Best Practice in International Engineering Accreditation and Future Challenges

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INTRODUCTION

Best practice in engineering accreditation will change with time so this paper outlines one version of current best practice and discusses the possible challenges to this in the future. The International Engineering Alliance (IEA) has been developing not only the standards to be achieved by engineering education but also the evaluation of accreditation systems which assess the qualifications. In recent years the IEA has worked closely with the European Network for Accreditation of Engineering Education (ENAEE) to develop a best practice exemplarforengineering accreditation but this is merely a start to world standards setting. Accreditationprocesses cannot be static and there are many challenges.

BACKGROUND

What is the IEA[1] – who are the members and how do they fit together?

The IEA is a group of self-regulating educational accords and professional competence agreements which have a substantially common view of what constitutes an acceptable professional engineering education and professional competence.

The educational accords apply to qualifications to enter practice. They comprise the:

- *Washington Accord* for professional engineering education,
- *Sydney Accord* for engineering technologist education, and
- *Dublin Accord* for engineering technician education.

The professional competence recognition agreements currently comprise:

- *The International Professional Engineers Agreement IPEA* (formerly the Engineers Mobility Forum) for professional engineers
- *The International Engineering Technologists Agreement IETA* (formerly the Engineering Technologists Mobility Forum) for engineering technologists
- *Agreement for International Engineering Technicians (AIET)* – for engineering technicians
- *The APEC Engineers Agreement APECEA* is a regional agreement whereas the other Accords and Agreements are intended to be able to have worldwide coverage.

[1] The IEA details can be found at http://www.ieagreements.org

The IEA competency agreements are multi-national agreements between engineering organisations in the member jurisdictions. The agreements create the frameworks for the establishment of international standards of competence for professional engineering and engineering technology. They then empower each member organisation to establish a section of the International Professional Engineers (IntPE) and International Engineering Technologists (IntET) registers.

The Alliance, which currently has lead engineering organisations from 25 nations as members (including five G8 and 11 G20 nations), is expanding steadily with China, Peru and Costa Rica being the latest to apply.

Thus there is recognition that mobility of engineers is important and therefore there is a need for recognised standards of education and accreditation to help mobility and optimise the utilisation of professional engineers worldwide.

OBJECTIVES OF ENGINEERING ACCREDITATION

Before looking at best practice is as well to ask why engineering accreditation is needed since this may affect the standards, their format and the accreditation process and structure. Accreditation can be for several purposes:

- To set the both the standard of education to meet national requirements and the accreditation processes for confirming that, and/or
- To confirm that the education meets international standards and accreditation process requirements and in that case
- To gain recognition by other relevant international authorities or institutions that the internationalrequirements have been met in terms of graduate outcomes, accreditation processes and quality.

If international recognition is the aim then then a further accreditation review process is required which generally involves periodic observation by international reviewers. The IEA has several methods of doing this, one of which allows continuous observation by international reviewers embedded in accreditation teams.

THE KEY ELEMENTS OF BEST PRACTICE

The recent IEA/ENAEE publication "Best Practice in Accreditation of Engineering Programmes: an Exemplar' is an exemplar giving guidance on current best practice.[2] Key elements of this include:

- ***Terminology:*** Defining accreditation, engineering occupation, programme outcomes/graduate attributes.
- ***Best practice:*** Definition of best practice and usageof the exemplar (i.e. scope and limitations of use)
- ***Constitution, scope and governance of the accreditation agency:*** Describes the essential characteristics of the accreditation body including ownership and governance, scope and bounds of activity, stakeholder relationships, independence, peer judgement, mentoring, consistency and transparency in relationships with educational regulations etc.

[2] Available at http://www.ieagreements.org/Best_Prct_Full_Doc.pdf?3368

- ***Criteria for accreditation:*** Development of standards and policies, criteria for programme approval including purpose, standards, student entry, programme design, assessment, teaching and learning, environment, resourcing etc.
- ***The accreditation process – the methods and means of delivery:*** Procedural criteria, professional standards, available open policies, system transparency, evaluation by peers, documentation requirements, review visit requirements, decision making criteria., reporting protocols, data base of accredited programmesetc.
- ***The agency's capacity to conduct accreditation activities:*** Components of capacity of the accreditation agency include funding, staffing, peer evaluators, training and benchmarking etc.

In particular while any accreditation system has to ensure that programme outcomes are achieved, it must not stifle innovation in programme design, teaching and learning. In addition best practice is not absolute and unchanging: there should be a general understanding that the document will evolve. One such area is in transnational accreditationwhere institutions provide programmes in perhaps a number of jurisdictions outside their home base. The IEA already has a good principles guideline in this area.

FUTURE CHALLENGES

While the best practice document defines the accreditation requirements and process in general terms it leaves open some details which can present challenges for international recognition.

1. ***Differing definitions of the educational outcomes required***: The achievement of international recognition leading toimproved mobility of engineers, both graduates and professionals, is the ultimate objective of an international accreditation system. However in order to achieve this the required educational outcomes must be agreed.

   While IEA and ENAEE use broadly similar terms to describe the educational outcomes they differ in detail and in scope of engineering. Hence the bases are somewhat different and straight mutual recognition of programmes is more difficult. In addition there are many branches of engineering so the core general attributes covering all types of engineering must be covered by the outcome definitions so that the scope of engineering is not limited and capable of further expansion as new areas of knowledge become available.

   In particular it is noted that engineering education is related to the attributesneeded to practice engineering which are far wider than mere technical knowledge. Thus internationally recognised engineering education requirements can only be determined in discussion with the international engineering profession as has been done by the IEA[3]. Other regional agreements have slightly differing requirements so further work remains to be done.
2. ***Definition of engineering as a profession:*** Accreditation has its most potent effect if it is the outworking of a profession's desire to establish minimum educational standards for that profession. If the highest level of engineer is the professional engineer what then is a profession? In deciding the requirements of a profession the following definition has been helpful:

[3] See IEA Graduate Attributes and Professional Competencies at http://www.ieagreements.org/IEA-Grad-Attr-Prof-Competencies.pdf

A profession is an occupational group which *specialises in the performance of such highly developed skills for the meeting of complex human needs that the right use of them is achieved only under the discipline of an ethic developed and enforced by peers and by mastery of a broader contextual knowledge of the human being, society, the natural world, and historical trends"* (Reeck 1982)

This definition has as key elements: knowledge, skills, contextual knowledge, peer discipline, ethics as well as knowledge of the effects on humanity and implies that complexity and judgment are essential components which must be taught in any academic programme.

The implication is clear that engineers have responsibility to the wider world and not just the area in which we happen to live.

It is also clear that an essential element is ethics developed and enforced by peers i.e. self-regulation and self-discipline. However ethical standards vary around the world so it will be necessary to agree on the essential elements that must be taught and evaluated in any academic programme. In view of widespread corruption in various parts of the world and in education, as discussed later, this may provide a challenge.

Thus the definition of the profession implies that simple engineering technical knowledge is not totally sufficient and has an influence on what must be taught and evaluated as educational outcomes.

3. ***Definition the various grades of engineer***: Engineering is generally a team effort which often includes a full range of theoretical knowledge and practical skills. Therefore before defining the educational requirements for the various grades of engineer it is necessary to define the essential characteristics of each grade including the educational requirements. Failure to do so means that the educational requirements cannot be accurately defined in way which relates to the practice of engineering which is the starting point for mutual recognition. The exemplar best practice document refers to the IEA graduate attributes and the EUR-ACE programme outcomes but they are slightly different. The IEA has defined three categories of engineering and corresponding educational requirements for each, but EURACE essentially defines two outcomes, bachelors and masters without any direct connection with any category of engineer.Reconciling these has proved challenging.
4. ***Reconciling the outputs of different education systems and processes***: In Europe professional engineering education is based on either a three year first cycle degree (Bachelor) or a five year second cycle degree (Masters) whereas in much of the rest of the world professional engineering education is generally based on a 3 year Bachelor degree for an engineering technologist or a 4 yearBachelor degree for a professional engineer. However years of study are an unreliable indicator of competence becausewhere one ends up depends on the starting point as well as the educational programme. In addition there are increasingly diverse methods of delivery of education ranging from on-the-job to in-class to on-line or any combination and any accreditation or evaluation system should be able to evaluate all pathways. Thus outcomes are the only reliable measure of capability and competence and should form the basis for any mutual recognition. Inputs are not necessarily particularly relevant though of course they may affect the robustness of the educational system. For example institutional finance and staffing are obviously important to achieving consistent sustainable outcomes. Outcome evaluation is not yet universally adopted and some evaluation systems still place excessive emphasis on input

criteria.[4]Interestingly it is not necessary,of course, that the outcomes of particular systems are identical provided that the outcomes are defined in such a way that the differences are identifiable and quantifiable.

5. ***Evaluation of personal characteristics:*** Engineering is an art supported by science and thus competence is not determined solely by education but requires a period of post graduate experiential learning to develop competence and judgment to a professional level through a process of mentoring as well as personal characteristics.Engineering is therefore creative and team oriented. The process for inculcating thesecharacteristics must be included in the education programme. Therefore as indicated previously it is important that the outcomes required for these qualitative characteristics are evaluated as part of the accreditation process.
6. ***Corruption both in delivery and assessment***: One of the aspects not often discussed openly in international meetings but frequently discussed privately is the question of whether or not a national accreditation system and the results from it are free from corruption. There is considerable evidence of global corruption in higher education including Transparency International's voluminous 2013 Global Corruption Report: Education[5] which observes that*"Corruption for resources, fame and notoriety place extraordinary pressures on higher education institutions……. In some instances, corruption has invaded whole systems of higher education and threatens the reputation of research products and graduates, regardless of their guilt and innocence"*[6]. Few countries appear to be entirely immune.

   There is no evidence that corruption has been an issue in the international agreements to date,although evaluation of corruption is based on detailed discussions among the international accord members and perhaps rather informal assessment by international review panels, plusobservation and ethical statements by those being reviewed. Mutual trust is at the core of any successful agreement. However as these various accords and agreements expand their membership to jurisdictions where relationships between them are more distant and less understood, the time has clearly come when formal procedures must be developed for evaluating this and reporting formally. This must include on-the-ground evaluations of this aspect.
7. ***The challenge of gaining and evaluating practical experience:*** Engineering is a practical art and thus there is an essential requirement to develop practical knowledge, which is often obtained concurrently with study, but from practical work in outside organisations. In some countries essential, part time, concurrent practical work has proved difficult to obtain with possibly some reduction in practical knowledge of graduates. The extent of practical knowledge required and its evaluation are important parts of the assessment process but is not perhaps currently given the appropriate emphasis.

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[4] Competence in any physical activity is not measured by inputs such as training or education but by outputs e.g. competitive sport or any trade.

[5] Available at http://issuu.com/transparencyinternational/docs/global_corruption_report_-_educatio/21?e=2496456/5037959

[6] Quoted in an article "Higher Education: A Hotbed of Corruption?
A blog from the Center for International Higher Education - July 26, 2015" in the CHEA IQG newsletter Vol 7 2015k

8. ***Continual review of best practice:*** Best practice is dynamic so the challenge is to determine when and how the acceptable educational outputs and best practice change with time. What are the systems to be put in place to determine that?Clearly high level standards and process requirements should not change too frequently but there must be process in place to assess this.Just as the price of freedom is eternal vigilance so it is also the price of best practice and quality. Formal,externally moderated review requirements should be included in any accreditation system.

CONCLUSION

It is clear that there are a number of challenges to be overcome if international accreditation continues to be seen as a cost effective and valuable marker and gains further traction and acceptability. Inevitably as the membership of international bodies becomes as diverse as the United Nations, there tend to develop regional and cultural points of view even though all members have signed on to common standards and processes. Balance must be maintained as without consensus the value of accreditation could decrease rapidly, possibly largely unacknowledged until too late.

All these challenges can only be met through patient international discussions and negotiations through international bodies in a collegial and professional atmosphere.

REFERENCES

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[2] EUR-ACE® Framework Standards and Guidelines. Available at http://www.enaee.eu/wp-content/uploads/2015/04/EUR-ACE-Framework-Standards-and-Guidelines-Mar-2015.pdf

[3] IEA/ENAEE Best Practice in Accreditation of Engineering Programmes: An Exemplar. Available at http://www.ieagreements.org/Best_Prct_Full_Doc.pdf?3368

[4] Transparency InternationalGlobal Corruption Report 2013. Available at http://www.transparency.org/whatwedo/publication/global_corruption_report_education

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An active Christian involved in the prison sector, he also enjoys flying aeroplanes and building things and has been a judge in national sausage and bacon competitions.