



ASEAN AUSTRALIAN ENGINEERING CONGRESS

Engineering Solutions in the Age of Digital Disruption

12th - 14th JULY 2022
HYBRID CONGRESS

“Employment Opportunities for University Graduates in the Digital Age”

By Academician Dato’ Ir. (Dr.) Lee Yee Cheong AO

Commissioner, UN Broadband Commission for Sustainable Development /President, Belt and Road International Education Consortium, China/ Honorary Chairman, UNESCO International Science, Technology, Innovation Centre for South-South Cooperation (ISTIC) /Distinguished Honorary Fellow, Institution of Engineers Malaysia/Former President, World Federation of Engineering Organisations (WFEO)/ Founder President, Engineers Australia Malaysia

1.0 The 4th Industrial Revolution

One of the pronouncements in the recent decade that has the most significant adverse impact on global development was that of 4th Industrial Revolution by Klaus Schwab, founder of the World Economic Forum in Davos January 2016.

He defined the four Industrial Revolutions as;

- (i) 1st Industrial Revolution 1784 with steam and mechanical power;
- (ii) 2nd Industrial Revolution 1870 with electric power and mass production;
- (iii) 3rd Industrial Revolution 1969 with electronics and ICT; and
- (iv) 4th Industrial Revolution 2015 with cyber-physical systems.

He justified the arrival of the 4th Industrial Revolution by citing:

“The possibilities of billions of people connected by mobile devices, with unprecedented processing power, storage capacity, and access to knowledge, are unlimited. These possibilities will be multiplied by emerging technology breakthroughs in fields such as artificial intelligence, robotics, the Internet of Things, autonomous vehicles, 3-D printing, nanotechnology, biotechnology, materials science, energy storage, and quantum computing.”

WEF had actually announced the arrival of the Digital Age!

The World Economic Forum also released in 2016 its study report “The Future of Jobs” that states “In the next five years, whilst there will be new 2 million jobs created in digital industrial and services sectors, there will be 7 million job loss in the traditional industrial and services sectors, leading to a net loss of over 5 million jobs”. It was even said in the Report that 65 percent of children entering grade school today will end up working in jobs that don’t even exist yet!

The above forecast of loss of jobs and lack of knowledge of future jobs have caused significant impact on international and national education and employment strategies.

2.0 Debunking the 4th Industrial Revolution

A revolution destroys existing systems and replaces them with new systems. Yet the steam engine of James Watts of 1784, the electric power system of Thomas Edison and the mass assembled T model Ford of Henry Ford in 1840 are still in use today. Cars are still mass produced. Of course, the modern versions have been much improved by technology progress.

In my opinion. there has not been any industrial revolution but a continuing technology evolution since 1784.

The current digital age is but the latest phase of the industrial development of the West including Japan in the past two centuries or so. Its key driver has been economic growth in the West through colonisation for raw materials and cheap labour.

To developing countries, the historical milestones in the past two centuries or more have been the African slave trade, the opium wars in China, and two disasterous world wars.

Currently digital technologies have even widened the social, economic, wealth and wellbeing divides between the developed and the developing countries, as most digital technologies are not available to most developing countries due to lack of accessibility and affordability.

The prediction in 2016 that there will be a net loss of five million jobs in the next five years has proved to be false. Now six years later, in 2022, the developed world and the high income developing world have been facing labour shortage in all industrial and services sectors.

The statement that “65% of children entering grade school today will end up working in jobs that don’t even exist yet” is even more ludicrous. If that is true, what is the point of long term planning for economic and social development in developing countries like Malaysia’s Vision 2020 and Vision 2035. How are universities to provide skilled human resources for jobs unknown!

Throughout human civilization, education has been key to develop the skilled human capital and human talent necessary to provide the population of the world with the basic necessities of life as per Chinese saying (衣食住行) or “Clothing, Food, Shelter and Transport”. When they become more prosperous, liberal arts education has provided them with quality of living as per Chinese saying (琴棋书画) or “Music, Chess, Book, Painting”.

3.0 The Impact of ICT and Digital Technologies on Education

In the last decade of the 20th Century and the first decade of the 21st Century, Information and Communication Technology (ICT) was regarded as the great white hope of the world. The UN World Summit on Information Society (WSIS) in Geneva 2003 and in Tunis 2005 urged all UN member states to invest heavily in ICT infrastructure so that they would not be left behind. I remember the Y2K panic and the great number of ICT graduates in Malaysia without jobs after the ICT bubble burst.

There is now an almost universal belief that digital technologies are the great white hope for the world. There is a relentless drive to make everything digital in government, industry and academia. If we were to go overboard in digital technologies, we will end up with a digital technology bubble with unemployment for too many digital technology graduates chasing too few jobs.

4.0 The United Nations Sustainable Development Goals (SDGs)

Fortunately, the development agenda for the world is not Industry 4.0 but the UN Post-2015 Development Agenda with its 17 SDGs and 169 Targets.



In my opinion, the SDGs are too comprehensive, inclusive and all embracing for most developing countries with limited resources and human capital to achieve by 2030. Developing countries should concentrate their limited resources in achieving SDG No. 1 “No Poverty”. If their populations are not able to lift themselves out of poverty, their societies and nations have little hope of achieving the other 16 SDGs by 2030.

The outstanding exception is China that has focused on poverty eradication first. In 2021, China announced the spectacular achievement of lifting 800 million of her population out of poverty. This is without parallel in human history! What is even more amazing is that the 800 million people have joined China’s society of moderate prosperity (小康社会).

China has thus been able to take care of all the basic needs of her population like clothing, food, housing and transport (衣食住行) as well as access to compulsory education, basic medical services, and gainful employment even in the most remote and almost inaccessible rural regions.

In the process China and her people has been improving their environment in turning desert into forest and farm land, cleaning up her rivers and lakes, and conserving her wetland, thus protecting its flora and fauna as required by the other SDGs. China's poverty eradication achievement and experience should be emulated by the developing countries through south-south cooperation.

China's poverty eradication success has been anchored by the comprehensive and inclusive physical and virtual infrastructure that permeates the length and breadth of China. With such infrastructure, even the most remote community in China has become part of not only China's economy but also the supply chain of the world. There is an old Chinese saying often quoted by President Xi Jinping : "To get rich, build road first" (要想富先修路).

Of course, the key is engineering and engineers!

Some world beating examples in science, engineering and technology in China's manufacturing and construction are:

- (i) Ever expanding network of high speed train reaching Xinjiang, Tibet and Heilongjiang overcoming extremes of altitude, climate and geography;
- (ii) Ocean crossing bridges linking Hong Kong/Macao/Zhuhai and that across the Hangzhou Bay, linking Shanghai and Ningbo;
- (iii) Multi-purpose water resource dams and reservoirs like the Three Gorges Dam with world's largest hydroelectric power generation at 18100 Mw;
- (iv) South-North Water Transfer project, sending the abundant water of Yangtze River to the water deficient Yellow River and its environs of Beijing and Tianjin;
- (v) Advanced Tunneling Technology;
- (vi) The inclusive broadband 4G network completely replaced by 5G in 2022;

(vii) Fastest super computers;

(viii) Aerospace development of rockets, spacecraft, rover on Mars and space station;

(ix) World's largest and most modern airports;

(x) World's largest and completely automated ports;

(xi) Ship building and transportation with the world's largest container fleet;

(xii) World's dominant rare earth industry;

(xiii) World largest renewable energy like solar photovoltaic, wind turbine and 4th generation molten salt thorium reactor ;

(xiv) World's largest market for robots;

(xv) World's largest producer of drones and

(xvi) World's largest supplier of batteries for electric vehicles and largest market for electric vehicles.

All the above have been made possible by China increasingly utilising digital technologies like automation, robotics, AI, IoT, 5G etc. Smart design, smart manufacture, smart construction and smart operation and maintenance in China are underpinned by digital technologies.

However, I would like to emphasize that digital technologies cannot by themselves uplift the economy without physical infrastructure like energy and water for the manufacturing factories and transportation by land, air and sea to deliver the goods to the consumers. The factories themselves also need accessories and components from their suppliers.

The anchor is comprehensive and widespread physical and virtual infrastructure.

5.0 One Belt One Road Initiative (BRI)

China has been sharing the fruits of her development success with the developing world through BRI. To me, the BRI is the platform for the developing world to lift their people out of poverty and become members of the shared community of prosperity for humankind.

Since President Xi announced the Belt and Road Initiative (BRI) in Kazakhstan in 2013, physical and virtual infrastructure projects built by China to Chinese engineering standards abound throughout the developing world.

Important projects in BRI in **Asia** include the already operational Istanbul-Ankara railway. The Astana-Almaty 1000km high speed rail project is under implementation by Chinese corporation.

The high speed rail project by China in Thailand will herald the 3,000km high-speed rail link from Kunming, China all the way down to Singapore through Laos, Thailand and Malaysia. The 1000km China-Laos railway project is operational. China is building the East-West Rail Link in West Malaysia. China has also been constructing the Jakarta-Bandung high speed railway project in Indonesia. China is building the Kyaukpyu Port in Myanmar, the Malacca New Port and the Kuantan New Port in Malaysia. China owns the Hambantota Port in Sri Lanka. China owns also the Port of Gwadar in Pakistan and is linking it through 3000km long route to Kashi, Xinjiang in China. The US \$46.0 billion “China Pakistan Economic Corridor” project is a “one in four” infrastructure project: highway, railway, oil and gas pipeline and broadband optic fibre. Projects under CPEC also include special economic zones and power plants.

In **Africa**, China has built and is operating the Addis-Djibouti railway. China built the African Union complex in Addis. China is building the new container port of Doraleh in Djibouti. China has started construction of the new Port of Lamu in North-East Kenya to link landlocked South Sudan and Ethiopia to the Indian Ocean. The project will include major highway, railway, power plant and oil and gas pipeline. The Mombasa-Nairobi Railway is in operation and is being extended to Naivasha.

In **Europe**, China leases and operates the Port of Piraeus in Greece. Rail link connecting it to Budapest through Serbia is under construction.

In **Latin America and the Caribbean**, Belt and Road projects include the North-South link of Jamaica's Highway 2000; Panama-Chiriquí Railway; the El Espino-Boyuibe Highway Project linking Bolivia to Argentina & Paraguay; Port Chancay Peru; Santiago-Valparaiso High Speed Rail, Chile; National Highway B Argentina; and the Bi-Oceanic Road & Rail Corridor, connecting Atlantic to Pacific across Latin America.

Western governments and media had consistently attacked BRI as China's economic colonialism, yet the G7 Summit 2021 announced that they would compete with BRI by supporting the development of infrastructure in the developing countries. Thus, they acknowledge that BRI is a great success and worthy of their imitating. Indeed, imitation is the sincerest form of flattery!

I believe their initiative is but empty propaganda as the infrastructure assets in the developed countries of US and UK themselves are badly in need of repair and renovation. Both countries have for several decades depleted their primary industry and secondary manufacturing industry in favour of investment in tertiary services sector especially financial services. They will not be able to enhance their infrastructure assets at home without involving China as China controls the supply chain of essential components of infrastructure construction.

Nothing symbolizes BRI better than the China-Europe freight rail service, replacing camels by trains. Since the first China-Europe freight train left southwest China's Chongqing in March 2011 much to the ridicule of the West, the service has reached more than 160 cities in 22 European countries. The China-Europe freight-train service has recorded more than 40,000 trips, with the transported goods valued at over 200 billion U.S. dollars. The trains made 12,406 trips in 2020. With the COVID-19 pandemic impeding sea and air transport, the China-Europe freight-train service has emerged as a reliable and economical choice in global logistics. It has truly been the lifeline for the landlocked nations of Central Asia, Eastern Europe and even Western Europe

In ASEAN, the Pan Asian Railway project originally proposed by Malaysian Prime Minister Mahathir Mohamad has been given a great boost by the completion of the 1000km China-Laos high speed railway project in 2021. Through the existing Laos- Thailand-Malaysia-Singapore rail network, China goods are reaching ASEAN countries with lower cost and higher speed.

6.0 Engineers at the Helm of Government in China

All the impressive infrastructure in China and the developing countries mentioned above have been built by human beings commonly known as engineers. China's spectacular development success has been underpinned by her graduating more than a million engineers and technologists a year from some 2900 universities and colleges. China has also been sending hundreds of thousands of her students to study overseas in developed countries, most of them learning science and engineering from the West. China also has the financial wherewithal to fund capital intensive infrastructure projects.

What is less known but very important is the fact that the top leaders of China in the past three decades have been engineers like President Jiang Zemin (江泽民), President Hu Jintao (胡锦涛), Premier Li Peng (李鹏), Premier Zhu Rongji (朱镕基) and Premier Wen Jiabao (温家宝).

Before 1998, all seven members of the top Politburo of the Communist Party of China Standing Committee were engineers. Of the nine members from 1998-2003, seven were engineers. Their successors in the Politburo 2003-2012 were predominantly engineers. President Xi Jinping is a chemical engineer. This is unique in the world. I believe their engineering education and practice have guided the spectacular development of China.

Engineers work in teams and engineering projects require engineers to work closely with fellow professionals like economists, financial experts, natural and social scientists. They must interact closely with government and civil society. Engineers must be prudent and pragmatic as the practice of engineering impacts life and property. Time spans of engineering projects are measured in years and decades. Engineers must be experts in long term planning and risk management.

Solutions to the major global challenges of poverty eradication and climate change require multidisciplinary collaboration and longterm multilateral comitment of all nations and peoples on earth.

Engineering education is thus ideal in developing the necessary multifaceted human talent in the current high speed engineering and technology development that is spurred on by digital technologies.

7.0 China's White Paper on "Youth of China in the New Era."

The State Council of China on 21 April 2022 published a white paper titled "Youth of China in the New Era."

My own takeaway from the White Paper: In the digital age, young people need to be "slash" people with multiple titles, jobs, and ways of working and living. They should be as proud to be E-sports players, live-streaming hosts, and web writers, as parcel and food couriers.

In fact, China has been vigorously promoting TVET, technical and vocational education and training as the digital age will require massive number of technologists and technicians. China is at great pains to afford them social recognition by accreditation of their education qualification and numerous model worker awards as per the Chinese saying "every occupation has its champion" (行行出状元).

I would urge all who are engaged in university education, especially in South countries to emulate the educational policy and practice of China, especially in engineering education. In social and community service programs of Chinese universities, university teams of different disciplines work together and work with the communities to help solve the social and economic problems of the communities. University undergraduates, graduates and faculty staff thus learn to develop their soft skills of effective communication that is so important in the current digital age. Above all, university education in China has a world view that inculcates in the young that the world is indeed their global village!

8.0 Employment Opportunities for University Graduates in the Digital Age

I am convinced that the employment opportunities of university graduates in the digital age remain very bright, especially in engineering.

We in the developing world must assure that there is balanced development in the traditional primary industry sector of agriculture and mineral extraction, the secondary industry sectors of manufacturing and industrialisation as well as the increasingly important tertiary services sector. We must not go overboard in digital technologies. With such all round social and economic development, the future of jobs for university graduates will be guaranteed whatever study courses they pursue.

Thank You

dlyeec@gmail.com