Mobility of Engineering Professionals

Up-dated Information paper on mobility prepared for WFEO Standing Committee on Education In Engineering (CEIE)

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Dedication

This work was initiated by the late Hisham A Malik Al-Shehaby, whose foresight and dedication to the profession and international cooperation were an example and an inspiration to us all.

Summary

World Federation of Engineering Organizations (WFEO) in its pre-eminent position in the engineering profession has a key role to play in the understanding, around the world, of the formation and assessment of engineers. Representing its members to major international agencies, it is ideally placed to facilitate exchanges between:

1. The organizations that set the engineering-education standards for accreditation and the assessment of professional competence
2. The employers of engineers and users of engineering products and services and
3. Other organizations affected by the quality and number of professional engineers.

WFEO members want to understand the standards (quality marks) and the assessment (benchmarking) of engineers. They approved WFEO's policy on Accreditation and the Mobility of Engineering Professional in 2009, and confirmed WFEO's role in assisting its members in this matter.

This paper is about what engineering mobility means. It goes on to talk about the position WFEO has adopted taking account of its opportunities, responsibilities and resources. The late Hisham Shihabi initiated this work for the WFEO standing Committee on Education and Training (CET, now CEIE) This up-dated paper reports progress up to the August 2011. The importance the related work of other WFEO standing committees is also described.

Acting as a central information source and facilitator between international organisations, WFEO is taking a significant step towards achieving its goals by contributing to accreditation and mobility.

A simple model of the engineering profession is described and offered as a guide in considering aspects of an engineer's career.

The paper introduces the topic of professional engineering mobility with some suggestions about what sort of engineer in needed and describes the organizations around the world that are working to ensure such engineers are assessed to appropriate standards.

These major accreditation and assessment organizations have widened their memberships, reviewed standards, the European Accredited Engineer (EUR-ACE) qualification has been implemented and the organizations are cooperating to achieve equivalence.

The stakeholders in professional engineering mobility are very different and have widely varying needs. Individual engineers have many reasons for becoming recognized professionals, which can affect both users and providers of engineering products and services. Some will be interested in international employment, while others will remain in their own country or region. The success of aid and loans for capacity building is often dependent on local or imported engineering expertise.

The Bologna Process in Europe intensified global discussion in organizations responsible for the:

1. Quality and standards of university programs and,
2. Impact on the assessment of engineers for independent practice.

These discussions will also have an impact on regional education of engineers. Engineering technologist and technician organizations are also monitoring the global debate.

Cooperation is very important among participants in these activities, including single-discipline institutions. Their learned society activities and publications are critical to the development and acquisition of knowledge. WFEO has its own central role to play. WFEO can add value to what other organizations are doing and ensure a voice for its members who want to improve their engineering capabilities and access to information.

Finally the paper revisits the question of life-long-learning and whole-of-career development. The debate so far only touches on the first quarter of an engineer's career. We need to spread the techniques and benefits of standards and assessment to the other three quarters.

Introduction

In 2009 WFEO approved a policy on the mobility of engineering professionals was prepared based an information paper written for a working group of the Committee on Education and Training.

In adopting the policy WFEO positioned itself to:

1. Publicise what the various regional and global accreditation and assessment organizations were doing
2. Cooperate with the organizations to facilitate WFEO member involvement and
3. Inform international agencies in its representative role.

Since material was gathered for that first information paper much progress has been made. Major changes have occurred in accreditation and assessment. WFEO members' interest has increased and most WFEO meetings and major engineering education congresses have had

sections on mobility. During formal visits of the last two WFEO presidents mobility has been a critical topic.

WFEO members want more information to help work towards adopting international standards or against which to test their standards. And a need for regional standards has emerged.

Related work has also progressed. WFEO is revising its Code of Ethics. Its Committee on Anti-Corruption is firmly established and encouraging development of much needed material and training. The WFEO Committee on Capacity Building has produced Capacity Building Guidelines that cover physical infrastructure but also include institutional and intellectual capacity building.

The world has recently suffered more national and man-made disasters with increasing frequency and intensity. Climate change causes increasing concern about planning and mitigation. Disaster response and climate mitigation have become global initiatives involving many professionals including engineers. Professionals, including engineers, must be competent to deal with these problems or to go into disaster areas. Candidates holding internationally recognized certification can be assessed more easily and quickly, depending on jurisdiction, particularly in the case of disaster work.

Engineers are still in short supply in many countries. Many sectors including mining, energy and transport need mobile engineers. Geographic distribution of engineers is also affected by economic and conflict migration adding to the need for further recruitment, education and training and assessment.

The above factors continue to affect activities of the development banks and other international agencies like the World Trade Organization. Good engineers are needed to satisfy all the above demands.

To produce these engineers we must have good educational institutions and training arrangements and some measures of performance. And because Engineering is a global profession — changing with time and place — we must be able to compare education and training in different locations. This needs to be done despite the on-going skills shortages in some countries and whether engineers are in plentiful or short supply.

The first information paper, the mobility policy document and a paper on global professional engineering mobility presented last year in Buenos Aries formed the starting point for this up-date. Both papers are on the WFEO web site under the “Committee on Education in Engineering (CEIE)” formally CET.

What is an Engineer and why should they be assessed for professional practice.

Engineers must be well educated, well trained and practice competently — technically, ethically and without corruption. And this must continue over the whole of their engineering careers.

When discussing engineering education, training, CPD and life-long-learning it helps to have a picture in mind of the engineering environment in which the recipients will work.

The Engineering Pyramid

Note to diagram: The management categories up the far corner may include technical as well as general management, with leadership skills essential in both streams. See whole-of-career diagram in Life-long learning section.

The diagram is a traditional view of engineering showing the many engineering disciplines and industries. The disciplines are less relevant these days. Most engineers identify with their speciality.

Engineers generally work in teams, often multi disciplinary, with technologists and technicians and perhaps professions like medicine, science and the law.

Management structures still tend to be hierarchical. The trend is towards fewer levels and flatter organization charts. New technologies and thinking may need other approaches especially in the increasing number of smaller organizations.

List of reasons why engineers want to achieve recognised professional standing, nationally or internationally

1. To become registered and capable of doing or signing-off particular engineering work, which is often covered by legislation. The main reasons for regulation via registration are where the engineering work affects public safety or where the recipient of the engineering work has little or no engineering knowledge. The latter reason is common to many professions and is sometimes called Asymmetry of Knowledge — the client knows much less than the professional and needs protection.
2. To do any work requiring an engineer in those countries where the title "engineer" in legally protected.
3. To use it in an immigration application for which an internationally recognised degree may be a pre-requisite for engineering work.
4. When individual engineers want the personal satisfaction of knowing they have achieved a certain standard. They also avoid having to assert their competence or having to justify it with each new employer or client.
5. Companies want to measure their engineers in an independent system.
6. Governments and companies can satisfy themselves that companies have the appropriate intellectual capital and human resources to complete engineering projects.
7. Development and funding agencies can satisfy themselves that the engineering-human-resource risk of funding engineering projects is acceptable.
8. Professional standing includes a commitment to practice ethically and competently.
9. Managers, banks and insurance companies want to reduce engineering risk.
10. Specific skills are indentified in professional recognition, which may not be clear from the engineer's qualification title or main discipline.
11. To work in disaster relief.
12. Work in certain industries like nuclear power engineering that are becoming more regulated.

The original list has grown, with conflicts and the engineering-skills crisis still affecting migration.

Accreditation and Mobility

In the context of this paper:

- Accreditation means the accreditation of university engineering courses or programs, the attributes of the graduates from the programs and the peer assessment of the equivalence of those programs internationally,

- Mobility means the movement around the world of engineering professionals, capable of independent practice having met the requirements for licensing or registration.

The major organizations leading the way on international accreditation and assessment for mobility at the moment are:

1. The International Engineering Alliance of several accords and forums (IEA), globally,
2. The European Federation of National Engineering Associations (FEANI), increasingly global and
3. The European Network for Accreditation of Engineering Education (ENAEE), which is the body responsible for operating the Accreditation of European Engineering Programs (EUR-ACE) Framework in Europe and neighbouring countries and now looking globally.

They are examples of multi-lateral agreements. Both IEA and FEANI have been involved for decades and ENAEE since 2004. Tables of the countries (or jurisdictions) are shown in Attachment 1.

Accreditation

The present measures of an internationally acceptable qualification for engineers are the standards set by:

1. IEA's Washington Accord (WA) accredited degree and
2. ENAEE's European Accredited Engineer (EUR-ACE) degree.

Other, regional, organizations have an interest in accreditation. Some are moving towards a system that will produce degrees to the Washington Accord or EUR-ACE standard.

Bigger countries, with perhaps a thousand universities, have difficulty achieving general quality control. Only a proportion of their universities may be accredited to an international standard. Washington Accord and ENAEE recognize programs or subsets of programs. They also guide and mentor countries working towards becoming signatories.

The Sydney and Dublin Accords — IEA members — benchmark and recognize qualifications for engineering technologists used by the Engineering Technologists Mobility Forum. In the future there may be a Forum for Engineering Technicians. Various groups including the Regional Council of Engineering Technology Organizations and other Caribbean associations are closely monitoring these arrangements.

Washington Accord

The Washington Accord, signed in 1989, is an international agreement among bodies responsible for accrediting engineering degree programs for entry to professional engineering practice. The accord recognizes the substantial equivalence of the graduate outcomes of programs accredited by those bodies, and of the accreditation processes used. Signatories agree to recognize graduates of programs accredited by the accreditation systems of the signatory bodies as having met the academic requirements for entry to the practice of engineering in their own jurisdiction. There are now fourteen signatories, with more than 6,300 accredited programs and six provisional signatories.

The Washington Accord emerged to badge good engineering graduate qualifications and improve the comparability between them. The Accord has led to an internationally-agreed qualification standard. The standard is expressed in outcome terms as a generic Graduate Attribute Exemplar, devised and agreed by the Accord signatories. Outcomes-based accreditation is consistent with contemporary higher education practice. The exemplar and its constituent attributes can be viewed on the IEA website.

First published in 2005, the exemplar was revised in 2009 to include higher expectations of knowledge, engineering-application ability and personal qualities. Engineering degrees that meet the exemplar are expected to be of four to five year's duration post secondary school, with most signatories currently accrediting degrees of four years duration.

Some individual Accord signatories have moved towards longer-duration programs, mostly with a master's level degree award, to meet the revised exemplar and local needs.

All the signatories have agreed to revise their accreditation systems to use the new exemplar and to fully implement the changes by 2019.

The Washington Accord and ENAEE (see below) have also started discussions to reach a common understanding of the similarities and differences between the IEA accreditation standards — expressed in the Graduate Attribute exemplar — and the EUR-ACE framework standards for both first- and second-cycle engineering awards. The main task to date has been to compile a common Glossary of Terms (in English) used in engineering accreditation and engineering education.

In comparing awards the emerging picture is complex. There is no single mapping of first- and second-cycle degrees, study durations, and award nomenclature amongst EUR-ACE authorised Agencies. There are similar variations amongst IEA members (noting that three of the seven EUR-ACE Agencies members are Washington Accord signatories and a further two are provisional members). Nevertheless, both the IEA Graduate Attribute Exemplar and the EUR-ACE Framework Standards allow individual jurisdictions to assess the level of their awards and accreditation systems.