Ir. Professor Abang Abdullah Abang Ali

President

The Institution of Engineers, Malaysia

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The Global Engineer

In Search of International Excellence

IR. PROFESSOR ABANG ABDULLAH ABANG ALI
B.Sc. (Hons)(Brighton), M.Sc. (Manchester), P.Eng., F.I.E.M, C.Eng., F.I.C.E., F.I.F.S., F.A.Sc.

By the grace of Allah, I feel deeply indebted to the IEM Council and indeed honored to be given a second opportunity to present this presidential address and be at the helm of our beloved institution, and once again I wish to say that I shall give it my best shot.

For this second address of mine, I shall try to present my personal views on a very important subject for engineers in this twenty-first century – the role and performance of an engineer in this globalised knowledge world.

ENGINEERING YESTERDAY, TODAY AND TOMORROW

Changing Times

As a young boy in school in the sixties, I was encouraged by my teachers to choose the science instead of art stream and later the professional discipline of engineering instead of basic sciences. By the thread of logic and after slogging it out through a relatively tough curriculum, I would naturally be on top of the world. Alas it was not so and indeed it came to me as a paradox. My art stream contemporaries managed to get into vocations which are of higher social standing and my scientist friends are enjoying vast opportunities in research and development. Much has been said about engineering losing its glory as a profession of choice, students shunning away from it and engineers forsaking it for greener pastures.

But despite all these, engineering remains important to the society, nation and economy. Engineers had been, are and shall be important contributors to the changing physical as well as economic landscape of the country. Engineers, trained to provide solutions with their analytical skills can make their contribution felt in all fields, ranging from technical to social, finance and even politics. Our training in engineering is our most important asset in positioning us as important members of the society.

Despite this realisation, the majority of engineers remain hooked to their technical work almost oblivious to what goes on around them. They remain focused on their professional work and rarely wander out of the box. The world is however changing fast and engineers have no choice but to start thinking and looking outside the box. To remain relevant and competitive, engineers have to unlearn old skills and learn new ones. This is necessary for us to survive in this highly competitive, multidisciplinary and fast changing knowledge-based world. And globalisation is forcing engineers to look afar; beyond national borders for new sources of information, knowledge, experience as well as opportunities.

THE GLOBALISED WORLD

A borderless marketplace

Fast communication especially air travel had opened up business on a global scale and the internet has extended it further. To stay competitive in this globalised world, countries need to consider the effects of globalisation on their governments and businesses. Globalisation demands international solutions and cooperation resulting in national rules being replaced with international ones through a framework of global and regional structures, where countries have to shed some of their functions as decision-makers, regulators and enforcers. Globalisation brings challenges as much as it is part of the solution to the world's problems.

Developed countries and their business communities are seeking a major liberalisation of services, agriculture and intellectual property rights including new initiatives on investment, competition and government procurement. Globalisation means that companies can with ease establish branches or enter into partnerships all over the world. Manufacturing can easily be relocated to low-cost countries. Many of these countries offer not only low salaries but also less developed workers' rights and low health, safety and environmental standards. Globalisation which is normally identified with the WTO and may be defined as the process enabling financial and investment markets to operate internationally due to deregulation is a primarily economic phenomenon, involving the increasing integration of national economic systems through the growth in international trade, investment and capital flows. It is expected to provide a rapid increase in cross-border social, cultural and technological exchange.

Critics on the other hand present it as worldwide drive toward a globalised economic system dominated by supranational corporate trade and banking institutions that are not accountable to national governments. The environmentalists blame global corporations for global warming, depletion of natural resources, production of harmful chemicals and destruction of organic agriculture. They argue that global companies take advantage of the lack of regulation in poorer developing countries, locating polluting industries in poor countries, logging tropical forests, and developing mines with inadequate controls. They oppose the production, use and global trade in toxic chemicals, nuclear materials and other products, such as genetically modified foods, endangered wildlife, including fish. The IMF and World Bank is said to contribute to poverty instead of alleviating it. Some says the WTO favour companies from wealthy countries and making it difficult for poor countries to protect their own industries. Critics of globalisation say that rising inequality is the result of market forces and large corporations investing in poor countries only because they can make greater profits from low wage levels and get access to the natural resources.

National corporations are usually small and financially weak and there is the likelihood that they will be pushed aside during the influx of large foreign companies. The ability to control the direction of our economy would be highly jeopardized. An important element of Malaysia's economic success is the heavy investment in the physical infrastructure and our trainable and skilled workforce. These have often been cited as important factors for the country's efficient and competitive business environment. Acquisition of technology and business expertise is thus very important for Malaysia, being unable to compete on cheap labour.

THE ENGINEERING DILEMMA

Soul searching for role and relevance

Engineering is at a crossroad today. It is a human activity in the same way as business, government, religion and the arts. It is an important part of the political processes directing the course of a country's development. The twenty-first century will signify a shift from those who move money around such as the managers, lawyers, accountants and politicians to the wealth creators such as technological innovators, designers, developers and manufacturers, the majority of whom must be engineers. Engineers are the creators of wealth, health and security and can be central to social welfare and prosperity in our country.

These are challenging times for engineers, who must compete in an increasingly global engineering marketplace. Engineers cannot be out of touch with society. Today's engineering graduate entering industry will spend more time explaining technology to lawyers, consumers, legislators, judges, bureaucrats, environmentalists, and the media. There is a greater-than-ever need for broadly educated engineers to heighten respect for technological solutions among the general public, and to help alleviate a cultural fear that occasionally challenges progress. Engineers must be sensitive to the social consequences of their work. Broadly educated engineers will be better able to explain technology to fellow citizens involved in democratic decision-making. This could indeed lead to opportunities for engineers in political and policy leadership. Our society needs technologically knowledgeable individuals in its highest councils. A broad and liberal education ultimately makes engineers more creative by expanding their minds and exercising their imaginations.

In the past 20 years professional engineering has lost its central position in society both in reality and in the hearts and minds of the public. The profession is grappling with this situation and trying to find its new and rightful position. Our very difficulty in understanding and addressing the issue is part of the problem. The very culture of engineering, having served us so well until quite recently, is responsible for our lost of relevance.

THE MALAYSIAN ENGINEER

Gearing for the onslaught

Despite its relatively large number of over sixty thousand engineers in comparison with the other professions, the Malaysian engineering community is still small compared to its planned number of over two hundred thousand by 2010 and highly fragmented at that. About two thirds are currently registered with the Board of Engineers, Malaysia and less than a quarter are active in The Institution of Engineers, Malaysia. Engineering academics are guided by the Malaysian Council of Engineering Deans and consulting engineers are led by the Association of Consulting Engineers, Malaysia. A large majority is not active in assisting and promoting the profession, despite being registered with the Board of Engineers, Malaysia and there has not been any known effort to promote cooperation between the different engineering bodies with each group attending to its separate albeit sometimes overlapping role.

There is thus an urgent need to initiate cooperation and networking between the different groups to ensure that the Malaysian engineering fraternity is able to develop into a powerful engineering force locally and at the global level. The synergy between engineers from the academia and those from the government and industry shall facilitate the education and training of local graduates who have to be scientifically strong and professionally competent and able to compete at the international level. The practicing world must work hand in hand with those who are custodian to and promoter of new engineering knowledge in the academic world.

Together we should strive to develop internationally accredited education and professional development training programmes as well as raising the standard our local professional practice. The local engineering community must strive to maintain a leading position in innovation and seek to master advanced technologies.

We need the support of the government and industry to ensure the relevance and success of engineering as a profession in the local as well as global marketplace. The government must come strongly in support of the growth of successful global Malaysian engineering companies which can compete against the giants in the global arena. Just as these giants were given strong support by their own governments, Malaysian companies require the same support from our government in their local as well as overseas business activities.

THE ENGINEERING TRIPOD

Essentials of the profession

The growth of Malaysian engineering must be supported by further initiatives to develop the three essential sectors of the profession that is education and training, innovation and professional practice.

Malaysia is rapidly becoming a major centre for education in the Asian region with quality higher education which is popular amongst locals as well as overseas students at affordable costs. With globalisation this situation may change.

As the world moves from the agricultural to industrial, IT and then knowledge or biology ages, Malaysian industries, which have been predominantly in the agricultural, manufacturing and construction area and relying heavily on cheap labour, may need to move into the high-tech arena. Malaysia now needs to give more emphasis on innovation and the production of high technology goods ahead of the other countries. This calls for the education and training of highly skilled technical human resource as opposed to those trained in the conventional way. These highly skilled technical personnel are sometimes referred to as engineering technologists. Subsequently, there is also a need for high technology sub professionals such as engineering technicians that can support the work of both the engineering technologists and engineers.

The term engineering and technology have always been confused. Engineering encompasses theories relating to research, development, design and operations whereas technology primarily focuses on hands-on, application of the theories and principles of engineering and science to every day operations such as manufacturing, electronics and medicine, marketing, field testing, design, and customer service.

The role of an engineer is to be a leader and coordinator in design, research and development using the knowledge of mathematics and natural sciences gained by study, experience, and practice, applied with judgment, to develop ways to economically utilize the materials and forces of nature for the benefit of mankind. Since engineering involves a wide spectrum of activities extending from the conception, design, development and formulation of new systems and products, engineers often work closely with engineering scientists in developing new technology via research projects.

Complementary to the engineers, the engineering technologists implement engineering work by applying

engineering and scientific knowledge combined with technical skills to support engineering activities. Their areas of interest and education are typically application oriented, while being somewhat less theoretical and mathematically oriented than their engineering counterparts. They typically concentrate their activities on the applied design, using current engineering practice. Engineering technologists play key roles on the engineering team; they are typically involved in product development, manufacturing, product assurance, sales, and program management.

The engineering assistants are supervisors of engineering work while the technicians are mainly doers in the engineering team.

The level of education in a country will determine its ability to develop and sustain its economy in a globalized world. Future business opportunity will turn on educational opportunity. The cost of investment in education is low but the returns are high, as shown by the developed countries. Current available technology levels the playing ground as everyone can get a chance to be educated through it. It breaks down the barriers of distance and national borders to give equal educational opportunities.

The era of globalisation plays a crucial role in influencing the current trend in the Technical Education and Vocational Training (TEVT) and in determining a country's qualification framework. With the Washington, Sydney and Dublin Accords, engineering institutions, boards and councils in various countries are taking up the challenge to not only gain international recognition for their engineering degrees, but also widening the scope of engineering qualification recognition to include the engineering technologists, assistants and technicians. There is a need to rethink our education and training priorities in the light of global events and the changing needs of the market place. As technology becomes more sophisticated, employers continue to look for technicians who are skilled in the new technology and require a minimum of additional training. The engineering technician level will be more in demand as this is the area of greatest skill shortages in many countries.

The trend of education and training in Europe is leaning towards a more technically skilled approach. Students who have high academic achievements may choose or are attracted to technical institutes instead of the academic universities due to its good job-placement rates. In Germany, for example, training is aimed at providing a highly skilled workforce through a variety of institutions such as applied science university (fachhochschulen), vocational academies and technical trade schools. These institutions have different levels of entrance requirements, duration of study and alliance with industry. Engineering technology students receive an education that stresses the practical application of engineering principles. In the USA, the Bachelor of Engineering Technology is of similar 4 year duration with the Bachelor of Science (Engineering). The subjects covered however, differs in terms of practical and theoretical aspects. In the UK, the Bachelor of Engineering qualification that leads to the Incorporated Engineer status is of shorter 3 year duration.

In the effort to remain competitive and relevant in this globalized knowledge-based world, Malaysia has to further develop its TEVT sector and ensure that her workforce is sufficiently trained and competent to support the diversifying economy. The TEVT sector in Malaysia has to respond to the needs of the government, industry and communities in a rapidly changing world, influenced by globalisation and the latest advances in technology.

It is a well-known fact that although research and development is important in engineering and it is accepted as one of the three possible routes to professional membership in the institution, engineers are lagging behind scientists in research and development in the country. Most of the major national research institutes in the country such as MARDI, RRIM and FRIM are in the agricultural or biological sciences area, established in the early years. When engineers began to seek the formation of engineering research institutes, the government by that time had reached a situation when it can no longer support these costly institutions, and engineering researchers are now practically left to fend for themselves and have to make do with research centers or institutes at the university level only. This lack of strong research management support and facilities in engineering is something that the country needs to attend to if we are to be successful in the area of innovation.

At the same time, engineers busy with their business endeavours have shown little interest in research and development. The number of engineering researchers in the country is small. The time has come for the institution to reemphasize the importance of research and development. One of the four main strategies in the IEM Strategic Plan is to enhance research and development but the action plans on this are a bit slow in taking off the ground, because of lack of enthusiasm in its implementation. There is a dire need for us to undertake an engineering foresight study to identify the thrust areas in research and development in engineering, to serve as a guide to researchers in the country and as a rallying point for them to build their research networks. The industry must come in strongly in support of engineering research initiatives with grants, endowment, chairs or financial support for the establishment of research centers or institutes.

The healthy growth of the engineering industry is dependant on its success on the business front. There is a need to study the effectiveness and competitive of our local industry. For example, the consulting industry is suffering from the inability to impose the Board of Engineers, Malaysia scale of fees. I have known of engineers making do with very low fees, much lower than that prescribed in the scale of fees, obliged by business prudence. But as the saying goes, if we pay peanuts, we get monkeys at the design offices or drawing boards. On the contrary do we negotiate the fees with our surgeons? Do we select the cheapest lawyer in the market to attend to our cases? But in engineering projects we have to choose the lowest tender, consultants are pressured to accept fees below that prescribed by the scale of fees and direct negotiation can exclude more deserving companies.

There is also the relatively low capital outlay for many engineering projects. There is a need to impress upon the authorities that lower capital outlay can result in higher long term maintenance costs. The practice of life cycle costing where the long term management, maintenance and necessary upgrade of a project is built in into the initial project costs should be promoted, so that authorities can prepare for a long term budget and ensure that constructed facilities are properly sustained into the future. The practice of risk management must also be explained to ensure that project costs are related to the quality and safety of the finished product, whether these are roads and buildings on hill-site, cars, aircraft, or even manufacturing and production facilities.

There is a need to further promote professionalism in the local engineering fraternity, to encourage engineers to be able to talk to policy makers and to stand by our professional standards and ethics. There is also a need to encourage government and private sector partnerships to ensure that the country's infrastructures are built to an acceptable high standard for long term use and safety.

CAPACITY BUILDING

Mobility at its best

ASEAN leaders have instructed officials to commence negotiations on Mutual Recognition Arrangements (MRAs) for Professional

Services, at their 7th Summit held in Bandar Seri Begawan, with the view to facilitate free flow of professional services in the ASEAN region by the year 2020. Malaysia maintains the ASEAN Engineers Register. There are numerous initiatives leading to the mobility of manpower within the globalisation setup. Among these are the Engineers Mobility Forum (EMF), Engineering Technologists Mobility Forum (ETMF), the APEC and AEAN Engineers Registers. The EMF agreement is a multi-national agreement between engineering organisations of member countries providing the framework for the establishment of an international standard of competence for professional engineering. It empowers member organisations to establish a section of the International Professional Engineers Register. The standard of competence applied is the same as for the APEC Engineers agreement. However, the EMF agreement is truly global as non-APEC countries can join the EMF, but not the APEC Engineers agreement. The ETMF adopts the same approach as the EMF.

The Washington Accord is an agreement of quality assurance process for the accreditation process and the standards of the educational institutions of the countries involved. The Sydney Accord, the equivalent to the Washington Accord for engineers, is for engineering technologists. The Dublin Accord is for educational qualifications for certificated engineers or technicians.

In Malaysia, engineering degree programmes offered by public as well as private institutions of higher learning are being accreditated by a one-stop Engineering Accreditation Council (EAC) comprising of representatives from the BEM, IEM, National Accreditation Board (LAN) and the Public Service Department (JPA). Accreditation enables graduates of a local institution of higher learning to register with BEM as graduate engineers and join IEM as graduate members and sit for the professional examination after a minimum of 3 years of practical experience in order to achieve the professional status.

ENGINEERING EXCELLENCE

From technical performance to professional excellence

The government has recently established the Professional Services Development Centre (PSDC) to help ensure Malaysia remain competitive and able to be a net exporter of professional services. Amongst others the PSDC shall strive to promote continuing professional development and lifelong learning, research and development as well as accreditation of professional service providers to international standards and best practices in its effort to ensure Malaysian professionals remain amongst the best in the world.

To succeed in the global engineering business, engineers must graduate from technical performance to professional excellence. This can be achieved by enhancing the education and training standards, indulging in innovation so that Malaysian engineers remain at the forefront of technology, and raising professional competence and standards. Engineers must graduate from talking about performance, high factor of safety and cost effectiveness to achieving excellence in their work.

There is also the debate about quality versus quantity. The education system in Malaysia while maintaining a certain minimum standard has been emphasizing on quantities to the extent that the question of quality has often taken the back seat. It is however interesting to note that the government has recently indeed begun to emphasize on quality assurance as well as academic and research excellence in local universities in addition to accreditation to a certain prescribed standard. Malaysia must learn to benchmark against the best in the world to be competitive in the global market.

IEM itself as a learned society and a knowledge-based learning organisation should strive to develop into a center of excellence in engineering. IEM should become a focal point for state of the art multidisciplinary areas such as nanotechnology, bioengineering, robotics, intelligent transportation systems, homeland security and sustainability. IEM should also assert its global leadership and take advantage of its good reputation in emerging markets. We should continue to develop our institution as one that is truly knowledge-based — an organisation that promotes, creates, assimilates and exchanges technical information and knowledge. Our efforts should create the technological rain that nurtures the education of aspirants to the engineering profession, creativity of the engineering innovators and the technical and professional excellence of the practicing engineer.

ENGINEERING OUR FUTURE

Nurturing home grown talent

Globalisation for whatever it is worth is here to stay and countries must strive to make the best from what it can bring. To remain competitive, Malaysia must reemphasize the importance of knowledge creation through active involvement in innovation and place a premium on capacity building initiatives. We have to take cognizance of recent developments in engineering education and training of human resources the world over and work towards an engineering qualification framework, education and training system as well as accreditation process which compares well with the best in the world. We must actively encourage engineering research and development activities, and support innovation endeavours in order to be at the forefront of technology. We have to ensure our professionals are given sufficient opportunity to continuously upgrade their knowledge and skills and given an opportunity to develop technically and financially strong professional outfits to compete in the local and global markets.

Our vision is to be the premier engineering organisation locally as well as at the international level. We have to strive to bring our beloved institution to greater heights. As a learned society, our mission should be to create, assimilate and exchange knowledge. This is our future. We are living in a knowledge-intensive society and age and we must excel as a knowledge-based organisation and facilitate the development, dissemination and application of engineering knowledge. We need to reschedule our programmes and services as well as our priorities if we are to graduate from just another professional organisation to one which can provide leadership in this global knowledge age. We have to change our culture, recognise the central position of men of knowledge in our institution, be dynamic, creative, proactive and open to new ideas and knowledge.

Insya Allah, we shall prevail.

Note:
This Presidential Address had been delivered at IEM Conference Hall during the 45th IEM Annual General Meeting held on 17 April 2004.