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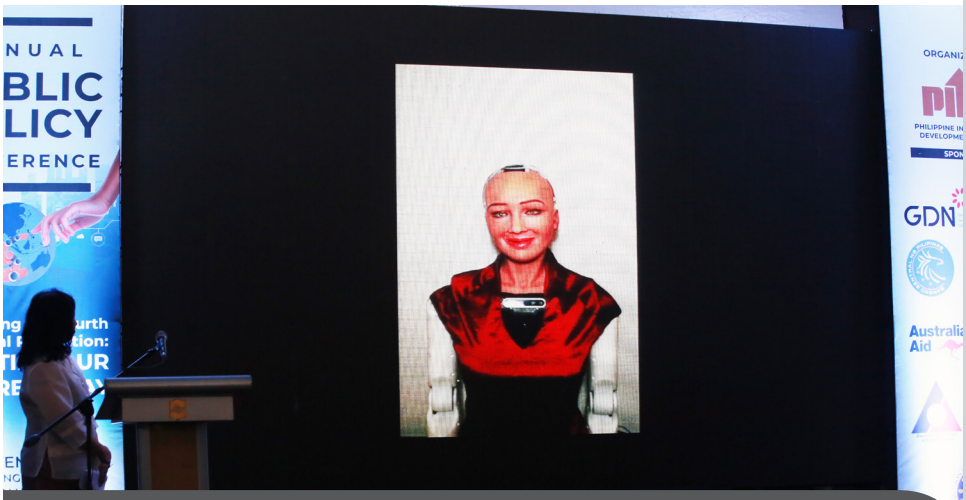
PH urged to be optimistic toward FIRe

ALTHOUGH STILL FAR from being a digital nation, the Philippines must remain optimistic about the Fourth Industrial Revolution (FIRe).

During the fourth Annual Public Policy Conference (APPC) led by the state think tank Philippine Institute for Development Studies (PIDS), PIDS President Celia Reyes revealed that the country may not yet be ready for the changes in production systems that will be brought about by these new technologies.

Citing the *Readiness for the Future of Production Report 2018* of the World Economic Forum, Reyes argued that this is because the country has been exhibiting weak performances in terms of technology and innovation, human capital, and institutional framework, among others.

These issues, however, should not hinder Filipinos from appreciating FIRe, in general, according to Dr. Yasuyuki Sawada, chief economist at the Asian Development Bank



Sophia, a social humanoid robot and United Nations Development Programme's innovation champion, graced the Fourth Annual Public Policy Conference through a video record, encouraging everyone to harness the new technologies to speed up the country's socioeconomic development. (Photo by Henri De Leon/DOST-STII)

Editor's Notes

Industrial revolutions have opened the world to vast opportunities—from the use of steam power in the late 18th century, the emergence of trains and automobiles toward the end of the 19th century and the rise of the mass assembly lines in the early 20th century, to the introduction of digital electronics such as computers, mobile phones, and the internet in the second half of the 20th century. Today, we are transitioning to the Fourth Industrial Revolution (FIRe), which, as experts describe, is the fusion of the physical, digital, and biological worlds that is expected to alter the way we live and work.

In this issue of the *Development Research News* (DRN), we look at what experts say about the prospects, opportunities, and challenges facing the Philippines in the advent of this new industrial era. It summarizes the presentations and insights shared by local and foreign speakers who participated in the events led by the Philippine Institute for Development

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What's Inside

(ADB), and Dr. Stephen Ezell, vice president of the Washington DC-based Information Technology and Innovation Foundation (ITIF), who served as speakers during the APPC.

"Technological advancement drives higher productivity, creates better-paid jobs, and advances economic growth," Sawada explained.

Meanwhile, Ezell highlighted the promise of FIRe technologies, particularly in terms of safety, personal mobility, as well as environmental and economic productivity.

The ITIF official also explained that the emerging technologies, such as artificial intelligence (AI) and robotics, may even help the Philippines boost its annual productivity growth by as much as 1.5 percent, following a 2015 study by the McKinsey Global Institute.

Not all jobs

During his presentation, Sawada dispelled the misconceptions about the impact of FIRe on jobs in the Philippines.

In July 2017, Senator Bam Aquino, chair of the Senate Committee on Science and Technology, expressed alarm over the perceived impact of FIRe technologies, particularly AI, on the employment of Filipinos.

"These systems use AI and are capable of performing the tasks of human employees, putting their livelihood at risk," he said.

"We have to guard against trends that will take jobs away from our people," he added.

However, Sawada explained that FIRe technologies only involve automating specific tasks associated with a job, not the job in its entirety.

He added that only the routinary and manual jobs, particularly those of assembly line workers, sewing machine operators, accountants, and bank tellers, are at risk of being automated.

Meanwhile, the cognitive and nonroutine jobs of researchers and managers and those of cooks and hairdressers are less likely to be automated simply because robots may not be able to perform their "complicated" tasks.

In terms of sectors, Sawada clarified that industrial robots are only concentrated in capital-intensive sectors, such as electrical and automotive sectors, where employment shares are relatively small.

The textile industry, which has one of the highest employment shares, has barely utilized industrial robots, he said.

The ADB chief economist also explained that while some workers may indeed be displaced, FIRe will lead to emergence of new occupations, which are expected to be nonroutine and cognitive in nature.

"We should remain optimistic because new occupations and industries always emerge with new technologies," he clarified.

Specifically, Sawada cited the Asian experience in the past century, where, despite the disruptions of the past revolutions, the Asian economy was able to adjust and create a large number of new jobs.

"In the manufacturing sector alone, 30 million jobs are created annually,

In his talk, Asian Development Bank Chief Economist Yasuyuki Sawada pointed out that, despite the risk of manual job displacement, the Fourth Industrial Revolution will also bring in new jobs that are cognitive and nonroutinary in nature.

According to Jaime Augusto Zobel de Ayala, chair and chief executive officer of Ayala Corporation, the government's technical certification program should be revamped and made responsive to the requirements of future jobs.

which became the foundation of Asian growth," he added.

Wages have also grown more for these jobs, leaving low-skill occupations behind, he said.

Upskill, reskill the workers

To prepare the workers for these new jobs, the government, the private sector, and the academe should work hand in hand to upskill and reskill the workers.

The government, Sawada explained, can contribute mainly in the education and training of the workers and in the crafting of favorable labor regulation, social protection, and tax policies.

Specifically, it must facilitate skills development and job matching, as well as provide the needed public goods and services to support the country's workforce.

Sawada also argued it should invest in infrastructure, advance antitrust and consumer protection, and pursue technology adoption, which are all relevant in the mobility of workers.

Meanwhile, Jaime Augusto Zobel de Ayala, chair and chief executive officer of Ayala Corporation, pointed out the lack of linkages between education and employment, whose gap has continued to widen in recent years.

While it is the role of the academe to equip the students with the needed skills, Zobel de Ayala explained that the industry must find ways to give feedbacks to ensure the quality and responsiveness of education.

He also raised the need for a rebranding of the government's technical certification to ensure that high school graduates can be employed even without a college degree.

"We should give it a new name, and make it responsive to the current needs of emerging industries," he explained, citing the reality in the Philippines, where only few are able to finish college education.

The government, according to Zobel de Ayala, should likewise improve the certification of technical schools to give them a higher standing in the country's educational system.

Nonetheless, he urged both the public and private sectors to be open to accepting high school graduates equipped with technical certificates.

The workers, he said, should likewise be cognizant of the changing needs of the industries and should be comfortable in adopting emerging technologies.

Innovation over precaution

The experts were also in unison that the Philippine government should adopt an innovation principle, not a precautionary principle.

By innovation principle, "it should be the burden of the government and regulators to show that a new technology or a new business model will cause potential harm to society or consumer," Ezell explained.

"The bias should always be for the innovator to let them share their new products and business model to the world," he said.

"Most of our scientists and engineers live here in Asia. The Philippines must seize the opportunity to benefit from the technologies they create," he added.

The ITIF official also urged the government not to introduce barriers to cross-border digital trade, as they may hinder the growth of the emerging markets in the Philippines.

"Our point of view is not that there should be no regulations at all, but we should do a better job in experimenting with regulatory frameworks to support innovation-based industries," he explained.

Zobel de Ayala also urged Filipinos to be comfortable with transformations, arguing that "optimism should be the name of the game."

"Regulation is not necessarily bad. However, it tends to be structured around existing rules and regulations, as well as existing ways of doing things, which can hinder innovation from happening," Zobel de Ayala explained.

"We should overweigh innovation as opposed to precaution to allow us to move forward than stay where we are," he added.

The APPC is the main and culminating activity of the Development Policy Research Month, a nationwide celebration led by PIDS to promote the importance of policy research in the formulation of evidence-based policies, programs, and projects in government. Since 2015, it has gathered experts and researchers in the social sciences to discuss and recommend policies on current and emerging issues that need the attention of policymakers.

This year, the APPC centered on the theme "Harnessing the Fourth Industrial Revolution: Creating Our Future Today". It aimed to promote awareness and understanding of the FIRe and encourage everyone to be proactive in preparing for and adapting to the changes that come along with it. **RGV**

WEF warns: PH unprepared for FIRe

THE FOURTH INDUSTRIAL REVOLUTION (FIRe) is here, but the Philippines is not yet prepared to manage it effectively, the World Economic Forum (WEF) has revealed.

This is particularly true in terms of production, where the country has exhibited low level of readiness as manifested in its weak performances in terms of technology and innovation, human capital, and institutional framework, among others, according to WEF's *Readiness for the Future of Production Report 2018*.

This situation poses threats to the country, as its progress as a developing country depends on its ability to absorb technology. According to WEF, this calls for the need to capitalize on future production opportunities, mitigate risks and challenges, and be resilient and quick in responding to unknown future shocks that may come along with FIRe.

It also urged the Philippines to focus on establishing a solid basic foundation for sustained learning and on accumulating various types of capital, while progressively and systematically closing the existing technological and knowledge gaps.

Poor infra, policy

One of these existing technological gaps is the country's lack of proper information and communications technology infrastructure (ICT), as highlighted by Acting Secretary Eliseo Rio Jr. of the Department of Information and Communications Technology (DICT) during the fourth Annual Public Policy Conference (APPC) led by the state think tank Philippine Institute for Development Studies (PIDS).

In terms of internet speed, for instance, the country still lags behind other Asian countries, based on the *2018 Ookla Speedtest Global Index* report.

Rio explained this may be probably due to the country's low public investments in ICT infrastructure, which is mainly financed by the private sector.

The study of the World Economic Forum calls for reform in the education system to keep up with the Fourth Industrial Revolution, arguing that the presence of technology courses as part of basic education will be beneficial.

Apparently, even the DICT—the national government's arm in advancing the ICT development agenda—is not yet ready for the FIRe, the DICT official admitted.

"The only way for us to be ready for FIRe is to light up our ICT infrastructure," he explained.

"If we go straight to FIRe without the necessary preparations, we might face problems in security and employment," he added.

Aside from the poor infrastructure, the country is also facing issues concerning its policy framework on ICT, which is "barely catching up with the rapid pace of technological growth, and will unlikely catch up in the near future," according to Department of Budget and Management Secretary Benjamin Diokno, in his closing remarks during the APPC.

Improve educ, competition

For Christopher Bernido, president of Central Visayas Institute Foundation and 2010 Ramon Magsaysay awardee for dynamic learning program, the best way to prepare for FIRe is through basic education.

"We must go back to the fundamentals to produce an analytical, critical thinking workforce that will thrive in FIRe," explained Bernido, who also spoke during the APPC.

However, he also recognized the lack of qualified teachers as a looming problem in the Philippine education system.

Meanwhile, in a 2018 study on FIRe, PIDS researchers emphasized the need for the country to be open to international trade and investment, which can help in the rapid transfer of and acquiring technology and innovations from foreign investors and partners.

They also called for the reduction of anticompetition practices, especially in key industries, such as the information and communications technology sector.

To improve the human capital, the PIDS researchers also stressed the importance of a universal social protection to keep the people secure, especially the poor and vulnerable, in the midst of unprecedented business and employment disruptions.

Given that FIRe will displace jobs but will also create new ones, they also urged the country to adopt an educational system that will offer courses on emerging technologies and trainings that will fit the nature and demands of jobs in the future.

At the same time, businesses should train their workers so that the latter can keep up with the needs of their companies, according to PIDS researchers. **RTT, MJLS**

PH lags behind in S&T, innovation

THE PHILIPPINES IS lagging behind in science, technology, and innovation (STI), posing a major obstacle in harnessing the benefits of the Fourth Industrial Revolution (FIRe) in the country.

Speaking at the fourth Annual Public Policy Conference, Dr. Jose Ramon Albert, senior research fellow at the Philippine Institute for Development Studies (PIDS), cited the *Readiness for the Future of Production Report 2018* by the World Economic Forum that said the Philippines has a strong production base but has a weak performance across drivers of production, including technology and innovation.

This makes it difficult for the country to keep up with other countries that are doing well in terms of preparing for and adapting to the FIRe, according to Albert.

Weak demand

Dr. Joel Cuello, president of Philippine-American Academy of Science and Engineering, emphasized the need to advance STI in the country.

Looking at the country's science and technology (S&T) program, Cuello lamented the apparent country's lack of science, technology, engineering, and mathematics (STEM) graduates that are employed, despite producing about 120,000 STEM graduates annually, as reported by Commission on Higher Education in 2016.

"A good number of them end up leaving the country and working abroad, which is a huge loss for the Philippines," Cuello said, blaming the country's weak demand for them.

"This is because the demand side is pretty anemic; there simply are not enough enterprises to absorb the graduates," he added.

Creating an 'STI ecosystem'

To address the weak demand for S&T, Cuello called for the creation of an STI ecosystem to enhance local interest on S&T, as well as attract tech companies to invest in the country, which will result in an increased demand for STEM graduates.

He likened the proposed STI ecosystem to the Silicon Valley of the United States, which is comprised of various clusters ranging from semiconductor chips cluster, software and internet cluster, smart gadgets cluster, to health and bioinformatics clusters.

The Philippine STI ecosystem, on the other hand, could include clusters from the information technology and business process management and manufacturing subsectors, including automotive, electronics and electrical, aerospace parts, chemicals, food processing, biotechnology and biomedical, and ship building.

In terms of ensuring a good supply of graduates well-equipped for the FIRe, the academe and industries should also collaborate with each other and encourage lifelong learning and relearning.

"We need to have universities and industries working much more closely together to feed the needs of industry and to keep the supply of workforce in an appropriate way moving forward," Dr. David Hall, senior technical advisor for Economic Development at RTI International, said.

Hall urged the country not only to reinvent its tertiary education, including its technical and vocational education and training, but also to involve industries in curriculum development to help its workforce in keeping up with the new demands of FIRe.

Meanwhile, Albert advocated the increase in investments in research and development (R&D) to encourage innovation among companies.

A 2017 PIDS study also showed that the country is currently allotting 0.14 percent of its gross domestic product to R&D, which is way below the 1-percent benchmark recommended by the United Nations Educational, Scientific, and Cultural Organization. GBDC

65% of current skills to become obsolete in two years

SIXTY-FIVE PERCENT of the work skills learned in schools today will become obsolete in two years' time.

This was according to Michael Fung, chief human resource officer of Singaporean government agency, SkillsFuture, in his presentation during the fourth Annual Public Policy Conference led by the Philippine Institute for Development Studies in Mandaluyong City.

"The half-life of skills in the future of work will decrease to five years. Individuals on a 30-year career have to refresh their skills throughout their careers," he explained.

The jobs of the future will require new skill sets, including those that are not yet even introduced, Fung added.

"One-third of the desired skills set of future jobs will be comprised of skills not seen today. And that is going to hit us quite soon, as early as two years from now," the Singaporean official claimed.

"What we have learned within the twelve years of our lives is not going to work anymore [in future jobs]," he added.

Elizabeth King, senior fellow at the Washington DC-based policy think tank Brookings Institution, seconded Fung on this matter, arguing the workers' inability to adapt to the requirements of the digital economy might lead to higher unemployment rates, slower growth, and, worse, inequality.

Michael Fung, human resource chief of SkillsFuture, encouraged individuals to engage in lifelong learning as skills requirements of future jobs change rather quickly.

"Hence, the challenge for schools and universities is to transmit new knowledge, build new skills, and engender innovativeness, flexibility, and adaptability among students to use disruptive technologies," King explained.

Inability to equip the workforce for future jobs may be attributed to the current education models used, which Fung described as very structured and focused on academic qualifications.

"Skills are becoming increasingly important than academic qualifications, particularly in technology companies. For instance, a technology company in Singapore has already made a big move of hiring based on skills and not just degree qualifications," Fung shared.

Lifelong learning

Fung called for the restructuring of the current education models to focus more on continuous skills development to catch up with the fast-paced labor market.

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FIRe poses perils to women, Muslims in PH

Mindanao's footwear industry—which predominantly employs women—faces high risk of job displacement due to automation.

THE TECHNOLOGIES EMERGING from the Fourth Industrial Revolution (FIRe) are posing various issues to the country's marginalized sectors, particularly women and Muslim Filipinos.

This was revealed by Dr. Jose Ramon Albert, senior research fellow at the Philippine Institute for Development Studies (PIDS), and Amina Rasul-Bernardo, president of the Philippine Center for Islam and Democracy (PCID), during a press conference led by PIDS in September.

In the case of women, Albert revealed that they face greater risk for job losses than men as a result of the adoption of emerging technologies under FIRe.

Citing a 2018 study of the International Labour Organization, the researcher explained this may be because female workers usually assume the low-skilled, routine tasks, which are expected to be adversely affected by automation.

"Repetitive tasks can be programmed into computers, and what is not codified today may be codified tomorrow, especially with the artificial intelligence," he explained.

In the Philippines, these repetitive tasks are prevalent in the textile, clothing, and footwear sector, which predominantly employs women, according to Jose Roland Moya, director-general of the Employers Confederation of the Philippines.

This makes the displacement in this sector "gendered", he added.

For Love Basillote, executive director of the Philippine Business for Education, this gendered-displacement can be rooted in the culture of the educational system in the country.

Apparently, women are the minority in the science, technology, engineering, and mathematics (STEM) courses in colleges and universities, according to Basillote.

"You need a lot of technological know-how to do cutting-edge research. Given women are in the minority, they may find it hard to take part in FIRe," she further explained.

With this, she urged the government to improve the participation of women in STEM courses.

"Only by encouraging our girls to try STEM can we have qualified women to work in a STEM profession," she added.

Muslims, too

Meanwhile, Rasul claimed that extremist groups, such as the Islamic State of Iraq and Syria (ISIS), have started utilizing the social media to strengthen their hold in the Bangsamoro.

Citing a 2018 survey of the Social Weather Station, she said that the social media access rate in the evacuation camps, which house the internally displaced people, can strangely be high as 36 percent.

"You can rightfully say they are doing this because they want to escape from reality. But there is also the other question: Is somebody else accessing them?" she added.

"The other group that is using social media has already found its way to Marawi, and that group is ISIS. ISIS knows how to use social media in the way that the governments and civil society do not," she explained.

She likewise claimed that the benefits of FIRe can only be felt in Manila, and, to some extent, the major cities of "Christian Mindanao", such as Davao, primarily because their region and the Muslim Filipinos still lack the resources to fully enjoy the fruits of FIRe.

A 2016 PCID study found that more than 600,000 adults, or a third of the labor force, from the Autonomous Region in Muslim Mindanao (ARMM) can barely read and write.

The Philippine Statistics Authority, meanwhile, found that ARMM also registered the nation's lowest functional literacy rate of 72.1 percent in 2016.

Aside from literacy issues, she added that Mindanao is also lacking the needed infrastructure not just for FIRe but also for the development of agriculture and aquaculture in the island.

The World Bank, in its Philippines *Mindanao Jobs Report 2017*, also raised these issues, saying the severe underinvestment in infrastructure, education, and health has left Mindanaoans without good jobs and opportunities for growth. It also called for reforms to improve connectivity in the island, which could promote greater job growth in Mindanao.

"Why is the government wisely-positioned to invest so much effort on FIRe when it will not touch many of us in the South?" she asked, claiming roughly 25 percent of the Mindanaoans, primarily the Moros and the indigenous peoples, will not be participating in FIRe due to widespread illiteracy and poor infrastructure in their region.

For Rasul-Bernardo, the government's failure to address these issues will widen the inequality and may even lead to worsened extremism in their region.

"I hope that whatever investment we have for industrial revolution does not take away the need to help the other Mindanao," Rasul-Bernardo explained.

The press conference was part of a series of events PIDS has organized throughout the month of September in line with the celebration of the 16th Development Policy Research Month (DPRM).

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ARMM's high illiteracy rate and poor infrastructure hinder the region from participating in the Fourth Industrial Revolution, says Philippine Center for Islam and Democracy President Amina Rasul-Bernardo.

Agri development to stir FIRe in Mindanao

ONLY THROUGH AGRICULTURE can Mindanao participate in and benefit from the Fourth Industrial Revolution (FIRe).

This was the unanimous message from experts during the fourth Mindanao Policy Research Forum organized by the Philippine Institute for Development Studies (PIDS) and the Mindanao Development Authority (MinDA) in partnership with the University of Science and Technology of Southern Philippines (USTP).

According to Linda Boniao, regional director of the Department Trade and Industry (DTI) Northern Mindanao, this is because Mindanao remains an agriculture-based economy, with at least a third of its land area devoted to agriculture.

The island is also considered the Philippines' food basket, producing 40 percent of its food needs and contributing more than 30 percent to national food trade, according to a 2013 study of the Organisation for Economic Co-operation and Development.

In 2012 alone, about 60 percent of its economy and employment was driven by agriculture, according to the World Bank.

However, while Mindanao's comparative advantage is agriculture, the *Mindanao Jobs Report 2017* showed that the sector has been plagued by various problems,

Mindanao's agicultural sector needs to "graduate" from the mechanization phase to participate in the Fourth Industrial Revolution. (Photo by IRRI)

like low productivity and lack of necessary infrastructure.

As such, it has remained in the mechanization phase, generally considered part of the second industrial revolution, the DTI data revealed.

Sadly, "Mindanao cannot go forward to FIRe without graduating from the first three revolutions," said John Gaisano Jr., chair of the Davao City Chamber of Commerce and Industry.

Innovation, agribiz

For MinDA Director Reyzaldy Tan, innovation should be one of the key strategies in achieving growth and development in the region, together with infrastructure acceleration and interconnectivity.

Mindanao's academic institutions have contributed to this goal by engaging in various research and development (R&D) projects relevant to the advancement of agriculture in the region.

Researchers from USTP, for instance, have designed an information management system for agriculture to integrate technology to agriculture and provide an enabling environment

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The impact of internet of things on Philippine manufacturing

Alvin B. Culaba and Elmer P. Dadios

INTERNET OF THINGS (IoT) refers to the use of the internet to enable data transfer across multiple devices and appliances to come up with optimal decisions and strategies for several problems. Globally, IoT technologies have already been proven effective in the manufacturing sector.

A 2017 study by research institution Bosch Center for Artificial Intelligence reveals that the adoption of these technologies in manufacturing leads to reduced test time and calibration, improved production quality, and higher yield. IoT also improves the efficiency of operations and reduces the possibility of unexpected breakdowns in systems. Indeed, the future of the Philippine manufacturing sector is promising with the integration of IoT.

Sadly, IoT technologies have yet to be effectively and efficiently adopted in the Philippines. In fact, the country is considered as an underdog when it comes to IoT, which can partly be attributed to the country's poor infrastructure. The nation's internet connection, for instance, is currently the slowest in the Asia-Pacific region, according to the *2017 State of the Internet Connectivity* report by United States-based internet company, Akamai.

The Philippines also experiences difficulties in upgrading its manufacturing industries to create more sophisticated products given the government's poor investment in science and technology.

Philippine manufacturing should invest in emerging technologies, such as the Internet of Things, to further upgrade and improve the production process.

To harness the benefits of IoT in the Philippine manufacturing, several measures must be undertaken.

Foremost is improvement of the country's internet connectivity. Slow wireless connectivity of devices hinders the advantages brought forth by the IoT.

Aside from this, openness to the concept, trends, and ideas on the technology must also be promulgated. Advantages, such as interconnectedness of appliances, automation, and optimized operation, can be achieved by first understanding the principles of IoT and its proper implementation in the manufacturing process.

The government and industries may also consider adopting the best practices of IoT pioneering countries as models to develop implementing strategies suitable to the country's needs and conditions. It is recommended for the industries to steer the adoption of IoT into the manufacturing sector. The government, on the other hand, must also come up with enabling supplementary regulations, such as subsidies and incentives to support the industries.

Meanwhile, the labor force must be equipped with the skills needed in the advent of IoT in the manufacturing sector.

Given the fast-paced development of IoT technologies, the government and industries must also be open to novel ideas and technologies and effectively

incorporate the essential ones into the manufacturing sector. Doing so may allow the nation to stay at par with its neighbors, such as Korea, Japan, Taiwan, and Singapore, which have long integrated IoT in their own manufacturing processes.

Investments in local researches on IoT are also useful not only to reduce the dependence of the Philippines on foreign ideas and technologies but also to allow the nation to improve its own technology and know-how based on the needs of the industry.

Proper education of the consumers and the device manufacturers must also be ensured. Through this, the government and private sector may inform the concerned parties on the details concerning data collection and processing as well as the risks and measures involved. Moreover, legitimate processing of data must be observed. Consumers must always be protected per the provisions of the data privacy law.

Considering the possible data attacks, mitigating measures should also be in place. Security software must be able to protect information from malicious activities. Occasional privacy and security impact assessments are also recommended.

One thing is clear: IoT holds great potential in significantly improving the operations of the Philippine manufacturing sector. Through the recommended courses of action, the Philippines can maximize the technological benefits of IoT and become a much more competitive force in the global manufacturing industry.

The authors, Alvin Culaba and Elmer Dadios, are full professors at the Gokongwei College of Engineering - De La Salle University. They have served as consultants to studies relating to technology and innovation at the Philippine Institute for Development Studies.

Artificial intelligence and the Philippine economy

Elmer P. Dadios and Alvin B. Culaba

Artificial intelligence (AI) is one of the disruptive technologies of the Fourth Industrial Revolution (FIRe) that have taken place worldwide. Its continuous development extends its possibilities in various applications, which present both benefits and risks to humanity, according to Klaus Schwab, founder and executive chair of the World Economic Forum.

A 2017 report by the McKinsey Global Institute on the uses and effects of AI in Southeast Asia suggests that the Philippines is currently at the average level of adoption of AI in telecommunications, manufacturing, financial services, consumer package goods, and transportation and logistics. AI adoption in telecommunications has little effect in the labor market because it focuses on internet-based services. Thus, internet infrastructure needs to improve if the Philippines is to compete with nearby countries.

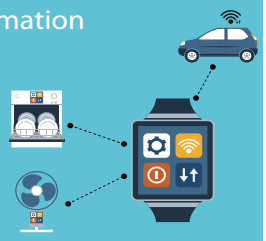
Sadly, the Philippines only has a few policy and programs on AI. To accelerate AI capabilities in the country, the government, with the help of the private sector and the public, should promote T.A.R.G.E.T.S. for AI, which stands for technopreneurship, aids and assistance, regulation, global cooperation and competitiveness, education and research, transparency, and safety for AI.

Frontier technologies of the Fourth Industrial Revolution

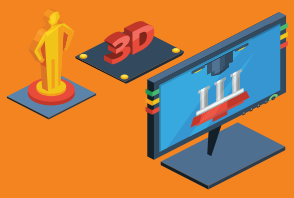
NANOTECHNOLOGY
the study and application of extremely small things and can be used across all other science fields, such as chemistry, biology, physics, materials science, and engineering

ARTIFICIAL INTELLIGENCE
ability of computers and machines to do tasks on their own creating complex future decisions and concrete conclusions based on previously learned data

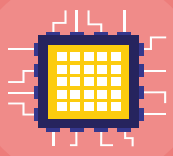
INTERNET OF THINGS
the network of physical objects, such as cars, buildings, and smart phones, equipped to send and process information through the internet



BIOPRINTING
process of creating three-dimensional models of tissues and organs using successive layers of living cells

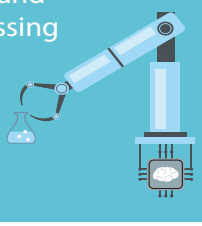


BIG DATA
digital data sets that are so large and complex derived from the use of electronic devices, social media, search engines, as well as sensors and tracking devices



BLOCKCHAIN
digital ledger of transactions shared by a network of computers, making use of cryptography to secure the authenticity of the transactions

ROBOTICS
the science of design, construction, operation, and implementation of robots, as well as computer systems for control, feedback, and information processing



NEUROTECHNOLOGY
products made to augment and heal brain activities and allow researchers and clinicians to see, map, and visualize the brain

SYNTHETIC BIOLOGY
union of biology and engineering disciplines to create artificial biological pathways, devices, organisms or products

This infographic is based on PIDS Discussion Paper 2018-11 titled "Preparing the Philippines for the Fourth Industrial Revolution: A Scoping Study". Read more here: http://bit.ly/dps1811.

65% of... from p. 7

"We have to reskill ourselves six times throughout our career. Training and education opportunities should be made available to enable lifelong-learning," he stressed.

He also pushed for the rebalancing of academic and vocational tracks, arguing the industry's human resource requirements now highly consider skills, apart from academic qualification.

"We have seen an increasing trend in employers also preferring skills in addition to academic qualifications," he noted.

Aside from technical skills, both Fung and King also emphasized the importance of developing the workforce's soft skills relating to mindset toward innovation and change to cope with uncertainties, new dynamics, and disruptions emerging from a more advanced labor market. **CPSD**

FIRe poses... from p. 9

The DPRM is celebrated across the country every September in view of Malacañang Proclamation No. 247 issued in 2002. The proclamation declares the observance of a DPRM to promote and draw public awareness and appreciation of the importance of policy research in the formulation of sound policies, programs, and projects. The proclamation also designated PIDS as the lead government agency in the yearly celebration of the DPRM.

This year's DPRM centers on the FIRe and aims to shed light on the potential impacts of automation and other innovations in science and technology.

Aside from Rasul-Bernardo, Albert, Basillote, and Moya, also present during the event were PIDS President Celia M. Reyes, PIDS Senior Research Fellow Dr. Ramonette Serafica, Secretary Fortunato de la Pena of the Department of Science and Technology, and Assistant Secretary Rafaelita Aldaba of the Department of Trade and Industry. **RGV**

Agri development... from p. 10

to increase production and marketing efficiency, as well as improve energy production and utilization.

They have also developed an emergency communication system for small-scale fishing boats that can track real time position and provide exact information regarding the direction traversed by a fishing boat. This system can provide important information to enable authorities to make a sound decision and take prompt action during emergency situations.

These R&D technologies, however, should not end up merely as research outputs but should move forward into commercialization so that more people can benefit from them, according to Emil Tapnio, program director of the nonprofit organization, Philippine Development Foundation.

Meanwhile, Dr. Roehlano Briones, PIDS senior research fellow, highlighted the need to transition from farming to agribusiness to advance agricultural development in Mindanao.

For instance, Briones explained that the rubber industry can level up if standards for rubber grade are established.

Moreover, he argued that required biosecurity procedures must be followed, such as in shrimp production.

"We need to address weak regulatory systems. Reform in agriculture can be achieved through multisectoral consultation and operationalization of agribusiness road maps," he added.

The Mindanao Policy Research Forum is part of the Development Policy Research Month celebrated annually every September to promote the importance of policy research in nation building. It convened key economic players across Mindanao, such as representatives from the academe, business, and government sectors to discuss this year's theme, "Harnessing the Fourth Industrial Revolution: Creating our Future Today". **MJLS**

Research Digests

PIDS RPS 2018-02
Measuring and Examining Innovation in Philippine Business and Industry
by *Jose Ramon G. Albert, Francis Mark A. Quimba, Ramonette B. Serafica, Gilberto M. Llanto, Jana Flor V. Vizmanos, and Jose Carlos Alexis C. Bairan*

In this paper, results of the 2015 Survey of Innovation Activities, conducted by the Philippine Institute for Development Studies, are described and discussed. Survey results suggest that less than half of firms in the country were innovators, with larger-sized firms innovating more than micro, small, and medium enterprises (MSMEs). The study also finds several issues affecting the innovation activities of MSMEs. Among others, the study found that firms have limited cooperation with the academe in terms of innovation activities. Firms cooperated more internally with establishments within their enterprise, their customers, and suppliers for their innovation activities. Given these issues, the government needs to have a champion for developing stronger policies and interventions to support and encourage innovation. Networking, linkages, and collaboration among the government, industry associations, and universities and research institutions also require further enhancement.

PN 2018-11
Barriers to Internationalization of Philippine SMEs
by *Jamil Paolo S. Francisco, Tristan A. Canare, and Jean Rebecca D. Labios*

This *Policy Note* identifies the challenges and enablers of connecting small and medium enterprises (SMEs) to global value chains (GVCs). Among others, it finds that Philippine SMEs are weakly linked to GVCs. The study recommends the enhancement of port and airport operations as well as the improvement of credit terms of SME loans. It also encourages SMEs to find new market niches where competition is not yet too tough.

DP 2018-13
Effect of Supply Chain Integration on the Business Performance and Competitiveness of the Philippine Small and Medium Enterprises
by *Elaine Q. Borazon and Vivien T. Supangco*

This study aims to determine the effect of supply chain integration on the business performance and competitiveness of Philippine small and medium enterprises (SMEs). A survey of 384 SMEs was done and structural equation modeling was used to test the hypothesis. Results show that internal integration strongly influences ($p<0.001$) both business performance (growth) and competitiveness of SMEs. Moreover, customer integration influences business performance (growth). It also mediates the effect of supplier and customer integration in business performance (growth) and competitiveness of SMEs.

DP 2018-11
Preparing the Philippines for the Fourth Industrial Revolution: A Scoping Study
by *Elmer P. Dadios, Alvin B. Culaba, Jose Ramon G. Albert, Vicente B. Paqueo, Aniceto C. Orbeta Jr., Ramonette B. Serafica, Argel A. Bandala, and Jose Carlos Alexis C. Bairan*

Technological breakthroughs and the interplay of a number of fields, including advanced robotics, artificial intelligence, data analytics, blockchain, cloud technology, and Internet of Things, have ushered in the Fourth Industrial Revolution (FIRe). The extent of the potential benefits that may be realized from the FIRe will depend on the country's ability to adapt to the global disruptions that come along with the industrial revolution. The country needs to establish a solid foundation for sustained learning and to accumulate various types of capital, while progressively and systematically closing existing technological gaps. Both the public and private sectors need to pay attention to the minuscule investment going to research and development. The government must have an informed view on how to improve its deployment efficiency. Trade openness, competition in key industries, labor market flexibility, human capital development, and an established social protection system, among others, must also be ensured to catch up with and benefit from the technological revolution.

DP 2018-09
Assessing the Effects of Simple and Complex Innovation Strategies on the Performance of Firms in the Philippines
by *Connie B. Dacuycuy and Lora Kryz C. Baje*

This paper analyzes the effects of simple and complex innovations on labor productivity and employment growth. Results show that there is no single best innovation strategy that a firm must undertake. However, if firms are constrained by their budget, a simple innovation will help in improving labor productivity and, to some extent, employment growth. Firms that do not face cost issues can benefit more from adopting a complex innovation strategy. In addition, several specific types of complex innovation strategies can be adapted depending on whether the firm aims to increase its employment or to boost its labor productivity.

Editor's ... from p. 1

Studies during the month-long Development Policy Research Month (DPRM) in September. These events include the fourth Mindanao Policy Research Forum, the DPRM press conference, and the DPRM's culminating event, the fourth Annual Public Policy Conference on the theme, "Harnessing the Fourth Industrial Revolution: Creating Our Future Today".

Foremost in their recommendations to address the country's low level of readiness to embrace FIRe is for the government, the private sector, and the academe to work together in upskilling and reskilling workers for the jobs of the future. The educational system needs to be aligned with the needs of industries while learners have to acquire new skills set that stimulates innovativeness, flexibility, and adaptability to use modern technologies, ideally starting at the basic education level. Experts also emphasize the need to adopt the concept of lifelong learning to catch up with the fast-changing labor market. Given that increased automation may result in job cuts and a likely rise in inequality, crafting relevant labor regulations and social protection schemes is essential to mitigate the negative impacts on affected sectors.

Another important recommendation is forging a vibrant academe-industry collaboration to ensure responsiveness of the academe to the needs of industry. This will help promote not only technology development but also technology commercialization, allowing more people to benefit from new innovations.

Also vital is increasing the pool of science, technology, engineering, and mathematics (STEM) graduates, especially among women who remain a minority in STEM courses and occupations, alongside creating more employment opportunities for STEM graduates by encouraging enterprises to innovate. This can be facilitated by attracting technology companies to invest in the country, which will help increase demand for STEM graduates and facilitate rapid transfer of technology and innovation from foreign investors. Experts underscore the importance of making the regulatory environment conducive to investments and adaptive to the unique needs of innovation-based industries, as well as removing anticompetitive practices to attract investors.

In addition, they called for the adoption of a whole-of-nation approach to widely promote innovation in the country. Under this approach, national government agencies, local government units, and legislators have to work in tandem with academe and the business sectors to foster innovation. Still, it is the government that should provide the leadership and impetus in bringing people and institutions together.

This DRN issue likewise looks at the challenges confronting Muslim Mindanao, a poverty- and conflict-stricken region, in the face of new advancements in science and technology. It emphasizes the dichotomy of innovation being a double-edged sword—it can be beneficial in terms of accelerating agricultural and rural development but can also be detrimental as evidenced by its misuse to propagate extremism. This signals the need for deeper analysis of the benefits and costs of modern technologies and crafting of appropriate interventions to harness their potentials while also managing the risks that come with their adoption and misapplication.

Completing this issue are an article explaining the Internet of Things and how this technology can improve the Philippine manufacturing sector, and two infographics. One of the infographics discusses ways to accelerate the artificial intelligence capabilities in the country while the other illustrates the frontier technologies of FIRe. DRN

Staff Box

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