1. Introduction

Construction management is one of civil engineers diversified professional option areas and its importance has increased in the last years. However, the construction managers are not obliged by law to fulfil any specific educational requirements. International literature refers that many curricular contents of the undergraduate courses still do not meet the needs of practice [1]. Thus, it appears to be appropriate to analyse the impact of higher education contents on the practice of construction management.

The subscription of the Declaration of Bologna by 29 European countries, in 1999, is responsible for structural changes in education and learning models in many higher education institutions of the European countries. Also in Portugal, many educational institutions have started a process for implementing the Bologna Model, following the established by the Portuguese Decree Law 74/2006 of 24 of March [2], which approved the new legal regime of degrees and diplomas for higher education. This profound educational change has already lead to deep modifications in the legal framework, and the Portuguese professional associations are also being obliged to establish new statutes and regulations. So, this could be a unique chance to design civil engineering courses that answers more effectively to the needs of professional.

The impact of the Bologna process on the construction profession is something that just will be possible to assess and analyze in the future. This paper is part of a major study that has the aim of providing an overview of the practice in construction management, investigate its problems and future challenges as a consequence of the new legal framework related with the implementation of the Bologna model.

2. Methodology

The methodology used consists of a literature review on government publications, curricula structures of civil engineering courses in representative higher education institutions, and statutes and regulations of Orders and Professional Associations.

Secondly, it was used a case study on the experiences of implementing in the Polytechnic Institute of Bragança, in the last year, the reformulation of the curriculum

structure of the Civil Engineering Course according to the Bologna model.

3. The role of the construction manager in the construction process

The construction process has various phases and participants. In all these stages, important decisions must be taken by the owner or sponsor, generally with the support of technically qualified professionals. The owner can appoint a project manager to coordinate the activities of the owner, designers and contractor, thus providing himself with the opportunity to participate actively in the construction progress. It is the interest of all parties that the owner takes an active interest in the whole process.
In the early stages, the owner proposes a project scope based on a market demands and an initial financial viability study is undertaken by financial consultants, with the aid of lawyers, engineers and architects.

Generally, several common types of professional services may be engaged. This multidisciplinary team consists of a group of professional participants who will carry out the tasks of project planning, design and construction in an integrated manner. But, the fact is that there is not a comprehensive legal framework that requires it.

Next, the design team makes the initial planning and project scheduling and the preliminary design, based on the project program and requirements elaborated during the viability analysis. It is true that a focused attention on studies and details during the design phase is certainly a better way for work planning, cost control and also quality assurance during the construction works. After the scope of the project is clearly defined, detailed engineering design will provide the design documents for the construction stage and a more effective-cost estimate will serve as the baseline for global cost control.

The design and engineering phase and its approval for the local governmental authorities is the starting point to pass to the construction stage. The following steps are the tendering process and the bidding process, where contractors formulate detailed plans and specifications of their offer based on the goals and requirements of the owner. A qualified contractor to be selected usually requires a minimum period of previous experience and financial soundness. In this phase, the contractors have to answer to the contract conditions and works information.

In accordance with the Portuguese legal framework, any public or private construction project must be under the responsibility of a construction manager, except the projects that do not needed local government approval. He/she supervises the construction site activities and usually acts as the contractor's representative. During the construction process, the construction manager has to interact with quite different participants: sub-contractors, design team, material and equipment suppliers, external service providers, suppliers, supervision team, safety and health team, accountants, lawyers, general managers, contract specialists, consultants, among others. He has to demonstrate capacities manage, design, programme, execute and control site works, added to an amount of specific competencies in the social field, e.g. communication, decision making and leadership. These aspects are directly related with responsibilities that characterize this task to guarantee quality assurance, schedule control, cost control and also safety and health, during the construction period [1].

It is usually perceived that after finishing the construction period, the work of the contractor is over as well as the role of the construction manager, but this is not true at all. The responsibility and supervision of projects project last from the brief period of the constructed facility to the construction warrantee period.

Figure 1 illustrates the project development process in Portugal.

4. Construction management in Civil Engineering curricular structures

4.1 Competencies acquired in Civil Engineering courses

The Civil Engineering courses in Portugal can provide competencies in the following major professional areas: conception and design; planning, management, execution and control. These professional competencies are also partially assured by complementary courses or by other professional courses (not higher education courses). In the particular case of the Bachelor Degree (3 years) and Licentiate Degree (5 years) in Civil Engineering, the competencies acquired by students are frequently disassembled and given in separated curricular subjects. In many courses, there is not an adequate and integrated group of curricular subjects to provide the competencies in construction management. In this study, we only found two courses with a final option in construction management, in the fifth curricular year. The curricular structure of one of those courses has six obligatory subjects in construction management area, between the second and fourth curricular years.

Table 1 shows the civil engineering subjects in some of the most representative Portuguese higher education institutions. Notice the reduced number of obligatory subjects that provide competencies in the construction management area.

4.2 – An overview of qualifications for construction management

After obtaining the degree, the graduate must submit himself to a period of training to be candidate to a membership of an Order or professional association. These entities are responsible for certifying the graduates engaged in professional practices. As an example, a graduate with a licentiate degree in an architecture course recognized by the Order of Architects is entitled to be an Architect. A graduate with a licentiate degree in Civil Engineering is recognized by the Order of Engineers (OE) as a Civil Engineer. Also, a graduate with a Bachelor degree in Civil Engineering is recognized for the National

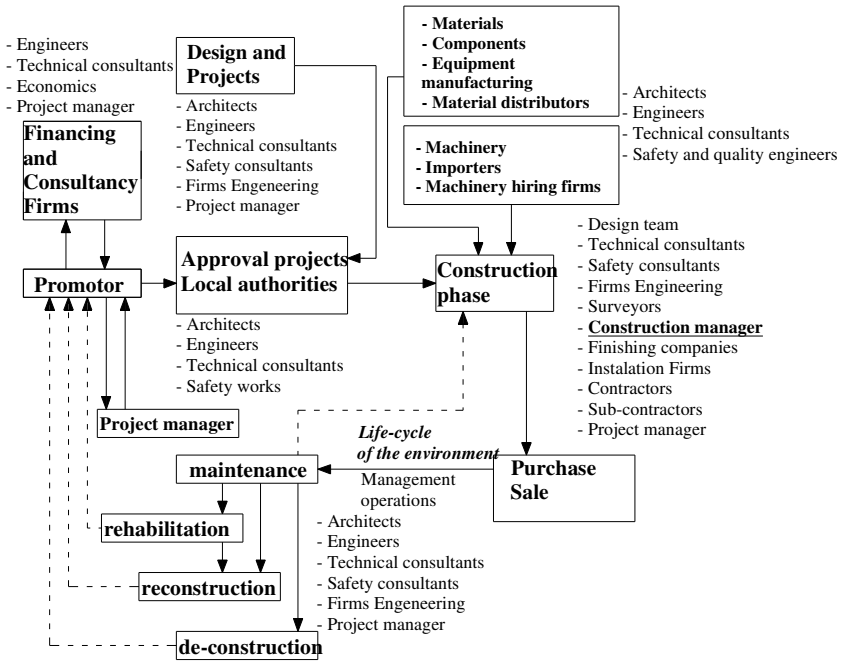

Figure 1 – Overview of the participants in construction project

Association of Technical Engineers (ANET) with the title of Technical Civil Engineer.

Figure 2 represents the most common participants in the construction process and the qualifications needed in professional practices.

In Portugal, there are some licentiate degrees in engineering approved by the Ministry of Science and High Education but not recognized by the Order of Engineers. The same has happened with some licentiate degrees in Architecture. According to these professional organizations, the courses are not recognized because they do not fulfil the minimum requirements demanded. But a graduate with a non recognized course by the professional entity can apply to an admission exam. In the case of approval, the candidate can initiate the period of training and then be accepted as a member.

Some subsidiary competencies can be achieved by attending professional courses that complement the courses provided in higher education institutions. These courses are offered by certified entities and the qualification can be attributed by other entities than Orders or professional associations.

The law requires that a construction project must be directed by a construction manager with de qualifications of Civil Engineer or Technical Civil Engineer, depending on the complexity of the project but does not define unambiguously this complexity. There are also some courses that became a complement to the basic competencies of the construction manager, such as Microsoft Project and Financial Control of Projects, although does not exist any entity responsible for certifying the qualification in these areas.

5. Institutional and legal framework

Nowadays, the Portuguese legal framework related with the construction industry excludes some professions that have an important role in this sector. For example, the legal framework that regulates the qualification of the design professionals is the Decree Law 73/73 of 28th February [3]. This diploma establishes that a typical architectural design can be carried out not only by architects but also by civil engineers, technical civil engineers, mining engineers and graduated civil constructors. The exception goes for projects in heritage protected areas (Decree Law 205/88 of 16th June) and for some tourist projects (Administrative Order 1064/97 of 21th October). The Decree Law 73/73 does not respond efficiently to nowadays labour market needs because establishes that the architectural design professional can be a professional without any kind of graduation in architecture and without the right competences for this practice [4]. This fact is not accepted by the Order of Architects and has resulted into serious problems of maladjustment between the competencies acquired in educational institutions and those required in professional practices. It is important to note that in 1973, the date of the creation of this legal document, there was a great concern for the systematization of the construction projects. There was a generalized lack of qualified professionals to answer to a great boom in construction.

With a growing number of architects that match the market needs, that legal document is undoubtedly out of date. Its revision is in the discussion phase, and has been subjected to several adjustments to look for the best structure to fit the domestic construction industry needs.

Table 1 – Subjects related with the construction management area in some Portuguese civil engineering courses

Universities and Polytechnic Institutes	Year	Subjects (curricular year)	Degree/Obligatory ou Optional
Engineering Faculty - University of Porto (FEUP)	2003/ 2004	- Construction Management (5º) - Construction quality (5º)	Licentiate/ Optional area: Construction
		- Projects evaluation and review (5º) - Inspection on construction works (5º)	Licencia te / Optional subjects
Higher Institute of Technical (IST)	2003/ 2004	- Management and theory of decision (3º)	Obligatory
		- Construction management (5º) - Economy and quality in construction (5º)	Licentiate/optional area: structures design and construction
		- Construction site management (5º)	Licentiate/ several optional degree areas
Science and Technology Faculty - University of Coimbra (FCTUC)	2006/ 2007	- Construction management (4º) - Introduction to environmental engineering (4º) - General management (5º)	Licentiate/ Obligatory
		- General management and construction inspection (5º) - Safety and quality construction works (5º)	Licentiate /Optional subjects
Higher Institute of Engineering - Polytechnic of Oporto (ISEP)	2005/ 2006	- Organization and planning in construction (2º) - Quality, safety and environment (2º) - Construction site management and construction equipments (3º) - Construction management (3º) - Safety and health in construction(3º) - Quality assurance in construction (4º)	Bachelor/Obligatory
		- Project management and construction I (5º) - Project management and construction II (5º) - Organization and general management (5º) - Law and safety in construction (5º)	Licentiate/Optional area: construction management
		- Project management and construction (5º)	Licentiate/Optional areas: infra-structures and environmental/ construction
Higher Institute of Engineering - Polytechnic of Lisbon (ISEL)	2005/ 2006	- Equipment and construction site management (3º)	Bachelor / Obligatory
		- General management and behaviour of organizations (4º)	Licentiate / Obligatory
		- Law and safe in construction (5º) - Planning and construction management (5º) - Cost control in construction (5º) - Safety and health in construction (5º)	Licentiate/Optional area: construction management
Polytechnic Institute of Bragança (IPB)	2005/ 2006	- Civil engineer and environmental (3º) - Project management (5º) - Economy and quality assurance in construction. (5º) - Construction site organization(5º) - Safety and Health in construction (5º)	Licentiate/Obligatory

The existing proposals call for the necessity of a multidisciplinary team throughout the multiple stages of the construction process. There are also stated intentions to define qualifications and responsibilities of the construction manager [5].

The administrative control and the approval of construction permits by local authorities is regulated by the Decree Law 555/99 of 16th December, as amended by the Decree Law n.º 177/2001 of 4th June, known as the *General Regime of Building and Urban Development*. This legal diploma describes the figure of the design team, stipulates the administrative supervision tasks taken by local authorities and prescribes the qualifications needed for professional practices, though does not specify about educational requirements of the latter. However, the *General Regime of Building and Urban Development* is in fact the only document that describes the responsibilities of the construction manager. Regulations and requirements of the Orders and professionals associations describe the professional qualifications needed for the exercise of the profession.

6 – Most current problems in construction management

In the last ten years, it has been witnessed that the activity in the construction management area is one of the most current employment options for civil engineers in Portugal. This practice faces today some problems: the optional nature of this area on most of the higher education courses is incomprehensible when all studies show that many civil or technical civil engineers are precisely doing this task; the social, economic and organizational factors, crucial for the success and failure of construction projects, are not adequately taken into account by design and construction teams; after finishing

their studies, newly graduates feel an insufficient preparation in this area and they have to learn from the experiences of professional colleagues; due to fact that the construction manager is responsible for almost all the management activities in the construction stage, they have little time to supervise construction works; the great diversity of construction technologies used from one project to another implies a constant necessity for adaptation; the absence or reduced number of complementary courses available in construction management, restricted to the bigger cities; the contract conditions do not usually describe the competencies needed; the inexistence of a legal framework concerning the competencies and responsibilities of the construction manager; in the majority of small projects, the construction manager is a passive agent and the supervision is carried out directly by the client or by the owner of the construction enterprise, which frequently has a negative impact on the conformity of the constructed elements according to the design specifications.

The economic, organizational and social factors can condition the success or failure of construction projects. The truth is that during their career, most engineers often spend much more time on planning and management then on the traditional engineering practice, which form the core of most educational curricular structures. Of course, engineers are not expected to know every detail of management techniques, but they must know enough to solve some management problems so that they can work harmoniously with other professionals of the project team in order to carry out the project successfully.

7. An overview on the Bologna process

7.1 The aims of the Bologna model

The Process of Bologna is based on some basic principles [6]: new paradigm in the educational process; new relation between education/labour market; new mission of the higher education institutions; flexible curricular structures and graduations with a professional practice goal. The first principle is related to a new educational model. Traditionally this model was focused in the teacher and in the transmission of knowledge but this new model must be centred in the student learning process. Now the student has an active role in the learning process and should also be responsible for its development. The goals of the educational course must be based on the learning outcomes and the competences to be acquired. The second principle establishes that the educational institutions must guarantee not only the initial graduation period but also provide conditions for continuous education. So, there will be needed even more specific postgraduate courses for people who have already a professional activity. The third principle means that the institutions have the mission of guaranteeing the necessary conditions for students to acquire the needed competences or skills but also the ethical values, the capacity for communicating, decision making, self-learning and development of team spirit. The fourth principle implies more flexible curricular structures, like the attribution of credits to the curricular subjects based on the *European Credits Transfer System*, and the necessary accumulation

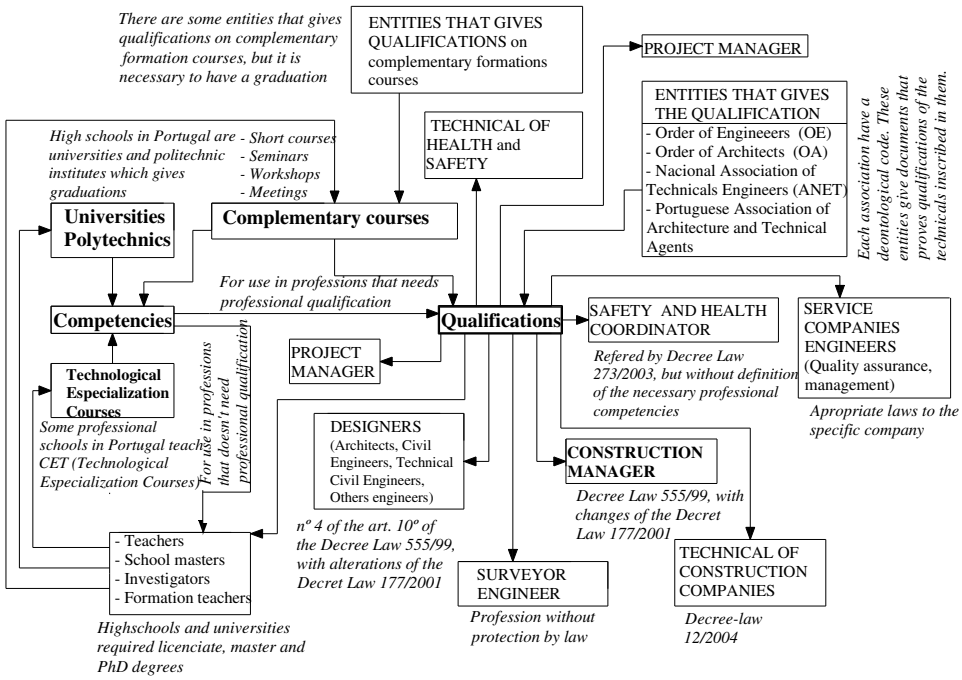

Figure 2 – Overview of most common participants in the construction process

of a established number of credits for attribution of the diploma. Finally the fifth principle establishes that the courses must prepare students for professional practice right after the completion of their study.

7.2 Professional association documents to cope with the Bologna process

To cope with Bologna process the National Association of the Technical Engineers (ANET) published a document that defines the acts of engineering practice and sets out the necessary competencies and qualifications for graduate professionals. For the construction management area, ANET defines [6] important knowledge areas such as: equipments, site work management, construction planning and management; supervision and inspection, cost control, project evaluation, quality assurance and safety and health control. As complementary knowledge areas, the legal framework related with construction projects is deemed as an important one. On this document ANET also defines the construction management fundamental competencies and the professional acts (Table 2).

Table 2 – Competencies and professional acts of civil engineers in construction management

Competencies	Professional Acts
The graduate must: Design Assemble/ Integrate Lead Execute Manage Communicate Assure Quality Inspection	Participation in the tendering process
	Participation in the Biding Process
	Contract Administration
	Elaboration of Works information
	Materials and equipments planning and control
	Human resources management
	Budgets and project design measurements
	Construction site supervision
	Cost control
	Scheduling control
	Safety planning and control
	Quality assurance

According to ANET, the first cycle of the Bologna model must provide students with the basic and essential competencies for professional practice. However, there is, in our opinion, a drawback in this model: as a three-year course, the first cycle cannot be very specialized and some learning outcomes must be achieved in post-graduation courses or in complementary courses.

7.3 Study case

The study case presented consists of the experiences collected in the reformulation of the civil engineering course in the Polytechnic Institute of Bragança according to the Bologna requirements.

The nº 1 of the article 8 of the Decree Law 74/2006 of 24th March [2], establishes that in polytechnic institutions, the first cycle of studies must have 180 credits and six curricular semesters. This kind of cycle has the recognition of the Professional Association of Technical Engineers (ANET). It was adopted a modular curricular system organization, with five curricular units for each curricular semester, corresponding each curricular subject to six credits, in accordance with one of the models in the *ECTS Users Guide* [7]. A core curriculum was established in three areas: Foundation Sciences, Engineering Sciences and Complementary Sciences, in accordance with the Order of Engineers´ recommendations. The task of attributing the contents and the correspondent competences required considered the following aspects: the scientific and pedagogical affinity between different contents; the expected competences based on *Qualification Describers* of Project Tuning [8] and chapter 2 of a portuguese national report [9]; the acquisition of knowledge and capacity of understanding its application; the capacity of judgements and decision making; the use of effective communication and interpersonal skills; the self-learning; the commitment to professional standards and social responsibility; the most used learning methodologies and educational resources available and the established time period for each curricular unit, that is, 162 hours, of which 60 are contact hours.

Two questions were raised: what kind of graduated profile to be designed; and what are the qualifications and competences required for construction management practice? First, the undergraduate curricular subjects and corresponding credits were made consistent with the definitions provided in the referred document [6] of the National Association of the Technical Engineers (chapter 7.2). Thus, and following this document, the definition of the curricular scientific areas and their contents were designed to provide competencies, capacities and knowledge for the accomplishment of the necessary professional practice. The mentioned study on the *Introduction* chapter of this paper [1] presents an overview of different top subject areas needed for the practice in the construction management field: programming, quality management, productivity and industrial relations are some of the identified areas. But also, administration, oral communication, controlling, co-ordinating, decision making and leadership are fundamental competences to be acquired. Remember that the new educational model requires that the students must achieve transversal competences, for example, communication and decision making, just the competences that are very crucial for this activity. The same study also states that construction management subjects need to focus on management of resources within defined parameters, namely: cost, health and safety, productivity, quality, schedule and environment. It concludes by stating that that it is fundamental to empower graduates to improve the construction process: in customer service, health and safety, productivity and quality management. [1]. As *Lopes* referred in [4] there has been an increasing concern by industrial and professional associations for the safety, quality and environmental aspects of the built environment. Therefore, it was made a great effort to introduce on the

curricular structure even more contents on those matters. Therefore, it was felt a great need to introduce a scientific area in the construction management field named *Management and Law in Construction.* The general learning outcomes established were: knowledge on construction management, quality assurance, safety management and environmental impact assessment of construction works; knowledge of the construction legal framework, procurement practices, contract administration and competition process; ability to apply fundamental principles to solving problems in new and unfamiliar situations on the construction site; good oral communication skills; capacity to investigate, implement and innovate; sensibility to the importance of leadership quality and ability to handle effectively with interpersonal relationships within an organization, and commitment to professional codes and rules and to ethical professional values.

8. Prospects

Knowing the critical aspects concerning the construction manager labour market and the problems in its practice, the Bologna model has provided an excellent opportunity to introduce some curricular modifications to the benefit of different partners concerned with the construction industry activity.

In Portugal, the reorganization of some civil engineering courses should be designed with a strong emphasis on construction management because this has been the most promising area of those professionals' labour market. A construction manager who has a solid educational background in engineering design and also management can apply to some jobs more successfully.

It would be also a good strategy to increase the offers on complementary courses for newly graduates that intend to work in construction management and also for those that already have experience in the area.

The Order of Engineers and the National Association of the Technical Engineers should provide a specialization in construction management to improve professional performance and to regulate the activity.

A professional association of construction managers should be created and envisage a mechanism for classification by levels, in accordance with the experience achieved and years of practice. This classification could thus guarantee a better service to customers and bring seriousness to this professional activity.

However, we realize that much work must be done in the curricular structures in order to provide better prepared graduates in the construction field. Thus, the changes imposed by the Bologna model should be seen as an opportunity for the institutions of higher education to take the initial steps in designing curricula that contributes to the credibility of the construction management profession.

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