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Engineering Education Options in Malaysia

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INTRODUCTION

In Malaysia, it is compulsory for children at age six to attend primary school for six years and this is followed by another five years at the secondary level. Altogether, eleven years of education are provided free under the Malaysian education system. An additional year or two (at STPM Level) is required to qualify for basic entry requirements into Bachelor degree programmes at higher educational institutions [1].

In public universities, professional courses like accounting, law, medical and engineering are the most sought-after courses. However, the annual intake of undergraduates in these courses are relatively strict and seat-limited. Private higher educational institutions provide additional courses to cater to the influx of students seeking professional degrees or certification.

Professions such as engineering require an intensive and extensive mix of knowledge and application. With the demand for engineers increasing every year, both public and private educational institutions have a strong impact on the quality of engineers churned out every year by the local education system. Unlike the general study of science, the study of engineering has different scopes and applications. Apart from topics focusing on engineering theory and practical skills, engineering education should develop the skills or competencies and nurture the ethics of an engineer. The ability to think, analyse, troubleshoot, judge and deliver solutions that are beneficial to society are the paramount core values idealised in engineering education.

ENGINEERING EDUCATION IN MALAYSIA

The fields of engineering today has expanded into scores of different engineering expertise, with more than 40 engineering categories (which varies from region to region, as some engineering fields are interchangeable or interconnected with others, depending on established general regional categories.) From agricultural to aeronautical, electrical to telecommunications, civil to naval architecture, mechanical to mining and more, engineering fields have narrowed and refined to key areas of engineering specialities.

In a recent interview with Professor Engr. Abang Abdullah bin Abang Ali, the former president of IEM and an educator himself revealed that "Engineers make up the biggest professional group in the country and they are very important in the country's development process." He added that, "Engineers are also highly regarded because of their analytical skills, which accounts for their solid performance in banking and finance; and are capable of contributing even as political leaders in the country. China is known to have a very high percentage of its ministers from amongst engineers."

Due of the importance of engineering today, new engineering education initiatives have to be properly conceived in order to meet the required standards while existing engineering education has to be altered accordingly with respect to technological advancement. Nonetheless, while engineering education is vital to instill a level of professionalism in our current or future engineers, it is also necessary that engineering education relate to society and the nation on the importance of engineers and their efforts in keeping pace with national advances and world progress.

Table 1: Tertiary Education Institutions

Institution	2000	2005
Public		
University	11	11
University College	0	6
Polytechnic	11	20
Community College	0	64
Public Total	***22***	***71***
Private		
University	5	11
University College	0	11
Branch Campus	3	5
College	632	532
Private Total	***640***	***559***
TOTAL	**662**	**630**

Source: The Ministry of Higher Education

THE NATIONAL EDUCATION SYSTEM

PUBLIC AND PRIVATE INSTITUTIONS

In 2005, the Ministry of Higher Education recorded a total of 71 public institutions comprising 11 universities, 6 university colleges, 20 polytechnics and 34 community colleges. Also, there is a total of 559 private institutions comprising 11 universities, 11 university colleges, 5 branch campuses and 532 colleges (Figure 1). Altogether they total

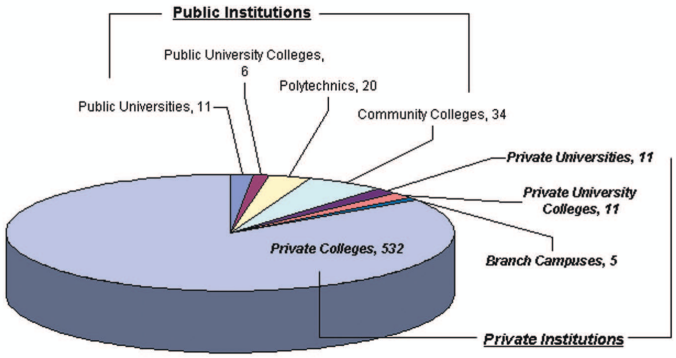

Figure 1: Breakdown of public and private institutions in Malaysia

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630 education institutions with 731,698 students nationwide [2].

Based on the Ninth Malaysia Plan presented earlier this March, Malaysia aims to increase the number of students to 1,326,340 by 2010 with a total annual growth rate of 16.9% in the public sector and 6.7% in the private sector to meet market demand. Under the plan, which emphasises knowledge economy and human capital development, an allocation of RM 16 million (compared with RM 13 million allocated for 8MP) had been made to accommodate development in education and training at tertiary level alone [3].

Last year, a total of 48,970 engineers were produced. Public institutions led the output by a margin of three quarters over private institutions. Mechanical engineering is generally viewed as the prime engineering field, followed by electrical engineering and civil engineering. However, private institutions had a noteworthy number of graduates in the field of electrical engineering (highest overall) compared with fields like mechanical engineering and civil engineering (lowest). Eventually, the 9MP foresees a two-fold increase of the number of engineering graduates from both public and private institutions. With the target annual growth rate of 12.2% (public) and 20.8% (private) for engineers, we can expect more than 100,000 engineering graduates annually by 2010.

Under Thrust 2 of the 9MP, Malaysia emphasises priority in capacity building as to "*build world class human capital that is knowledgeable and highly skilled, flexible and creative as well as imbued with positive work ethics and spiritual values.*" Life-long learning will also be a main focus under the second Thrust and with the Malaysian Qualifications Agency (MQA) to be set up next year, having a diploma after a first degree will de-emphasise the need for graduate studies. Quality enhancement also requires a review of institutions' curriculum every three to four years.

In terms of tiertary education, the response to market requirements will also be examined and put into action (mentioned in the 9MP) to reduce skill mismatch, increase collaboration between industries and institutions and emphasise on the requirement for internship and industrial attachment programmes.

The need for human resource with science and technology (S&T) capacity and capability will be enhanced as well under the STI development thrust. Through the 8MP over the last five years, science and engineering alone had the highest projects approved (26.9%), which is worth RM 137.1 million. The 9MP continues to see growth in research and the requirement for more human resource with S&T capacity and capability [3].

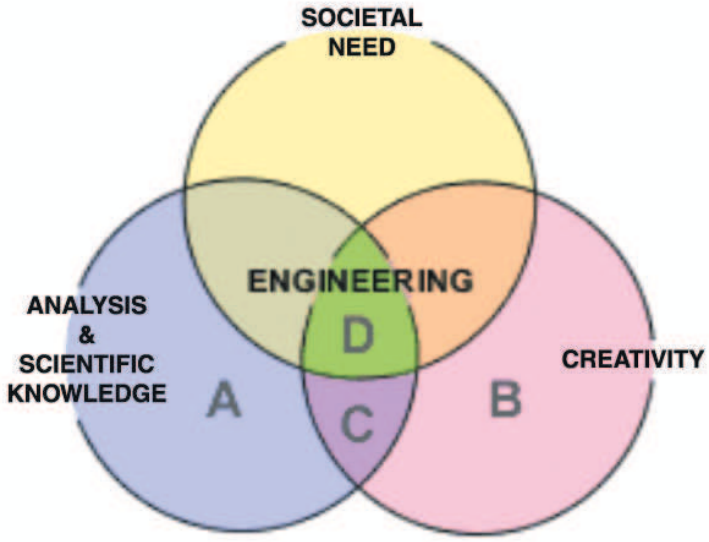

Figure 3: Venn Diagram of the relationship of engineering to societal needs, scientific knowledge and creativity

BECOMING AN ENGINEER

THE ROLE OF AN ENGINEER

Before the role of an engineer can be addressed, the difference between science and engineering has to be made clear. While engineering is a scientific field that is based on scientific principles and methodology, science itself or scientific study is driven by curiosity. Science, which is not bound by the immediate needs of society, is often less fettered or less encumbered by issues of societal responsibility. Curiosity, or the inherent dedication to solving nature's elaborate complexities, is the main characteristic that spurs scientists to seek answers. Engineering, on the other hand, is the application of science that is central to the interest and development of present society. The pursuit of engineering is often bound to the practical and applicable needs society.

In 1997, Steven Nichols and William Weldon wrote in Science and Engineering Ethics (Volume 3, Issue 3) about the role of an engineer in society [4]. They mentioned that "Engineering is based on that relationship with society..." and argued that "... yet, the education process and professional societies pay inadequate attention to the area."

The Venn diagram above (Figure 2) shows the engineering relationship with societal needs, scientific knowledge and creativity with different regions intersected. Region A solely describes the engineering science domain where capabilities of solving scientific problems lie. Region B shows the creative capacity in engineering domain. Together, intersection of region A and B creates region C, where engineering design are a result of real world problem solving from the marriage of engineering science and creativity. Region D illustrates the domain where region A, B and societal needs meet. This region exemplifies the ideal role of engineering and the individual engineer.

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Nichols and Weldon opined that engineers have to possess strong analytical skills, yet to be effectively productive, one has to be creative. This is vital; as complex situations emerge, sound knowledge and practical creativity will aid in resolving problems. They also stated that the engineer has direct responsibilities to society. An engineer should ethically and professionally resolve engineering problems, designs and interaction. Finally, they urge engineering graduates to acquire teamwork experience, strong verbal skills, written communication skills, economic, social, environmental and international awareness.

"It is thus important for engineers to realise the importance of their roles in society as well as in the physical infrastructural development in the country," commented Professor Abang Abdullah Abang Ali.

THE COST OF EDUCATION

Most of the public and private institutions in the country today offer a first degree in engineering. With the government's support (through subsidies) for public institutions, potential students are able to cope with financial shortcomings with relative ease. Universiti Malaya, one of the oldest and best public universities in Malaysia, offer various engineering courses bearing the Bachelor of Engineering with Honours degree for approximately RM 2,500 per semester including accommodation. In the East Coast, the 12-year-old Universiti Malaysia Sabah offers 5 major fields (mechanical, electrical, civil, chemical and computer) in engineering bearing the Bachelor of Engineering with Honours. Tuition fees for each of these courses are only at approximately RM 1,500 per semester and this includes accommodations as well. Generally, all engineering courses offered by local institutions require engineering undergraduates to study for a total of four years or 8 semesters. To complete an engineering course, a particular student only has to pay between RM 12,000 to RM 20,000 per course over four years. In contrast with private institutions, public universities are generally more cost-effective for students to pursue an engineering degree.

In private institutions, the tuition fees are distinctly higher. Private universities, such as Monash University, Malaysia, offers several engineering courses at approximately RM 120,000 per course over 4 years. MMU also covers several engineering categories and students will have to spend approximately RM 45,000 over a period of 4 years for tuition fees. In Sarawak, Curtin University of Technology provides engineering courses for local students at RM 21,200 per annum while international students are charged slightly higher at RM 24,200 per annum. Needless to say, private institutions may be more expensive but the top private institutions are generally blessed with up-to-date and advanced facilities and services.

In an informal interview, Wong Yew Hoong, a local engineering graduate claimed that, "I was lucky enough to secure a place in the public university and I did my degree in Electrical and Electronics Engineering in Universiti Malaysia Sabah with financial aid from PTPTN. Some of my friends did their engineering degree in private universities but when we compared each other's education experience, there was barely any difference."

ENGINEERING DISCIPLINES

Generally, most people would agree that engineering disciplines cover the field of mechanical, civil, electrical and chemical engineering. Presently, there are more than just four fields or branches of engineering thanks to the evolution of science and technology in the past millennium. These various engineering disciplines (including the oldest four and its sub-disciplines) are:

- Aerospace
- Aeronautical
- Astronautical
- Agricultural
- Biomedical (or Bioengineering)
- Chemical
- Oil & Gas
- Civil
- Structural
- Geotechnical, Soil & Rock
- Water resource
- Transportation
- Drainage, Irrigation and Flood Mitigation
- Urban Planning
- Computer
- Electrical and Electronic
- Power
- Communication (Telecommunication)
- Environmental
- Geological and Mining
- Industrial and Management
- Production
- Automation
- Operations
- Quality Control
- Materials
- Mechanical
- Mechatronics
- Automotive
- Nuclear

The emergence of this variety of fields has direct association with society's needs. Some sub-disciplines were conceived due to scientific and technological advancement in those specific fields that became too complex and complicated and thus related new fields were born.

OPPORTUNITIES AND CHALLENGES AHEAD

In the eyes of the public, engineers should ideally place the needs of society as a priority above other considerations. Therefore, engineering education and engineering educators should instill in students a sense of civic and societal responsibility. Additionally, it is the opinion of this writer that there are two guiding principles which should be taken into account and practiced at all times in engineering education. The first principle is the capacity and capability of having practical and analytical thinking, accompanied by the implementation of successful engineering methodology. The second principle centers on having creativity in engineering. Creativity allows engineers to think outside the box and investigate unique and innovative solutions to practical engineering problems. These two principles serve as essential requirements and act as the supreme foundation in engineering education.

Engineering is entering into yet another new stage of advancement. Fast-paced technopreneuer developments are emerging at an accelerated pace; there is no

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doubt that engineering education needs to reinvent itself in order to suit the ever-evolving environment and compete with other professions.

"As the country realises that we may lose out in manufacturing to lower-cost countries, the emphasis now is on preparing Malaysia for the knowledge economy," explained Professor Abang Abdullah Abang Ali. "Capacity building or the development of human capital is thus an important issue now, with greater emphasis on education and training. The Ministry of Higher Education is currently preparing a proposal on the transformation of higher education to be submitted to the cabinet by 30 September 2006 as a follow-up to a study report on higher education by a committee led by Tan Sri Wan Zahid."

CONCLUSION

Engineering education requires a keen focus on the responsibilities for producing and exporting valuable human resource, as the country's imminent engineering vision inches another step closer to realisation. Through new channels and redirecting efforts on k-economy and human capital basis, engineering education continues to play new major roles and contribution to the society and country. Consequently, the comprehensive and Ninth Malaysia Plan has commenced and it is calling the nation's attention to exercise their capacity and capabilities.

Engineering educators need to promote lifelong learning by all means to meet the ever-changing society needs. On the global scale, engineering education in Malaysia needs to maintain a minimum standard in quality and formulate opportunities in engineering advancement, in order to become an international hub of engineering education. Ultimately, careful development of engineering education will enable Malaysia to produce homebrew engineers of the highest quality and these valuable resources and assets will contribute greatly to national and world progress. ■

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