

Global Engineering Education: An Overview of Professional Qualifications

Alfredo Soeiro, Universidade Porto, avsoeiro@fe.up.pt

IEOM2017 – Paper Session Tuesday 11 April 2017 14:55 – 15:20

1. Mobility of Engineers and CPD

Mobility is important for engineers. On one hand it is due to the increasing demand for flexible deployment on an ever more international labor market. On the other hand it is caused by the varying availability of highly qualified engineering personnel in some parts of the world. Employees as well as employers require user-friendly tools that offers an educational profile based on internationally recognized standards.

A popular opinion on the basis of development of technologies at present time is that twenty percent of an engineer's knowledge become obsolete each year. Therefore, lifelong learning is very important for every engineer. In this context, one might ask what Continuing Professional Development (CPD) is. A generally accepted definition is: "CPD is the systematic maintenance, improvement, and broadening of knowledge and skills, and the development of personal qualities necessary for the execution of professional and technical duties throughout the practitioner's working life".

Continuing means that professionals have to commit themselves to a lifelong learning process. Achieving the initial professional qualification is only the start of self-development. Professional implies that persons will take an approach to their self-development with which they will earn the respect of their fellow professionals. The word Development means the cumulative development of competencies. CPD can have a positive effect on salary development, personal motivation, and career progression in general.

CPD plays a very important role in many countries and fields of occupation. Many professional associations are active in the promotion of CPD. However, there is still much room for improvement. There are three key elements for successful Continuing Professional Development from the individual or an organisational point of view.

First, there must be a commitment by the individual to self-development. Personal development plans are a valuable instrument to help people with evaluating their own situation and with projecting their further development. The planned development must take into account key competencies. Secondly, organisational structures must be adapted to make staff coaching and development one of the central activities of managers. Managers too have to be trained, developed, rewarded, and promoted based on their performance in human resources management. Thirdly, organisations must be learning organisations. This means that they maximise their learning processes and that they possess a consistent and cohesive value system.

Far too many individuals leave it to others for continuing professional development. For example, the bigger the company, the more there seems to be a tendency to look to the training department or human resources to provide CPD. This mind-set is dangerous, because responsibility passes from the individual to the organisation. However, as mentioned above, no approach to CPD can work unless the individual is committed to its self-development. Success is to a large degree dependent on the frame of mind of the individual. People have to ask themselves how they want to develop their career, over the next year, over the next five years, or over an even longer period.

2. Engineers Descriptors of Qualifications

The need for descriptors is presented by CEDEFOP [1]: Level descriptors are essential elements of the qualification frameworks. Almost all 36 countries participating in the European qualifications framework (EQF) have defined – and mostly adopted – their levels of learning outcomes. While technical in their character, these descriptors define what is meant by learning outcomes, describing what an individual is expected to know, be able to do and to understand, having acquired a qualification at a particular level. Level descriptors can thus be seen as the single most important element in promoting the shift to learning outcomes.

In terms of functions to be fulfilled by the descriptors these are identified as [1]:

- a) they need to be sufficiently detailed and multifaceted to capture the institutional complexities of the national qualification system;
- b) they need to be sufficiently general to accommodate different parts of education and training systems;
- c) they need to mirror the way qualifications are valued by economy and society;
- d) they must be able to reflect how knowledge, skills and competences increase in breadth, depth and complexity when moving from lower to higher levels;
- e) they need (increasingly) to act as a reference point for international comparison.

A good definition of qualification descriptors is [2]:

“Qualification descriptors are generic statements of the outcomes of study (cf. learning outcomes). They provide clear points of reference that describe the main outcomes of a qualification often with reference to national levels. Descriptors can work as examples of competences expected from a certain qualification.”

The European Qualification Framework (EQF) descriptors were classified in three categories:

- a) Knowledge (factual or theoretical);

- b) Skills (cognitive or practical);
- c) Competences (autonomy or responsibility).

There are eight levels of EQF with descriptors for each one [3]. Other qualification frameworks for professions present descriptors in similar structures having levels of proficiency and separation of the attributes, generally in three categories [4].

3. Engineering professional descriptors - examples

3.1 EURORECORD

This a reference work resulting from a project that created an abridging set of Engineering descriptors and recording of competences of engineers [5]. Some examples of these descriptors considered in this framework are grouped in six parts:

- A – Reflection, Self-awareness
- B – Ethics, Principles and Values
- C – Generic Professional Competences
- D – Generic Professional Engineering Competences
- E – Engineering Competences Related to Specific Activities:
- F – Engineering Body of Knowledge

In EURECORD the levels of accomplishment for each competence are five to differentiate progress.

3.2 Australian National University

Another example of descriptors is presented by the Australian National University for staff, in general, and, in particular, for its own engineers [6]. It has two main groups as primary and secondary descriptors the first group to characterize the levels and the second to define the functions. The descriptors are training level or qualifications, occupational equivalent, level of supervision, task level, organizational knowledge, judgement, independence, problem solving and typical activities. It is an approach that combines tasks and competences in the descriptors for each category of staff.

3.3 Global Engineering Grades

In order to address the variety of ways companies describe and structure engineering jobs in markets around the world, Watson Wyatt has developed the Watson Wyatt Global Grades. This Global Grading System is designed to underpin survey job matching on a consistent world-wide basis. It is a reference system that allows comparison of engineering jobs around the world. The

descriptors for different types of engineering are based on level, job description and global grade [7]. Levels have descriptors for experience, knowledge, responsibilities and hierarchy. Position descriptions are presented and these are associated with a global grading.

4. Conclusions

Considering engineering as an activity that involves mobility across the world on a global scale it is convenient to have frameworks that address the diversity of qualifications deriving from initial academic education and from the acquired CPD. In terms of initial qualifications several agreements have been made like the Washington Accord and the APEC Engineer. Accrediting systems like ABET and EUR-ACE also were helpful to recognize competency at entry levels. The situation is different when engineers' competences need to be recognized including their continuing professional development achievements.

It is a challenge to produce a system of qualifying engineers CPD. Several initiatives were implemented at a national and regional levels. It is missing a global approach that may be accepted by professional engineering organizations, industry and government agencies. The system that relies on subsidiarity may be applied if national, regional and world professional organizations define the minimum annual requirements of CPD for engineers in terms of credits and rely on the local professional organizations to verify the compliance of engineers. The approach has been working for the APEC Engineer area and can be adopted by other regional professional engineering organizations.

References

- [1] - Analysis and overview of NQF level descriptors in European countries, CEDEFOP, doi: 10.2801/27040, 2013.
- [2] - European Consortium for Accreditation, <http://ecahe.eu/>, accessed 31/08/16.
- [3] - Descriptors defining levels of the European Qualification Framework, <https://ec.europa.eu/ploteus/en/content/descriptors-page>, accessed 31/08/16.
- [4] - UK Quality Code for Higher Education, Part A, www.qaa.ac.uk, accessed 30/08/2016.
- [5] - EURORECORD - Professional Record of Achievement In Engineering: Towards Portable Qualifications, Christopher Padfield and Anders Hagstrom, Proceedings, 7th World Conference on Continuing Engineering Education, IACEE, Turin, Italy, 1998.
- [6] - Australian National University, <https://services.anu.edu.au/>, accessed 29Aug16.

[7] - Level Guides, Position Descriptions and Global Grades,
<http://www.hr.virginia.edu/uploads/documents/media/wwcallcentercustomersvc.pdf>,
accessed 29Aug16.