Engineering Education – The Past, Present and Future

by Ms. Reika Kua Kee Eng

EVER since the first engineering degree course was introduced in the University of Malaya about five and a half decades ago in Malaya, engineering education has gone through significant transformation to adjust to the changing needs of the nation over time. In order to better understand the major advancements achieved in engineering education, as well as provide answers to some of the pressing issues confronting the institutions of higher learning and the engineering profession today, *JURUTERA* interviewed three prominent personalities, namely the Vice-Chancellor of Universiti Putra Malaysia (UPM), Y.Bhg. Dato' Ir. Prof. Dr Radin Umar bin Radin Sohadi, President and CEO of Universiti Tunku Abdul Rahman (UTAR), Y.Bhg. Academician Dato' Ir. Prof. Dr Chuah Hean Teik, and Y.Bhg. Dato' Ir. Dr Abu Hashim bin Abd. Ghani, the Director of Perunding Hashim & NEH Sdn. Bhd. It is hoped that their views will shed some light on the relevant engineering education issues from the educational sector's perspective as well as from the industry's perspective.

A QUANTUM LEAP IN ENGINEERING EDUCATION

Tracing back to the days when engineering education at tertiary level first began in Malaya in 1956 with the establishment of the Engineering Department at University of Malaya's Bukit Timah campus in Singapore, it is indeed undeniable that engineering education has made tremendous progress throughout these five and a half decades.

Beginning with only a bachelor's degree course in Civil Engineering, the pace picked up quite rapidly when the department was upgraded to Faculty of Engineering during the relocation of the campus of University of Malaya (UM) to Lembah Pantai, Kuala Lumpur in 1958. In the same year, the second bachelor's degree course in Mechanical Engineering was introduced. A year later, a bachelor's degree course in Electrical Engineering was added to the range of courses available to the undergraduates. After the introduction of the bachelor's degree programme in Chemical Engineering in 1970, all four courses were assigned to be managed by individual department in 1974.

Another significant milestone for engineering education in Malaysia that must not be overlooked was the establishment of Universiti Teknologi Malaysia (UTM) in 1975, which had evolved from a Technical School founded in 1904 to a Technical College in 1941, followed by the upgrading of its engineering courses from diploma level to engineering degree level in the 1960's. Back then, students enrolled in the courses at the college had the choice to sit for one of the professional examinations conducted by the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Royal Institute of British Architects, or the Royal Institute of Chartered Surveyors, all of the United Kingdom. The college was then renamed as Institut Teknologi Kebangsaan in 14 March 1972 by the King and was later conferred university status and became Universiti Teknologi Malaysia on 1 April 1975.

THE GOLDEN ERA OF ENGINEERING EDUCATION

Generally, the 1990's could be regarded as the golden era of engineering education in Malaysia due to the expansion in the types of courses that were available as well as the growing numbers of both private and public institutions offering engineering programmes at tertiary level. According to President and CEO of Universiti Tunku Abdul Rahman (UTAR), Y.Bhg. Academician Dato' Ir. Prof. Dr Chuah Hean Teik, the UM's Faculty of Engineering had introduced other engineering courses namely the Telecommunication Engineering, Environmental Engineering, Materials Engineering, Computer Aided Design and Manufacturing Engineering, and Biomedical Engineering in the 1996/97 session.

"If we are talking about making engineering programmes to be more visible, to have more content in the engineering programmes conducted in Malaysia, I would say that it became very apparent in the mid-1990's, when the government set up the Private Higher Educational Institutions Act 1996. At this point, many twinning programmes and *institusi pendidikan tinggi swasta* (IPTS) were

Y.Bhg. Academician Dato' Ir. Prof. Dr Chuah Hean Teik, President and CEO of Universiti Tunku Abdul Rahman (UTAR)

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introduced, particularly at Universiti Tenaga Nasional (UNITEN), and at Multimedia University (MMU) for engineering studies apart from public institutions of higher learning or *institusi pengajian tinggi awam* (IPTA)," said Y.Bhg. Dato' Ir. Prof. Dr Radin Umar bin Radin Sohadi, Vice-Chancellor of Universiti Putra Malaysia (UPM).

According to Dato' Ir. Prof. Dr Radin Umar, the IPTA and IPTS had expanded around the same time. "Various twinning programmes were being offered by IPTS and offshore campuses were established. For instance, we managed to bring in programmes from universities such as Nottingham, Monash, Swinburn and Curtin." He continued, "When the economy was booming in the mid-90's, we received feedback from the industry that the country was experiencing a shortage of engineers. As a result, there were demands to shorten the duration of study for engineering courses from 4 years to 3 years, and to offer a wider range of engineering programmes." In response, UPM established various departments to offer programmes such as aerospace, food engineering, chemical and computer engineering in addition to the traditional civil, mechanical, agriculture and electrical engineering courses.

He further elaborated that the major progress achieved during the mid-1990's could be attributed to the government's policy of liberalisation of higher education, which led to the establishment of the Lembaga Akreditasi Negara (LAN). During this period, the Institution of Engineers, Malaysia (IEM) and the Board of Engineers Malaysia (BEM) have always been there, playing their roles in the advancement and regulation of the engineering profession respectively.

He continued, "The shift from process-based education to outcome-based education (OBE) came into the picture, and we subscribed to receiving international accreditation through the Washington Accord. This was another significant milestone in engineering education for our country." Dato' Ir. Prof. Dr Radin Umar said that as a result of these developments, a larger number of engineers were produced.

"We attempt to produce two types of engineers to meet the needs of the country: the conventional research or scientific-oriented engineer, who is trained to excel in design theory and analysis, and his practice-oriented counterpart in industry who should be competent in resolving engineering challenges. And our country needs both types of engineers," said Dato' Ir. Prof. Dr Radin Umar.

SUSTAINING THE QUALITY OF ENGINEERING EDUCATION

"Maintaining high academic standards is essential for a professional degree programme such as engineering. University of Malaya was the first institution to offer engineering education in Malaysia," said Dato' Ir. Prof. Dr Chuah.

When it comes to overseeing the quality of engineering education, the joint effort of various parties, such as the tertiary education institutions, the relevant legislative departments, regulatory bodies and the major players of the industry, is inevitable.

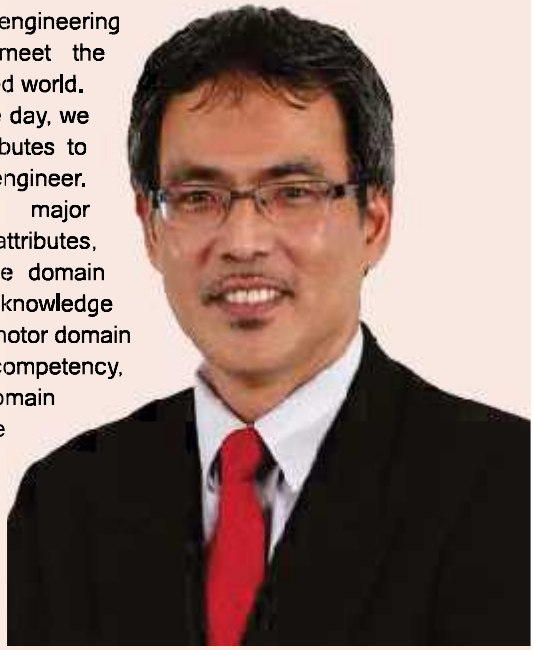
For instance, all academic programmes offered by institutions of higher learning, especially the private ones, are highly regulated by related legislation such as the Education Act 1996 and the Private Higher Educational Institutions Act 1996. All courses offered must be approved by the Ministry of Higher Education and accredited by Malaysian Qualifications Agency. Engineering programmes are also accredited by the Engineering Accreditation Council, comprising members from the Board of Engineers Malaysia, the Institution of Engineers, Malaysia (IEM), Public Service Department (JPA) and Malaysia Qualifications Agency (MQA).

In fact, Malaysia has long established a system of regulatory or professional bodies to oversee the standards of engineering education, regulate the practice of engineering and ensure that professional ethics are upheld. The Institution of Engineers, Malaysia (IEM) was established in 1959 and its primary function is to promote and advance the science and profession of engineering in any or all of its disciplines and to facilitate the exchange of information and ideas related to engineering. This was followed by the establishment of the Board of Engineers Malaysia (BEM) on 23 August 1972 to facilitate the registration of engineers and to regulate professional conduct and practice of registered engineers in order to safeguard the safety and interest of the public.

INTERNATIONAL RECOGNITION OF MALAYSIAN ENGINEERING DEGREES

The BEM has been a signatory of the Washington Accord since 2009. Engineering degree qualifications in Malaysia are recognised by member countries of the accord. The member countries include Australia, Canada, Chinese Taipei, Hong Kong, Ireland, Japan, Korea, Malaysia, New Zealand, Singapore, South Africa, Turkey, United Kingdom, and the United States. Thus, Malaysian engineering degrees are recognised worldwide and Malaysian engineering graduates should meet the mark of the developed world.

"At the end of the day, we still look at the attributes to become a qualified engineer. There are three major domains of the attributes, namely the cognitive domain which measures the knowledge abilities, the psychomotor domain which measures the competency, and the affective domain which measures the values. All these domains have to be balanced for any of the programmes," explained Dato' Ir. Prof. Dr Radin Umar.



Y.Bhg. Dato' Ir. Prof. Dr Radin Umar bin Radin Sohadi, Vice-Chancellor of Universiti Putra Malaysia (UPM)

He emphasised that graduates who have obtained a bachelor's degree in engineering should at least meet four out of the six levels of attributes in the cognitive domain, covering the fundamentals of engineering knowledge, comprehension, application, analysis, synthesisation, and evaluation abilities. They should also master the first four levels of attributes in the psychomotor domain, particularly the ability to demonstrate their competencies in handling engineering tasks such as design on their own, integrate all aspects of knowledge and skills, as well as handling complex problems with some guidance from the mentor. At the very least, these young graduates must have positive outlook of life, appreciate the importance of engineering ethics and their roles to the society which is part of the affective domain that governs values and ethics.

According to Dato' Ir. Prof. Dr Radin Umar, only by meeting these basic attributes in the cognitive, psychomotor and affective domains, would young engineers be qualified to carry out their roles and responsibilities in the society and would bring benefits to the mankind.

MEETING THE MARKET DEMAND

"Malaysia needs at least 200,000 engineers by 2020 in order to attain the status of a developed nation (on the basis of the ratio of engineers to the general population which ranges from 1:75 to 1:140 in many developed countries). Currently, according to BEM, there are about 75,000 registered engineers in Malaysia," said Dato' Ir. Prof. Dr Chuah. He added, "It is said that Malaysia has one of the smallest engineering populations in the region. Singapore (in 2008) already had more than 100,000 engineers. As you can see, we definitely need more engineers to be nation movers for the country."

In terms of fundamental knowledge and skills, all three interviewees, namely Y.Bhg. Academician Dato' Ir. Prof. Dr Chuah Hean Teik, Y.Bhg. Dato' Ir. Prof. Dr Radin Umar bin Radin Sohadi, and Y.Bhg. Dato' Ir. Dr Abu Hashim bin Abd. Ghani, shared the same opinion that as long as the graduates master the fundamentals of engineering knowledge and skills which are carefully structured and offered to them throughout the duration of their courses at tertiary level, these young engineers would be reasonably well-equipped to work in the engineering industry.

As an effort to continuously upgrade and modify the curriculum of the existing engineering courses to meet the changing market demand and employers' expectations, institutions of higher learning would often seek advice and feedback from experienced engineers from the industry by appointing them as advisors or consultants, who would also offer talks or lectures as visiting lecturers.

However, the interviewees also pointed out that it is essential for young engineers to gain hands-on experience from the industry and to constantly upgrade their knowledge to keep abreast with the rapid technological changes and advances. They should also attempt to improve on other soft skills such as communication, leadership, presentation, innovative thinking and entrepreneurship, in order to meet the expectations of their employers and to eventually become successful top-notch engineers.

"As I had mentioned earlier, Malaysian engineering degrees are recognised worldwide. However a recognised degree is one thing, but a quality graduate is quite another. Students who have been properly trained under an accredited programme will have the required standards. But to be a good engineer, the graduate will need other qualities such as good leadership, communication skills, resourcefulness, innovation and creativity," emphasised Dato' Ir. Prof. Dr Chuah.

THE IMPORTANCE OF COMMUNICATION AND SOFT SKILLS

All the interviewees were also of the opinion that the lack of soft skills amongst graduates from local universities, as compared to those who had graduated from universities abroad, was not due to any deficiencies in locally conducted courses, but rather was the result of circumstances whereby students studying overseas were forced to live in the unfamiliar surroundings of a foreign country, which would eventually require them to become more independent and outspoken.

"Communication skills will improve over time as fresh graduates gain more experience and training. However, soft skill training needs to be incorporated during the early school years and continue during university education," suggested Dato' Ir. Prof. Dr Chuah. According to him, one needs to be organised, eloquent and convincing, in order to become an effective consultant.

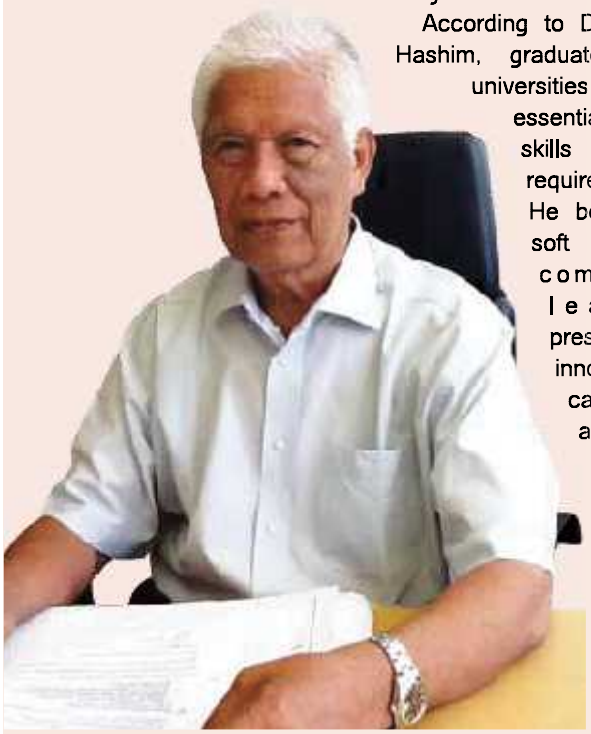
To help strengthen the soft skills of students, most local universities, both private and public, are offering additional communication programmes such as UTAR's Soft Skills Development Certificate programme which promotes a wholesome education for engineers. In fact, through its Centre for Extension Education and Department of Soft Skills Development that provides training in communication skills, enrolment is open to all of its students to hone their capabilities in these areas.

In terms of employability, Dato' Ir. Prof. Dr Chuah mentioned that about 97% of their graduates are employed upon graduation. "As our graduates are reputed to be disciplined, diligent and knowledgeable, there is not much of an issue with the rating of UTAR graduates as our graduates are of a calibre which makes them highly sought after by employers," said Dato' Ir. Prof. Dr Chuah.

Dato' Ir. Prof. Dr Chuah also suggested that more community projects should be organised for engineering students, so that they would learn and be able to contribute back to society from the knowledge and skills that they have acquired from their studies. This would also help them to cultivate good ethics and attitudes.

THE EMPLOYER'S VIEWPOINT

"Engineering graduates from both private and public institutions of higher learning receive a broad range of knowledge which is the key ingredient to a successful career. The only concern is how do these young engineers apply the knowledge that they have acquired to the task given to them," said Y.Bhg. Dato' Ir. Dr Abu Hashim bin Abd. Ghani, the Director of Perunding Hashim & NEH Sdn. Bhd., who has been actively involved in the engineering industry for close to four decades.



Y.Bhg. Dato' Ir. Dr Abu Hashim bin Abd. Ghani, Director of Perunding Hashim & NEH Sdn. Bhd.

According to Dato' Ir. Dr Abu Hashim, graduates from local universities do not lack the essential knowledge, skills and attributes required of engineers. He believes that the soft skills such as communication, leadership, presentation and innovative abilities can be developed and refined during their employment, where they would gain hands-on experience in their involvement in various engineering projects. Dato' Ir. Dr Abu Hashim also stressed that guidance from peers and seniors at the workplace also play an important role to help these young engineers improve their work performance.

"We don't discriminate our new recruits, as to whether they are graduates from local university or abroad, but we are looking at their capabilities in terms of engineering knowledge and skills. In fact, we prefer to hire fresh graduates who display good attitude and potential, and we are more than happy to train, guide and lead them to become first-rate engineers," expressed Dato' Ir. Dr Abu Hashim.

However, Dato' Ir. Dr Abu Hashim also pointed out that the job-hopping trend amongst the young engineers nowadays has become an issue of concern in the engineering industry. As it takes much time and effort to nurture and train young engineers to become good in the jobs, it would be difficult for the employer to sustain this if newly hired engineers merely work for a few months and leave the company as soon as other job offers with better remuneration arise.

"Engineering students need to be exposed to a variety of career paths in the engineering industry. For instance, most graduating students tend to know about engineering jobs offered by major corporations such as Sime Darby and the big telecommunication companies, but they hardly know about engineering consultancy firms nor about other firms that could also offer attractive remuneration and training schemes for young engineers," lamented Dato' Ir. Dr Abu Hashim.

When asked about the possibility of any specific engineering sectors that could face a shortage of engineers in the next few years, Dato' Ir. Dr Abu Hashim replied, "As I have mentioned earlier, engineering graduates of any university, so long as it is conducting an accredited engineering programme, would be equipped with the essential engineering knowledge and skills required. Thus, they could just as easily be trained for any specific sector of engineering". However, he also made clear that our country would have to continuously produce great numbers of quality engineers to meet the demand for many years to come.

On another note, Dato' Ir. Dr Abu Hashim emphasises that one needs to take great pride in what one does in order to produce great results. He believes that young engineers with a strong passion and unyielding determination will be able to produce great engineering design and output. He also highlighted that more joint efforts ought to be initiated between the institutions of higher learning and leading engineers from the industry. As an advisor and visiting lecturer of University Malaysia Pahang (UMP), he urges experienced engineers from the industry to play their part by involving themselves in various engineering programmes managed by the universities. "Highly qualified and well-experienced lecturers are needed in order to nurture quality engineers who will render their services in the industry in near future," emphasised Dato' Ir. Dr Abu Hashim. ■