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Educating the Global Engineer*

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Opening address by Fidel Valdez Ramos, the Former President of the Republic of the Philippines, presented at *The International Millennial Conference on Engineering Education* (IMCEE 2000), under the theme of *Educating the Global Engineer*, held at the Manila Midtown Hotel, Manila, Philippines, between 27 and 29 January 2000, and organised by the Philippine Association for Technological Education (PATE), Inc.

INTRODUCTION

Let me add my welcome to those already expressed here by the organisers to our foreign friends who have come to take part in this international conference. Some of us have travelled from India, Sweden, Australia, Indonesia, Kuwait, the United States of America, Singapore, Malaysia and Turkey, but we have all gathered here to compare experiences and insights on a topic that interests us all. This tells us how much our world has changed in the recent past.

Globalisation has given travellers like our visitors here the *seven-league boots* from the fairy tale, while the Internet gives us access to an *Ali Baba's* treasure cave of information and consumer goods and services. By letting our fingers do the walking, we can summon our clients, relatives and friends at the other end of the world instantly on our cell-phones.

Just as it is linking people across the barriers of geography and time, globalisation is linking national economies in a way they have never been linked before. World trade is growing at twice the rate of global industrial output, and cross-border investment at an even faster rate. From a yearly average of about US$24 billion in 1990, industry journals report that foreign direct investment reached US$120 billion in 1999.

In fact, countries are less and less distinct economic entities, and more and more essential segments of one worldwide economy. Transnational corporations increasingly disregard national borders when making production, marketing and investment decisions. Migrant portfolio capital can almost instantly move from one stock market to another.

Even economic orthodoxies are changing under the impact of globalisation. Consider, for instance, the unprecedented *long boom* the American economy is enjoying. Brought about by the application of new technologies, it promises to put an end to the boom-and-bust business cycle of the industrial era.

In the face of these rapid changes, it is vitally important that we adapt, or else be left behind. All our countries, like each of us as professionals, constantly feel the pressure, and the challenge, to keep up with the leaders, and try not to get sideswiped along the way.

THE RAPIDLY CHANGING ENGINEERING PROFESSION

This interest we share in engineering education has been greatly transformed by the convergent revolutions in computer science and information technology which, together, supply the motive power for globalisation.

In almost every country today, the composition of the work force is also rapidly changing. On the factory floor, the blue-collar worker is giving way to the *technician*. Like the old factory hand, the technician may also tend a machine, but in addition to hands-on experience this person also has substantial theoretical, *book* knowledge. The technician's range of skills, and his/her productivity, is therefore much higher. According to the *New York Times*, the spectacular gains in American productivity over this last generation arose from better-educated people working with smarter machines.

* An Opening Address presented at the *The International Millennial Conference on Engineering Education* on 27 January 2000.

The main change is that knowledge has become the key economic resource. In Peter Drucker's terms, the technological revolution is creating *knowledge societies*.

At the centre of gravity of the workforce in every developed country are the knowledge workers. These are people who do not work with their hands at all, but are being paid for what they have learned in school and the university. Of these knowledge workers, the engineer is the most highly prized.

The practice of engineering itself is changing with the times. Various sub-specialties of the engineering profession have emerged. Advances in information technology now provide engineers with tools and resources unheard of only a few years ago. Furthermore, the relationship between engineering and science today has become so intimate that at times the distinction between the two disciplines has become fuzzy and unclear.

As the need becomes more and more urgent to prepare our young people for the knowledge society, educators in the developing countries are becoming more and more concerned about the inadequacy of their national education systems. Even in Japan, business people and bureaucrats increasingly doubt whether an education system centred on the rote learning of processes and facts - without a clear understanding of their underlying fundamentals - can develop the creative and self-responsible workers needed by the knowledge-based society.

How can our countries keep up and complete with the rest of the world? Obviously through drastic, radical, improvements in technical education and through the replacement of teaching systems that encourage conformity, stifle originality, and produce graduates who cannot make decisions, cannot innovate, and cannot think for themselves. These needs of engineering education are impacting seriously upon the Philippines, as you will hear from our engineering education professionals in the parallel sessions that are the meat of this conference.

In the Philippines, engineering and technology are one of the three most popular courses in our colleges and universities. On average, some 200,000 young Filipinos enrol in the different engineering courses every school year. And we produce some 40,000 graduates yearly. This number is much greater than the number of young people who graduate in agriculture, forestry, fishery and veterinary medicine.

The Philippines also produces a good number of licensed engineering professionals. Of the top ten professions monitored by the Professional Regulatory Commission, four are engineering disciplines: marine, civil, electrical, and mechanical.

Apart from these mainstream engineering disciplines, we have also been producing engineers whose fields range from aeronautics, agriculture, and electronics, to communications, geodetic, and mining. These different engineering fields already make up about 20% of all our high technology professionals, and our colleges and universities are gearing up to produce more, and hopefully better, engineers. Already, our supply of competent engineers is attracting technological investments to our economy.

ENGINEERS ATTRACT TECHNOLOGICAL INVESTMENTS TO THE ECONOMY

That the Philippines is increasingly capable of high-tech manufacturing may not yet be all that well known. But since 1994, the largest multinationals in computer and other electronic technologies have been making heavy investments in this country.

The Semiconductor and Electronics Industry in the Philippines, Incorporated (SEIPI) which held its 59th general membership meeting and millennium party last January 21st, started with an initial number of only 13 member companies in 1984. Now its membership has grown to more than 100, and counts in its roster some of the biggest investors and multinational companies in the country. These include all the big players in the international semiconductors and electronics sector which are represented in our country today, such as: *Intel, Philips, Hitachi, NEC, Motorola, Texas Instruments, Matsushita, Amkor Anam, Cypress Semiconductors, Analog Devices,* etc.

In 1992, when I assumed the Presidency, the Semiconductor and Electronics Industry (SEI) exported goods worth US$3 billion with a 28% percentage share of total Philippine exports, and was projected to grow 20% annually.

But by the end of my term in mid-1998, SEI had leaped in both revenues and export share. In that terminal year, SEIPI exported goods worth US$20 billion, accounting for 67% of all our country's merchandise exports. Investments in the semiconductor and electronics industry also grew beyond our expectations. More than US$6 billion in investments entered our country over that six-year period.

SEIPI's member companies have been major job creators for the Philippine economy, counting now some 250,000 gainfully-employed technical workers, engineers and other skilled professionals. Aside from being top export winners, these companies are also bringing in training and knowledge that keep Filipino workers abreast of technological developments in the world.

More significantly in the Philippines, the industry is already shifting towards more sophisticated and more complex products, including Pentium chips, laptop computers, and digital-signal processors used in cellular telephones. The industry is riding a boom that has yet to peak. Current estimates are that the world's chip market will grow at a rate between 12-15% yearly during the next decade.

We believe that our adaptable, highly skilled and English-proficient workers can carve out market niches for our country (among other things) as a centre for computer and information technology.

SERVICES SECTOR GROWTH

Reforms carried out since the early 1990s stimulated investments in the services sector, so that over the period 1993-98, it grew faster than either industry or agriculture. Financial services alone expanded by 8.8% yearly as an average over this five-year period. Nowadays, the service sector has the largest share of our Gross Domestic Product (45% in 1998).

The thrust of reforms has been to get Government out of business and off the backs of business people. This would allow the Government to ultimately focus on the basic things that Government should be doing. And that is to provide the political stability, the infrastructure (both physical and human), and the rule of law that business people need, so that they can build up our country's international competitiveness.

In the Philippines today, we count on the growing services sector to give us an advantage over our competitors and neighbours. We believe our adaptable, highly skilled and English-proficient workers can carve out market niches for our country as a centre for information technology, accountancy, engineering construction, architectural design, and entertainment, and also as a hub for professional, health, home care, hotel and tourism services.

In fact, we already are running back-office operations in accounting, software development, management education, skills training, and technical support for many of the great service-industry multinationals. America On-Line, and Andersen Consulting are among the majors that have recently set up Philippine operations.

Recently McKinsey & Company identified 11 white-collar services with an estimated demand worth US$180 billion by 2010 that the mature economies can profitably outsource, and for which the Philippines is uniquely positioned.

EXPECTATIONS OF GLOBALISATION

People of the Philippines already look to the time when the traditional infrastructure of trade, such as highways, bridges, airports and seaports, will give way to less tangible, but equably effective connective networks. While muscle-power may have built the foundations of our economy, only the combined forces of intelligence, scientific know-how, and creativity will enable less advanced countries to move to higher stages of development.

To generate high-wage jobs, the key is investment in human capital. Where the Philippine state may be constrained from so doing by its limited resources, even ordinary Filipino families have been generous.

The Filipino's love for education is legendary. It was acquired from the Americans who, unique among the colonial powers, introduced mass education into their Pacific colony in 1900. Today, for instance, thousands of our young people are turning themselves into computer literates. Even provincial towns throughout the archipelago have private schools teaching programming and other software skills. Classes in computer engineering are packed, and we have one of East Asia's fastest-growing linkages to the Internet.

The Government itself has been trying to strengthen its vocational and technical education and training programs. As the financial crisis eases, Congress is giving scientific research and development (R&D) a higher priority in our new budget. The end-object of all these is to find - and win - the competitive niches in the global economy we must begin to develop by overcoming our infirmities and building on our basic strengths.

INTERNATIONALISING STANDARDS OF ENGINEERING EDUCATION

But, more than quantity, quality is of highest importance. Will all the engineers we produce be able to compete with the engineers from other countries? Indeed, they should if we want our graduates to survive in a highly competitive world.

We must internationalise national standards of engineering education. While schools must continue to teach the basic principles on which engineering science is founded, training and education in the latest technologies and developments in the field should also be emphasised.

As engineering becomes more and more involved in life sciences, courses in this area may need to be added. Engineers are increasingly taking over leadership of various industries and professions, so they need

to be taught communication and management skills. Today's engineer cannot be merely a technician who is able to design the perfect bridge or the sleek skyscraper. Today's engineer, like any other modern professional, must be someone who can see the big picture.

The key here is for schools to think of what their students need to do well in their chosen field, taking into consideration the changes happening around them. In internationalising engineering education standards, we could look to the Asia Pacific Economic Co-operation's (APEC) effort to establish common standards for goods and services throughout the Asia-Pacific region.

Engineering educators can certainly pattern their efforts on APEC's endeavours to create and adapt *best practices*, which are internationally recognised standards of quality meant to ensure that the region's infrastructure (both hard and soft) are of the highest character, and allow for seamless inter-operability. In this regard, APEC has a Human Resources Development Working Group dealing with the needs of the member economies. Its network for industrial technology is involved in setting up technical and professional standards; identifying skill shortages; and organising vocational training and related activities.

APEC has also taken steps to speed up the mutual recognition of professional qualifications among member economies. To this end, it is assisting professional engineering bodies in the Asia Pacific in setting up an APEC Engineer Register as the basis of a system for facilitating the free movement of professional engineers to work sites all over the region.

National Governments should strive to meet the changing expectations of their knowledge workers by providing a policy regime and support programs that will enable their colleges and universities to keep abreast of the rest of the world. They should continue improving their linkages with the global community to maximise the benefits their people receive in the global exchange of knowledge and technology.

CONCLUSION: EDUCATION IS A LIFELONG PROCESS

As for schools and teachers, the school of the future must be different from the school of the past, and even from the school of today. Technology will transform the school of tomorrow just as radically as technology will transform the business corporation of tomorrow. Technology will liberate teachers from much of the routine work of classroom instruction and free them to work with individual students: to shore up the students' individual weaknesses, and to nurture their individual strengths.

In the knowledge society, learning will not stop with graduation because knowledge, by definition, makes itself obsolescent.

Some experts forecast that the Internet may be wiring together a world in which the rich still get richer and the poor get poorer - only faster. Even James Wolfensohn of the World Bank affirms that:

> *...the underlying social structure has to be developed to underpin an effective and fair global financial and trading system.*

We of the developing countries look to multilateral agencies such as the World Trade Organisation to lead in drawing up new equitable rules for the global game. This is to see to it that there are equal places for everyone, not only at the bargaining table but also at the dining table, and that the new economic order is based not on one single favoured model of governance but on a broader, pluralistic and pragmatic sense of consensus-building within the international community.

In this sense, the truly educated individual is one who knows how little he or she really knows and is therefore eager to continue learning as a lifelong mission. Knowledge workers must refresh and renew their stores of knowledge periodically for they cannot afford to live on the intellectual capital they accumulated in college.

In this process of continuing education and lifelong learning, the great universities and the great corporations will certainly need to collaborate increasingly. In the end, of course, lifelong learning is up to the individual, for lifelong learning is both the gift and responsibility of one to oneself.

Engineers, like doctors or lawyers, are specialists. But specialists are not people who get educated automatically. A truly educated individual is one who is:

> *...capable of relating an area of special knowledge to the universe of knowledge and of human experience.*

In the end, this is the vision that our colleges and universities must strive to cultivate. For our educational institutions, educating the global engineer must transcend specialised competence. The challenge that must be confronted now is how to make knowledge a means to human development, or in Peter Drucker's words, *to discover education as the road to wisdom.*

Kaya ba natin ito???
Maraming salamat at mabuhay kayong lahat!

BIOGRAPHY

Fidel Valdez Ramos' distinguished career is marked with many achievements. He graduated in 1950 from the United States Military Academy at West Point, New York, USA (Phi Kappa Phi Honor Society). In 1951, he achieved a Master of Science in Civil Engineering from the University of Illinois in the USA, and passed the Civil Engineering Board in 1953 within the top ten. He also gained a Master of National Security Administration from the National Defense College of the Philippines in 1969, and a Master of Business Administration from the Ateneo de Manila University in the Philippines in 1980. He has been conferred with over 20 honorary doctorates from various international academic institutions, and was also elected an Honorary Fellow of the American Society of Civil Engineers in July 1994.

While his career as a public servant spans 51 years, he will best be known as the 12th President of the Republic of the Philippines from from 30 June 1992 to 30 June 1998. He is remembered for his leadership skills, as well as his willingness to listen to the people whom he served. He steadfastly and faithfully promoted the principles of people empowerment and global competitiveness. He always looked towards the future and his optimism helped to propel the economy forward. He is remembered for his positive energy that seemed to burst from his cool and at times steely demeanour. He pursued, focused and converged programs to fight poverty in accordance with the will of the Filipino people expressed by 229 structural/reform laws enacted by Congress from 1992 to 1998. In December 1997, he received an award from the Christian Democrats International in recognition of his defense and promotion of democracy.

During his term as President, the Philippine economy recovered dramatically and a comprehensive Social Reform Agenda (SRA) was implemented that addressed long-standing problems regarding education and skills training, health, housing, environmental protection, children and the youth, the elderly and the handicapped, jobs and livelihood, agrarian reform and access to equal opportunity. The average income of the Filipino family grew more during his administration than in the preceding two decades. He pushed for the deregulation of key industries and the liberalisation of the economy, and encouraged the privatisation of public entities, including the modernisation of public infrastructure through the expanded Build-Operate-Transfer law.

Fidel Ramos has a recognised history as a peacemaker, and was a military hero of the peaceful people-power revolution in February 1986. In October 1993, he was presented with The Man of Peace Award from the World Jurist Association in recognition of his commitment to peace and the rule of law. Communist insurgency dwindled to historic lows during his term as President. He achieved a peace agreement with military rebels and the MNLF southern secessionists which won for him (together with Chairman Nur Misuari) and the Philippines the coveted 1997 UNESCO Peace Prize, the first for Asians.

He was presented with the University of California Medal in recognition of his leadership in the Pacific, and received further awards for his efforts at building closer ties within the region from nations including Thailand, Malaysia, Korea, Indonesia and Pakistan.

Fidel Ramos has been decorated with many state awards in his role as a public servant and soldier, plus additional awards in recognition of his efforts and support of diverse organisations as the World Ecologists Foundation, the United Nations Environment Programme, the Red Cross, the World Scout Movement, Rotary International, and the Veterans Federation of the Philippines.

At present, he holds many eminent positions; he is Chairman of the Ramos Peace and Development (RPDEV) Foundation; Chairman Emeritus, Urban Bank; Chairman, International Advisory Board, MDVISTA Telemedicine; Member, Advisory Board, Metro Bank; Member, Asia Advisory Board, Carlyle Group; Founding Member, Policy Advisory Commission, World Intellectual Property Organization (PACWIPO); Honorary Member, World Commission on Water for the 21st Century; Member, World Bank East Asia Pacific Anti-Corruption Advisory Board; Member, Advisory Group, UN University for Peace; Patron, Opportunity International (Phils.); Honorary Chairman, Yuchengco Center for East Asia, Dela Salle University; Honorary President, Human Development Network (HDN) Philippines; Lifetime Honorary President, Christian Democrats International (CDI); and Chairman Emeritus, Lakas-NUCD-UMDP-Kampl Political Party.

Conference Proceedings of the *3rd UICEE Annual Conference on Engineering Education* under the theme: *Collaboration in Engineering Education*

edited by Zenon J. Pudlowski

Published by the UNESCO International Centre for Engineering Education (UICEE), this volume of Proceedings comprises papers delivered at the *3rd UICEE Annual Conference on Engineering Education*. The 15 keynote addresses, 14 lead papers, and 60 regular papers demonstrate the international nature of UICEE meetings and provide readers with valuable insights and experience in engineering education contributed by academics from almost 30 countries worldwide in the global community.

The papers tackle topics of vital importance to engineering education. The Conference's theme of *Collaboration in Engineering Education* seeks to discuss internationalisation, and the opportunities it brings for regional and global networks. Papers have been placed into various groups, with each chapter headed by a lead paper that is felt to be most representative of the topic under discussion:

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