Thailand 4.0 and the Future of Work in the Kingdom

29 March 2017

By Will Baxter[1]
Freelance journalist

A background article based on interviews with Thai businesses, industry leaders, researchers and national stakeholders

Introduction

In Thailand and across the globe, the nature of work is being transformed by a complex and interconnected set of factors such as technological advancement, unprecedented pace of innovation, demographic shifts, climate change, rising inequality and increasingly fragmented production systems. Rather than allow these trends to further polarize society and lead to greater inequality, countries big and small must proactively address these tectonic changes. These are urgent times and countries at all stages of development must rapidly evolve. In part, the urgency of such issues is why the International Labour Organization (ILO) has launched the Future of Work Centenary Initiative. Under the Initiative, the ILO seeks to foster a greater understanding of the changes we are witnessing and help countries develop effective policy responses that proactively shape the Future of Work.

Worldwide some 600 million new jobs need to be created by the year 2030 just to keep pace with the growth of the working age population.[2] In addition, the roughly 767 million people living in households that survive on less than US$1.90 a day also require better employment opportunities that allow them to lead fuller, more meaningful lives. To meet the decent work targets outlined by the United Nations' 2030 Agenda for Sustainable Development, such jobs will need to be forward-thinking, fully respect fundamental principles and rights at work, and stimulate economies without harming the environment. To help facilitate national dialogues on the future of work,

the ILO has developed a framework based on four "centenary conversations": work and society; decent jobs for all; the organization of work and production; and the governance of work. As ILO Director-General Guy Ryder noted in his report for the 104th Session of the International Labour Conference in 2015, "The ambition is not to mark the ILO's centenary in a purely ceremonial way, but with a process that will help to guide its work for social justice into its second centenary."[3]

To help foster debate on the occasion of Thailand's national dialogue on the Future of Work, this article examines a number of topics including Thailand 4.0, Industry 4.0, and the potential impacts these will have on the Kingdom's workforce. As the Future of Work is so closely intertwined with education in Thailand, this article will also discuss measures to improve Thailand's education model, and by extension, the capabilities of its workers.

Setting the Stage for Thailand 4.0

In the two decades that have passed since the 1997 Asian financial crisis left Thailand reeling, many of the country's leading economics experts, research institutions, industry insiders and policymakers have bemoaned the need to move up the value chain, start innovating more and producing goods and services of higher quality. The Kingdom has made considerable progress in that direction, however production systems in Thailand could use a face-lift with a renewed focus on transition to new technology and innovative ways of doing business.

In order to escape the middle-income trap in which Thailand has long been mired

Thai companies must evolve. That requires upgrading human resources, investing in research and development (R&D), automating manufacturing processes, embracing digitalization and customization, striving to innovate more and moving into more original design manufacturing (ODM) and original brand manufacturing (OBM). Concerted efforts in this direction are important to surge ahead of regional neighbours and to catch up with countries such as Singapore and South Korea.

The good news is that the Kingdom's policymakers recognize the need to propel the country headlong into what has been dubbed "The Fourth Industrial Revolution", or "Industry 4.0". To that end, they have devised "Thailand 4.0", an economic model based on creativity, innovation, new technology and high-level services. The aim of Thailand 4.0 is to metamorphose the Kingdom into a value-based economy by reforming its existing major industry clusters (i.e., automotive, electronics, affluent medical and wellness tourism, food, agriculture and biotechnology) and scaling up the development of new sectors such as robotics, digital industry, aviation and logistics, biofuels and biochemical, as well as further solidifying Thailand as a major regional medical hub.[4]

The nature of work is being transformed by technological advancement, demographic shifts, and fragmented production systems. Countries big and small must proactively address these tectonic changes.

The Thai government is also devising a 20-Year National Strategy intended to help the country achieve sustainable development. Referred to as the "6-6-4 plan", it consists of six target areas, six primary strategies and four support strategies. The six target areas include security, competitiveness enhancement, human resource development, social equality, green growth and public sector development. The six primary strategies seek to enhance and develop the potential of human capital; ensure justice and reduce social disparities; strengthen the economy and enhance competitiveness on a sustainable basis; promote green growth for sustainable development; bring about national stability to foster national development, prosperity and sustainability; and enhance the efficiency of public sector management and promote good governance. The four supporting strategies then focus on development of infrastructure and logistics systems; improving science, technology, research and innovation; development of urban, regional and economic zones; and promoting international cooperation toward sustainable development.[5]

The aim of these government efforts is to revive GDP growth, which for the last decade has been less impressive (3.3 per cent between 2005 and 2015) than regional neighbours. Thailand's shrinking labour pool presents yet another challenge. The Kingdom's birthrate has fallen dramatically and it is also the third-most rapidly ageing society in the world, making it one of the middle-income countries facing the dual challenge of a shrinking labour pool coupled with a greying population. By 2040, Thailand's aging population is set to increase to 17 million, meaning that one out of every four Thais will be a senior citizen. As the authors of ILO's issue note, *The Future of Labour Supply: Demographics, Migration, Unpaid Work,* observed: "This demographic shift poses a range of policy challenges for which there are no easy answers."[6]

Given these challenges, the key to Thailand 4.0's success lies in improving human resources by drastically reforming and improving the education system while also creating new, dynamic education systems designed to produce specific workers for specific roles; encouraging creativity, innovation, critical thinking, entrepreneurship, sustainability and inclusiveness; ramping up digitalization and automation; and putting into place the necessary infrastructure demanded by these advancements. Another area to address is the lack of adequate protections for informal and migrant workers, which will require that unsustainable employment practices and rights abuses come to an end. As Thailand has among the highest income inequality in Asia, reducing the gaps

between socioeconomically advantaged and disadvantaged groups will also be crucial if the Kingdom is to leave no one behind on its path to become a high-income country.

Thailand 4.0 and its objectives are commendable, but achieving them is going to be difficult. To compound matters, Thailand's competitive edge over comparable economies has dulled in recent years due in large part to rising overheads, policy discontinuities and political turmoil. Countries with better talent pools and higher productivity are grabbing a growing share of manufacturing investments. Such losses are significant given that the manufacturing sector accounts for over 30 per cent of Thailand's US$395 billion GDP and employs 6.2 million people.[7] Thailand's Doing Business ranking has also slipped in recent years, falling from a rank of 18 in 2014 (out of 175 countries) to 46 in 2017 (out of 190 countries), according to the World Bank.[8] In the 2016–2017 Global Competitiveness Report published by the World Economic Forum, Thailand was ranked 34th among 138 nations, which is remarkable for a non-OECD country.[9] However, in key areas like innovation, technological readiness, infrastructure, institutions, as well as higher education and training, Thailand has experienced a sharp decline in its performance from a decade earlier.

The difficult question going forward is this: can Thailand take concerted measures to reform its production systems, overhaul education and improve the capabilities and talent of its workforce? To take full advantage of the opportunities presented by new technology and innovation, the Kingdom will need to put in place right set of policies, leveraging public-private partnerships to achieve the goal of Thailand 4.0. Most importantly, the success of Thailand 4.0 and the Government's 20-year strategy will be paramount in ensuring productive employment and decent work for all – Goal 8 of the Sustainable Development Agenda.

Embracing Industry 4.0

Industry 4.0 and the degree to which it is embraced in Thailand will transform the nature of business and jobs in the coming years. In a November 2016 article in the German-Thai Chamber of Commerce's *Update Magazine,* SAP IndoChina Managing

Director Liher Urbiza Sierra wrote: "When compared to previous industrial revolutions, the fourth is disrupting almost every industry in every country, including Thailand."[10] These disruptions should spur Thai companies to become more nimble and malleable as they adjust to a brave new digitally connected world. "For manufacturers in Thailand and around the world, the revolution requires new approaches to nearly every facet of their business. From internal processes to customer relations, new business models can and must be imagined," Sierra wrote.

This Industry 4.0 revolution is being driven by several core factors. The first is hyper-connected products, or the Internet of Things (IoT), which are products and tools capable of "talking" to each other as they collect, store and share data. The second driver is supercomputing, or "Big Data", which provides major analytics tools that store and interpret massive amounts of information. Smart technology encompassing robotics, artificial intelligence (AI), simulation, augmented reality and 3D printing is the third driver, while cyber security and cloud computing make up the remaining two.

The age of single-function standalone products is fast ending. In the not-too-distant future, essentially every "thing" will be connected to the Internet. That includes consumer electronic devices, vehicles, home appliances, door locks, medical devices, clothes, groceries, sports equipment and more. This ultra-connectedness will encompass not just physical products, but also online products and services which are increasingly being incorporated into networked platforms to create integrated cyber-physical systems of hardware, web-based applications and human services.

In manufacturing, this offers huge benefits. For example, networked platforms create space for a complete rethinking of a company's innovation cycle. By meshing its value chain and sharing data with suppliers, vendors and customers, a company can now gather greater insight and then adjust accordingly. In addition, digitalization makes it possible to find out in minutes if alterations to products or processes are necessary in order to deliver a desired outcome, as well as how quickly and at what price these changes can be made. Then once an order is placed, digitalization allows it to be immediately executed at minimal

cost with an automatic trigger. This leads to higher efficiency, shorter time-to-market and greater adaptability.

Dr. Singh Intrachooto, head of the Creative Center for Eco-design (and the founder of Scrap Lab) in the Faculty of Architecture at Kasetsart University, said that already, at least on a modest scale, "new technologies and digital applications are impacting most Thai industries and our labour market on many fronts". These advancements allow Thai manufacturers "to monitor and work collaboratively over long distances", to collect data, and analyse production processes and output. "This in fact helps improve product traceability and accountability over the supply chain, especially in the agriculture sector," Dr. Singh said.

However, in terms of broader implementation of automation and digitalization, Thai industry to date has unfortunately leaned more heavily toward inertia rather than initiative. "As we know, in the world community Thailand lags behind in our application of technology in our work processes. Innovation is also still lacking," said Dr. Katiya Greigarn, chairman of the Institute of Research Development and Innovation for Industry at the Federation of Thai Industries (FTI). Thai companies, he said, tend to "disregard automation" if they still have significant capacity such as a surplus of machinery, adequate supply of cheap manpower, etc.

"Thai business owners are in a comfort zone and they do not feel that they need to compete or develop," reasoned Sarit Chokchainirand, an executive director at PYI Consulting. "Many of the companies still use the machines they bought 30 to 40 years ago for their production line." This cautious approach might seem like a prudent calculation to protect against financial risk and eek out more capacity from machinery investments, but it's actually rather self-defeating in today's Innovate-Or-Die manufacturing environment. While it's true that automation can come with a steep initial price tag and also lead to the loss of a percentage of jobs, in the case of Thailand, a far more likely scenario is that an across-the-board failure to automate and innovate will be the death of many Thai companies and, as a result, be the catalyst for massive job losses in manufacturing.

Industry 4.0 and the degree to which it is embraced in Thailand will transform businesses and jobs in the coming years.

Across a wide range of industries, sentiments are that Thai businesses and decision-makers need to be more open when it comes to investment in R&D, digitalization and innovation. On the occasion of the "Solution Summit 2017" held under the theme of "Digital Transformation in Action," Orapong Thien-Ngern, General Manager of Microsoft (Thailand) Limited, said, "While digital transformation has been widely discussed and highly regarded as important among experts and businesses today, the reality is that the actual transformation process is not happening quickly enough." Orapong added: "Organizations today should anticipate the major changes to come instead of simply adapting to current trends for survival. They have to question the way they are currently doing business and gather data for in-depth analysis to seek out new perspectives that drive decisions and strategies."[11]

Sound advice. If Thai companies were to heed these words and evolve in a timely manner then they'd be well positioned to exploit the region's growing connectivity due to the country's solid physical infrastructure and its geographic location in the heart of Southeast Asia.

"Thailand has a special role in ASEAN," said Martin Wenzel CEO Thailand/Malaysia at KUKA Robotics (Thailand) Ltd. While it cannot yet compete with Singapore and Malaysia in terms of high-level value-added services, lesser developed countries like Cambodia and Myanmar still have a long way to go before catching up. If Thailand automates, embraces digitalization and ramps up R&D it can maintain its position as the region's top manufacturing hub. "If they make all those changes they will be ahead of Indonesia and the Philippines,"

Wenzel said. However there is another, faster evolving economy also vying for ASEAN-based business.

"There is only one real threat against Thailand and that is Viet Nam," Wenzel said, cautioning that if Viet Nam is quicker to fully automate and move into R&D and IT, then it could overtake Thailand as the region's go-to manufacturing destination. Due to the decision-making autonomy of its socialist government, Viet Nam is also better placed than Thailand to implement "very strong industry policy", Wenzel pointed out, adding that Viet Nam is beginning to establish a significant edge over countries at a similar development level in computer sciences and the quality of IT engineers.

Dueling Digital Hubs

Like Thailand, Viet Nam's government is pushing for it to become a major player in the digital economy and has launched an ambitious Silicon Valley Project, which has drawn significant international attention from tech giants and investors. Viet Nam's government has also established a US$45 million startup fund.

For its part, the Thai government has announced that building digital communities, establishing digital parks for SMEs and creating digital innovative startup networks are its three major digital initiatives for this year. Hoping to attract some of the digital economy heavyweights, the Government is also planning to eventually open Digital Park Thailand and offer tech companies incentives such as tax breaks, unlimited bandwidth, and submarine cables to Europe and China's "One Belt, One Road" project.[12] Last year, the Thai government also established a US$570-million venture fund for the development of a startup ecosystem. The goal of all of this is to spur IoT research, aviation collaboration, e-commerce, e-payments, as well as the development of encryption technologies and hardware and software solutions.

In addition, a Thai branch of Silicon Valley's 500 Startups, 500 TukTuks, is also now managing a multi-million dollar fund to groom Thailand-based startups. "One of the main things missing in Thailand's startup scene previously was funding," Krating Poonpol, a venture partner at 500 TukTuks,

told BK Magazine in August 2016. "Things are looking up now," he said.[13]

While these are positive developments, the difference between Thailand and Viet Nam is that the latter is more likely to be able to staff such a hub given its improving talent pool. One indicator is Viet Nam's performance in the 2015 Programme for International Student Assessment (PISA), in which it placed 8th in science and 22nd in mathematics (Thailand came it at 54th in both science and mathematics).[14] While this is just one measure, Viet Nam's startup ecosystem has also proven its ability to spawn successful startups like the Flappy Bird game app, e-wallet MoMo, as well as VNG (a gaming, media and communications company that is already rumored to have a "unicorn" valuation, meaning a startup valued at more than US$1 billion). Major tech players and funders have taken note of these achievements, with tens of millions of dollars in venture funding flowing in from numerous sources. Google has also pledged to train 1,400 local IT engineers in Viet Nam, with the tech giant's Chief Executive Sundar Pichai saying that Viet Nam "will easily be in the top 10 countries for many companies and people who are building products" in the coming years.[15]

At least in the short term, on a large scale, it will be more difficult for Thailand to become a major Digital Hub and attract significant numbers of pioneering tech companies and startups to settle it because Thailand lacks the skilled domestic workforce needed in this arena, said PIY Consulting's Sarit, adding that the current education system and learning environment do not allow young people to prosper in this discipline. "You can see a lot of bright young kids in this sector [who are] not willing to work in Thailand, and choose to stay and work abroad. And if we have high-level technicians or engineers, they always focus on product development rather than understanding markets or trying to commercialize products," Sarit said.

IT skills notwithstanding, Thai graduates also struggle to master the common non-programming language of Digital Hubs: English.[16] Even sites dedicated to promoting the Thai startup scene like www.digitalthailand.in.th lack English language content, despite the fact that its navigation is in English. As one anonymous tech source pointed out, "if it is difficult to

find staff who are English-speaking, then I think a Digital Hub is very difficult to set up because a Digital Hub is for multinational staff. Most of the technical people in Thailand do not have a full command of English, and therefore, I doubt that the Digital Hub will be ready in a few years' time. In terms of infrastructure alone it takes longer than two or three years."

Promoting R&D and Collaborative Partnerships

In general, the collective belief among foreign investors and firms operating in Thailand has long been that to actually promote substantial R&D activity, Thailand needed to do more than just offer tax breaks and duty exemptions on imported equipment. For starters, there needs to be dedicated R&D funding, and an environment where public-private partnerships can flourish.

Typically only the biggest players in Thai industry have been willing to assume the financial risk to invest in R&D and innovation. Thailand's dearth of qualified researchers has not helped matters. For years the country has struggled to pair its limited number of researchers with companies that can fund their work and help them hone in on areas that benefit Thai industry. There's no question about the potential financial benefits such pairings can engender. New World Bank data from a sampling of 66

countries shows that the average return on an R&D investment is 168 per cent. But when you look at countries with below US$12,000 GDP per capita, that return on investment skyrockets to 333 per cent.

The good news is that companies interested in R&D, including Small and Medium-sized Enterprises (SMEs), are starting to get the support they need. In February of this year, the government passed the National Competitive Enhancement Act for Targeted Industries (2017), which aims to enhance Thailand's competitiveness within the Thailand 4.0 core industry clusters by waiving a company's corporate income taxes for up to 15 years and offering a subsidy of 10 billion baht to cover investment expenses for R&D and innovation.[17]

Meanwhile, the Ministry of Science and Technology recently set up Talent Mobility, a programme that is designed to foster cooperation between the private sector and top university research programmes and public research institutes in Thailand.[18] The aim of the programme is to encourage the development of applications for new technology in order to improve efficiency, productivity, and R&D capabilities. FTI's Dr. Katiya said Talent Mobility had already proven beneficial at helping to match research projects to the needs of major private sector corporations and SMEs. In 2016, around 50 companies lent support to some 70 projects, he said.

There needs to be dedicated R&D funding and an environment where public-private partnerships can flourish.

Thailand's National Innovation Agency (NIA) has also collaborated with FIT to launch Innovation Coupon, which focuses on stimulating the development of innovative projects at SMEs.[19] The initiative provides SMEs with a 100,000-baht coupon to cover the cost of a feasibility study for their intended project, which, if all goes well, qualifies them for an additional 400,000-baht coupon to support implementation of the project. Coupons can be used for the assessment of new technology; early stage R&D and prototyping; adoption and

development of new products, processing technology, applications, practices, and/or operations; upgrading of existing products, processing technology, applications, practices, and/or operations. NIA's goal is to support more than 200 projects per year. This is a good start. But as Thailand's 2.9 million SMEs account for a large share of enterprises in the Kingdom and contribute around 40 per cent to the country's GDP, far more should be done to provide them with the support they need to make their ideas a reality.

In addition to facilitating R&D, public-private partnerships can also prove invaluable in terms of preparing future workers for high-tech industry. KUKA Robotics' Martin Wenzel said that Thai companies offering solutions in automation and robotics should "collaborate with education institutions, ranging from vocational schools to universities, in the transfer of robot technology know-how in order to prepare the workforce for the transition to automation".[20]

One programme that is already taking advantage of such partnerships is the Institute of Field Robotics (FIBO) at King Mongkut's University of Technology Thonburi (KMUTT).[21] Dr. Supachai Vongbunyong, a lecturer and assistant director of research and international affairs at FIBO, said his team is currently collaborating with a number of companies big and small on a broad scope of projects such as robotics-related product R&D, industrial automation, the application of industrial robots in production lines and logistics. The education aspect of KMUTT's robotics programme is structured around four key pillars — Social responsibility, Integrative thinking, Life-long learning, and Knowledge), or "SILK".

"The programme is designed based on learning outcomes that reflect the expected qualifications of our graduates," Dr. Supachai said. "Project-based learning is one of the key mechanisms to prepare our students to be able to handle real world problems." When students get hands-on experience working on actual R&D and application projects, "theory and practice can be connected seamlessly", Dr. Supachai said. The result is that FIBO is able to produce graduates who are able to continuously adapt, develop new skills and think systematically which is "crucial" if they want to be competitive in their field, he said.

Reimagining work: An Industry Perspective

So, how will all of this impact those already in Thailand's workforce? Just as previous industrial revolutions have led to the phasing out of certain types of occupations, so too will the current one reshape the jobs we do. Much like the industries in which they work, with a proliferation of new technology Thais will have to "adapt to new ways of working" and face head-on the challenge of "learning new methodologies and working processes", PYI Consulting's Sarit said. In short, they have to take it upon themselves to acquire the necessary new skills to remain relevant in an increasingly competitive job market. Such workers will need to be multidisciplinary, self-reliant and able to adapt quickly to new technology and the trends it drives.

As automation and the use of robots expand and more lights-out factories become the norm, a certain level of organic job loss will occur. ASEAN countries may be at particular risk. According to ILO's report, *ASEAN in Transformation: The Future of Jobs at Risk of Automation,* about three in five jobs in ASEAN countries face "a high risk of automation". The report also noted that in Thailand, the automation risks are notably acute for almost one million shop sales assistants, 624,000 food service counter attendants, 606,000 cooks and more than 800,000 combined office clerks and accounting associate professionals.[22]

"We can see that labour has [already] been hurt in many sectors that can replace humans with machines," Sarit said, adding that this includes the automotive and electronics sectors. In both, the demand for lower-skilled labour has waned in recent years. Likewise, due to factors such as age, socioeconomic status and education level, a percentage of workers will be unable to acquire the skills necessary to remain employable in the manufacturing industry.

Unable to find work, many of these individuals will shift to the "agricultural and informal service sector or be jobless", said Supanutt Sasiwuttiwat, a senior researcher at Thailand Development Research Institute (TDRI). "I think it is hard for the old workers to be re-trained as they have weak technical skills," he added. But even Thai farmers, known as the "backbone of the nation", are at risk of being replaced by drones and sensors designed for Precise Farming. That's daunting given that the agriculture sector employs as much as 40 per cent of Thailand's workforce. Dr. Katiya said it was likely that only young farmers, next generation farmers and large companies would be capable of learning and utilizing new farming technology.

One foreign manufacturing executive who wished to remain anonymous explained that, in his view, it is possible to upgrade some

medium-level workers that perform hands-on factory roles into "isolated IT workers" who perform low-level programming and do not work in a multidisciplinary manner, but unskilled workers are less likely to possess the capacity to upgrade their skills sufficiently. He believed that those living in urban centres like Chiang Mai, Phuket, Pattaya, Bangkok and Ayutthaya stand the best chance of upgrading their skills due to higher average incomes and the availability of training.

Another manufacturing industry insider whose factory is already automating said that even though their capacity has more than doubled in the last two years, their number of staff has remained constant. Upgrading lower-level workers would be a hard decision for a company to commit to, he suggested. "If someone has been to a technical college or a university, you're able to upgrade their skills somewhat. But those who haven't, and the ones who are on the factory floor who've had no formal training will require major re-skilling efforts," he said. "Even if they are really reliable, they will hit a very low ceiling. People with a technical qualification will have a higher ceiling, but they will never get to the level of an engineer."

However, for those with proper training and advanced skills, Industry 4.0 and Thailand 4.0 will offer a breadth of opportunities. Gone are the days when one worker focused on completing a single task over and over, with the workers on either side of him/her also performing a single function. As the authors of ILO's issue note, *Technological Changes and Work in the Future: Making Technology Work for All,* observed: "Many of the emerging mobile robots will not replace humans, but will augment their cognitive, collaborative and physical capabilities. Workers will increasingly focus on those tasks that cannot be performed by computers and as a result, jobs will become more complex. Collaborative worker-machine interaction requires a higher level of autonomy of operators and designers, shifting focus from rule-following to value-finding."[23]

Through the National Competitive Enhancement Act for Targeted Industries (2017) and Talent Mobility programme, companies interested in R&D are now getting the support they need.

Likewise, the same process innovations that supplant human workers will at the same time create demand for individuals capable of developing, designing, building, maintaining and repairing a new generation of robots and smart machines. It will also generate jobs in the construction and maintenance of infrastructure to support the demands of higher tech industry. A slew of new occupations will be born of this revolution, such as big data architects and analysts, cloud services specialists, software developers and digital marketing professionals. In Thailand, experts who understand the aspects of both manufacturing and IT — and can drive forward a synthesis of the two — will be in high demand.

As KMUTT's Dr. Supachai Vongbunyong points out, "a lot of companies have been considering implementing robots and automation in their production systems in order to improve performance and help resolve issues regarding the skilled worker shortage." Previously, only large companies considered using robots to improve productivity, but nowadays it has become more cost effective for SMEs to do so as well. "Therefore, an increase in this demand can be a great opportunity for System Integrators and robot and automation producers who can be considered the key players in this transformation," said Dr. Supachai. At the moment, though, the number of System Integrators in Thailand is still just a fraction of what is needed and this could prove detrimental as Thai companies struggle to automate.

Unable to generate enough graduates with adequate skill levels from Thai universities and vocational schools, several private firms have taken the initiative to establish their own education institutions. In 2013, PTT founded the Kamnoetvidya Science Academy (KVIS), a boarding school for

gifted high school mathematics and science students. Classes, which are capped at 18, are conducted primarily in English while the curriculum is structured around hands-on laboratory exercises that build upon lecture material. Each student must also finish a research project, complete with mini-thesis, before graduating. In 2015, PTT also founded the Vidyasirimedhi Institute, a higher education facility that aims at fostering innovation, and science and technology research.

"Of course [Industry 4.0] will challenge the labour market, but by investing in qualifications and innovations you can avoid that kind of negative impact," said Ralf Opierzynski, head of the Bangkok office of Fraunhofer Institute for Factory Operation and Automation (IFF), a German applied research firm which has been operating in Thailand since 2008. "Industry 4.0 offers a lot of new business opportunities too, so actually for the labour market in general, if you have the right people with an adequate qualification, if you are motivated, if you are investing in innovation, then the market can even grow."

These sentiments were echoed by FTI's Dr. Katiya. "If you automate now, people will not lose jobs," he said. But if Thai industry does not automate, if they continue to delay, factories will start to go out of business soon. "I would say in 3 to 5 years. Gone. If you don't automate, and you compete with China, you will be gone. It means more people will be out of jobs."

Thailand's five-year 12th National Economic and Social Development Plan (2017-2021) is focused on helping steward the Kingdom toward achieving sustainable development. Yet numerous groups, including informal workers and migrants, do not receive adequate protection and are at risk of exploitation as industry evolves. Indeed, workers in Thailand's informal sector who do not fully receive social security or welfare benefits can easily end up exposed to unregulated employment practices and face risks in terms of wage protection issues, particularly in rural provinces. Foreign migrant workers enjoy even fewer rights. Guaranteeing adequate protections for Thais as well as guest workers is essential if the country is to achieve sustainable development as it implements Thailand 4.0.

Reforming Education

To begin producing vast numbers of graduates with the ability and know-how to thrive in high-tech industries and multinational working environments, major reforms must be carried out in Thailand's education system. Of course, everyone in Thailand already knows this. The tricky question has always been: How? Unfortunately, solving that conundrum isn't the only hurdle. In addition to structural and policy reforms, a drastic transformation in how Thais perceive and place value on education must also occur. If these two phenomena cannot take place in a cohesive, timely manner, the Kingdom will have a difficult time shucking the perception that its workforce is simply not competent enough for an increasingly competitive, knowledge-based global economy.

Perpetuating the image of an unprepared Thailand is that in a variety of international rankings its students regularly turn in subpar performances in indispensable subjects such as science, mathematics and English. In the 2016–2017 Global Competitiveness Report by World Economic Forum, Thailand's primary education ranked seventh and its higher education fourth out of the nine ASEAN countries included in the survey. As stated earlier, the latest rankings of the Programme for International Student Assessment (PISA) does not put the Kingdom in good light. Time and again, when asked about this topic, everyone from manufacturing executives to educationalists to economists expressed a similar view: Thailand's workers fall short when it comes to critical thinking, autonomy, creativity, innovation, science, mathematics, engineering, technical literacy, English, and working in a multidisciplinary manner.

Consolidating Schools

There's something to be said for getting the basic structure of the education system in better order before proceeding with other reforms. To that end, the World Bank's Dilaka Lathapipat believes that the most important changes needed are actually to consolidate the number of schools, equip centrally located hub schools (or "magnet schools") with adequate resources and facilities, and "get enough properly trained teachers in front of the classrooms".

About 64 per cent of Thai primary schools are "critically short" of teachers, which is defined as having, on average, less than one teacher per classroom, according the World Bank.[24] The result is that teachers in understaffed schools end up overloaded, often teaching multiple subjects across multiple grades and therefore unable to create proper lesson plans or deliver quality lessons. "You can talk about giving schools more autonomy as much as you like, but as long as one teacher has to run around to Grade 7 to teach all subjects then whatever autonomy a school has is not going to yield a lot of benefit," Dilaka said.

While Dilaka noted that almost all Thai schools have a shortage of teachers, "the differences between advantaged and disadvantaged schools are huge". According to the World Bank's research, the number of teachers per classroom "is the main factor — the most important factor — that pulls down education equality." The potential positive ramifications of rectifying this imbalance are really quite simple. Placing more teachers in disadvantaged schools means these schools will produce better-educated graduates who are more likely to excel in the workforce or tertiary education, and are also more likely to be successful at taking advantage of opportunities they encounter along the way.

A look at the data shows that if the number of schools is consolidated from 31,193 to 15,854 schools, then only 400,000 teachers would be needed to increase the teacher-per-class ratio from 1.15 now to 1.38 following consolidation (with 404,000 teachers, Thailand already has enough). That would represent a significant step toward ensuring that specialized teachers are spread more evenly. Conversely, if Thailand were to staff up so that it can allocate enough specialized teachers to each existing classroom, it would require 27 per cent more teachers (around 108,000 people). Because of Thailand's low birth rate, in the coming years there will be around 1.2 million fewer students in Thai schools.

While there certainly needs to be more emphasis on teacher training and professional development, some of the qualitative changes required to transform Thailand's teaching force could occur organically. In the next five to ten years, more than 200,000 public school teachers are expected to retire, creating room for an influx of younger talent. "Because the teacher salary went up so much (minimum starting salary is 15,050 baht for a teacher with a bachelor's degree), now we are getting more, better qualified students entering the teaching programmes in universities," said Dilaka. "So there's a good chance that we will get new generation teachers who are better trained" to replace those who are retiring.

Of course Industry 4.0 will challenge the labour market, but by investing in qualifications and innovations, you can avoid that kind of negative impact.

Attracting bright young minds to be teachers is one thing. Keeping them is another. To do that, TDRI's Supanutt said teachers should be given incentives to improve their students' learning progress and that schools should eliminate the massive amount of unnecessary paperwork teachers are saddled with. "Teachers, even ambitious and hard-working ones, are not given the time and space to improve their teaching skills," he wrote in his 2014 paper, *Don't miss the chance to reform education*.[25] Meanwhile, under the current system, "as civil servants or karachakan-kru some teachers who make no attempt to improve their teaching skills and student performance would hardly ever

have their employment terminated". "We think performance-based contracts should be put in place for all new teachers", said Supanutt, adding that new hires should be allocated to understaffed schools.

English proficiency is the other elephant in the classroom. Thailand ranked 56 out of 72 countries in the latest EF English Language Proficiency Index.[26] Throughout the education system, there remains an over emphasis on English grammar in lieu of progress on improving conversation, comprehension and overall communication skills. A significant improvement in the English language capabilities of Thailand's

graduates would not only make Thailand a more attractive destination for foreign firms, but would also boost the prospects and performance of Thais who pursue degrees abroad. It would also allow learners to access resources not available in Thai. However, a marked improvement in this particular skill is likely to remain elusive without more student contact hours with fluent or native English-speaking instructors.

Thailand has proven itself quite adept at creating moving, influential public service campaigns that address issues like poverty, health care costs, cancer, and smoking. Similar campaigns aimed at encouraging young Thais to learn English would be much welcomed.

Coding and Computational Thinking

A decade from now members of the 2027 graduating class will be applying for jobs that haven't even been invented yet. In most cases, such jobs will require IT skills. That's why numerous tech companies are urging schools to teach programming languages, or coding, as a core part of curricula in primary and secondary school. "We have to lay the groundwork for confidently navigating the digital world at a young age. Young people have to be capable of doing more than just using the apps on their smartphones. They should also know a programming language, because that's the only tool that will allow them to make their ideas reality," Dr. Werner Struth, a member of the Bosch board of management, said in 2015.[27]

According to a 2015 Microsoft survey, three out of four students in Asia Pacific (75 per cent) wish that coding were offered as a core subject in their schools, while 77 per cent said they believe coding will be important to their future careers, and 63 per cent said coding could help them better understand the digital world we live in today. "As our world continues its evolution into one that is mobile-first and cloud-first, it is important for educators in the region to stop asking whether or not to offer coding as a subject — but how it can be integrated into the curriculum as soon as possible," said César Cernuda, President, Microsoft Asia Pacific.[28]

Now, if the idea of Thailand's six-year-olds coding between recess and milk breaks sounds crazy, it shouldn't. Kids today are "Digital Natives" and grasp the functionality of personal devices far quicker than grown-ups in most cases. Plenty of toddlers can work out how to take a selfie and can navigate an interface before they even learn to read. The point being that it is no stretch of the imagination that they could begin learning the basics and establishing a base from which to build upon at a young age. In fact, a growing number of countries are introducing coding as a core part of primary and secondary school curricula. In 2012, Estonia launched a pilot programme to teach coding to all primary and secondary students. Others soon began to follow suit. Today Bulgaria, Cyprus, the Czech Republic, Denmark, Finland, Greece, Ireland, Italy, Lithuania, Poland, Portugal and the United Kingdom have all incorporated computer programming into their curricula. Closer to home the likes of Australia, Malaysia and Singapore are also introducing coding in primary and secondary education.

Thai farmers, known as the "backbone of the nation", are at risk of being replaced by drones and sensors. The next generation of farmers will need to learn how to utilize new farming technology.

The UK offers an interesting case study. Much like in Thailand, tech companies in the UK have long complained that the country is not producing enough qualified graduates. So, in 2014, the UK launched an ambitious new curriculum with mandatory computer science classes for all children between the ages of five and 16. For such an ambitious initiative to have any chance of success, public-private partnerships are essential, as is providing teachers with the training and skills they need. For example, a

great resource for educators unfamiliar with the UK's new computing curriculum is the Computing at School QuickStart Computing website, which offers Continued Professional Development (CPD) materials and advice designed to help primary and secondary teachers plan lessons and execute the new curriculum. From the private sector, both Google and Microsoft played key roles in helping to launch teacher-training initiatives in the UK.

Thailand, too, could start by trying to tap a major tech company to help it develop the curriculum for a coding pilot programme in primary and secondary schools. It could also seek to partner with a smaller organization, and the investment need not be prohibitively expensive.

Furthering the Debate

Thailand is at a critical point in its journey toward high-income status, and must evolve quickly if it is to shrink the gaps between it and the likes of Singapore, South Korea and Taiwan. For starters automation, digitalization, innovation and R&D can no longer be viewed as financial burdens and unnecessary risks, but rather, must be embraced across numerous sectors as the way forward. Consolidating schools and equipping hub schools with the necessary teachers and resources is also likely the smartest, most direct way to help reduce inequalities in education. Down the road, introducing computer programming as a core part of school curricula will also help Thailand improve its IT workforce. Many of the challenges, opportunities and trends touched upon in this article are already hot-button issues in Thailand. But as the national conversation about Industry 4.0, education reform and the Future of Work continues to unfold here, below are policy

relevant questions that may help facilitate a constructive debate:

- What are new potential sources of job creation and what policies could be implemented to help expedite job creation in these areas? How can Thailand work to ensure that changes to its economic model do not exacerbate its already high levels of income and wealth inequality, as well as expanding social protection coverage and improving working conditions?

- How can the skills of workers be upgraded to meet the demands of Industry 4.0? Of those workers who are unable or unwilling to upgrade their skills, what are their future employment options and which sectors are best positioned to employ them?

- What policy reforms and monitoring mechanisms are needed to better protect foreign migrant workers and informal workers in Thailand? What are some ways to help members of Thailand's aging population cultivate new skills and increase their income?

- What new incentives could be effective in persuading Thai companies to invest more in innovation, automation and R&D? What is the best way to foster joint R&D between Thai and international firms, and build mutual confidence among the two?

- How can Thailand further encourage the forming of public-private partnerships? How can companies, universities and researchers work more closely to focus R&D efforts on areas that are of benefit to Thai industry and help tailor tertiary education to produce highly skilled workers?

REFERENCES

1   *The future of work centenary initiative,* by ILO
    http://www.ilo.org/global/topics/future-of-work/WCMS_448448/lang--en/index.htm

2   *Decent work and the 2030 Agenda for Sustainable Development,* by ILO
    http://ilo.org/global/topics/sdg-2030/lang--en/index.htm

3   *Report of the ILO's Director-General: The future of work centenary initiative*
    http://www.ilo.org/ilc/ILCSessions/104/reports/reports-to-the-conference/
    WCMS_369026/lang--en/index.htm

4   "Developing the Country toward Thailand 4.0", by Thailand's Government Public
    Relations Department
    http://thailand.prd.go.th/ewt_news.php?nid=4498&filename=index

5   "Thailand's 20-Year National Strategy and Thailand 4.0 Policy", by Thailand's
    Government Public Relations Department
    http://thailand.prd.go.th/ewt_news.php?nid=3578

6   "The future of labour supply: Demographics, migration, unpaid work", by ILO
    http://www.ilo.org/global/topics/future-of-work/WCMS_534204/lang--en/index.htm

7   *Summary of the labour force survey in Thailand: January 2017,* by the National
    Statistical Office of Thailand
    http://web.nso.go.th/en/survey/data_survey/200260_summary_Jan_2017.pdf

8   Doing Business Report, by the World Bank
    http://www.doingbusiness.org/data/exploreeconomies/thailand

9   Global Competitiveness Report 2016–2017, by World Economic Forum
    http://www3.weforum.org/docs/GCR2016-2017/05FullReport/
    TheGlobalCompetitivenessReport2016-2017_FINAL.pdf

10 *Update Magazine,* by the German-Thai Chamber of Commerce
    https://issuu.com/germanthaichamber/docs/update_q4-2016

11 *Microsoft and business leaders reveal Thailand's path to digital economy era in
    Solution Summit 2017,* by Microsoft
    https://news.microsoft.com/th-th/2017/02/08/solution-summit-2017_en/

12 "Digital Park Thailand is a go", by Disruptive.Asia
    https://disruptive.asia/digital-park-thailand-go-minister/

13 "Why Bangkok is emerging as ASEAN's hub for startup businesses", by BK Magazine
    http://bk.asia-city.com/city-living/news/bangkok-emerging-business-startup-hub

14 2015 Programme for International Student Assessment
    https://www.oecd.org/pisa/pisa-2015-results-in-focus.pdf

15 "Vietnam: The rise of ASEAN's Silicon Valley", by Asian Correspondent
    https://asiancorrespondent.com/2017/02/vietnam-rise-aseans-silicon-valley/

16 2016. Kaur, A., D. Young and R. Kirkpatrick, "English Education Policy in Thailand:
    Why the Poor Results," in English Language Education Policy in Asia, Publisher:
    Springer International Publishing, Editors: Robert Kirkpatrick, pp.345-361

17 "New law to make Thailand more competitive in targeted industries", by the Nation
    http://www.nationmultimedia.com/news/business/EconomyAndTourism/30306346

18 Talent Mobility:
    http://talentmobility.or.th/home/

19 Innovation Coupon:
    http://coupon.nia.or.th

20 *Update Magazine,* by the German-Thai Chamber of Commerce
    https://issuu.com/germanthaichamber/docs/update_q4-2016

21 Institute of Field Robotics at King Mongkut's University of Technology Thonburi
http://fibo.kmutt.ac.th

22 *ASEAN in Transformation: The Future of Jobs at Risk of Automation,* by ILO
http://www.ilo.org/public/english/dialogue/actemp/downloads/publications/2016/asean_in_transf_2016_r2_future.pdf

23 *Technological Changes and Work in the Future: Making Technology Work for All,* by ILO
http://www.ilo.org/global/topics/future-of-work/WCMS_534201/lang--en/index.htm

24 "Thailand's small school challenge and options for quality education", by World Bank
http://blogs.worldbank.org/eastasiapacific/thailand-s-small-school-challenge-and-options-quality-education

25 *Don't miss this chance to reform education,* by Thailand Development Research Institute
http://tdri.or.th/priority-research/dont-miss-this-chance-to-reform-education/

26 EF English Language Proficiency Index:
http://www.ef.co.th/epi/

27 *Bosch board of management member Struth on the IT Summit: Industry 4.0 needs an education offensive*
http://www.bosch-presse.de/pressportal/de/en/bosch-board-of-management-member-struth-on-the-it-summit-industry-4-0-needs-an-education-offensive-43129.html

28 *Three out of four students in Asia Pacific want coding as a core subject in school,* reveals Microsoft study
https://news.microsoft.com/apac/2015/03/23/three-out-of-four-students-in-asia-pacific-want-coding-as-a-core-subject-in-school-reveals-microsoft-study/#sm.01gcl3pf14bsexx10x4236sexh5az#iopMDVM2OCSd0skl.97