

ACCREDITATION AND QUALITY OF ENGINEERING EDUCATION: THE MALAYSIAN EXPERIENCE

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ABSTRACT

Accreditation is recognition that institutions or programmes have satisfied the requirements set by accrediting bodies. The recognition provides confidence to public, government, employers and sponsors that graduates from the institutions or programmes have the required outcomes for the work they have been prepared for. Not only meeting the minimum standard that is important but the realization that programmes must be keeping abreast with the development is equally important. "Change" is the only constant and resisting change can be detrimental. The need to embrace the quality culture cannot be resisted anymore. Accrediting bodies are now focusing on ensuring programmes are relevant and adapting to the changing needs. Thus accreditation is becoming synonymous to "quality". Globalisation has brought another dimension to accreditation where graduates may be employed anywhere in the world despite graduating from a country. There are various networks of accrediting bodies spread out in the world, and mostly regional in nature. The Washington Accord (WA) is the community of accrediting bodies that is wider in its membership, spanning four continents. Malaysia became a provisional member in 2003 and has been getting the feedbacks from the WA mentoring team to reduce its prescriptive nature associated with accreditation to a flexible approach that allows innovative and creative aspects to be taken on board. Apart from that the outcome based approach to curriculum development and implementation has also been forwarded. Thus there is a paradigm shift in the way accreditation is conducted in Malaysia. Though the quality culture was about permeating in Malaysia in the nineties, the revolution lacks the substance. With the outcome based approached, the quality systems are more robust and able to take challenges. In Malaysia accreditation is granted to programmes that provide the breadth and depth of engineering education, employ the outcome based education approach and implement continual improvement with an established quality management system. This paper highlights the issues and challenges that emerged while Malaysia is on the course towards the full signatory status of the WA. It includes the influence of Washington Accord on the accreditation process. The paper also introduces the structure and mechanisms of the EAC and expounds the expected criteria set by the EAC in relation to the outcome based education approach.

Keywords: Accreditation, quality, engineering education, Washington Accord

HISTORY OF ACCREDITATION

Accreditation of engineering programmes in Malaysia began in 1957 with the Public Services Department (JPA) conducting it for the purpose of employment in the government service. Later in 1959 the Institution of Engineers Malaysia (IEM) began accreditation of engineering programmes at the bachelor level and it was modeled after the UK's Institution of Civil Engineers. In 1967 the newly formed Board of Engineers Malaysia (BEM), a regulatory body for practice of engineering and together with the IEM were responsible for the accreditation of all engineering programmes at the bachelor level. The BEM is a regulatory body in Malaysia that registers graduates, professional and temporary engineers.

All the while engineering programmes were offered only by the public institutions of higher learning (IHL). However, Malaysia embarked on democratization of higher education in the mid-nineties which then saw the expansion of the public IHL as well as mushrooming of private educational institutions. The National Accreditation Board (LAN) was thus formed by the Government to control the quality of private education, and it became the fourth body to conduct accreditation of engineering programmes.

In 2000 all the four bodies agreed to the formation of the Engineering Accreditation Council (EAC), a delegated

body of the BEM as the “one-stop” accreditation centre for engineering programmes at the bachelor level. The BEM and the IEM are the major stakeholders, by virtue that both represent the engineering fraternity. LAN became the Malaysian Qualification Agency (MQA) in late 2007 and thereafter expected to cover accreditation of both the private and public IHL. The Malaysian Qualification Act that was passed in 2007 acknowledges the responsibility of the professional bodies, such as the BEM, to conduct accreditation of professional programmes. Thus, accreditation of engineering programmes at the bachelor level is under the purview of the BEM through its delegated body the EAC. However, both the BEM and the MQA are hosting a separate list of the accredited programmes.

THE ENGINEERING ACCREDITATION COUNCIL

The EAC is solely responsible to accredit engineering programmes in Malaysia that would enable graduates of accredited programmes to register with the BEM as Graduate Engineer. Similarly, recognised foreign degrees by the EAC would also enable graduates of such programmes to qualify to register with the BEM. It is illegal for any unregistered graduates to practice as engineers in Malaysia.

In 2008 the EAC was recomposed into a 17 persons Council, with six (6) representations from the BEM, six (6) representations from the IEM, one (1) each from the MQA and the JPA and three (3) representatives from the major industry. A close 50:50 balance between representatives from industry and academia is ensured within the EAC membership. The chair comes from the BEM and the deputy chair from the IEM.

The EAC is the custodian of quality in engineering education, which it exerts through its accreditation policy and process. The EAC makes the decision on accreditation, which then requires endorsement from the BEM. Its independence is exhibited by its ability to be financially independent from the regular contribution by the Government of Malaysia. Its income is sourced mainly from the accreditation fees collected from the IHL (including reimbursable paid by the IHL) and the professional development programmes that it conducts from time to time. The BEM underwrites any shortcomings in the EAC financial commitments.

THE ENGINEERING ACCREDITATION DEPARTMENT

The EAC is supported by the Engineering Accreditation Department, EAD (formerly known as the Engineering Accreditation Unit, EAU), which had seen an increase of staff in April 2007 to six (6) full time staff and two (2) part-time associate directors, and headed by a full time Director. Since then another two (2) part time associate directors have been added. The EAD has also moved into its new premise at Kelana Jaya in June 2007 as part of its expansion.

The EAD is responsible to liaise with the IHL, the EAC evaluators and the EAC Council to ensure a seamless accreditation process. All applications for approval and accreditation of engineering programmes now go through the MQA, where these applications will be forwarded to the EAD to be processed. Upon completion of the approval or accreditation process the IHL would be informed of the decision by the BEM through the office of the EAD.

The EAD has also introduced the window for accreditation visits which stretches from March to September inclusive. All submission must be made by the 31 of January of each year, and for re-accreditation of a programme the submission must be made in the last year the programme is still accredited. This is to ensure the continuity of the accreditation period. Reminders would be sent to the IHL annually to avoid a gap in the accreditation period due to late submission. For a new programme, the self-assessment report must be submitted six (6) month before the graduation of the first cohort.

The EAD is also responsible to ensure effective implementation and monitoring of the EAC strategic plan. Among the major activities conducted by the EAD include provisions of trainings to evaluators on accreditation and trainings to IHL on the outcome based education. The EAD has been conducting talks, seminars, conferences

and workshops for both the evaluators and IHL to manage the paradigm shift towards the quality culture and outcome based education. The EAD is also working with professional bodies and the IHL to facilitate the transformation towards global engineering education.

THE EAC EVALUATORS

To date nearly 50% of the evaluators come from the Civil Engineering discipline, as the discipline has managed to attract the most number of professional engineers. It is a requirement of the EAC that an evaluator must be a professional engineer with extensive work experience in academic and/or industry. On-going recruitment programme for new evaluators would eventually allow a balance composition in the evaluators' disciplines. The challenge for the EAC is to ensure that the pool of evaluators, who are volunteers, would remain as committed as ever despite the greater expectations in accreditation. Greater effort and diligence are required of the present day EAC evaluators to ensure a comprehensive and in-depth evaluation of the engineering programmes.

A high level of professional judgment by the evaluators is needed for sound evaluation. The shift to outcome based requires the evaluators to also familiarise themselves with the knowledge. The departure from the prescriptive approach in accreditation, as promoted by the mentors, also requires the evaluators to be retrained. Thus it became the issue of ensuring a balanced and consistency approach in the conduct of accreditation including in decision making. Consistency of evaluators in the conduct of accreditation was enhanced through the numerous training programmes (refer to Table 1) and "on-the-job" mentoring by the EAD director and associate directors. Evaluators were expected to attend the training programmes based on the new approach which started with the 2005 revised draft EAC manual (that was approved in 2006 and revised again in 2007).

INSTITUTIONS OF HIGHER LEARNING

The IHL are also encouraged to participate in the training programmes that are geared towards reinforcing the knowledge on OBE and expectations of accreditation under the new paradigm shift. Table 1 shows the various programmes organised by the EAC for the council, evaluators and institutions since 2006. The explosion of these programmes allows acculturation of quality in engineering education at the IHL and also an enhancement of the accreditation process.

Table 1: Programmes for EAC council, evaluators and the institutions

Programmes	Target Group
Seminars by Washington Accord Representatives	Institutions/Evaluators/Council
Conference on Engineering Education	Institutions/Evaluators/Council
Workshop on Expectations of the EAC	Institutions/Evaluators/Council
Workshop on Submission to EAC	Institutions
Lead Trainer for Institutions Training Course	Institutions
Talks on Accreditation	Institutions
Meeting Engineering Deans	Institutions/Council
Workshop on Outcome Based Education	Institutions/Evaluators/Council
Workshop on EAC Manual	Institutions/Evaluators/Council
Lead Panel Evaluators Training Course	Evaluators/Council
Panel Evaluators Training Course	Institution/Evaluators/Council
Workshop on Accreditation Report for Evaluators	Evaluators/Council
Workshop on Aplomb and Decorum of Evaluators	Evaluators/Council
Refresher Workshop on Accreditation	Evaluators/Council
Workshop on Accreditation Decision	Evaluators/Council
Local & Overseas Accreditation Observation Visit	Institutions/Evaluators/Council
Regional & International Accreditation Meetings	Council
Stakeholders Meeting	Industry/Institutions/Council
EAC Manual Review Workshop	Industry/Institutions/Council

Accreditation has pushed the IHL towards continual improvement and rigorous benchmarking the breadth and

depth of their engineering programmes, instead of merely satisfying the minimum requirements. Initial resistance by the IHL to the paradigm shift on the outcome based approach has been tackled through the imposition of the accreditation policy on outcome based approach, while opening the line of communication through dialogues and the application of persuasion approach. The advent of the quality culture in the seventies that seeped into the education sector has helped those IHL that have adopted the system approach to manage the teaching and learning processes. Many IHL had already embarked to be certified to the ISO9001 in the field of teaching and learning before the advent of outcome based education. The incorporation of the outcome based approach in fact provides the engine that drives the programme to attaining the set objectives effectively. The continual quality improvement which is the noble aim of the ISO9001 is in line with the EAC's expectation on accreditation.

The impression that embracing the quality culture would lead to voluminous documentation as propagated by some quarters only shows the lack of understanding on the expectations of a quality process. What is expected is that there are consistencies in the implementation and to ensure evidences are made available. One has to be creative and innovative to come out with a lean documentation and yet adequate. Outcome based education is set to stay and programmes need to demonstrate that graduates attain the expected outcomes.

Institutions have been known to reward educators for their research excellence rather than their teaching excellence. Participation of educators in activities related to undergraduate education, such as curriculum development, instruction, or assessment do not attract any reward and this might influence individual decisions about emphasis given to teaching. Thus it may only be the institutions' administrators that are concerned with the paradigm shift but the academic staff may not be attracted to or "buy in" the idea. Accreditation would be a nightmare for such institutions as the aspects of continual quality improvement would not be given emphasis even though collectively the outcomes many indirectly be achieved (though no means of knowing it at the time of graduation). Consequently no intervention could be made to improve the students learning throughout their stay at the institutions.

Accreditation would remain an effective instrument for quality assurance in engineering education provided; outcomes assessment and continual improvement are not foreign to academic experience and culture (usually there is a high level of discomfort at the initial period), active communication and educational efforts emphasised to both evaluators and those evaluated, a significant investment of effort to develop an effective programme of outcomes assessment and continual improvement, and no excessive documentation required. Once the programme is established, less effort is required to maintain such a system, however continued and not periodic attention is required. Outcome based education accreditation system would result in the emphasis shifting away from building a high standard of technical competence to the development of a broad range of 'softer' skills in engineering graduates is in fact a misconception but believed by some academics.

WASHINGTON ACCORD'S INVOLVEMENT

The Washington Accord sponsoring visit by Engineers Australia (IEAust) and the Engineering Council of United Kingdom (ECUK) at two universities, International Islamic University (UIA) and Universiti Teknologi MARA (UiTM), had paved the way to Malaysia's acceptance as a provisional member to the Washington Accord at Rotorua, New Zealand in 2003. This is a landmark beginning for engineering education in Malaysia at the international level, though the engineering programmes in Malaysia have been recognized for entry into further studies at the international level, especially in Europe and the United States.

Three jurisdictions, chaired by the IEAust, were appointed to mentor Malaysia towards achieving the full signatory status. ABET Inc. and Hong Kong Institution of Engineers (HKIE) were the other two mentor organisations. Emeritus Professor Alan Bradley and later replaced by Emeritus Professor Michael Brisk was leading the mentoring team. Emeritus Professor Skip Fletcher and Dr Alex Chan were representing ABET Inc. and HKIE respectively.

The five (5) Washington Accord mentoring visits between 2004 and 2008 (see Table 2) were extremely useful in bringing the accreditation process in Malaysia to a new level. The Washington Accord has fuelled success to the EAC to its present status, envied by accrediting bodies of other professional disciplines. The outcome based

education or fondly known as the OBE is synonymous to EAC. The implementation of the outcome based approach in engineering education, which started in 1999 was expedited in 2004 with the expectation that all IHL have to devise a plan to implement the OBE approach in their curricula development. The EAC raised the bar in 2008 where it expected significant implementation of the OBE and visible execution of continual improvement by the IHL.

Malaysia has set a target to gain the full signatory status in 2009. The Washington Accord mentoring visit in March 2008 informed the EAC that there had been significant improvement on the conduct of accreditation process by the panel as well as the conduct of the accreditation decision meeting. The EAC applied for a Washington Accord review to take place in July 2008 based on the favourable recommendations. The review team from three jurisdictions, namely, New Zealand, Ireland and Japan has been tasked by the International Engineering Alliance (IEA) (previously IEM).

The two review visits (see Table 2) were chaired by Professor Hodgson from New Zealand. Professor Honjo and Dr Glennon from Japan and Ireland, respectively, were the team members. The review team had ample time to submit their report before the February 2009 deadline to be considered for the IEA meeting in Kyoto, Japan in June 2009. The reviewers in their draft report indicate that the Malaysian accreditation process is substantially equivalent to the Institution of Professional Engineers New Zealand (IPENZ).

Table 2: Washington Accord sponsor, mentor, review and evaluator visits

Type of Visit	Date	Institute of Higher Learning visited/ activities	Jurisdiction
Sponsor	2002	Universiti Teknologi MARA (UITM)	United Kingdom
		International Islamic University (UIA)	Australia
Mentor	Dec 2004	Universiti Kebangsaan Malaysia (UKM) Malaysia	Australia
		Multimedia University (MMU)	United States
	Dec 2005	Universiti Teknikal Malaysia Melaka (UTeM) <i>(formerly Kolej Universiti Teknikal Malaysia Melaka, KUTKM)</i>	Hong Kong
		Universiti Teknologi Malaysia (UTM)	
		Jul 2007	Universiti Malaysia Perlis (UniMAP) Universiti Teknologi Petronas (UTP)
	Dec 2007	Universiti Teknologi MARA (UiTM) Kuala Lumpur Infrastructure University College (KLIUC) Accreditation Decision Meeting	
Mar 2008	Universiti Tenaga Nasional (Uniten) Accreditation Decision Meeting		
Reviewer	Jul 2008	Universiti Putra Malaysia (UPM)	New Zealand
		Universiti Kebangsaan Malaysia (UKM)	Japan Ireland
	Nov 2008	Accreditation Decision Meeting	
Evaluator	Jul 2008	Universiti Putra Malaysia (UPM)	Singapore
		Universiti Kebangsaan Malaysia (UKM)	Australia
	Jul 2009*	Universiti Teknologi Malaysia (UTM) Malaysia Multimedia University (MMU)	Canada

* Expected from CCEB

ACCREDITATION PROCESS

Accreditation of engineering programmes conducted by the EAC is a peer-review process that assures the quality of the engineering education that students receive is appropriate for preparing towards the Professional Engineer career. IHL volunteer their programmes to undergo this accreditation review periodically (every five years) to determine that the criteria for accreditation are met. Despite accreditation by the EAC is voluntary, as mentioned

earlier anyone who wants to practice as an engineer in Malaysia needs to be registered either as a Graduate or Professional Engineer with the BEM, thus implying accreditation of engineering programmes as compulsory.

Accreditation provides the assurance for the BEM and the stakeholders that graduate engineers have the necessary skills and competencies as reflected in the graduate outcomes specified by the EAC. Engineering programmes that do not meet the four-year duration of the study, such as the three-year programmes as accorded in the United Kingdom, are not considered for accreditation.

The EAC believes in international benchmarking and is committed towards continual quality improvement in engineering education. As such, the EAC embarked into several initiatives of mutual international recognition such as with the European and Asian networks, apart from the Washington Accord.

Prior to 2005, accreditation evaluation was highly prescriptive and quantitative, with marks allocated to the five accreditation criteria; academic curriculum, student, staff, facility and quality system. These criteria were looked at in isolation, and engineering programmes were granted accreditation upon attaining the overall percentage marks of 70% and exceeding the 50% percentage marks for each of the criteria. The prescriptive nature of the then EAC Manual facilitated the evaluators to make their recommendations though. A set of prescriptive guidelines with categorized “major non-compliance”, “minor non-compliance” and “desirable”, had helped the EAC to make their decisions. Thus consistency of evaluators at the accreditation visit and the EAC in the decision making were not an issue.

The EAC Engineering Programme Accreditation Manual has transformed into a less prescriptive document. Some aspects from the Manual have been moved to the Guidelines for Panels as part of the effort to make it less prescriptive. The appendices of the Manual are considered as guides or examples that IHL need to reflect when developing their curricula. A prescriptive manual would normally stifle creativity and does not allow IHL to explore new and emerging disciplines of engineering. However, a total freedom could result in the establishment rogue programmes. In a young and inexperienced environment relaxation of the policies and criteria may lead to chaos whereas in an established environment self-regulation would rule the day. Thus tightening and relaxing of the policies and criteria are essential from time to time. The EAC Manual has its fair share of prescriptiveness when persuasion does not yield.

Sharing of best practices and experiences from the mentoring jurisdictions had also transformed the EAC Manual into a more dynamic and forward looking document. The EAC Manual now allows new policy decisions to be implemented immediately without requiring a complete accreditation cycle to pass. The forward accreditation principle where accreditation is given to graduating cohorts instead of the intakes, in reality has not resulted in a different outcome but dictates engineering programmes to address the new policy decision for the cohorts that are still in the pipeline.

The 2006 revised Manual has removed the inconsistencies within, and make the outcome based approach more explicit. In the words of the Washington Accord mentors, the Manual “Provides very **significant improvement** to quality & consistency” and “A **sound, outcomes based accreditation framework**. The mentors also commented that, “Rigorous application of this accreditation system is essential to deliver outcomes substantially equivalent to those used by the signatories to the Washington Accord”.

The EAC Manual and the Guidelines for Panels are the two documents used for accreditation. The five criteria; academic curriculum, staff, student, facility and quality system, are the main components of evaluation which are centred on the programme objective and programme outcomes. The Manual expects a top-down approach in curriculum development, i.e., all programmes must begin with the programme objective. It is the intent on the type of engineers that a programme wants to develop. The Manual specifies the IHL to consider what the graduates would be in the early three to five years in their career. The necessary programme outcomes (or ability) would then be developed before arriving at the curriculum and the contents. The IHL need to also relate to the appropriate delivery methods to ensure the learning process takes place. Assessment and evaluation to demonstrate attainment of the programme outcomes are essential. The four remaining criteria, apart from the academic curriculum, are expected to facilitate the attainment of the objectives and outcomes.

The 2007 revision of the Manual saw the clarification on the expectations from the self-assessment reports to be submitted by the IHL. Now the EAC Manual would undergo an annual review exercise to ensure that it is always updated and keeping abreast with the development of engineering education. A thorough self-assessment account of the programme with clear statements of objectives and explaining the due process in programme reviews are required. The report should discuss the practices and the continual quality improvement (CQI) conducted at all relevant levels and the appropriateness of the resources made available. It is the responsibility of the programme to demonstrate the attainment of the programme objectives and the outcomes.

The qualitative approach that is being applied in accreditation is not new, as from the early years the approach to accreditation was also qualitative. The move to quantitative evaluation was short-lived, due to the recommendation made by the mentors to return back to qualitative evaluation, though liked by the evaluators and the council very much. The move was not without difficulty, as evaluators had to be retrained to triangulate their findings before arriving at their recommendations. The EAC had introduced two new documents; Accreditation Decision and Aplomb and Decorum, to facilitate the retransformation. The prescriptive approach was also not without disadvantage, as evaluators were brief in their report as their findings were sort of summarized via the allocated marks. The less detail written report does not allow the IHL to visualize the extent of improvement that could be made.

Accreditation criterion on academic curricular for engineering programme would be changing with time subject to the demand of the industry and globalisation. There is always the fear that the criterion may be diluted to an extent that engineering education may become training of competent technologists of the demand for this group of practical oriented engineers presently. Accreditation agency's stakeholders are generally the professional bodies and the institutions, whereas the institutions major stakeholders are the industry and the students. The direction of accreditation however would be subject to who holds the strongest opinion. Accreditation agency must however take the leading role to safeguard the sanctity of engineering education despite adapting to the demand of the industry, professional bodies and institutions.

QUALITY AND ACCREDITATION

Accreditation is synonymous to quality. What is quality with respect to accreditation? Does having an accredited programme means quality is maintained? Does quality means having a certified or accredited educational system? Does quality means more documentation? These are typical questions and issues that linger in the mind of academics alike.

For accreditation to support quality in institutions or programmes the accrediting body must embrace the quality element. The accreditation process would then push for the establishment of a quality system. In any quality system there are always the three components of importance, namely, people, process and paperwork. The system is often driven by the objectives set which can be measured of its effectiveness. For a quality system to function effectively, the "doers" (in an educational establishment, the academic staff) must be competent (and trained) of their duty. The extent of documented procedures (or process) may vary subject to the level of the "doers" experience. However, if the turnover of staff is high and to ensure new staff are guided effectively, the procedures may need to be detailed out by the institution. Paperwork can be minimized but without compromising the quality of work.

One must however not forget that the institutions must demonstrate the achievement of the objectives and outcomes. How can this be evident, unless documented evidence is provided? Ensuring the evidences are compiled in a coherent manner is very important and this effort must not be done at a very late stage.

A quality system is always looking for continual improvement and mechanisms must be established to ensure the process is sustainable. The corrective and preventive actions are always applied to ensure non-conformances are addressed and potential failures are avoided.

Documentation and implementation without stressing on the “substance” may result in a good process performance but devoid of the expected quality. Quality systems that focus on the process achievement but lack on the achievement of the “substance” are merely paying the lip service. To ensure that the “substance” is not ignored, internal auditors must also be practicing persons, and not just any staff.

Accreditation system that is quality driven would push the programmes to focus on satisfying the customers’ requirements and implement continual improvement. The institution is expected to implement plan-do-check-act (PDCA). The plan (academic curriculum and associated functions) must be developed after consultation with various stakeholders (eg the academic programme must receive inputs from stakeholders; industry, staff, students, alumni etc). The teaching and learning process to impart the curriculum has to be implemented and measured of its achievement (the programme objectives and outcomes) and acted upon (continual quality improvement, CQI) to improve the process (updating the curriculum) towards achieving the objectives and outcomes. One can develop a quality system based on the ISO 9001 requirements or any other systems but must place the emphasis on the “substance” to ensure success.

A quality driven accreditation process thus pushes for the implementation of PDCA before a programme can be accredited. Indirectly, the level or depth of coverage, whether the programme can be recognised as an engineering programme is demonstrated by the achieved desired outcomes.

CONCLUDING REMARKS

Accreditation in the engineering education sector has progressed towards requiring programmes to demonstrate the obtainable outcomes of the graduates and expects the institution to apply the continual quality improvement principle on all aspects of its process. Accredited status is synonymous with achieving quality standards. The quality push is to ensure that the breadth and depth of engineering education is sustained and continually improved with outcome based approach. Though it may be a struggle to educate evaluators and educators as accreditation moves from the past practice of process based to a more open criteria and stresses on outcomes based but the benefits it provides by means of a path of equivalence of qualification for possible international mobility outweighs it. The Washington Accord is in fact a means to attaining quality engineering education for the benefit of mankind and the world at large.