Review of Professionals Accreditation Systems and their relation to Higher Education Studies in the branch of Engineering

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Abstract

This paper aims to analyze and compare the accreditation systems of people applying to higher education professionals independently of the area of accreditation to which they belong.

To do this, we will analyze five certification systems: Project Management Institute (PMI), Registration and Certification Center of People (CERPER), General Council of Industrial Engineering (COGITI), Association of Naval Architects and Ocean (COIN) and National Qualifications Authority (INCUAL) based on eleven indicators derived from the study of different sources of information.

This comparative allows us to analyze and evidence the similarities and differences of existing accreditation systems of people.

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1. Introduction

In the development of Higher Education European System, appears a new scenario that seems to blur the relationship between academic qualifications and professions, especially in the field of engineering, which will be enhanced as a result of the next passing of Professional Services Act.

Actually the role of the engineer in society is changing, it must be prepared to deal not only technical issues, but to solve problems and formulate an interdisciplinary mode integrated solution alternatives. The goal to strive for greater integration in terms of application of skills in the academic and professional field has led to a profound modification in the concept of competence, understood as a combination of attributes applied knowledge, abilities, skills and responsibilities describing the level proficiency in performing a function. From the educational standpoint competition focuses on the teaching-learning process, while in the professional field concept focuses on the effectiveness and efficiency of work.

Although until now it was possible to identify the qualified professional based on their qualifications, it is expected that in a near future we need new mechanisms to achieve this, such as the accreditation of professionals.

The process of accreditation seeks to declare publicly that a product, process or service conforms to the requirements. The areas of activity of an engineer can be classified according to the type of company where you work or service function to develop. Depending on the type of company include industrial business or service (Management: technical, commercial, production, ...; Projects: products, facilities, ...; Organization: quality, stocks, production, ...), government or public company (technical assessments, project management, ...), and freelance (projects, technical reports, ratings,

...). Depending on the work to develop: Leadership and Management, Process Control, Product marketing, R & D, Technical (Technical Office), Consulting etc.

The main objective of this paper is to analyze and compare systems of accreditation of people that to be applied to professionals in higher education and who have a national or international recognition independently of the area to which they belong.

So we will describe different accreditation systems to establish indicators that allow a comparison of the systems to establish the similarities and differences that may exist between the systems analyzed.

2. Conceptual basis

2.1. Accreditation Systems of People

The current situation in the workplace and mobility of people who exist in the European Union has made that to be needed the recognition of professional qualifications. Through the Directive 2005/36/CE of the European Parliament and of the Council of 7 September 2005, has established the procedure for the recognition of professional qualifications.

The directive distinguishes five levels of professional qualifications:

- Certificate of competence: general training of primary or secondary education, or professional experience of three years.

- Certificate: training at secondary education technical or professional.

- Accrediting Title: formation of post-secondary level.

- Accrediting Title of higher or university education: at least three years.

- Accrediting Title of higher or university education: minimum of four years.

With regard to higher education the RD 1027/2011, of 15 July, provides a map of national qualifications (levels, learning outcomes and descriptors), dividing it in four levels: Technician, Grade, Master and Doctor.

The qualifications, in formal education, is defined in Article 2.a) of RD as "any degree, diploma or certificate from an educational institution accredited that have acquired a set of learning outcomes, having successfully passed a training program in a legally recognized institution in the field of higher education. "

However, the Law 5/2002 on Qualifications and Vocational Training, defines the vocational qualifications in Article 7.3.a) as "the set of competences with significance in employment that can be acquired through training or other modular training as well as through work experience". Giving special importance to work experience for the recognition of professional qualifications.

As a combination of the facts appear different institutions that acquire an interest in the certification of professional competences. Being the certificate of people the process by which an independent third party ensures that a person meets the requirements contained in a certification scheme. Including criteria to ensure skills, competencies, experience and training (Tallo 2009).

The ISO 17024 standard for organizations engaged to certification of persons provides in paragraph 4.3 the importance of impartiality due to the impact of the certificates to be issued by accredited organizations. The ENAC establishes that "The organization of certification must be structured to provide confidence in its competence, impartiality and integrity to stakeholders" (CGA-ENAC 2009), as a prerequisite for accreditation.

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2.2. Taxonomy of engineering competences

It has professional competence who has the knowledge, skills and attitudes necessary to practice a profession, can solve professional problems independently and flexibly and is trained to assist in their professional environment and work organization.

The main requirements of skills demanded to the workers by business are synthesized into three groups: technical, human and analytical. As shown in Table 1, the tasks that are grouped in each of three identified groups are diverse:

Table 1. Professional requirements in European companies

Type of knowledge	Functional Task or skills
Technical	Management, production, organization and systems design, quality control, scheduling, etc.
Human	Creativity, organization and coordination of tasks, decision making, teamwork, leadership, communication, etc.
Analytical	Development of diagnostics, information and analysis of problems, forecast future scenarios, design business strategies, etc.

In the table 2 (Torres and Abud 2004), is showed generic skills of the engineer in order to further establish the possible indicators for its evaluation.

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Table 2. Integrated view of generic competences of Mechanical Engineer

Knowledge, Skills, Attitudes and Values
"The engineer has skill / ability / willingness / attitude ..."
Investigate, generate and manage information and data
Analyze, propose and solve real engineering problems
Designing systems to meet needs
Complementary skills
Communicate effectively
Interact and work in teams
Encourage self-development and continuous improvement
Commitment to ethics and professional, legal, social and environmental responsibility
Assess the social, artistic and cultural diversity

3. Methodology

The summary of the methodological process has been carried out to define and compare the different systems of accreditation of people analyzed are shown in Table 3.

Table 3. Summary of the methodology

Factor	Initial considerations
Object of study	Systems Certification: PMI, AEC-CERPER, COGITI, COIN, FP
Sources information used	Primary sources of information such as books, magazines, reports and websites. Secondary sources of information such as libraries and databases.
Data collection	Is employed document analysis
Analysis and interpretation of data	Study of indicators that are clear, concise, and show relevant information and are in line with the objectives.

For definition of indicators have followed the next steps of review of information sources, selecting the relevant information, identifying and developing indicators and legend definition for each indicator.

4. Accreditation System Analysis

In this section we will investigate the different certification systems together with their indicators and comparative.

4.1. Project Management

In project management certification exists mainly four systems of certification at international level: IPMA, PMI, P2M y PRINCE2. These systems possess organization of knowledge, standards and certification processes themselves. Given the similarities between these standards (Cardoza 2011), is propose to analyze the PMI system because it is very interesting in the field of engineering.

PMI (Project Management Institute) is a non-profit association for the profession of project management. Founded in 1969 in Pennsylvania (USA), currently has more than half a million members and certified professionals, and has credentials in 185 countries. The PMI is accredited by the American National Institute of Standards (ANSI).

PMI	
Objetive	Seeks to promote the profession of project management through standards and certificates recognized worldwide
Accreditation	ANSI Accredited to ISO 17024 and ISO 9001:2008
Accreditation levels	Three levels of certification in project management: ☐ Program Management Professional (PgMP). ☐ Project Management Professional (PMP). ☐ Certified Associate in Project Management (CAPM).
Scope of International	International

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Recognition	
Certification process	☐ PgMP Certification Process: Application for presentation, review of completed application, payment application process, audit process, review before the exam of multiple-choice eligibility, evaluation of several reviewers panel. ☐ PMP: Request for production, review of completed application, payment application process, audit process, exam of multiple-choice eligibility. ☐ CAPM: Request for production, review of completed application, payment application process, audit process, exam of multiple-choice eligibility.
Evaluation	Audit assessment of the application and review
Cost	400 – 600 €

4.2. Quality Systems and Environment

The Registration and Certification Center of People (CERPER) belonging to the AEC (Spanish Association for Quality) plays the mission of the personnel certification schemes based on the European Organization for Quality (EOQ).

AEC-CERPER	
Objetive	Find certified professionals in Quality and Environment.
Accreditation	Accredited by ENAC, according to the UNE EN ISO 17024 Certification of Persons, the National Accreditation Body (ENAC), providing 12 certificates in the fields of Environmental

	Quality and the PRL, food security and innovation.
Accreditation levels	These certifications are divided into three levels (CERPER 2011): • Coach • Manager • and Auditor.
Scope of International Recognition	National
Certification process	The certification process consists of three phases: ☐ Initial Certification ☐ Documentation Phase ☐ Evaluation Phase ☐ Registration Phase ☐ Track ☐ Recertification
Evaluation	All certification processes include audit process the request and both written and oral examination.
Cost	250-400 €

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4.3. Professional Accreditation Systems for Engineers

From the General Council of Industrial Engineering (COGITI) has developed and implemented a procedure for accreditation of Continuing Professional Development (CPD) for engineers.

COGITI	
Objetive	The DPC patent and certify professional competence, consisting of training and professional experience throughout the professional life of an engineer. (DPC 2011)
Accreditation	---
Accreditation levels	Accreditation is structured in four levels: • Junior • Senior • Advance • Expertise The first three of which are divided into two sublayers (A and B), in order to achieve a greater distinction.
Scope of International Recognition	National
Certification	DCP accreditation process comprises the following steps:

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process	• Submission of documentation and initiation.
	• Rating and qualification records.
	• Dossier evaluation by the Accreditation COGITI table.
	• Certificate Delivery.
	• Accreditation Audits.
Evaluation	This certification process is to audit and verification of the curriculum presented.
Cost	25-150 €

4.4. Professional Accreditation Systems for Naval Engineers

The Association of Naval Architects and Ocean (COIN) has a future plan for their professional certifications based, assessing the need for such certification be accredited by ENAC, since they allow EU recognition.

COIN	
Objetive	Its mission is to ensure the quality of the work done in the field of naval engineering-and by extension in the maritime sector - through adequate monitoring of vocational training of people working in this field.

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Accreditation	Accredited by ENAC according to ISO 17024
Accreditation levels	This plan establishes certification areas in which the professional can certify their skills, whether in one or more of these areas (Lomo 2011). The system defines two levels of qualification: - Enabling professional generic: certified professional in one of three areas (design, production and repair). - Partial professional Enabling: certifying professional competence in one of the established areas. These sub-areas are: Basic design, PRL in nautical industries, stability, hydrodynamics, naval electronics, ports, Shipping, etc.
Scope of International Recognition	International
Certification process	The certification process comprises: - Filing of the application to the President of the Commission for access. - Evaluation by the entry fee of the professional activity of the candidate. - Issue Report by the Commission. - Opinion of the committee. If it is favorable, related

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	ratings, but information of training activities by the COIN.
Evaluation	Audit application and written evaluation.
Cost	7.500-20.000 €

4.5. Professional Qualifications

In the field of professional training, the National Qualifications Authority (INCUAL) has been commissioned to develop the National Catalogue of Professional Qualifications (Rodríguez 2012), in view of the Law 5/2002 of 19 June.

FP	
Objetive	Trainings aimed at insertion, update and labor reinsertion, whose main objective is to increase and adapt the knowledge and skills of current and future workers throughout life.
Accreditation	INCUAL (National Qualifications)
Accreditation levels	The National Catalogue is divided into 26 professional and 5 levels of qualification families, according to the degree of knowledge, initiative and autonomy required to perform this work activity responsibility. Each skill is divided into units of competence. As the unit of competency "minimum aggregate of professional skills recognition susceptible to partial accreditation" (Rodriguez 2012).
Scope of	National

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International Recognition	
Certification process	The certification process of people has left the institutes, centers and agencies of the corresponding Autonomous Communities and / or the Office of State Employment Service (SEPS).
Evaluation	Audit application and written evaluation.
Cost	300-500 € / year

4.6. Indicators

After the review of the different certification systems of persons analyzed, are presented the 11 indicators to be used for comparison of the 5 certification systems studied (Cardoza 2011). In Table 4 are presented the indicators selected:

Table 4. Indicators

Nº	Indicators	Legend
		Description
1	Accreditation System	Differentiates according to systems validation processes that have passed: 1: Do not certified by any standards 2: Accredited ISO 17024 3: Certificate ISO 9001 and ISO 17024

2	Accreditation Body	Identifies the agency that accredits the certification process
3	Certification levels: number	Difference systems according to levels of certification: 1: Set 2 levels of certification 2: Sets 3 levels of certification 3: Set 4 levels of certification 4: Sets 5 levels of certification
4	Levels of certification: accessibility	Unlike the systems according give access from one level to another certification: 1: It is not necessary to have a lower level for admission to a higher 2: You need to possess a certain level below to access higher levels
5	Scope / Recognition	Difference according recognition systems in the geographical area: 1: National 2: International
6	Model Requirements: Experience	Establish levels of experience are requested to enter the certification process: 1: No experience required for any level of certification 2: minimum years of experience for some levels and lower levels are required is not mandatory
7	Model Requirements: training or education required	Sets the requirement for initial training or education to enter the certification process: 1: No initial training or education is required 2: training or education is required
8	Certification process: Grading system	Difference evaluation systems that are made: 1: Audit Request 2: Audit of the application and written evaluation.

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9	As experience	Sets the unit of measure of experience that is required to access certain levels of certification: 1: No requests experience 2: experience is requested in years 3: experience is requested in number of projects
10	Validity	Difference systems according to time expended validity of certificates: 1: Certificates 1 and 3 years 2: Certificates 3 and 5 years 3: Certificates only 5 years
11	Coste y mantenimiento	Difference systems according to the initial cost and maintenance of certificates expended: 1: Less than 150 € 2: Between 150-1000 € 3: Superior to 1000 €

4.7. Comparative analysis of certification systems

Each of the objects systems study was analyzed according to the indicators described above, obtaining the following comparative table, Table 5.

Tabla 5. Comparison of Certification Systems of Persons.

Indicadores	**PMI**	**AEC-CERPER**	**COGITI**	**COIN**	**INCUAL**
Accreditation System	**3**	**3**	**--**	**2**	**1 (Law)**
Accreditation Body	**ANSI**	**ENAC**	**--**	**ENAC**	**INCUAL**

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Certification levels: number	**2**	**2**	**3**	**1**	**4**
Levels of certification: accessibility	**1**	**1**	**1**	**1**	**2**
Scope / Recognition	**2**	**1**	**1**	**2**	**2**
Model Requirements: Experience	**2**	**2**	**2**	**2**	**1**
Model Requirements: training or education required	**2**	**2**	**2**	**2**	**2**
Certification process: Grading system	**2**	**2**	**1**	**2**	**2**
As experience	**2**	**2**	**2**	**3**	**1**
Validity	**2**	**2**	**1**	**3**	**--**
Cost and maintanance	**2**	**2**	**1**	**3**	**3**

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5. Conclusions

Analyzed and compared the five proposed systems, it is possible to identify a number existing commonalities between most of them despite being of certification of persons of different application areas and in different geographical areas.

First, organizations and institutions take a special interest in taking as a framework for system certification ISO 17024 Certification of Persons. (UNE-EN ISO/IEC 17024 2012) As well as being accredited by a recognized certification company certifying compliance with this standard within their system because they recognize the value as it relates to transparency and reliability of the system for both the institution and the people who certify.

Secondly, the evaluation systems of most institutions consist of audit record, written and sometimes include an interview. So as to ensure that the person tested has the powers he seeks are recognized.

Another important factor common to PMI, CERPER, COIN and INCUAL is to establish and clearly define the units of competency, so that certification is oriented to a specific field of knowledge (there different levels within each). In many cases the institutions develop standards that contain the knowledge to certify competence, such as the PMBOK Guide (PMBOK 2013) in the PMI and can thus ensure homogeneity within the same group that owns a certification.

Finally, there is an evident need for external reference models for the development of new qualifications in the EHEA, which Accreditation Systems could play a decisive role.

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