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Perspectives on the Future of Work in Asia

Edited by Duncan Campbell

Transitions and Transformations:

Perspectives on the Future of Work in Asia

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Table of Contents

About the Editor

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Campbell retired in December 2014 as director of Global Megatrends at the International Labour Organization, where he had worked as an economist for 25 years. He is the former director of five departments, including the Employment Strategy Department, all dealing with economic research on the labor market and development and, more recently, behavioural economics. He has been a visiting faculty member at Cornell University's ILR School, where he taught courses in labor economics, development economics, and technology and labor markets in the digital era. He was twice the principal author of an ILO flagship publication, the *World Employment Report*. He has worked with national governments, both at ILO headquarters and in a field posting the ILO's Regional Office for Asia and the Pacific, on national employment strategies in the context of development planning, on labor-market analytics, and on the economics of institutions. He has principally worked in South and Southeast Asia, Central Asia, but also in sub-Saharan Africa. He has worked as a consultant to the Asian Development Bank, the European Commission, the African Union, and the Government of Botswana. He is the author or editor of four books and over 40 articles broadly in the field of the economics of labor and development. He is a graduate of Bowdoin College and holds a Master of Arts in literary criticism from the University of Pennsylvania. He has a Master of Business Administration in finance and a Doctor of Philosophy in applied economics, both obtained from the Wharton School of the University of Pennsylvania. He is a currently a nonresident fellow at the Institute for the Study of Labor (IZA).

Foreword

Technology is rapidly changing the way we work, learn, and consume. Newly created digital solutions have helped governments and businesses navigate the disruptions caused by the COVID-19 pandemic, accelerating the shift to a digital future. Although technology can be a lifeline, it can also exacerbate unequal outcomes in education, employment, and access to healthcare and financial services. The seemingly growing divide between the digitally connected and disconnected needs to be bridged to provide equal opportunities for all to reap the beneficial impact of these technological changes.

The papers in this volume, ***Transitions and Transformations: Perspectives on the Future of Work in Asia***, published by the Konrad Adenauer Stiftung's (KAS) Regional Economic Programme Asia (SOPAS), examine how technology, digitalization, and other relevant forces shape the future of work in Asia. The first section provides an anticipatory look at how life and work is restructured by wide-ranging technological changes. The second section focuses on how our educational systems can be reconfigured to keep up and take advantage of these changes. Lastly, the third section evaluates how similar technologies have different impacts on different sectors of the economy.

The papers analyze and look at these issues from different perspectives. Some focus on the regional level, others present country analyses, while a few present micro case studies. We hope that this publication contributes to concrete policy action from both governments and businesses in supporting and preparing human capacities today for our work in the future.

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Introduction

Duncan CAMPBELL

Information: The Game Changer

Economies run on information, and not having it places one at a disadvantage—a costly one. Imagine a world in which trade and investment occurred without much prior information. This would amount to a blind gamble. While standard economic theory constructs a world of perfect information, one in which the only information that really matters is the price of something, this is not the world in which we live. How efficient can a job search be in the absence of any information, and how would labor markets function if there were no information on which skills were in demand?

Just as economies have always run on information, access to information has always been unequal. These asymmetries are the source of unequal bargaining power and inequality. And they influence behavior. Some of the herd behavior of stock-market movements derives implicitly from the sentiment that "someone must know something I don't." And, sticking with the same market example, insider trading is deemed an unfair and illegal instance where someone acts on information that others don't have.

A pertinent question is what happens when there is even more information, magnitudes more, for that is certainly the characteristic of the *digital economy*. The "digital" economy is, in fact, *built* on information—its creation, its analysis and transformation into knowledge, its instantaneous availability and exchange between people anywhere—traded between companies in instructing (not just using) our machines and exchanged between machines themselves through advances in artificial intelligence and the internet of things. One could say that information has become a factor of production in its own right.

ICT, the bundle of information and communication technologies underlying the digital economy, is a general-purpose technology defined as one that affects all our lives and our work. If an ad pops up on your screen today that you find "just for you," it's because it *is*, in fact, just for you—your digital footprint has left a detailed record of your preferences. Precise information on a potential client's likes is efficient and possibly profitable.

At present, the digital era is one of unparalleled opportunity and imposing risks. Change characterizes both. A poor person's access to health and education resources, to government services, and to timely information on the demand and price for her crops unambiguously show how access to information, a smartphone in this case, enhances well-being. On the downside risks, Joseph Stiglitz (2017),[1] awarded the Nobel Prize for his work on the economics of information, observed that

> There is a risk that the move to the "information economy" may give market power to those who dominate in grabbing information (such as Google and Facebook), distorting both the markets for goods and services (increasing the ability to price discriminate) and innovation, encouraging innovation in areas where there is high potential for grabbing rents based on information, thereby moving scarce research resources away from areas where social benefits would be higher.

Data Is Power

Computers and software spearhead the digital economy. Computers' constantly increasing speed and power process massive amounts of information (*big data*) and isolate patterns in those data, a task far beyond a human's computational skills. A pattern is a prediction. A prediction, in this instance, is that because you have recorded through your browsing your interest in x, you might also be interested in this item. This is a lot of information harnessed to a specific communication.

This power is harnessed in machines. With the exception of 3D printing, less heralded have been stunning advances in machines themselves and in optics technology (without which a self-driving car cannot function). From their effective but rather unversatile origins (in an industrial history that predates even Industry 1.0), "machines" have had to acquire a mechanical dexterity to match the richly complex digital instructions that inform their actions and reactions—the "body" (the machine), as it were, has needed to catch up with the "mind" (the software).

The forefront of the digital era is now far beyond the software and machines that replace routine work but towards machines whose software enables them to "learn" from new experience (*machine learning*) and has the capacity to exchange information (i.e., communicate), with other machines with no human interface (internet of things). Hao (2021) explains the power inherent in machines that learn: "Unlike traditional algorithms, which are hard-coded by engineers, machine-learning algorithms 'train' on input data to learn the correlations within it. The trained algorithm, known as a machine-learning model, can then automate

future decisions." We click (i.e., input data), and the machine learns (i.e., discovers the patterns in our clicks) and then reminds us of our preferences even as these change.

"Obeying" coded instructions is one thing; learning is quite another. It is a mark of intelligence—humanlike but artificial. The measure of AI fully attained is the ability to learn and adapt behavior accordingly in *all* human situations. As explained by Kallenborn (2021), "Although artificial intelligence—technically a super intelligent narrow AI—can beat the world's best human chess and Go players, that is far from a generalized, human-level intelligence like the Terminator." Such full autonomy still eludes the engineering community, even if we are (tantalizingly or terrifyingly) close.

An abundance of information in itself says nothing of its quality or its risks. There are dark edges of the digital era—the invasion of privacy, surveillance, threats to cybersecurity, our vulnerability to systemic failure arising from our dependence on microchips, which now enable access to our most basic needs such as drinking water. More fundamentally still, the same technology that gives seamless access to abundant information also gives access to misinformation and its more purposeful variant—disinformation. As a dramatic example, *deepfakes* can appear before our very eyes and deceive our ears, putting words into the mouths of influential persons with a credibility that is difficult to assail.

Tech Changes

Applications of digital technology are so broad that Klaus Schwab, the founder of the World Economic Forum, dubbed this new era of general-purpose technological change the Fourth Industrial Revolution, a label that has stuck and one that anticipates grandly the scope of change to come.

As in previous eras of rapid, generic technological change, concern arising over the future of work is never far behind—"concern," typically at the outset, rather than mere "curiosity" in the future of work. The reasons are self-evident. Broad-based economic change must certainly affect the jobs bound to a previous organization of the economy. *Disruptive*[2] is a word often associated with the labor-market consequences of digital transformation. And indeed, forecasting the future of work has become something of an industry.

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2 This is a term apparently associated with a Harvard Business School professor, Clayton Christensen, who meant the term to be far more specific, as when digital photography completely disrupted film photography.

Chief among concerns, quite obviously, is technological displacement, the loss of jobs. The concern is real, and "feels real," for those who find fewer travel agents, who use ATMs rather than bank agents themselves, who have books delivered in scarcely more time than it would take to visit a bookstore, who find far fewer cashiers in their supermarkets or toll collectors on highways.

Jobs Patterns

Among the many academic studies that have addressed job displacement in the digital era, and these are many indeed, a particularly seminal article stands out. Using detailed data on scores of occupations, Frey & Osborne (2013) found an astonishing number, 47%, of U.S. jobs that were likely to disappear altogether.

The authors' argument was a purely technical one. Jobs could be defined as either "cognitive" or "manual" and as either "routine" or "nonroutine." A routine job, defined as the repetition of an unvarying series of tasks, was one that could be replaced by a string of computer code, an algorithm substituting for the human that used to perform those repetitive tasks by transferring its instructions to a machine instead. The predigital economy was made up of many such jobs consisting of repetitive tasks. Many are manual, but many too are cognitive to the extent that they perform repetitive operations on, say, paper documents. It is nonroutine work—whether the cognitive work of a highly trained professional or the design and creativity of the manual work of a landscape gardener—that an algorithm cannot replace.

It would be premature to declare as settled the issue of technological displacement, of course, just as it would be premature to assume that we've seen the end of technological change. In the digital era, to date, we have seen examples of occupational transformation. The supermarket cashier's job first "went digital" when barcodes replaced the manual entry of prices into a cash register. The digital cash register reading the barcodes would not merely sum up the goods purchased but calculate and display the change due on a certain sum given. As such, the cashier's labor was de-skilled by the first technological change. With the second technological change—self-checkout—the cashier's job disappeared altogether.

There are hundreds of thousands of business data processing (BDP) jobs in Southeast Asia as a consequence of the trade in immaterial goods (i.e., digital products) that the digital economy enables. Some of these, however recently created, may also fall victim to further technological advances. Medical doctors in the West, for example, send their oral records on patients for written transcription in Southeast Asia. Advances in voice recognition and transcription technology

may obviate the need for these jobs. For many call-centre employees whose helpful answers to questions might be robotized, frequently asked questions, or FAQs, for instance, already imply that their answers are routine. An international "digital" division of labor that has been of job-creating benefit in some Southeast Asian countries may not be technology's last word on the matter.

We are right to be concerned about technological job loss. Yet two shortcomings characterize the early job displacement literature, and both are of relevance to the present volume. The first is that the disproportionate focus on job displacement is just that, disproportionate, or as economists might point out, a partial equilibrium analysis. It can be accepted that concern over job loss, and the technical rationale motivating such concern, is a topic in its own right. It would be wrong to suggest, moreover, that forecasts of job loss believe the latter to be the only consequence of technological change on employment. That said, the potential for job gain tends to be underreported in the literature. For one matter, we tend to be poor predictors of new occupations. Who would have predicted ten years ago that social-media management would become a sought-after skill in large corporations or, just a few years earlier, that web designers would be a trending occupation?

The second is that what is technologically feasible and economically likely are two different matters. Put rather simply, investments in technology tend to be labor saving in high-labor-cost countries. One estimate of the "hourly wage" of a robot on an automobile assembly line in the United States, for example, is 25 USD. In developing Asia, humans are likely in many instances to have a relative labor-cost advantage over machines that might replace them. This is obviously somewhat of a static argument, as technology prices decline and Asian growth is reflected in higher wages. It is safe to say at present, as do some chapters in this volume, that job displacement, while acknowledged, does not seem to loom as ominously a threat as it has in some of the advanced-economy literature.

The assertion that technological change results in more jobs gained than lost relies less on formal models than on the comforting conclusions of history in which net job growth has always prevailed. It did so quite massively in the First Industrial Revolution, and unsurprisingly, the consequence of that era's technological change was to divide the labor embodied in the skills of the single master craftsman into its component tasks and additional, albeit less-skilled jobs.

Knowledge as properly human is now embedded in the physical machinery that humans used to operate. There are advantages to this kind of displacement to the extent that machines substitute for human work of an arduous or dangerous nature (consider drones, for example). Automation once relieved human work

of its demanding physical nature. It now replaces at least some of the cognitive skills formerly used by people at work. This displacement might apply to entire occupations or to various tasks embodied in predigital jobs and occupations, preserving the job but transforming its content.

More recent literature on the digital era has usefully retained the distinction between the "job" and the "tasks" that comprise it. Many, beginning with the Organisation for Economic Co-operation and Development (OECD), now argue that technology is more likely to transform existing occupations by substituting for some of the tasks embodied in the job with computer-assisted ones. In consequence, the OECD concludes, outright job loss will amount to only 9% or so in OECD countries.

Technology Adoption in Asia

Time will tell, as it always will, of course, when discussion turns to the future of anything! A relevant question is how long do we need to wait. Relative to past episodes of widespread technological change, the present is noteworthy for its speed of diffusion. Relative costs might constrain technology adoption, but so too do the remaining physical constraints on connectivity. In absolute numbers, Asia dominates other regions in internet usage. This is not surprising, as Asia constitutes 55% of the world's population. By region, 64% of Asians are connected, relative to 43% of Africans and 94% of North Americans. National income is a predictor of connectivity; as is within country-income distribution, the wealthier strata are more likely to use the internet than poorer ones. Urban dwellers are more likely to be connected than the rural population, the more educated than those with less education, the young more than the old.

Critical to the rate of connectivity's diffusion is the technology's ability to leapfrog major, often costly and time-consuming, physical-infrastructure barriers through the use of mobile connectivity—the smartphone. Mobile connectivity dominates internet usage *the poorer the country*. Thus, the poor, uneducated farmer has the ability to profit from the economics of information by knowing in advance the demand for and price of the produce he or she grows.

Ironically, one can be connected to the digital era in parts of the developing world in which there is still no access to an electricity grid or to improved water and sanitation. In short, the Fourth Industrial Revolution has arrived in some places where the Second Industrial Revolution has yet to come. This is tantamount to saying that the future, including that of work, arrives sooner for some than for others, as has always been true; but in the digital era, the future is arriving sooner for more people.

Work Transformation in Asia

This holds true for Asian economies, where change is advancing at different speeds. It is not unreasonable to say for Asia's developing economies, and for the developing world as a whole, that for millions of people, the future of work will not be very different from the present of work for years to come. Sixty percent of Asia's labor force works in the informal economy, and despite economic growth over recent decades, the transition from informal to formal jobs can hardly be described as having been exponential. It is unlikely that the digital economy will vastly transform their livelihoods. But incremental transformation there is, as for the poor farmer whose newfound access to information reduces transaction costs. Or for the uptake of smartphone-based digital banking that offer banking services and access to credit for the first time for many. Or for the women participating in India's Mahatma Gandhi National Rural Employment Guarantee programme, whose work may still be defined as drudgery but whose payment is via a smartcard to a bank account of their own. Vu (Chapter 12) finds evidence of the use of smartphones among Hanoi's informal-economy street vendors—primarily to evade fines levied by the local police. Timely information reduces the cost of doing business!

This Publication

The volume is organized into three sections. In the first section, "Anticipating Life and Work in Digital Society and Economy," the first four chapters look to the future while taking account of the present. There is a focus on the costs and benefits to the labor force of technological change, balancing the loss of jobs against the potential for job gain, with the prognosis being, for the most part, favorable. The advantages of computer-assisted problem solving is a promise of artificial intelligence in Chapter 1, where Shakil underscores, among other things, a certain lighthouse effect of digitally processed information in detecting fraud. Nasrin and Aisah find reliance on digital means of maintaining incomes and having access to education and healthcare as important tools in weathering the COVID-19 pandemic and the acceleration of the use of digital tools in doing so (Chapter 2).

Chapters 3 and 4 both look at the advantages of policy readiness and institutional preparation through master plans to address both social and economic challenges going forward. Southeast Asia's largest country, Indonesia, comes under the microscope in relation to ASEAN's digital foresight plan and Indonesia's own vision for the future. Barany and Rafitrandi (Chapter 3) pay particular attention to the need for improvement in Indonesia's education system, both in quality

and content, such that the future labor force has skills in demand for an evolving, increasingly digital economy. In both analyses, Indonesia comes out rather well in its current level of preparation. This is true of Setiawan's discussion in Chapter 4 of Indonesia's readiness relative to the ASEAN Digital Masterplan. There, nonetheless, remain policy needs—how does one regulate the gig economy to minimize barriers to entry while protecting those in the gray area between "employee" and "self-employed"?

In the second section, "Renovating Education Systems for a New Labor Market," five chapters address what is probably the largest labor-market challenge—whether there will be jobs available and whether people will have the education and skills to make gainful use of the future of work. In Chapter 5, Cheng discusses the role of Chinese universities in fostering a culture of innovation. Now the world's second largest economy, China's economic leadership increasingly relies on whether its universities can autonomously ensure technological leadership through innovation where information does not freely circulate. Corrado, Kay, and Tungjan apply a similar effort at foresight in the much poorer circumstances of Cambodia in Chapter 6. In a novel review of the country's tertiary curricula offerings, the question is whether young Cambodians have access to an adequate STEM-based education to make the best of a labor market that will increasingly rely on digital skills. In Chapter 7, Ong, Lee, and Ng use original survey data to discover that even in "high tech" Penang, Malaysia's electronics-export champion, students feel that upon graduation, further science-based education is a necessary ingredient for their futures.

Rivera and Gutierrez raise the broader conceptual issue of *knowledge capital*, as distinct from human and physical and financial capital, in Chapter 8 to describe a central need for economies to prosper in the digital era. This involves the need for an indigenous innovation capacity, but the institutional density through which knowledge can be broadly disseminated and used. Giang, Nguyen, and Dang use original data from a multisector enterprise survey as well as follow-up and find quite optimistic opinions of employers on the skills attainment and readiness of their young employees (Chapter 9). Indeed, young Vietnamese appear to embrace the change towards a digital economy. This is bright news in a country whose early success since Doi Moi has relied on just the sort of unskilled factory jobs that are likely targets for automation.

The volume's final section, "Same Technology, Different Impacts for Sectors and Labor Market Subgroups," is an acknowledgement of the vast diversity of Asia in wealth and economic development in the array of the livelihoods it hosts, from subsistence farming and vast nonagricultural informal economy, both urban

and rural, to some of the world's wealthiest and most technology-intensive economies.

In Chapter 10, Nguyen and Quan introduce the first of the volume's two real-economy–sector studies. For the authors, this is the growth and adaptability of Vietnam's service sector—always a sector difficult to describe in aggregate terms, owing to its heterogeneous nature. Among other things, it is the sector where the need for physical proximity for some occupations and industries forecloses their being automated. Yet it is also the sector where a high share of output is immaterial (e.g., government services, the booking and travel arrangements of the tourism industry, as well as in Vietnam's rising gig economy). The Vietnamese government has set strategies for the sector, which, as the authors conclude, is the critical growth sector now and for the future of work.

What then can be said of the oldest sector, agriculture, in the digital economy? In short, much. Agriculture remains a vital sector; indeed, the sector employs hundreds of millions across Asia. As Vaghefi shows in Chapter 11, sector employment is on a declining path and is unlikely to be arrested. The digital era will mean that employment and value addition in the sector will continue to diverge. Applied to agriculture, digital substitution replaces "tractor drivers, irrigators, pest and week controllers," among other low-productivity jobs. The author's application of the Frey & Osborne framework on the technological sustainability of jobs is carefully and convincingly done.

And what of disadvantaged labor-market groups? Is the digital era happening elsewhere, or are their lives also affected? The "future of work" described by Vu's original survey of Hanoi's informal street vendors (Chapter 12) consists of largely advanced middle-aged women working informally in a legally threatened occupation and gaining advantage from the digital era—if they gain any at all—by the use of smartphones to preserve market contacts, to evade police patrols, etc.

Soun (Chapter 13) also uses an original survey to study how digitally assisted occupations might be of relevance to a traditionally disadvantaged group in the labor market—persons with disabilities. The results are mixed, partly because PWDs as a group have faced educational deficits well prior to entering the working-age population.

At the other end of the spectrum of advantage are those who work for one of the world's most sophisticated electronics companies, Fujitsu, which Fritz describes in Chapter 14 as having undergone a "revolution in working style" triggered by the pandemic and featuring widespread remote work for the company's employees—revolutionary indeed in a society with deeply embedded traditional norms of work culture.

To conclude where this introduction began, opportunity and risk are the rough boundaries of discussion in these chapters, with the balance tilting towards opportunity. Asia has been known for decades now as offering enough examples of "good structural transformation," where more productive jobs replace old, less-productive ones, and has done so in a context of continued poverty reduction. This has perhaps provided something of a social, economic, and also political template for structural change, an acquaintance with it to be welcomed rather than resisted. These aspects bode well for an Asian digital future.

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1

Anticipating Life and Work in a Digital Society and Economy

Artificial Intelligence and the Future of Work in Asia: Prospects and Challenges

Mohammad Hassan SHAKIL

Abstract

This study explores the importance of artificial intelligence and the future of work and identifies issues and challenges of artificial intelligence and the future of work in Asia. This study also proposes a policy framework and provides recommendations for artificial intelligence and automation in organisational processes. The findings of this study are relevant for regulatory authorities, standard-setting bodies, and corporations.

Artificial intelligence (AI) is defined as the imitation of human intelligence in machines (Frankenfield, 2021). In artificial intelligence, machines are programmed to think like humans and process data faster than humans (Frankenfield, 2021). In recent years, automation and AI is redefining the future of work globally. The Asian region is not far behind in adopting and implementing AI and machine-learning (ML) algorithms in different industries, such as agriculture, automotive, and export-led manufacturing industries. Farmers use AI in plant breeding to improve varietal assortment (Kapoor et al., 2018). Robots use reduces the inputs by more than 90% compared to traditional processes (Kapoor et al., 2018). Besides, the use of AI in the automotive industry is reducing jobs in the transport industry due to the implementation of self-driving cars (Kapoor et al., 2018). Likewise, AI and ML models are extensively used in the financial-service industry for fraud detection, credit scoring, and enhancing cybersecurity (Prasad & Rohokale, 2020; Leo et al., 2019). ML models effectively safeguard clients' credit cards and other confidential information and alert the authority if any suspicious activity occurs (Sarker et al., 2020; Gianini et al., 2019; Wei et al., 2013).

From the above discussion, it is evident that AI is displacing jobs and creating more vibrant opportunities for the expert workforce (Halal et al., 2016; Wajcman, 2017). There is a fear growing globally, especially in developing countries, that machines will replace humans in the workplace (Bresnahan & Yin, 2016). Between 2016 to 2030, around 15% of workers globally, which consists of about 400

million workers, will be displaced due to automation (Manyika et al., 2017). The technical feasibility of the country is the main influencing factor of automation. Besides, other factors, such as cost of deployment, labour market dynamics, and social factors, also influence automation (Manyika & Sneader, 2018). However, automation may vary considerably due to the above factors. Also, variation may occur due to diversity across industries and countries (Manyika & Sneader, 2018).

In the context of developed countries, machines are taking over jobs in specific industries, such as automotive, extractive, healthcare, and other industries. However, some developing countries in Asia, for example, are not highly affected by automation and AI. In contrast to replacing jobs, automation complements specific industries such as healthcare, export-led manufacturing, and agriculture (Chhichhia et al., 2018). These industries of developing Asian countries benefit from AI robots and ML models, increasing productivity and boosting economic growth.

Although AI has many advantages, there are still arguments over its use. Therefore, this study explores the use of AI and ML models in the context of Asian countries and presents the benefits of AI in the future of work in Asia. This study also identifies the issues and challenges that AI is facing and suggests policy recommendations for better implementation of AI and automation in Asian countries.

The rest of the manuscript is organized as follows. Section 2 discusses the background of automation and AI in Asia. Section 3 discusses the advantages of AI in work. Section 4 identifies issues and challenges of AI and work. Section 5 suggests policy recommendations to tackle the challenges of AI and future of work. Lastly, section 6 concludes the study.

Background of Automation and Artificial Intelligence in Asia

Asian countries are performing well in generating jobs for their workforce. In the last three decades, the developing Asian region has introduced over 30 million nonagricultural jobs yearly (Chhichhia et al., 2018). Since the beginning of the 21st century, an investigation of changes in employment in Asia shows how adapting new technologies and automation is redefining and shaping the future of work. In recent years, several firms and industries in developing Asian countries are initiating aggressive strategies to transform their activities to automation. Between 2010 and 2015, industrial robots increased 70% to 887,400 units in nine developing Asian countries (Chhichhia et al., 2018), as robots can perform production activities more efficiently without the help of human control. However, the installation of industrial robots in Asia dropped by 13% in 2019

compared to 2018 (IFR, 2020). This happened due to the difficult times that the automotive and electronics industries faced and the trade conflict between the United States and China since 2018 (IFR, 2020).

However, manufacturing in developing Asian countries still rely more on workers due to technological and economic advantages. For instance, the production of garments is more sophisticated compared to the production of automobiles. In the garments sector, human intervention is essential to supervise the stitching process, whereas in the automobile industry, robots generally follow up the whole process and less human supervision is needed. Besides, the average wage in the apparel industry is low, which makes automation less economical (Chhichhia et al., 2018). Therefore, automation is more pronounced in a capital-intensive industry. For example, the automotive and electrical sectors account for 35% of robot use in 2015 (Chhichhia et al., 2018). On the other hand, apparel, textiles, and leather together account for only 0.1% of robot use in 2015 (Chhichhia et al., 2018).

Although robots are capable of increasing productivity, it will not be feasible for robots to take over the labour-intensive sectors (Chhichhia et al., 2018; Marinoudi et al., 2019). In recent years, the demand for sewing robots is increasing, but it may not provide a cost-effective strategy for the apparel sector due to higher establishment and operating costs (Vashisht & Rani, 2020). It is more cost effective for developing Asian countries, like Bangladesh and India, to use cheap local labour to meet the production demand.

In addition, rapid technological development is evident in the healthcare sector. However, it will not displace labour in Asia. Magnetic-resonance imaging and precision-medicine technologies deliver facilities that humans cannot offer (Chhichhia et al., 2018). The healthcare technologies complement healthcare workers by adding values, and in Asian countries, there is still a shortage of healthcare professionals. Therefore, it is evident from the above discussion that the future of work in Asia varies across sectors. Automation and AI will not reduce employment. However, in specific industries, it adds value and increases the wages of workers.

Advantages of Artificial Intelligence in Work

The future of work is changing due to the rapid change and development of technology. Due to automation and the bulk amount of data, information processing and decision making becomes complex. It is getting difficult for humans to process a bulk amount of information and make an effective and prompt decision. In recent years, AI's excellent analytical, computational, and

quantitative capabilities to process colossal information and prompt decision-making ability provide them with a competitive advantage over human expertise (Jarrahi, 2018). Nowadays, AI and ML tools are given more priority over humans for specific reasons, such as lower time in data processing, fraud detection, and higher accuracy in decision making. Besides, AI can do much more than data processing. For example, deep learning can enable the machine to learn from the data (Jarrahi, 2018). The advantages of AI and ML tools are discussed in detail as follows:

Decrease in errors

In general, humans make mistakes frequently, especially if a bulk amount of data is involved. The possibility of error is higher if humans are processing the data manually. However, in the case of machines, the possibility of making mistakes is less if the analysis process is programmed correctly (Kumar, 2019). For example, AI in weather and stock-price-volatility forecasting is much more accurate than humans due to the machines' ability to think like humans but process the data at a much faster rate (Kumar, 2019).

Performance of risky and life-threatening tasks

AI robots can perform challenging tasks that are risky for humans and animals. For example, AI robots can be used in mining, nuclear, and oil- and gas-refining fields (Kumar, 2019). They can be used to provide security in hostile places (Joh, 2017). Introducing AI robots in such industries will reduce the lifetime risk of individuals involved, as working in these sectors is life-threatening and may result in substantial physical and psychological damage.

Fraud detection

The use of AI tools helps detect fraud, reduce costs, and increase the profitability of an organisation. The use of blockchain technology and data robots is helping tax authorities to detect tax evasion by multinational firms and help local governments to collect more taxes. Besides, big accounting firms such as PricewaterhouseCoopers (PwC), Deloitte, and Klynveld Peat Marwick Goerdeler (KPMG) are using AI in their auditing and tax processing. The use of AI is helping these accounting firms to detect fraud easily and reduce the lead time for auditing (PwC, 2015). Besides, fraud is considered the biggest challenge for the finance industry. Credit-card fraud is the most crucial in the finance industry, and a report shows that in 2019, there were 270,000 cases of credit-card fraud in the United States alone (Daly, 2021). Cybercriminals use individuals' credit and bank account details to perform fraudulent transactions and steal money from victims'

accounts. Nowadays, banks use ML models to detect fraudulent transactions and alert the authorities if they find anything suspicious. Cybersecurity firms like Teradata and Datavisor provide AI-based solutions to detect financial fraud (Trehan, 2020).

Issues and Challenges

Automation of business activities and AI are transforming global businesses and contributing to the economic growth by accelerating productivity. AI is contributing significantly from healthcare to climate change. Although AI contributes enormously to economic growth and creates new job opportunities for the workforce, it is also dislocating specific jobs. Job-seeking individuals should acquire certain skills to cope with automation in the job sector and compete with machines with their human intellect.

Necessity for good-quality training data

Training data is the labelled data used to train machine-learning models to make effective decisions (Appen, 2021). Good-quality training data is a prerequisite for artificial intelligence. If the quality of data is flawed and does not clean properly, it may provide biased results, and the decision a firm takes based on the data may harm the firm in future (Appen, 2021). For example, if someone wants to build a self-driving car, the training data will include images and videos of cars, people, and street signs (Appen, 2021).

Use of proper artificial intelligence techniques

Communicating the results generated by ML algorithms is challenging due to the diverse nature of training data, regulations, and diversity in different industry settings (Manyika & Sneader, 2018). For example, financial lending is a complicated case, and the decision can be varied due to potential bias in data and algorithms and data privacy. Mainly, three sectors dominate the adoption of AI—automotive, finance, and telecommunications. Therefore, the proper ML techniques should be adopted based on industry and training data, and expert supervision is essential to double-check the training data for unbiased results and accuracy of the AI techniques.

Pressure on the wage structure

Automation will put extra pressure on wages. The majority of the middle-wage jobs in developed economies are manufacturing and accounting, which can easily be automated, and there could be a possible decline in these types of jobs

(Manyika & Sneader, 2018). High-wage jobs will see significant growth in the near future, mainly medical and tech jobs, eventually worsening income inequality and wage polarization (Manyika & Sneader, 2018).

Policy Recommendations

The government and firms should initiate appropriate measures and policy responses to implement automation and AI transformation to overcome the issues and challenges. The recommendations are discussed in detail as follows:

Investment in human capital

Most Asian countries are developing, while a few are economically developed. The developing Asian countries should invest in human capital to develop the workers' skills (Manyika & Sneader, 2018). Investing in human capital and arranging training for the workers improves productivity, contributing to the country's economic development. The skilled-labour forces are an asset for the country, which can contribute in many ways. Skilled workers may provide training to new workers and make them ready for the future workforce.

Use artificial intelligence and automation safely

Although AI and automation have many benefits and increase the productivity of an organisation, there are still some concerns that need to be addressed, such as security and safety (Manyika & Sneader, 2018). The firm should be careful about data privacy, data security, and fraud. The firm should use the data legibly so as not to violate the data protection act of a specific region or country. For example, the General Data Protection Regulation of the European Union is complicated. Therefore, firms operating in the EU are careful when using personal data and need to obtain permission before they could use the data. Otherwise, they might face the consequences of breaching the European Union's data protection act.

Review formal education and implement on-the-job training

Policymakers should review the current education system, revise formal education, and introduce AI in education. Besides, firms can implement on-the-job training for their workers to develop their skills in AI and ML (Manyika & Sneader, 2018). Introducing AI in the service and education sector will gradually improve the expertise of the workers, which eventually help firms to improve their productivity, and in the long run, it will contribute to the economic development of Asian countries.

Job security

In the automation process, there could be a significant reduction in employment. Many workers can lose their jobs. Companies should support workers for mobility and offer a conditional transfer (Manyika & Sneader, 2018). They should adopt social safety nets and provide a viable solution to retain workers by creating new opportunities and providing them with the proper training to serve longer (Manyika & Sneader, 2018).

Conclusion

This study explored the practices of AI and the future of work in Asia and provided insights into the progress of AI in the Asian region and discussed the need to adopt AI in specific industries. It also suggested availing artificial intelligence in business operations based on the feasibility and need of firms. Firms should do detailed feasibility and cost analysis before they implement AI-enabled processes in their business operations. Otherwise, it will be a vital cause to increase production costs in the future. We have also identified in this study the advantages of AI and how firms and countries can benefit by adapting ML tools to increase productivity and boost economic growth to its full potential.

In addition, this study listed downs the issues and challenges faced by AI in Asian countries. Significant issues include the need for quality training data, difficulty identifying proper machine-learning techniques, and job loss. To overcome these challenges, we have provided specific policy implications to tackle these challenges in future. The Asian region, especially developing countries, should have proper planning and regulatory guidelines for automation. All sectors are not equally essential, and automation is not necessary in specific sectors where human supervision is essential, for example, the apparel industry. Therefore, regulatory bodies should provide policy-support training and create proper infrastructure for quick transition to automation and implement AI and ML models for better productivity and efficiency.

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Is COVID-19 Accelerating the Automation and Digitalization in Emerging Economies in Asia?

Shamima NASRIN and Aisah

Abstract

The COVID-19 pandemic leads to a new normal environment, where automation and digitalization become inevitable in all spheres of life. The definition of "traditional industry" changes by amalgamating the traditional business models with automation and digitalization. This paper provides evidence that the COVID-19 pandemic boosts the usage of digital technologies and automation, especially in manufacturing, service, and financial sectors in emerging Asian countries.

Coronavirus disease (COVID-19) has caused a remarkable number of infections leading to morbidity and mortality of millions of people. COVID-19—with its triple threat to health, education, and livelihoods—is undermining human development globally (European Investment Bank [EIB], 2020). On January 30, 2020, the World Health Organization (WHO) declared this coronavirus outbreak as pandemic. However, the pandemic has accelerated the power of automation and digitalization to help combat crises. In response to this pandemic, automation and digitalization contributed significantly to several traditional activities all over the world. China's use of digital payments and e-commerce was hastened by the SARS epidemic in 2003. Interestingly, the COVID-19 context also saw the emergence of several innovations in e-commerce, telehealth, e-learning, and virtual meetings as one of the social-distancing measures of controlling the spread of the pandemic (WHO Regional Office for Africa, 2020).

No country in the world is exempt from the havoc of this pandemic. Asia is also not an exception in this case. Many Asian countries are affected by the coronavirus pandemic. A huge number of people have died, and many are getting infected day by day, even though containment measures such as lockdowns and quarantines are still there. A significant portion of emerging Asian families depend on the informal economy. In informal economies, families look for a new source of income every day. However, lockdowns during the COVID-19 pandemic caused

an economic halt and an increase in poverty rate in some Asian countries. In order to keep businesses open while limiting the spread of the virus with lockdowns and other safety measures, Asia is realizing the utmost necessity of automation and digitalization.

Artificial intelligence, advanced robots, and digitalization have the potential to drastically alter our employment and daily lives. While these emerging technologies are not new concepts, they have gained traction in recent pandemic periods in emerging Asian countries. Hence, the digital revolution is affecting all sectors and activities of the economy, with a far-reaching social and economic impact (Rhee & Possen, 2018). Moreover, the internet of things (IoT) and the Fourth Industrial Revolution (4IR) are changing the way people live. People are constantly prodded, if not outright forced, to embrace digital revolution.

There are different ways in which technology could interact with the pandemic. New technologies have enormous promise for making public services such as healthcare, transportation infrastructure, and education more effective and efficient. Many people turned to paying bills, collecting benefits, and buying online because many stores, banks, and government offices were closed during the outbreak. Investments in digital technologies that provide immediate solutions to the pandemic will also build medium-term and long-term economic resilience (EIB, 2020).

This paper focuses on several emerging Asian countries. Data on various dimensions of digitalization and automation are compiled using global data sources, including the Global Innovation Index. This paper considers data from 2019 as the "before COVID-19" and 2020 as "after COVID-19" pandemic scenarios of several emerging Asian countries.

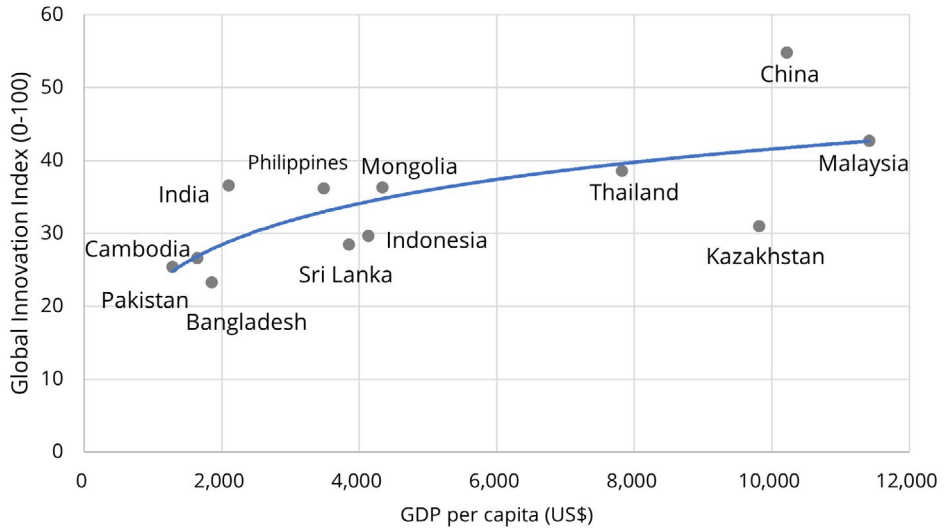
The structure of this paper is as follows. In Section 2, this paper talks about Asia's emerging landscape of digitalization and automation, where heterogeneity is found in technological adoption. In Section 3, it discusses COVID-19 and digitalization in emerging Asian countries. In Section 4, the paper presents COVID-19 and automation in emerging Asian countries. In Section 5, it explains the economic impact of digitalization and automation, which shows technology is used to supplement labor, boost productivity, and create additional jobs, but in others, it also replaces labor. Moreover, this paper provides a brief analysis of how digitalization and automation affect employment in emerging Asian countries, as most of the countries are labor intensive. In Section 6, there are some proposed recommendations that can be used as policy instruments to prevent and overcome adverse effects of the pandemic while patronizing digitalization and automation.

Asia's Emerging Landscape of Digitalization and Automation

According to the futurist Martin Ford, "People will prefer to go to a place that has fewer workers and more machines because they feel they can lower overall risk" (Thomas, 2020). This prediction is also going to be true for Asia. In terms of digitalization and automation of consumption, production, and innovation, Asia has made great progress. Moreover, Asia has been at the forefront of the digital revolution, though with heterogeneity across the region (Rhee & Possen, 2018). As of 2019, the Asian population is six times that of Europe and 12 times that of North America (Deloitte, 2020). With such a large population, digital life has limitless potential. Moreover, most of the Asian countries will enjoy demographic dividend as young people make up a substantially larger proportion of the population in South and Southeast Asia.

The Global Innovation Index (GII) measures innovation based on criteria that include institutions, human capital and research, infrastructure, credit, investment, linkages; the creation, absorption, and diffusion of knowledge; and creative outputs. Figure 1 shows GII and GDP per capita of several emerging Asian countries. Among the Asian countries, China, Malaysia, and Thailand have higher GII, which is aligned with their GDP per capita. The Philippines, India, and Mongolia are in higher ranks in terms of innovation, even though their GDP per capita is not increasing. A few characteristics such as social penetration, consumers' receptivity to new technologies and the mobile internet, and companies' willingness to innovate make the influence of digitalization more pronounced in Asia than in other markets.

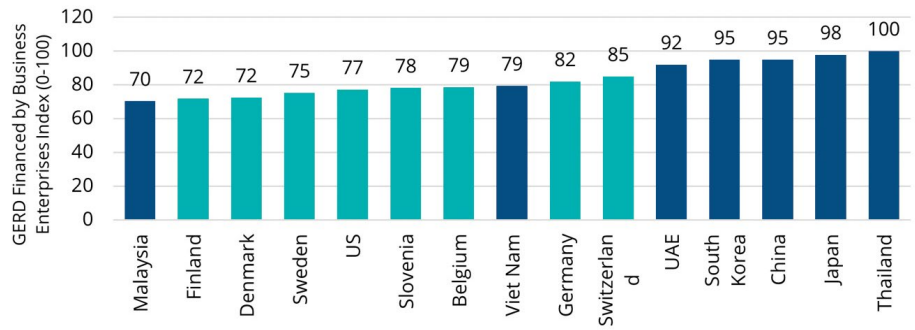
Figure 1. GDP per capital and Global Innovation Index 2019



Source: From the World Bank and the *Global Innovation Index 2020: Who Will Finance Innovation?* (13th ed.) by Cornell University, INSEAD, & World Intellectual Property Office. (2020). S. Dutta, B. Lanvin, & S. Wunsch-Vincent (Eds.). https://bit.ly/3g6nXUd. Copyright 2020 by Cornell, INSEAD & WIPO.

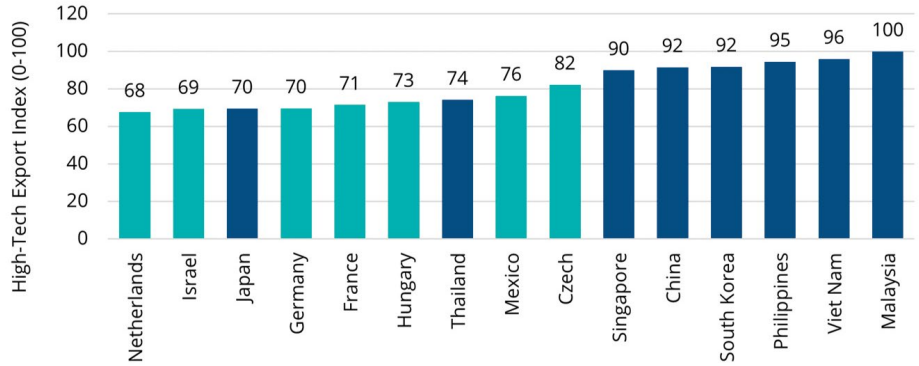
In Southeast Asia, Thailand has embraced digitalization as a means of escaping the middle-income trap, reducing social inequality, alleviating poverty, and ensuring social and environmental sustainability. Figure 2 shows that Thailand is first in business R&D globally in 2020, surpassing even the developed countries. This is because in 2019, Thailand's gross expenditures on R&D (GERD) totalled to 193.072 billion Thai baht, or 1.14% of their GDP; and the main sectors for expenditure are quantum technology, space science & technology, high-energy physics, and molecular biology. However, other emerging Asian countries like Vietnam and Malaysia are also making a significant investment in R&D, leaving many developed countries behind (Office of National Higher Education, 2021). Malaysia is also doing commendably in digitalization and automation. The country is having rapid expansion of export of high-tech merchandise, consisting mostly of electronics integrated circuits, telecommunication devices, and computerized office machines, to East and South Asian destinations, specifically Singapore, Hong Kong, China, Thailand, Japan, Taiwan, Korea, Vietnam, and India (Vun, 2019). Figure 3 shows that in 2020, Malaysia ranked top in net high-tech exports globally. This is also noticeable that other Asian countries like Thailand, Vietnam, Philippines are also maintaining high rankings, surpassing many developed countries like Japan, Germany, France, and so on.

Figure 2. Gross Expenditure on Research and Development (GERD) Financed by Business Enterprises Index 2020



Source: From the *Global Innovation Index 2020: Who Will Finance Innovation?* (13th ed.) by Cornell University, et. al (2020).

Figure 3. High-Tech Export Index 2020



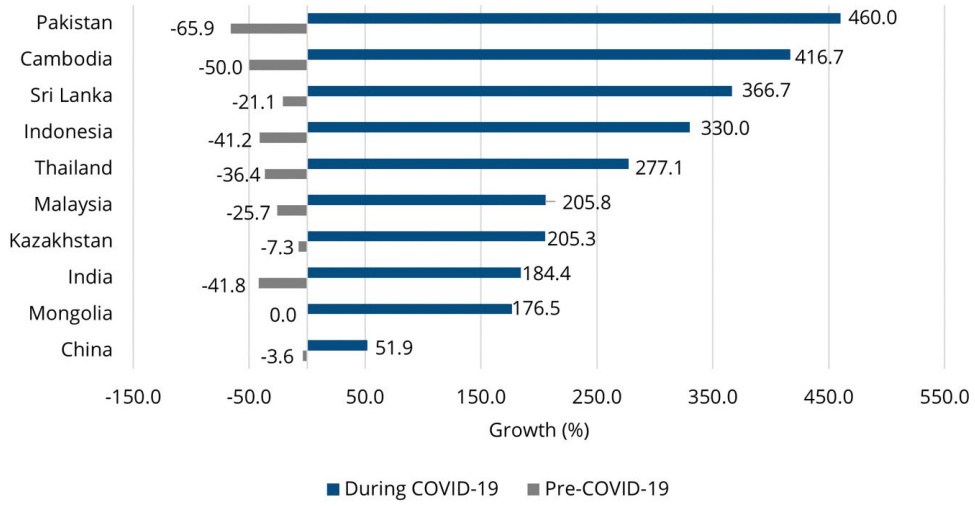
Source: From the *Global Innovation Index 2020: Who Will Finance Innovation?* (13th ed.) by Cornell University, et. al (2020).

Economies such as the Republic of Korea and Japan are global trendsetters not only in the adoption but also in the production of technology. On the other side of the spectrum, there are economies such as Myanmar and the Lao People's Democratic Republic that rank low in digital adoption (Sedik, 2018, p. 31). However, the adoption of digitalization and automation has grown rapidly in emerging Asian countries such as Bangladesh, Thailand, Malaysia, and Indonesia. Some Asian countries such as China, Japan, and South Korea have accelerated automation in manufacturing via industrial robots, and the use of these robots has accelerated since 2010 (International Monetary Fund [IMF], 2018a).

COVID-19 and Digitalization in Emerging Asian Countries

The digitalization of economic activity can be broadly defined as the incorporation of data and the internet into production processes and products, new forms of household and government consumption, fixed-capital formation, cross-border flows, and finance (IMF, 2018b). The COVID-19 pandemic has boosted digital-technology uptake and use throughout the world. Because of the coronavirus, some governments have had to quickly deploy new digital technologies to help connect with the public, boost healthcare, and track the pandemic's progress. The figure below presents a picture of how COVID-19 is contributing to the acceleration of digital-technology adoption in Asian countries. The online creativity index is considered as the representative of digital technology adoption, and Figure 4 shows that during COVID-19, activities through online use have increased rapidly in 2020 compared to 2019.

Figure 4. Growth of online creativity before and during COVID-19



Source: From the *Global Innovation Index 2020: Who Will finance Innovation?* (13th ed.) by Cornell University, et. al (2020).

Business-to-consumer revenues of digital platforms reached 3.8 trillion USD in 2019 globally, with Asia and the Pacific accounting for about 48% of the total or 1.8 trillion USD, equivalent to 6% of the region's gross domestic product. These figures are expected to have significantly increased in 2020, as more business transactions—such as ride hailing, food delivery, and e-commerce—migrate to the digital space amid restrictions imposed to curb the spread of COVID-19 (Asian Development Bank [ADB], 2021). In the following section, the paper will present

how the COVID-19 pandemic is accelerating the digitalization in emerging Asian countries.

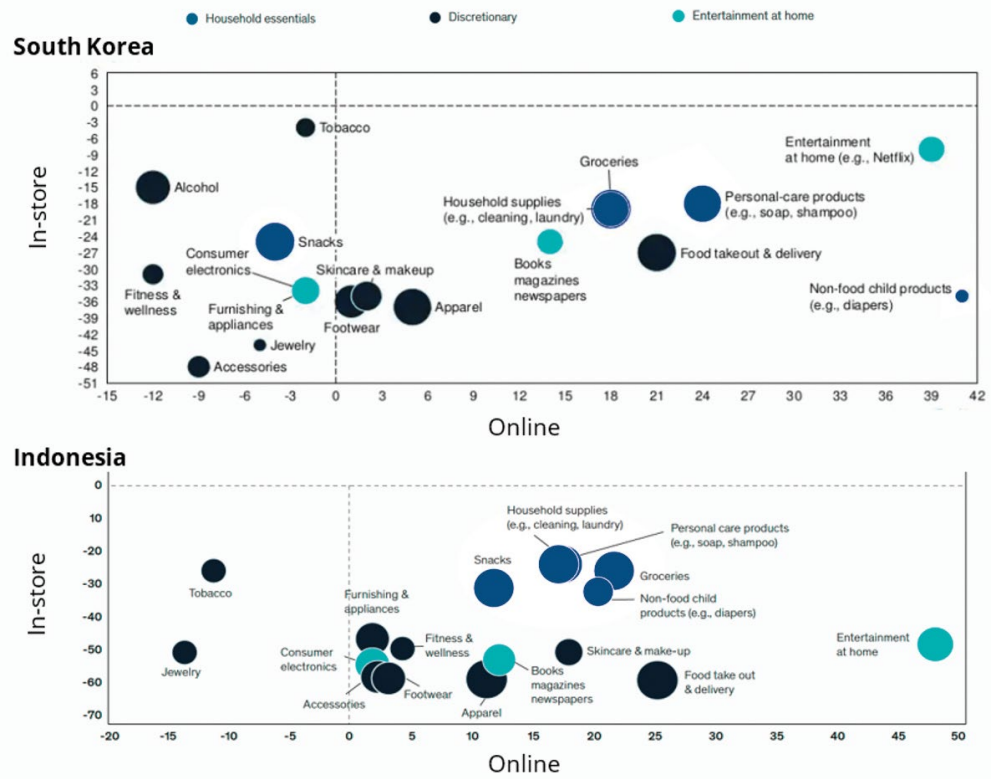
E-commerce purchase and delivery platforms

During the epidemic, digital commerce has shown that it can meet people's requirements. In reality, several online platforms are being used to purchase and transport things when physical distance is imposed. This means that digital commerce—as a contact-reduced way of providing products and services—can allow for food security and economic resilience even when shops are closed or movement is restricted due to lockdown measures (EIB, 2020). In Asia, the crisis has hastened the growth of online commerce. To satisfy people's demands, online platforms are evolving and supplying important products. Hypermarkets and small-scale companies are also participating.

In India and Indonesia, nearly 50 million people a day use their electronic wallets to read about developments in the pandemic without the need to go out and buy a newspaper (Money Compass, 2020). Indonesian users of e-commerce and shopping apps rose by up to 70% throughout the February–June 2020 period, according to a report from a California-based analytics company, AppsFlyer.

E-commerce platforms such as Bukalapak, Lazada, and Tokopedia are competing for the largest e-commerce market in Southeast Asia (Sedik, 2018, p. 32). China's online share of retail sales rose from 19.4% to 24.6% between August 2019 and August 2020. In Kazakhstan, the online share of retail sales increased from 5% in 2019 to 9.4% in 2020 (UNCTAD, 2021).

Figure 5. Expected shift from offline to online channels in South Korea and Indonesia



Note: Expected change in shopping channel per category over the weeks of April 13 and April 20. Axes show net intent, bubble size relative to share of respondents that have purchased category in last six months. Net intent is calculated by subtracting the percentage of respondents stating they expect to decrease frequency from the percentage of respondents stating to increase frequency. (Source: McKinsey & Company COVID-19 Consumer Pulse - Korea and Indonesia)

From Figure 5 above, during the pandemic, there is a clear shift from offline to online usage for household and entertainment goods in South Korea and Indonesia as representatives of Asian economies. Because of several lockdowns, people cannot visit the in-store shops for their necessities, and as they stay at home more, their leisure activity has also shifted towards online entertainment.

Digital financial services

Digital financial transactions have grown in tandem with e-commerce. During the COVID-19 health crisis, digital financial services can and do help with contactless and cashless transactions. Because digital financial services are faster, more efficient, and less expensive than traditional financial services, they have become increasingly popular. The usage of mobile payment in the public sector has exploded, particularly in the delivery of cash support via digital networks. Prominent examples include the distribution of consumption coupons via Alipay and WeChat Pay in China (Agur et al., 2020; Rutkowski et al., 2020), the JAM (Jan Dhan-Aadhaar-Mobile) Trinity system in India, and Bono COVID-19 in Chile (Prady, 2020). In the Philippines, the leading mobile-wallet company, GCash, reportedly saw a 700% year-on-year increase in transaction volume for the month of May (Globe, 2020). LinkAja, a state-backed financial technology platform, saw top-up transactions among LinkAja users grow twofold since COVID-19 hit Indonesia and recorded a 700% growth in transaction (EKONID, 2020).

Digital healthcare

The epidemic has revealed a number of gaps in public-health preparedness in both developed and developing countries. However, the COVID-19 epidemic has disrupted healthcare delivery, and digitization has emerged as a critical component in reshaping the healthcare sector.

The outbreak has brought attention to the importance of technology in healthcare. To make healthcare more accessible and affordable, mobile operators are integrating mobile and frontier technologies. At a time when COVID-19 information was crucial, telemedicine grew significantly. In addition, doctors' inability to see patients in person pushed video consultations to new heights. In China, the AliPay HealthCode app automatically detected contacts by concurrent location and automated the enforcement of strict quarantine measures by limiting the transactions permitted for users deemed to be high risk of COVID-19 (Budd et al., 2020).

Praava Health, Daktar Bhai, and TONIC are some of the digital healthcare solutions operating in Bangladesh. These telehealth services in Bangladesh are playing a vibrant role during this COVID-19 pandemic by providing doctor consultations via voice, chat, and video, along with digital prescription in the app and SMS.

Digital education

During pandemic, because of lockdowns and social distancing, educational institutions have to be closed. Education has changed dramatically ever since COVID-19, with the distinctive rise of e-learning, whereby teaching is undertaken remotely and on digital platforms (Kaur, 2020). Some schools, colleges, and universities have initiated online-based distance learning or online classes for their students during this time.

Many countries are resorting to online education, social media, television, radio, and other kinds of digital education to keep up with the times. During the global wave of pandemic lockdowns, e-learning grew at an unprecedented rate. The Asia Pacific region is one of the fastest developing regions in the world, and it now comprises 32% of the e-learning market's growth (Kaur, 2020). However, for growing Asian countries, ensuring equal learning opportunities for kids who lack access to gadgets, internet connection, and a conducive learning environment at home through proper social-protection measures and other methods is a challenge during this COVID-19 situation. As a result, this epidemic will create learning poverty with long-term negative implications for economic growth and human capital.

COVID-19 and Automation in Emerging Asian Countries

Development of technologies has been emerging, such as artificial intelligence and advanced robotics that lead to automation (Lamb, 2016). Automation introduces a superhuman performance, replacing what humans could do (Manyika et al., 2017a). In the long run, new technologies may mature to the point where artificial intelligence (AI) may replace humans in the performance of most activities, and individuals will no longer require advanced arithmetic or programming abilities to use them.

In addition, a study indicates the potential benefits of automation in improving businesses production. The growth of global productivity increases by 0.8 to 1.4% annually (Manyika et al., 2017b). Despite the advantages of automation, studies foresee disputes in the labor force as automation grows. In Canada, 42% of the labor force has a high possibility of being taken over by automated machines over the next 10 to 20 years (Lamb, 2016). Furthermore, one-third of the workforce in Germany and the United States would have to seek new occupations by 2030 if automation is implemented immediately (Manyika et al., 2017).

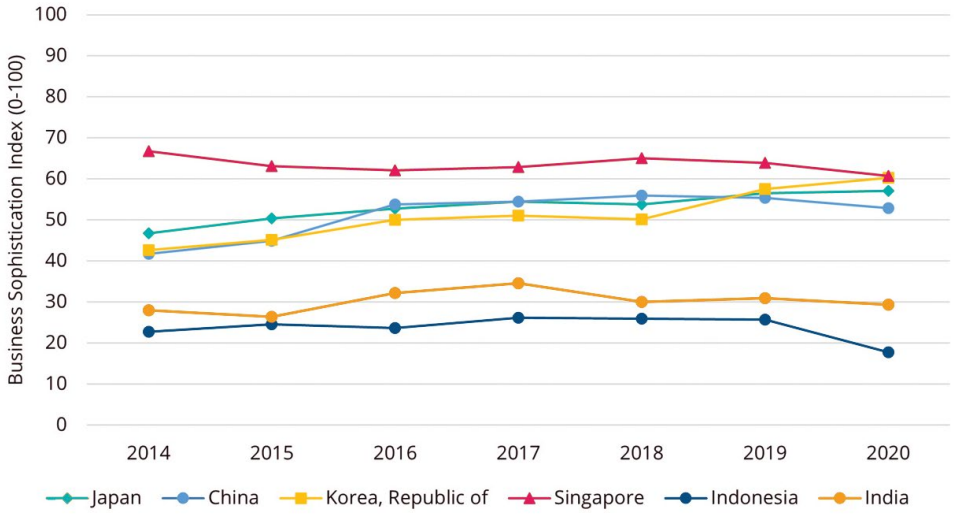
Nonetheless, history teaches a valuable lesson on developing technologies followed by creation of new jobs (Manyika et al., 2017b). Certain jobs with specific characteristics are able to be automated. For example, routine and repetitive tasks are strong candidates for automation (Karr et al., 2020). COVID-19 triggers automation and AI to displace work with high physical contact (Smit et al., 2020). On the other hand, several activities are at low risk of being automated, such as management, expertise, interface, and unpredictable physical activities (Manyika et al., 2017). Every economy has their own pace in adopting automation. In advanced countries, automation could be an alternative solution to labor shortage and high wages (Manyika et al., 2017). However, emerging countries could take advantage of automation to maximize labor productivity and minimize human failures (Arbulu et al., 2018).

In Asia, studies show how automation affect their labor force. A McKinsey Global Institute research estimated that currently demonstrated technologies have the potential to automate roughly half of the work activities performed in ASEAN's four biggest economies, Indonesia (52% of all activities), Malaysia (51%), the Philippines (48%), and Thailand (55%) (Chitturu et al., 2017).

Many Asian economies are export-oriented or seeking to expand exports as a means of economic development; thus, if future international competitiveness is dependent on automation, they have reason to be concerned. Figure 6 indicates that emerging countries like Indonesia and India are lagging behind in adoption of automation compared to other countries like South Korea, Japan, and China. There is a digital divide among the Asian countries.

The use of modern technologies and robotic systems can help businesses overcome the negative impacts of pandemic shocks more rapidly while keeping their employees safe. In the following, the contributions of two most crucial automation technologies—robot and medical AI—are discussed.

Figure 6. Business sophistication in Asia

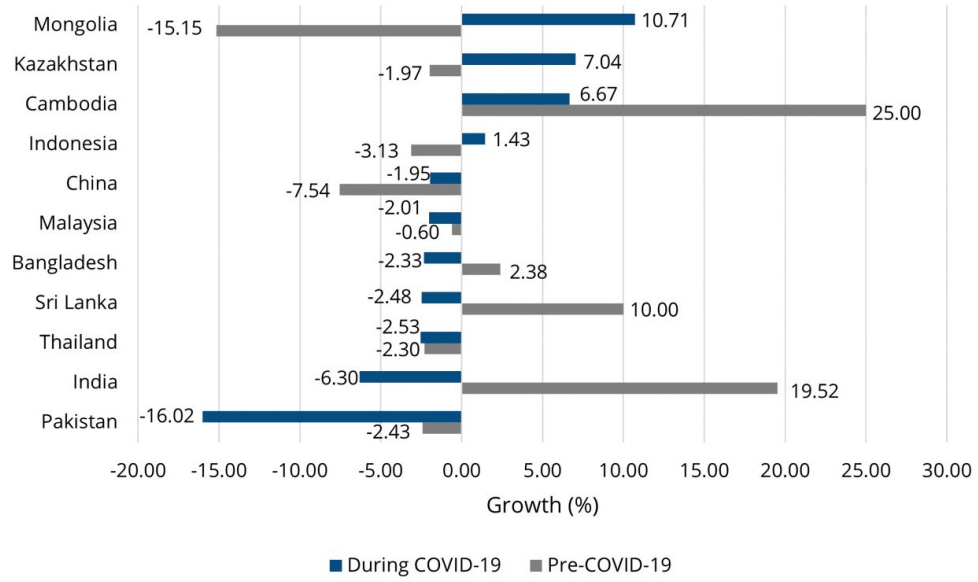


Note: Business-sophistication index is a tool to assess how conducive firms are to innovation activity. The index is measured from knowledge workers, innovation linkages, and knowledge absorption. From the *Global Innovation Index 2020: Who Will finance Innovation?* (13th ed.) by Cornell University, et. al (2020).

Robots

COVID-19, as well as the possibility of future pandemics, has the potential to hasten the automation process, as companies replace workers with pandemic-resistant computers and robots. On the other hand, usage of robots may go down as it requires huge investment. Global robot installations in 2020 were down by 2%, particularly under the impact of the coronavirus pandemic. Still the decline in sales was more moderate than expected (International Federation of Robotics, 2021). Though South Korea, Singapore, and Japan are the current leaders in robot density, emerging Asian countries are still facing problems in robot adoption, as the import of high tech is expensive and the industries that are required to use robots are not prepared enough for it. Figure 7 shows the import of high tech by emerging Asian countries during the pandemic. Most of the countries show a negative growth for imports of high-tech goods. Though robotic technology has high potential to combat the crisis, emerging Asian countries cannot reap the benefit.

Figure 7. Growth of high-tech imports before and during COVID-19



Source: From the *Global Innovation Index 2020: Who Will finance Innovation?* (13th ed.) by Cornell University, et. al (2020).

Medical AI

Coronavirus has infected a lot of people at the same time. Hospitals need to diagnose the disease as soon as possible so that the infected people can get proper treatment right away. Artificial intelligence can help in the way to speed up the diagnostic process. In China, Thailand, and the Philippines, AI-based COVID-19 scanners have been developed to read and analyse a patient's CT scans within three seconds (Roy, 2020). Moreover, the importance of AI during COVID-19 can also be seen from an installment of AI masks and infrared body-temperature detection to check whether people who enter the hospital are wearing a mask and have a normal body temperature to ensure the safety of visitors, patients, and medical staff (Roy, 2020).

Other technologies in containing COVID-19 are also developed in Korea through a fast-developed testing kit and smart quarantine information system without sealing down its economy (Amaresh, 2020). Furthermore, India provides COVID-19 therapy helpline numbers and many start-up apps to help India's mental-health issues. AI gives promising solutions to the problems during the pandemic, with some challenges in production such as financing, complex algorithms, and massive data sets (Um et al., 2020). The outbreaks caused the need of technology-advanced product worldwide, which would impact the healthcare market.

Economic Impact of Digitalization and Automation

Technology and innovation are two of the most important engines for a country's growth and development. In both developed and developing economies, digitalization and automation have substantial impact on economic growth. As the pandemic unlocks the digital economy's potential, digitalization and automation are becoming a regular feature of the economy.

Digitalization and automation have a huge impact on production and growth, as well as on creation of new jobs. According to research, each additional 10 percentage points of broadband penetration contributes 1.21 percentage points of per capita GDP growth in developed countries and 1.38 percentage points in emerging markets (Qiang et al., 2009). Moreover, financial technologies, or fintech, shore up the potential growth and reduce poverty by financial development, inclusion, and efficiency gain in the financial sector. Fintech can help millions of individuals and small- and medium-sized enterprises leapfrog access to financial services at an affordable cost, particularly in poor countries (Sedik, 2018, p. 32).

With recent developments in robotics, artificial intelligence, and machine learning, technologies not only can do things that we thought only humans could do but also can increasingly execute them at superhuman levels of performance. Automation of activities can help firms enhance their performance by eliminating errors, increasing quality and speed, and, in some situations, attaining results that are beyond human capabilities (Manyika et al., 2017b). Research by McKinsey shows that because of automation the growth of global productivity increased by 0.8 to 1.4% annually (Manyika et al., 2017b) .

In certain cases, technology may be used to supplement labor, boost productivity, and create additional jobs, but in others, it may be used to replace labor. While automation increases productivity and thereby causes unemployment, there are countervailing effects such as increasing product demand, local demand spillovers, increasing demand for new skills or even new jobs required for new products and services (Vermeulen et al., 2018). Fifty-six percent of jobs are at high risk of automation in ASEAN (Schlogl & Sumner, 2020, p. 64). From 2005 to 2015, in 12 Asian economies, there were 101 million job loss per annum due to modern machine tools and ICT equipment, which were offset by 134 million jobs created due to higher demand for goods and services (Schlogl & Sumner, 2020, p. 64).

During the pandemic, jobs in the work arena with higher levels of physical proximity witness more change. For example, in retail outlets, banks, and post offices, among other places, e-commerce will supplant the on-site client-

engagement arena. Productivity will rise as a result of COVID-19–induced technological progress. Workers in some occupations, however, may be furloughed, resulting in significant lifetime-earnings losses. As a result, it poses a danger to employment in Asia's labor-intensive countries.

While digitalization and automation are critical for the region's economy, they also bring with them societal challenges. In the changing market, job seekers need to be helped and prepared with competitive skills. Moreover, Asia's educational system has yet to catch up with the changes brought on by automation and robotics. Many governments in emerging Asian countries, on the other hand, are facing major financial difficulties and the lack of financial and technical resources needed to develop the domestic capacities and ecosystems needed to respond to COVID-19 and future crises.

So following the fast growth of digital networks across Asia, a number of studies suggest that digitalization and automation contribute not only to productivity and efficiency but also to broader socioeconomic development.

Policy Recommendations

In this time of crisis, we face two particularly important choices. The first is between totalitarian surveillance and citizen empowerment. The second is between nationalist isolation and global solidarity (Harari, 2020). Naturally, governments of all countries are responsible, first and foremost, for their citizens' well-being, and the focus on health is understandable and desirable. Countries have invested massive quantities of money in the pursuit for a coronavirus vaccine, which is unprecedented. Once the epidemic is under control, however, support for digitization and automation is critical.

In order to construct a better world after COVID-19, while availing the benefits of digitalization and automation and avoiding their disruptive effects, governments should work in a new dimension. Most governments in the world are focused on short-term responses to the epidemic, but others have begun to consider longer-term strategic recovery needs. Several developing-country governments have stepped in to preserve enterprises and individual incomes. Fragile and less-developed countries, in particular, do not have the financial power to withstand the economic troubles caused by this crisis.

In the following section, this paper has made some policy recommendations for emerging Asian countries for digitalization and automation.

Focusing on individual country strength

Companies in emerging countries have been sluggish to adopt digital technology, much alone modern types of AI and automation, because it takes considerable investments and reengineering of business processes. Because of their huge populations, emerging Asian countries' adoption of automation may create unemployment. However, digital financial services and e-commerce businesses have huge potential for these countries. So each of these countries should focus on their own individual strength.

Prioritizing education and training

Industry, governments, and educational institutions must work together to ensure that these individuals can improve their abilities through education, giving the technical and soft skills needed for tomorrow's jobs. Proactive training and retraining should also be implemented by the public and private sectors to help individuals in high-risk occupations adjust to potential occupational restructuring or job loss.

Reducing digital divide

Regulators can often be a roadblock to the creation of a digital economy since they are risk cautious when it comes to financial services, lacking in providing required infrastructure. This is a very common phenomenon in developing countries, where digitalization is still at an emerging stage of development. This leads to digital divide and inequality. So all countries must collaborate to fill data gaps, allowing for improved benchmarking, evidence generation, policy formulation, and the identification and prioritization of policy review and action. This may help to ensure equal opportunity for all and bring the real benefit of digitalization.

Conclusion

Every crisis presents new possibilities for creative disruption. The COVID-19 pandemic has resulted in an unparalleled global economic slowdown. The current crisis struck at a time when the innovation landscape was booming. Fundamentally, the pandemic hasn't changed the reality that there's still a lot of room for breakthrough technology and innovation. It has spurred innovation in a variety of industries, including education, remote work, and retail. The development and adoption of advanced technologies, including smart automation and artificial intelligence, has the potential not only to raise productivity and GDP growth but also to improve well-being more broadly, including a healthier life and longevity and more time for leisure.

For the future of work, digital technology and automation hold enormous promise. However, the speed and scope of automation and digitalization will be determined by technical, economic, and social considerations. Aside from technological feasibility, the cost of technology, labor-force competition on skills, supply-and-demand dynamics, performance advantages, and societal and regulatory acceptance will all influence the pace and extent of digitalization and automation.

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ASEAN Digital Masterplan 2025: Future of Work Perspective in Indonesia

Catherine SETIAWAN

Abstract

Automation in the Association of Southeast Asian Nations (ASEAN) and Indonesia will eliminate but also create more new jobs by 2030. To fully capture the productivity boost of automation, the government must conceive ways to address skills transitions. This paper aims to (1) analyse the ASEAN Digital Masterplan 2025 in the perspective of the future of work, (2) future of work perspective in Indonesia, and (3) provide recommendations on how to successfully implement Indonesian digital plans to be ready for the future of work.

ASEAN is home to over 600 million plus people (O'Neill, 2021), and as the fastest-growing internet market in the world, the ASEAN digital economy is projected to grow significantly, adding an estimated 1 trillion USD to the regional GDP over the next 10 years (World Economic Forum, 2019). It is further predicted that ASEAN's jobs in the future will be more automated, causing the displacement of 28 million workers in the ASEAN region by 2028 (Oxford Economics & Cisco, 2018). It is then important for the ASEAN governments to take further actions in preparing their workforces.

The ASEAN Digital Masterplan 2025 (ADM 2025) was launched during the first ASEAN Digital Ministers' Meeting in early 2021. This master plan maps out and guides the region's digital landscape in the next five years. The plan would prioritize ASEAN's recovery from COVID-19, connect businesses and facilitate cross-border trade, and build a digitally inclusive society. The plan is to build a digitally connected community within ASEAN to help businesses and citizens benefit from the opportunities presented by the digital economy.

As one of ASEAN members, Indonesia will also gain many benefits from an expanding digital economy. Indonesia's digital economy is predicted to contribute 124 billion USD by 2025 (Google et al., 2020). For future of work, McKinsey (2019) noted that Indonesian automation will eliminate up to 23 million jobs but will also create up to 46 million new jobs by 2030 (Das et al., 2019). To fully capture the

productivity boost of automation, it is imperative for the Indonesian government to work together with business, community, and educational institutions in a concerted way to address transitioning skills.

In embracing the future of work, the Indonesian government has been introducing several digital master plan and strategies in recent years, including Making Indonesia 4.0 by the Ministry of Industry and the Digital Literacy Roadmap by the Ministry of Communication and Information Technology (MCIT). Making Indonesia 4.0 is a roadmap on Indonesia's strategy in implementing Indonesia 4.0 and is hoped to revitalize Indonesian industry through the usage of advanced technology like artificial intelligence (AI), internet of things (IoT), advanced robotics, and 3D printing. MCIT's Digital Literacy Roadmap is aimed to guide Indonesian people in transitioning the skills for the future.

This chapter aims to analyse future of work in the perspective of ADM 2025 and Indonesia's digital-related plans and policies in relation to the aforementioned master plan's outcomes. This paper will eventually provide recommendations on how to successfully implement Indonesian digital plans to be ready for future of work. At the end, we hope this paper can convey the message and solutions to maximize Indonesia's digital potential for the future.

ASEAN Digital Masterplan 2025: Future of Work Perspective

ADM 2025 (ASEAN Secretariat, 2021) was designed in consideration of (1) COVID-19 pandemic and how it can assist the region's recovery from the pandemic; (2) climate change, as it has become a major and increasingly urgent issue, and how the digital services can have a significant role to play in reducing carbon emissions; and (3) global technology trends, since it is largely global in nature, and how these trends will have a significant impact on the way digital services are delivered and used in ASEAN over the next five years.

The *future of work*, influenced by technological, generational, and social shifts, describes changes in how work will be done over the next decade (Gartner, n.d.). The ADM 2025 has four visions for a wide range of digitally enabling economic activities that are still related to the future of work: (1) how ASEAN people can use digital services to enhance their daily lives, (2) how digitalization can increase productivity quickly and effectively with partners in their value chains, (3) making a more prosperous ASEAN region as digital services improve trade between ASEAN member states (AMS), and (4) creating a more sustainable ASEAN economy in the long-term to recover more quickly from the COVID-19 pandemic over the next few years. The ADM 2025 is comprised of eight desired outcomes and thirty-seven enabling outcomes as mentioned in Table 1.

Table 1. ADM 2025: Summary of desired outcomes and enabling outcomes

Desired Outcome	Enabling Outcome
1. To speed [up] ASEAN's recovery from COVID-19	• Make the economic case for prioritising ADM 2025 actions • Assess the economic case for facilitating use of digital services that would help recovery from the COVID-19 pandemic
2. Increase the quality and coverage of fixed and mobile broadband infrastructure	• Encourage inward investment in digital and ICT • Move towards best practice permission and access rights for local and national infrastructure including submarine cable repair • Facilitate adoption of region wide telecommunications regulation best practices by market players to provide regulatory certainty • Ensure adequate international Internet connectivity. • Reduce the carbon footprint of telecommunications operators in ASEAN • Ensure increased and harmonised spectrum allocation across the region • Adopt regional policy to deliver best practice guidance on AI governance and ethics, IoT spectrum and technology. • Develop regional mechanisms to encourage skills in integrated and end-to end services • Establish a centre of excellence for best practice rural connectivity.

3. The delivery of trusted digital services and prevention of consumer harm	• Enable trust through greater and broader use of online security technologies • Build trust through enhanced security for finance, healthcare, education, and government • Identify improvements in legal and regulatory measures on the management of protection of data and other data-related activities that could be harmful. • Improve coordination and cooperation for regional computer incident response teams • Promote consumer protection and rights in relation to e-commerce
4. A sustainable competitive market for the supply of digital services	• Continue to identify opportunities to harmonise digital regulation to facilitate cross-border data flows • Deepen collaboration between ICT and competition regulatory authorities across ASEAN on the ICT sector and digital economy • Monitor developments in regulation of digital platforms in other jurisdictions
5. Increase in the quality and use of e-government services	• Establish ASEAN wide reporting on the level of use of e-government services in line with ITU requirements • Help make key government departments more productive through their internal use of ICT and e-services • Explore how to introduce digital identities in each AMS in a way which safeguards civil liberties • Help developing AMS improve the quality of their e-government e-services • Improve the cohesion of AMS by making key government e-services interoperable across the ASEAN region

6. Digital services to connect businesses and facilitate cross-border trade	• Facilitate compliance and secure the benefits of telecommunications services and electronic commerce in line with relevant ASEAN trade agreements • Support trade digitalisation through seamless and efficient flow of electronic trade documents (e.g., invoices) and goods within ASEAN • Assess the net benefits of including IR 4.0 technologies in trade facilitation processes • Reduce regional business travel costs, by lowering roaming rates for mobile data services across ASEAN • Promote e-commerce trade in ASEAN, enhance last-mile fulfilment cooperation, and improve competitiveness in the digital economy
7. Increased capacity of businesses and people to participate in the digital economy	• Continue to support the advancement and harmonisation of ICT qualifications across ASEAN • Promote development of advanced digital skills, such as coding, hackathons, innovative challenges • Develop a framework that encourages the development and growth of digital start-ups in ASEAN • Progress the work on smart cities begun in AIM 2020
8. A digitally inclusive society in ASEAN	• Ensure citizens and businesses have the skills and motivation to use digital services • Reduce affordability barriers to getting online • Reduce accessibility barriers to getting online • Encourage deeper adoption and use of 'vertical' digital services

Source: ASEAN Digital Masterplan 2025 (ASEAN Secretariat, 2021).

As defined by Deloitte (2019), *future of work* is the result of many forces of change affecting the work (what), workforces (who), and workplaces (where) (Schwartz et al., 2019). With that definition, the element that will be discussed more in this paper is in the workforce (who), and in the purview of ASEAN Digital Masterplan

2025, there are two related outcomes, namely outcome 7 and 8, on digital human-resource capability. Details linkage can be seen in Table 2.

Table 2. Future-of-work elements in ADM 2025 purview

Future of Work Definition	ADM 2025 Outcomes
The work, the workplaces	**Outcome 2:** Increase the quality and coverage of fixed and mobile broadband infrastructure.
The workforces	**Outcome 7:** Increased capacity of businesses and people to participate in the digital economy.
	Outcome 8: A digitally inclusive society in ASEAN.

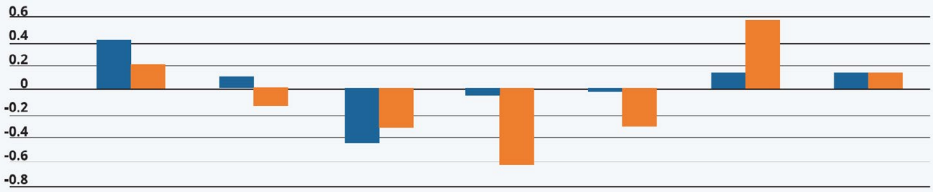
Sources: Deloitte (2019), ADM 2025 (2021).

Future of Work: Indonesia's Related Digital Policy and Plan

Digitalisation and globalisation have sparked radical shifts in how we live and work, and it is further accelerated by the COVID-19 crisis beyond anything we could have imagined (OECD, 2021). Google, Bain, & Temasek predicted that Indonesia's digital economy can reach as high as 124 billion USD in 2025, from only 44 billion USD in 2020 (Google et al., 2020). Unlike any other sectors that collapsed during the pandemic, the information and technology (ICT) sector contributed the highest, amounting to 57% contribution to GDP growth in 2020 from only 15% pre-COVID (2019). As shown in Figure 1, other sectors mostly experienced a decline on their GDP growth contribution during COVID.

Indonesia has introduced several digital-related plans and strategies in recent years related to future of work.

Figure 1. Indonesia GDP growth per sector contribution (%)



	Agriculture, Forestry, and Fisheries	Mining and Quarry	Construction	Transportation and Warehouse	Accommodation, Food, and Beverages	Information and Technology	Financial and Insurance Services
2019	0.45	0.09	-0.45	-0.03	-0.02	0.15	0.13
2020	0.22	0.14	0.33	-0.64	-0.31	0.57	0.13

Source: Badan Pasat Statistik (2021).

Industry 4.0 in Indonesia

The Fourth Industrial Revolution does have a huge impact on future of work, considering it is largely driven by four specific technological development (force of changes), including high-speed mobile internet, AI and automation, the use of big data analytics, and cloud technology (Change, 2017). The first is initiated by the Ministry of Industry (Making Indonesia 4.0). Making Indonesia 4.0 is a roadmap on Indonesia's strategy in implementing Indonesia 4.0. With this roadmap, the government is hoping to revitalize Indonesian industries through the use of advanced technology like AI, IoT, advanced robotics, and 3D printing. In implementing these technologies, Indonesia will focus on five main sectors, namely, (1) food and beverage, (2) textile and apparel, (3) automotive, (4) Electronics, and (5) chemicals (Ministry of Industry, 2018).

Indonesia will further push the 10 national priorities in fulfilling the Making Indonesia 4.0 initiative:

1. Improving the flow of goods and materials
2. Redesigning the industrial zone
3. Accommodating the sustainability standard
4. Cultivating small and medium enterprise
5. Developing the national digital infrastructure
6. Attracting Foreign Investment
7. Improving human resource quality

8. Developing innovation ecosystem
9. Incentive for technology investment
10. Harmonizing policy and regulations

We can see that Indonesia's Industry 4.0's priorities are relevant to ADM 2025, especially in increasing the capacity of human resource and business in Indonesia (priority 7). Despite the automation potential, Indonesia is facing a shortage of digital talents (AlphaBeta, 2020). AlphaBeta found that an accelerated pace of digital skilling is important, considering how much contribution digitally skilled workers can give to Indonesia's GDP in 2030 (4,434 trillion Indonesian rupiah [IDR], or equivalent to 303.4 billion USD).

As mentioned in ADM 2025's outcome 7, increasing capacity for businesses and people to participate in the digital economy can be seen in four aspects: (a) supporting the advancement of Indonesian ICT qualifications, (b) promoting advanced digital-skills development, (c) developing a framework to encourage digital start-up growth in Indonesia, and (d) progressing the smart cities in Indonesia.

Increasing capacity for businesses and people in Indonesia

1. **Support the advancement of Indonesian ICT qualifications.**

   A study conducted by ILO (Wiryasti et al., 2020) mentioned that ICT employment would increase consistently with digitalization in various industries. As a result, the world of work and skills need to change rapidly. ILO further identified seven ICT roles that will be demanded by industries in Indonesia, namely,

   a. IT support/computer support/maintenance/helpdesk
   b. IT system programmer/developer/system analyst
   c. IT web designer and developer
   d. Creative content/creative designer
   e. Mobile app developer
   f. Social media/digital/multimedia/marketing/SEO specialist
   g. IT software engineer/quality assurance/quality control/tester/developer

Consistent with ILO's prediction, MCIT already prepared the seven ASEAN ICT skill standards for domestic industrial human resources to face the ASEAN free market or MEA. The ICT Skill standards are (1) software development, (2) ICT project management, (3) enterprise architecture design, (4) network and system administration, (5) information system and network security, (6) mobile computing, and (7) cloud computing (MCIT, 2015). In addition, MCIT also has a Strategic Plan for 2020–2024 prepared by the Agency of Research and Human Resources Development, covering some strategy and plan for human-resource capability in ICT sector (MCIT, 2021b).

2. Promote advanced digital-skills development.

Besides the strategic plan, MCIT also has the Digital Literacy Roadmap with some programs on digital literacy. As listed in Table 3 below, we can see the digital-literacy framework, classified into basic, intermediate, and advanced levels, looking through target and program example.

Table 3. Digital-skill grouping in Indonesia

	Basic Digital Skill	Intermediate Digital Skill	Advanced Digital Skill
Target	Society	Technical Workers	C-level, practitioner, bachelor graduate, expert
Program example	Siberkreasi	Digital Talent Scholarship	Digital Leadership Academy

Source: Deloitte (2020); MCIT et al. (2021)

Basic digital skills have a purpose to (1) increase knowledge, understanding, awareness, creativity, and digital technology skills; (2) improve and develop the cultural capacity of using safe digital technology; (3) encourage the improvement of basic antinegative content skills (antihoax, anticyberbullying, antihate speech, antipornography, antipiracy, antiradicalism, etc.); (4) provide, encourage, and improve basic knowledge and understanding of the use of new digital technologies (emerging technologies such as robotics, IoT, AI, big data, etc.); and (5) strengthen knowledge, empowerment, and facilitation of digital technology-based communities.

Unfortunately, based on the discussion with the Siberkreasi team of MCIT, there are yet further information and details in relation to intermediate and advanced digital-skills curricula. The only parameter that can be seen is through target aspect and program example (MCIT, 2021a). Also, some

advanced digital-skills training like coding, hackathons, and innovation challenges are being held across Indonesia, pioneered mostly by private companies like Gojek and Tokopedia.

3. **Develop a framework to encourage digital start-up growth in Indonesia.**

Table 4. Update on 1000 Start-up program

Number start-ups being pioneered	1,160+
Potential founders	85,000+
Mentors	400+
Location	20 (Medan, Toba, Pekanbaru, Batam, Pontianak, Balikpapan, Jakarta, Bandung, Semarang, Surakarta, Yogyakarta, Surabaya, Malang, Denpasar, Mataram, Makassar, Manado, Kupang, Ambon, Jayapura)

Source: 1000StartupDigital (n.d.)

For start-up focus, the 1000 Start-Up Movement that was launched in June 2016 by President Joko Widodo aims to foster 1,000 start-ups by the end of 2020 (to 5,000 by 2024) (MCIT, n.d.), with an expected valuation around 10 billion IDR (Castel-Branco, 2021). The programme includes networking, workshops, hackathons, bootcamps, and incubation programmes that are carried out across twenty large Indonesian cities (1000StartupDigital, n.d.). As of the last quarter of 2021, there are already more than 1,160 start-ups being pioneered and more than 85,000 potential founders applied to this program. The update detail for this start-up program can be seen in Table 4.

In addition to the 1000 Start-Up Program, the Ministry of Industry also has another strategy to aggressively encourage the development of technology-based start-up business incubation, with the support of capital incentives and facilitation of facilities and infrastructure. So far, there are already several areas that have incubator centres built by the government, such as, among others, Bandung Techno Park, Bali Creative Industry Centre (BCIC), Incubator Business Centre in Semarang, Makassar Technopark and Mobile Design Centre in Batam. This strategy is hoped to continuously strengthen Industry 4.0.

Unfortunately, there is a challenge in regulatory perspective, as there is an absence of start-up regulations in the digital ecosystem that could specifically

connect each start-up with users or investors. This could somehow raise doubts in the minds of young innovators who want to give further contributions in helping new start-ups.

4. **Progress the smart cities in Indonesia.**

The smart-cities programs also progress well in Indonesia. The movement towards 100 Smart Cities is a joint program of the MCIT, Ministry of Home Affairs, Ministry of Public Works and Housing (PUPR), Ministry of National Development Planning (Bappenas), and the Presidential Staff Office. This movement aims to guide regencies/cities in preparing smart-city master plans so that they can maximize the use of technology, both in improving public services and accelerating the potential that exists in each region. In Indonesia, there are several cities that are ready to implement smart cities, namely DKI Jakarta (Local Province Governor, 2016), Bandung, Makassar, Yogyakarta, Surabaya, Medan, Padang, Banyuwangi, and other cities (Devega, 2017).

A Digitally Inclusive Indonesian Society in ASEAN

As we can see from Table 5 below, there are 77% internet users in Indonesia, compared to population numbers. It further shows in the table that compared to other ASEAN countries, internet users in Indonesia are the highest, contributing to 41% from total internet users' percentage in ASEAN.

Table 5. ASEAN population and internet users, June 2021

Country	Population (2021 Est.)	Internet Users	Penetration % Population using Internet	Internet Users % ASEAN
Brunei Darussalam	441,532	461,600	105%	0.09%
Cambodia	16,949,438	12,444,000	73%	2.41%
Indonesia	276,361,783	212,354,070	77%	41.04%
Laos	7,379,358	3,845,000	52%	1%
Malaysia	32,776,194	29,161,765	89%	5.64%
Myanmar	54,806,012	28,530,000	52%	5.51%
Philippines	111,046,913	91,000,000	82%	17.59%
Singapore	5,896,686	5,173,907	88%	1.00%

Thailand	69,950,850	58,500,000	84%	11.31%
Vietnam	98,168,833	75,940,000	77%	14.68%
Total	**673,777,599**	**517,410,342**		**100.00%**

Source: Internet World Stats, 2021

This promising number needs to be supported with adequate digital skills and motivation to ensure its inclusivity.

Ensuring citizens and businesses have the skills and motivation to use digital services

Siberkreasi at the MCIT targets 50 million people (MCIT - Directorate General of Informational Application, 2020) to follow the digital literacy curriculum and receive related materials. Through the Digital Literacy National Movement, Siberkreasi has partnered with 108 entities from various digital-literacy organizations and communities in carrying out the digital-literacy program. The topics discussed in Siberkreasi's five pillars are (1) digital content/lifestyle, discussing the use of technology and the internet in daily life, especially through social media and digital platforms; (2) digital parenting, discussing the development of technology and the internet that must be known by parents and teachers in developing parenting patterns and the education system; (3) digital economy, discussing the use of technology and the internet in the business world, developing marketplace/e-commerce and buying and selling transactions that can be utilized by businesspeople and the public; (4) digital society, discussing ethics as a smart and responsible citizen of the digital world; and (5) digital governance, discussing the use of technology and information by the government to provide information and public services that are more efficient and need to be known by the public.

Reducing accessibility and affordability barriers to getting online

A digitally inclusive Indonesia in ASEAN society needs to consider not only digital skills but also connectivity as one of the barriers to achieving access to digital services for everyone in Indonesia. Provision of Internet Access is one of the USO (universal service obligation) programs in the telecommunications and informatics sector managed by the Telecommunications and Information Accessibility Agency (BAKTI) (MCIT, 2018), and with Internet Access Program for Villages, this service provides internet access in schools, vocational-training centres, health centres, village halls, government offices, and public locations in 3T areas (frontier, outermost, underdeveloped).

MCIT will continue this effort to distribute internet access through BAKTI by deploying 4G signal access in 12,548 villages that have not been reached by 4G networks in Indonesia (MCIT, 2019). Distribution can be seen in Table 6 below.

Table 6. 4G access distribution in Indonesia

	Number of Villages
Total villages in Indonesia	83,218
Villages with 4G access	70,670
Villages with no 4G access	12,548
3T	9,113
Non 3T	3,435

Source: MCIT (2019).

This large project is planned to be implemented and its achieved by the end of 2022 (MCIT, 2019).

Conclusion and Recommendations

Indonesia's digital policies and regulations are consistent with the ADM 2025, looking through related outcomes. Unfortunately, there are still some challenges that remain.

Increased capacity of people and business

The Indonesian digital-literacy roadmap needs to be elaborated, especially in defining the medium and advanced curricula. It is not an easy task for the government to define the medium and advanced skill sets needed, considering how fast this sector has been growing. Digitalization also has many complexities in its different layers and aspects. That said, involving all relevant players (beyond the government) in building our curriculum is very important. Having regular discussions with the private sector and other related players is much needed to ensure that (a) the curriculum is consistent with the skill sets needed and (b) it is not outdated but innovative and suitable to the future of skills needed. The right curriculum will, at the end, match the labour supply with the industry demand.

The digital curriculum needs to also be implemented as part of school or vocational-education curricula. By making this as part of curriculum, the future generation will be equipped with relevant future skill sets at an early age.

In terms of start-up, it is important to have start-up regulatory policies in the digital ecosystem, especially in emphasizing further on the connection and relationship between the start-up and users or investors. Having a clear regulation will standardize all related procedures in each phase of the start-up, especially on the right and responsibilities of the founders, users, investors, and other relevant players. This will end up creating a sense of security and further encouraging more relevant players to participate actively in the digital ecosystem.

A digitally inclusive society

To be more digitally inclusive, MCIT, through Siberkreasi, needs to collaborate actively with other related ministries and private sectors, especially in providing more digital training that are relevant for each sector. Besides, MCIT needs to also conduct a regular study or research to innovate and to ensure that the programs offered are not outdated and consistent with the current situation and demand.

MCIT need to seriously prioritize people in the rural areas, especially in 3T areas (frontier, outermost, underdeveloped). This to reduce the digital divide and to ensure the welfare of all people living in all areas in Indonesia.

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Towards Indonesia 2045: Unleashing Indonesia's Workforce Potentials

Lestary Jakara BARANY and Dandy RAFITRANDI

Abstract

To achieve the 2045 Vision, Indonesia must significantly improve the quality of its workforce. Although policymakers recognize the importance of improving human capital, there is still work to be done. This article focuses on education and skill development as Indonesia's main binding constraints to be a high-income country. Specifically, this paper examines Indonesia's aspirations and challenges, the future of jobs, and the condition and government policy response using the skill-formation framework.

In the last few decades, Indonesia has recorded progressive economic achievements, although in 2020, this progress was hampered due to the COVID-19 crisis. Indonesia's average economic growth is 4.8% during 1991-2020, with a contraction due to the crisis by 13.1% in 1998 and 2.1% in 2020. The main driver of economic growth is the consumption of the middle class, which is around 12% annually since 2002. The middle-class group needs to be expanded to level up Indonesia's income status to become a high-income country. Unfortunately, only one-fifth of Indonesians are middle class. Half of Indonesia's population (approximately 115 million people) are aspiring middle-class, a group of people who have moved out of poverty and "aspire" to enter the middle class.

One of the challenges to expanding the proportion of this middle-class group is providing pathways for upward mobility, for example, through work. As technology advancement disrupts the labor market, the nature of work changes, requiring different skill sets compared to conventional occupations. According to Oxford Economics' estimation, 10.2% of ASEAN-6 workforce will be displaced by automation by 2028 (Oxford Economics & Cisco, 2018). There will be a 9.5 million job loss in Indonesia since the economy still relies on a large agricultural sector. Other sectors such as manufacturing and wholesale & retail are also affected greatly by automation. However, the benefit of technological adoption, reflected by these sectors' income effect, outweigh its displacement effect. Therefore,

it is crucial to understand the future of work and identify prerequisite skills and education. In this regard, this article aims to explore the future of work in Indonesia by identifying the skill gap, policy intervention, and market responses.

From the government side, the Indonesian 2045 vision in the human development and mastery of science and technology pillar is an ambitious one. This writing will focus on this pillar since the government already spent a vast national budget on education and health. Some of the key targets in 2045 are (1) twelve years average years in schools, (2) 60% of gross university enrollment, (3) labor-force participation at 78%, and (4) 90% of the labor force has at least twelve years of education. The vision also states that the first phase of labor reform will emphasize quality improvement in education and training by strengthening its relevancy with the demand from industry.

The article will be divided into four parts. The first section discusses Indonesia's aspiration in 2045 to improve human capital and employment quality and its challenges. The second section explores technology and its impact on future jobs. The third section analyses the condition and government's policy response using the skill-formation framework. Finally, the last section encapsulates the article and provides some policy recommendations.

Indonesia's Workforce Aspiration in 2045: Why It Matters

In general, 2045 is seen as the "deadline" for Indonesia to achieve high-income-country status. The year 2045 is crucial, as it will be a century milestone for Indonesia's independence. Indonesia aspires to be in the top 5 highest GDP globally, wherein Bappenas estimates that Indonesia's GDP per capita is projected to exceed 23,000 USD. Indonesia's aspirations are contained in the Indonesia Vision 2045, which has four pillars, namely (1) human development and mastery of science and technology, (2) sustainable economic development, (3) equitable development, and (4) strengthening of national resilience and good governance.

In 2045, Indonesia's population is estimated to be 318.9 million people. From the demographic perspective, Indonesia is heading towards the end of the demographic-dividend window in 2037. According to Indonesia Population Projection, Indonesia's demographic-dividend peak is expected to occur in 2021-2022. During this period, Indonesia will have the lowest dependency ratio—100 productive citizens will only support 45.4 unproductive citizens—which brings the potential for a greater society. The high proportion of the productive-age population becomes the development capital. However, countries may only fully benefit from the demographic dividend if they can create productive jobs for those aged 15 to 65 (Booth, 2021). Indonesia needs to ensure that this workforce

is absorbed into the labor market. If Indonesia's workforce cannot be absorbed in the labor market, the demographic bonus will turn into a demographic disaster. This may lead to unstable socioeconomic conditions. It can be worsened if Indonesia does not have well-managed safety nets.

After passing the window of opportunity for the demographic bonus in 2037, the proportion of the elderly population will increase in the next period. As a result, the population structure is slowly aging. The demographic bonus in several countries like Korea and Japan is a prerequisite for getting out of the middle-income trap.[1] With aging population, it will be more challenging to improve Indonesia's state income. If the demographic potential is not accompanied by the availability of quality jobs, which will make it difficult for workers to prepare for their old age, then in 2045, this unproductive population can increase the burden on the fiscal budget.

Towards 2045, Indonesia has determined several targets on the labor force, but education outcomes continue to be an impediment to meeting these targets. Table 1 shows Indonesia's main objectives on labor force and education (Kementerian, 2019). These targets are bold undertakings. The government aims to significantly increase labor-force participation, especially the high-skilled labor force. Moreover, female labor-force participation is expected to increase 15% when it has been stagnant for decades. On the other hand, unemployment and the share of agriculture workers are expected to decrease. This implies that there is hope for a labor shift to high-productivity sectors (manufacturing and services).

1 The term "middle-income trap" was first introduced by Gill & Kharas (2007) to describe economies that were squeezed between low-wage poor-country competitors who dominated in mature industries and rich-country innovators who dominated in industries undergoing rapid technological change. Although there is still debate about the theory and empirical studies on this "trap" concept, this article uses it to describe the conditions in Indonesia's efforts to climb the economic ladder to become a high-income country.

Table 1. Indonesia's key targets on labor force and education in 2045

	2015	2045
Labor force participation rate (%)	65.8	78
Female labor force participation rate (%)	48.9	65
Labor force (million people)	122.4	197.2
Unemployment rate (%)	6.2	3-4
Agriculture sector workers proportion (%)	32.9	13
Labor force with at least 12 years of education (%)	39.3	90
Average years of schooling	8.3	12
Gross Enrollment Ratio Higher Education (%)	29.9	60
Science, Technology, Engineering, Art, and Mathematics (STEAM) graduates (%)	39.9	70

Source: Bappenas.

Labor-force targets are accompanied by fairly ambitious educational targets. According to the National Development Planning Agency (Bappenas), there will be more people of school age between 2015 and 2045. The gross enrollment rate is expected to more than double from 30 to 60%. Besides that, in order to anticipate the impact of technology in the workplace, STEAM graduates are expected to increase significantly from 40 to 70%. To achieve these targets, Indonesia should make a structural reform within the next two decades.

Unfortunately, pandemic threatens Indonesia's effort to capitalize on the demographic dividend. The COVID-19 pandemic, which has been afflicting Indonesia since March 2020, has made achieving the dividend even more difficult. Many population experts doubted Indonesia's ability to capitalize on the dividend before the pandemic (Wahyudi, 2020). COVID-19 makes it more difficult for everyone to obtain decent work and education, especially the marginalized and vulnerable populations. In addition, based on the Central Statistics Agency, the pandemic and the resulting social restrictions affected employment. In February 2021, COVID-19 left around 1.62 billion people unemployed, 1.11 billion people temporarily out of work, and 17.72 billion people experiencing reduced working hours (Badan Pusat Statistik, 2021). To overcome the impact of the pandemic on workers, the government responded by adding a "semi-social assistance" function to the Preemployment Card program, which was previously designed as an upskilling and reskilling program (Kementerian, 2021; see Appendix A).

On the other hand, as a double-edged sword, the pandemic has positive consequences, such as accelerating digital transformation. In addition to the

demographic dividend, discussions on skill, education, and jobs are crucial in Indonesia's economic development since the country is struggling with digital divide. Amid rapid progress in digitalization, various studies reveal that Indonesia is experiencing a shortage in digital-skills labor (World Bank, 2018). Without a planned and comprehensive intervention, this shortage will continue and impact Indonesia's ability to seize the benefits of the digital-economy advancement. Finally, achieving vision 2045 without using technology as a catalyst to expand Indonesia's future workforce will be extremely difficult. As a result, understanding how technology works and its implications on the labor market is required.

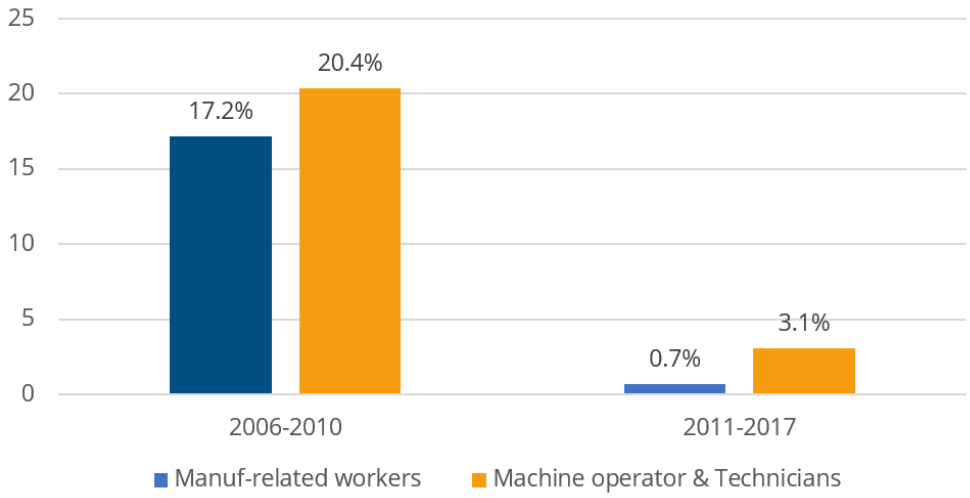
The Impact of Technology on Jobs and Digital-Skills Gap in Indonesia

Technological change is a common phenomenon, but this time is different. The global economy is rapidly transformed by globalization and robotics, or *globotics*. Instead of being the exception, service-led development may become the norm. Developing countries can export their comparative advantage, which is low-cost labor, without first having to produce goods with that labor. This technological advancement has led to the rapid development of digitalization, massive use of platformisation, and the expansion of the gig economy. It has been transforming business models, changing the nature of work and demand for skills. History shows advances in the use of computers in routine tasks, algorithms for big data with the ability to recognize patterns can replace a variety of workers in cognitive nonroutine tasks, to the use of robots equipped with senses and agility so that they can perform many manual tasks (Autor, 2013).

A study finds that the trend of employment reallocation is already materialized in Indonesia (Wicaksono & Mangunsong, 2020). Using the National Labor Force Survey (Sakernas) and Indonesian Family Life Surveys (IFLS) data, the study shows a slowing down in manufacturing jobs with high routine tasks and wage stagnation in middle-skill jobs. Figure 1a describes that technology might significantly reduce the demand for high-routine-tasks jobs (e.g., manufacturing-related workers and machine operators). The lower demand might lead to lower wages for routine-task jobs in the future (Figure 1a). Figure 1b explains the trend in average wage by occupations' skill rank. The occupation-sector group with high skill ranking is defined by those with high average wages and calculated by the average wages for the same occupation-sector groups in 2017 while maintaining the rank of the occupation-sector groups in 2000. With almost 20 years of gap data, it turned out that the job-polarization trend, as Acemoglu & Autor (2010) stated in their study, is reaffirmed by a wage-growth stagnation in middle-skill occupations.

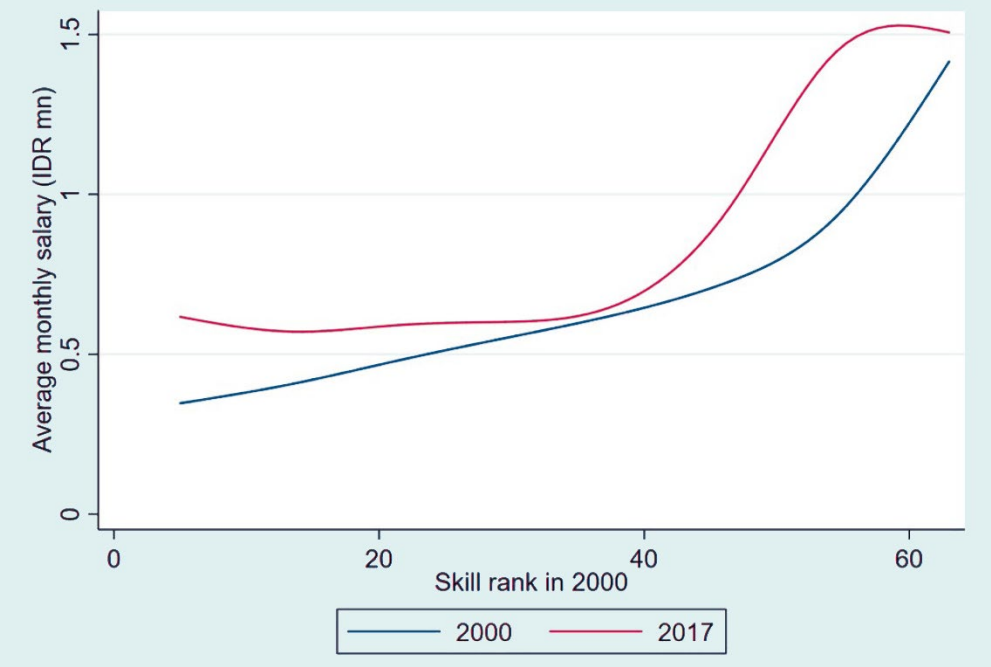
Although this trend implies a fear of automation creating a jobless economy, some studies indicate that automation can accelerate growth and create new jobs. McKinsey (2019) argues that by 2030, automation could help Indonesia accelerate its growth trajectory, creating jobs for many of the 25 million new entrants to the country's labor force. Historically, innovation generated a new form of work, and the new development of technology could create 10 million jobs in new occupations. As small-medium enterprises dominate Indonesia, digital technology supports Indonesia's entrepreneurial dynamism. Online commerce could directly or indirectly support up to 26 million full-time-equivalent jobs by 2020.

Figure 1a. Average annual growth of manufacturing jobs, 2006–2017



Source: Wicaksono & Mangunsong (2019).

Figure 1b. Average real monthly wages by skill rank in 2000 & 2017



Source: Wicaksono & Mangunsong (2019).

As the digital economy expands, there is also an increasing demand for digital skill sets. The desired level of digital skills varies depending on the level of digitization. For example, the massive digitization in the core ICT sector is driving a high demand for advanced digital skills in data analysis, cloud computing, cybersecurity, and application development to develop new digital services and optimize resources (Chaochi & Bourgeau, 2020). On the other hand, more traditional industries such as agriculture and construction face relatively minimal digitization and rely more on workers with only basic or intermediate digital skills.

Furthermore, in Indonesia, the demand for digital talent is also increasing. The Mandiri Institute (2018) reveals that industries such as automotive, electronics, food and beverage, textile and clothing, and footwear show concern over the lack of workers with the knowledge needed in new technologies. In the financial sector, one of the factors hindering the adoption and development of financial technology is the lack of IT and other experts. In addition, the World Bank (2018) states that in 2015 to 2030, Indonesia will experience a shortage of 9 million skilled and semiskilled ICT workers with ICT graduate skills, often not meeting the industry's needs. Today, the industry demands more complex technical ICT skills, including soft leadership skills, communication, and business/marketing

skills. This argument is supported by McKinsey (2019), indicating that new skills will be needed for the automation age. These include not only technological skills but also social and emotional and higher cognitive skills such as creativity and advanced problem solving.

In general, there are three types of skills: cognitive skills, social and behavioral skills, and technical skills. Cognitive skill is a basic skill that captures numeracy and literacy ability and problem solving and critical thinking. Social and behavioral skills, or soft skills, are interaction and communication skills such as teamwork, empathy, and conscientiousness. Lastly, technical skills are a job-specific skill (e.g., mechanical aptitude for electricians). Jobs demand the combination of these skills at a different level. For instance, a software engineer will require more cognitive skills (i.e., complex problem solving and creativity) than a receptionist, who might need soft skills for customer relation.

As more technology-intensive jobs arise, it is reasonable that one might think that IT and computer-related skills are the most important ones. Programming skills, more specifically, will be on demand since it is the "language" for human-machine interaction. It means skills such as statistical programming (R, Phyton), machine learning (neural networks, natural-language processing), and data management (SQL, Hadoop) will be on demand.

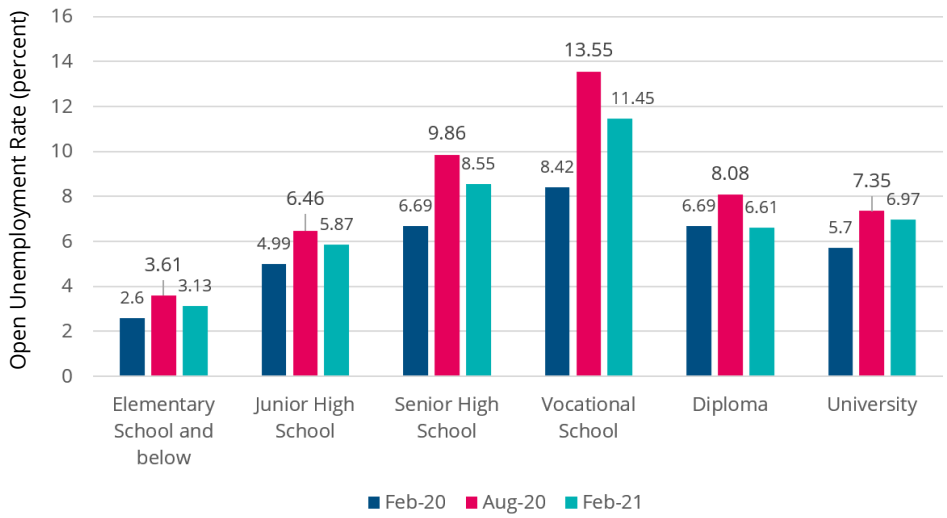
On the other hand, high cognitive skill alone is insufficient. Tasks that are repetitive and programmable are more prone to automation. Accountant and paralegal are examples of relatively high cognitive skills with relatively low requirement for social skills. These jobs have fared lower than jobs that combine both social and math-intensive in the United States. The point is, cognitive and science competencies are necessary but inadequate skills for future jobs. Teamwork, flexibility, and adaptability are the skills that will set us apart from robots since these skills are still difficult to automate and replicate.

Moreover, in the context of digital talent, the demand for digitally skilled labor has increased much faster than the supply-side growth. Domestic demand, especially in the banking, business, and retail sectors, has fueled the growth of Indonesia's ICT sector. As a result, future demand for ICT specialists will be driven by domestic-market trends in areas such as e-commerce, e-government, e-agriculture, e-medicine and health technologies, e-education, and e-banking (ILO, 2019).

Meanwhile, from the supply-side perspective, in general, being more educated does not necessarily mean that employability has increased substantially. As shown in Figure 2, the unemployment rate among higher education (diploma

and university) graduates is still higher than the unemployment rate among primary and junior secondary education only. Furthermore, those who finished graduates of vocational schools remains the highest at 11.45% when compared to graduates of other education levels in February 2021. Meanwhile, those with an elementary-school education or less have the lowest unemployment rate, which is 3.13%. One possible explanation is that education is of poor quality, resulting in the educational outcomes that do not meet the needs of the labor market.

Figure 2. Open unemployment rate by education completed



Source: Indonesia Statistic Agency (2021).

Nevertheless, various literature indicates the innovation process is privileging educated workers while lowering the demand for low-skilled workers. Highly educated workers tend to adopt new technologies more quickly than those with less education. In the 1980s, a period of rapid growth in computer adoption in the workplace, more educated workers were more likely to use computers on the job (Krueger, 1993). Using the Workplace and Employee Survey during 1999 to 2005, Riddel & Song (2017) found that education increases the likelihood of using computers at work.

Furthermore, digging deeper on digital talent, there are numerous factors that influence the shortage. Many factors influence the shortage of digital talent. ILO (2019) explains this shortfall's reasons, which include changing technological trends, outdated and non-interdisciplinary educational curricula, and poor teaching in mathematics, technology, and ICT in specific technical and vocational

education and training (TVET) and undergraduate institutions. The students' digital-literacy skill was at a deficient level. In addition, there was a significant difference in students' digital literacy skills based on the different educational levels (Perdana et al., 2019). As a comparison, according to the OECD Adult Skills Survey (PIAAC), globally, 15% of adults lack basic digital skills and 13% lack basic digital, numeracy, and problem-solving skills. The World Economic Forum predicts that by 2022, 54% of all employees will require significant retraining. This worsens the conditions in developing countries like Indonesia, which is exacerbated by the prevalent digital divide.

Lastly, the geographical aspect also plays a role. Access to and relevance of education and training opportunities is not evenly distributed in all regions in Indonesia. While almost the entire population of DKI Jakarta is literate, about one in five people in Papua is illiterate, and the literacy rate in West Nusa Tenggara is much lower (OECD, 2020). The COVID-19 pandemic has worsened conditions for work and education in Indonesia. There is a risk of permanent negative impacts of the ongoing pandemic in the long term on education outcomes in Indonesia. It might widen disparities between provinces. The crisis is likely to result in a rise in dropouts, particularly among the poorest members of society, who may be forced to leave school to support their families' economic needs. In addition, provinces that are not prepared for virtual learning may face more significant difficulties than others.

How to Improve Indonesia's Readiness Towards 2045

Rethinking skill formation in Indonesia

In the last decade, several trends in Indonesia's workforce needs special attention. Figure 3 shows the increasing number of educated unemployment. In other words, education is no longer a guarantee of a higher employability. One of the reasons is the mismatch between the available workforce and the demand from private sectors (Allen, 2016). From 2016 to 2020, the average growth of unemployed with a university degree was 9.6%, followed by vocational high school with 8.92%. Furthermore, there is also an increasing trend of the youth unemployment rate, or NEET (Allen, 2016). Compared to other countries in the region, Indonesia's NEET is relatively and persistently higher in last decade (Figure 4).

Figure 3a. Unemployment by educational attainment (in a million people)

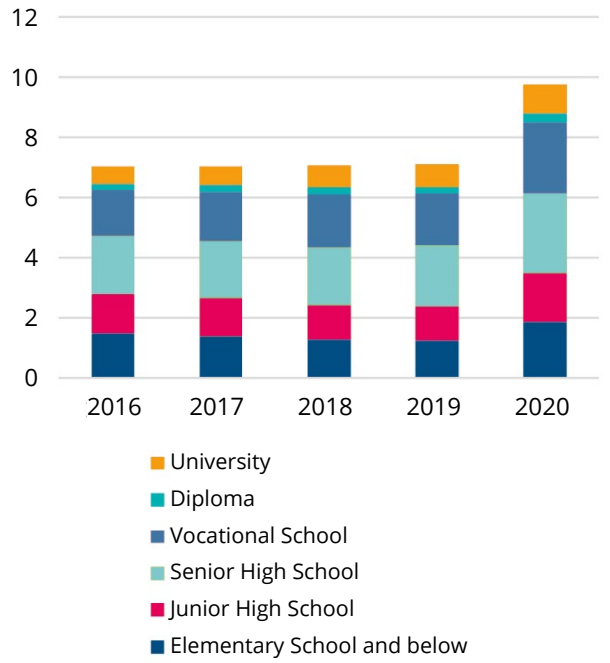
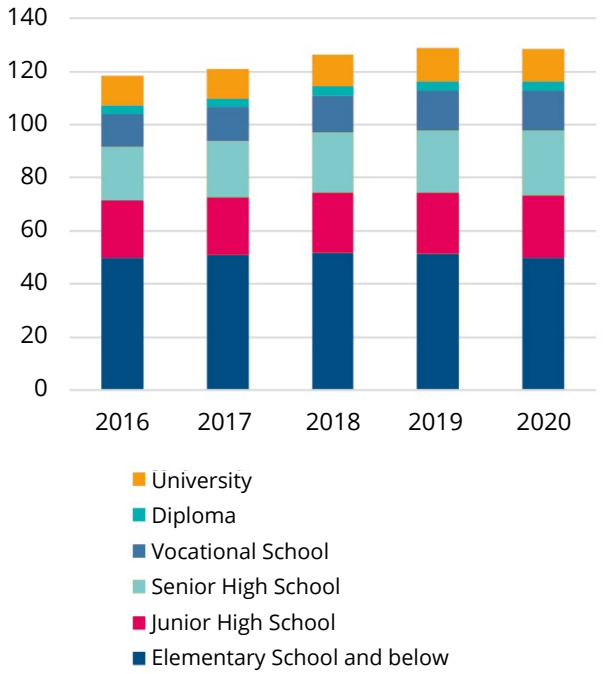
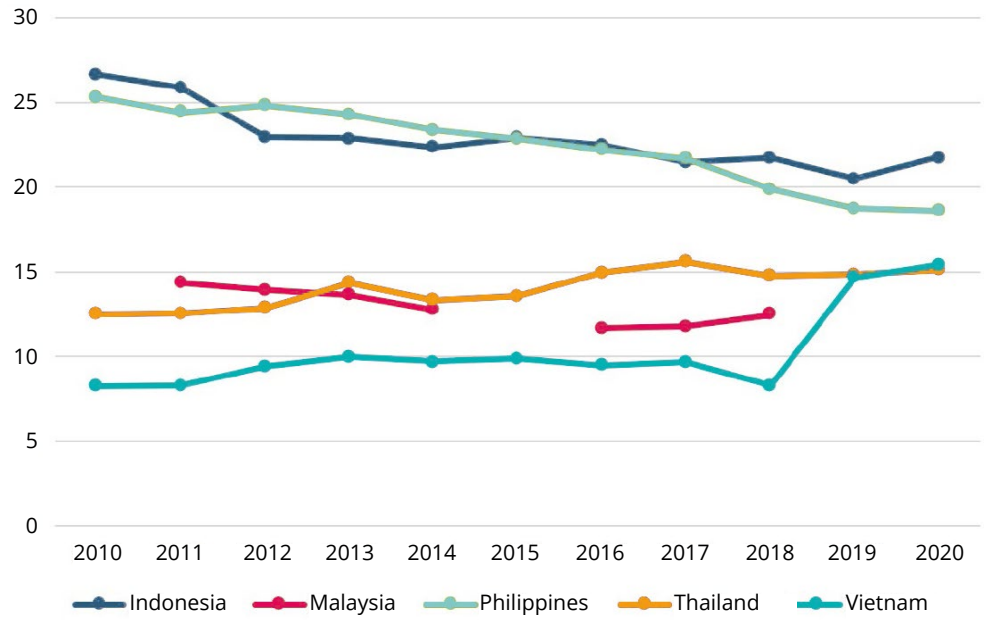


Figure 3b. Employment by educational attainment (in a million people)



Source: Indonesia Statistics Agency

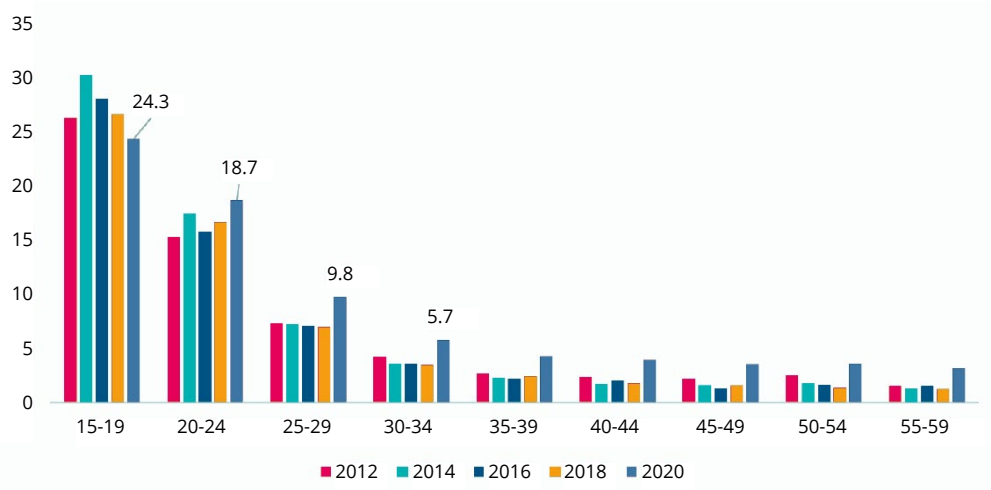
Figure 4. NEET rate in selected countries (%)



Source: International Labour Organization.

Figure 5 below shows a significant increase in unemployment for the productive age group, especially the 20-29 age group. This explains that educated unemployment in Indonesia has also increased. In addition, government should also focus on revitalizing education due to the pandemic. An estimated 30 million children in the world may never return to school (UN, 2020). According to the World Bank, the long-term economic cost of lost schooling could be as much as 10 trillion USD in lost productive output. If this impediment is not correctly addressed, the learning loss could be the source of wider inequality in the future and hamper Indonesia's 2045 vision.

Figure 5. Unemployment by age groups (%)



Source: Indonesia Statistics Agency.

To improve the workforce quality, a comprehensive framework to address the challenges is needed. This section will use the skill-formation framework to identify some of the critical challenges in Indonesia's workforce, especially regarding skills. Skill formation is a dynamic, lifelong process and evolves continuously from prenatal to adulthood. In the next part, the skill-formation approach will be used to identify several challenges in developing solid basic and future-proof skills.

In the early childhood education and development (ECED) stage, the rate of return to a dollar of investment made while a person is young is higher than the rate of return to the same dollar invested later (Cunha et al., 2006). However, compared to other stages, the ECED has been neglected and disconnected from the education system in Indonesia until Presidential Regulation No. 60/2013 on Holistic Integrated Early Childhood Development (HI-ECD) was enacted. One of the key challenges is the quality assurance of ECED schools/institutions since most of them are private/community-based and handle almost 97% of the ECED students (World Bank, 2020). In addition, there is still a lack of access problems and low awareness regarding the importance of ECED in society. To improve this condition, formal ECED should be included in the mandatory basic-education system, focusing on improving learning readiness and some foundation skills such as analytics, literacy, numeracy, creativity, and teamwork. Therefore, there will be a clear mandate to mobilize the budget, especially from districts and villages.

In terms of basic skills, Indonesia also has not performed well in the 2018 Programme for International Student Assessment (PISA), which assesses students' reading, math, and science abilities. There was no significant improvement in the score for the last 18 years, and even the score for reading skills was lower than 2000 PISA. In addition, the students' performance in Indonesia is relatively lower than in other countries in the region (Figure 6a). This substandard performance is also reflected in the IFLS. Figure 6b shows that the percentage of students that can rightly answer IFLS Standardized Numeracy test in 2014 is lower than in 2000. The study also found that learning declined by approximately 0.25 standard deviations in 14 years (Beatty et al., 2021). Given a large amount of education budget, this condition is a serious hurdle for human-capital improvement in Indonesia.

Figure 6a. PISA performance, Indonesia 2000-2019

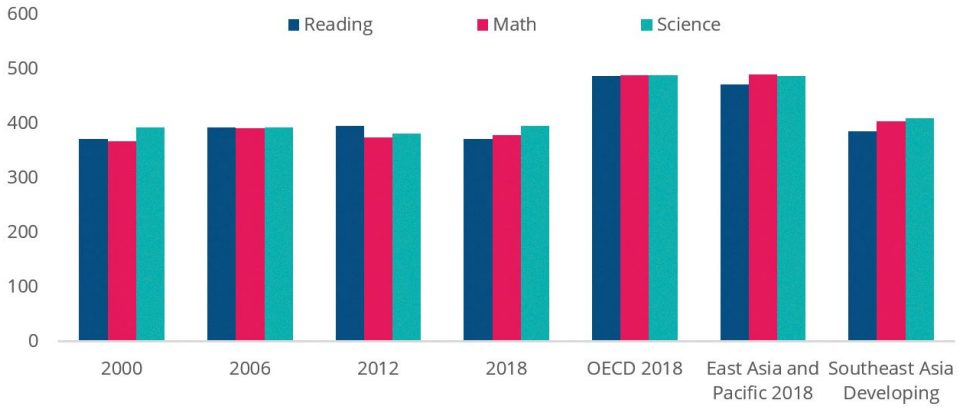
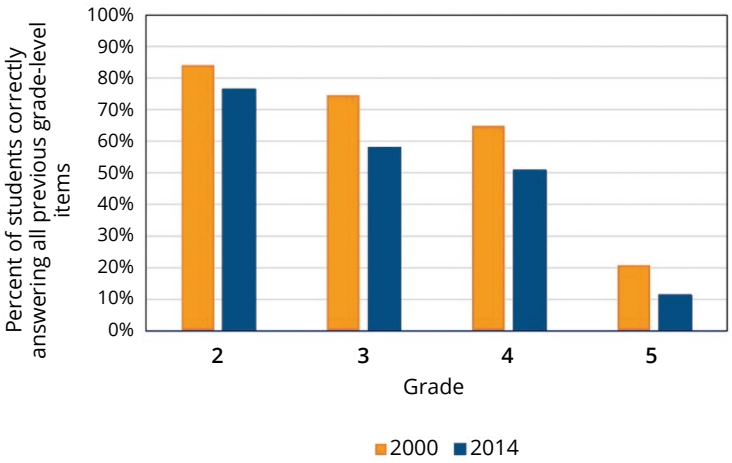


Figure 6b. Test-based IFLS standardized numeracy test



For early education and K-12 intervention, the curriculum should focus on building strong foundation skills such as analytics, literacy, numeracy, creativity, and teamwork. These skills are critical for future jobs, as it gives a solid step towards future employment, especially STEM-oriented jobs. The skill should also include digital literacy. Furthermore, the government should ensure equitable quality and access to basic education to achieve an inclusive and open education system. This is to make sure that no one is left behind. Lastly, it is necessary to improve teaching quality by making them more relevant especially on technology and digital knowledge. Vietnam has been regarded as one of the most successful countries with good performance in PISA. One of the contributing factors is convergence in school quality. Under significant reform in the education sector in Vietnam, the government has enacted new accreditation and quality-assurance mechanisms and has created a national-qualifications framework (Dang & Glewwe, 2017).

Furthermore, the technical and vocational training education (TVET) system plays an important role in skill formation. It is the preferred education system to emerging technical jobs such as construction, tourism, and healthcare. It ensures that employers can hire work-ready employees, and it is more inclusive since it improves earnings of the marginalized labor force such as women and youth (OECD, 2019). Therefore, the program could play a significant role in increasing employability and reducing poverty and inequality. However, TVET still has an inferiority complex as second best and only for dropouts. The curricula are usually also lagging from the market, which has translated to bad impression of its graduates.

The TVET system consists of formal and nonformal channels in Indonesia. The formal system is overseen by the Ministry of Education, Culture, Research, and Technology and the Ministry of Religion. Meanwhile, the Ministry of Education, Culture, Research, and Technology and the Ministry of Manpower oversee nonformal training institutions. Formal vocational education prepares young people (16-24 years) for their first job in vocational high schools (SMK) at the secondary level and polytechnics and colleges at the tertiary level. The latest data shows that there are almost 14,301 SMKs, with a proportion of around 74% being private SMKs, consisting of almost 5 million students in 2019. Table 2 shows that the number of schools and students for SMK is higher than SMA. However, SMK graduates have a higher unemployment rate more than other educational-attainment groups.

Under the Ministry of Education, Culture, Research, and Technology, there are around 3,166 vocational higher-education institutions serving nearly

347,150 students. Table 3 explains that vocational higher education is still underdeveloped. It comprises only less than 10% of new entrants, enrolled students, and graduates. The number of study programs and lectures is also less than 12% of the total lecturers for higher education. For nonformal education, there are 5,706 job training centers (BLK), covering 2 million students, and 19,633 operated training institutions (LKP). These programs specifically focus on providing triple-skilling training (i.e., skilling, upskilling, and reskilling) to the workforce. More than half of the training institutions are relatively small by international standards, with less than 200 students each.

Table 2. Higher secondary (SMA) and senior secondary school (SMK)

	Senior secondary schools (SMA)	Senior secondary schools (SMK)
Number of schools	13,939	14,301
Number of students*	4.98	5.25
Number of employees by education attainment (2020)*	24.34	14.85
Number of unemployed by education attainment (2020)*	2.66	2.33
Unemployment rate (2020) (%)	9.86	13.55

*In millions
Source: Indonesia Statistics Agency.

Table 3. Higher education in Indonesia (2019–2020)

	Public		Private		Total
	Academic	Vocational	Academic	Vocational	
Number of institutions	75	47	2,064	980	3,166
Study program	6,338	844	14,115	1,700	22,997
New entrants	703,555	58,529	1,011,299	57,613	1,830,996
Enrolled students	2,841,488	152,527	4,180,371	194,623	7,369,009
Graduates	420,714	44,231	804,447	61,472	1,330,864
Lecturers	71,787	8,866	165,527	17,374	263,554

Source: Ministry of Education, Culture, Research, and Technology.

On higher education, there is a need to revolutionize the system. It once represented a secure pathway to high-skill, high-wage jobs. However, recent trends show that the university's outcome is not improving. There is a growing rate of skill mismatch, both vertical and horizontal, hampering the labor market.[2] Apart from improving access and completion rate, higher education should be more "closer" to the business sector by understanding the recent trend of skills in the job market. Therefore, the curriculum should be more adaptive to answer the fast-changing future skills (see Appendix B).

Lastly, the university should also capture the demand for lifelong learning. Using recent technology such as *massive open online courses* (MOOC), the university could provide on-demand courses, degrees, or certificates for retraining midcareer employees. In terms of training and skilling for adults, Singapore's SkillsFuture initiative is a great example. This program allows Singaporean to develop their skills by providing tailor-made courses, including data analytics, cybersecurity, and entrepreneurship. The government subsidizes the initial credits, to be topped up in the future. Even for Singaporeans older than 40, around 90% of the government will fund the training. In addition, universities and colleges provide training to enhance lifelong learning and stay relevant in the job market. Fellowship and other awards are also available. Lastly, the dedicated budget for the program is about 1 billion Singaporean dollars (SGD) a year from 2015 to 2020.

Lastly, harnessing technology and online learning is the way forward to address the skills-development problem in Indonesia. For example, new users of the education technology (EdTech) platform have been accelerated since the pandemic due to the schools' closure and mobility restriction. Some local platforms such as Ruangguru and Zenius reported a jump in new users and web hits during the pandemic. These marketplaces provide a wide range of services—self e-learning, interactive learning, and assignment/test preparation. In addition, Skill Academy, Pintaria, and MauBelajarApa focus on skill training and workshops. However, this development should be looked into more carefully. The inequitable access to these platforms might be the potential source of learning inequality since digital infrastructure and adoption are still unequal across regions in Indonesia. Based on the World Bank survey, EdTech penetration is still highly concentrated in Java Island, especially in the Greater Jakarta area (World Bank, 2021).

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2 *Vertical mismatch:* the level of education or qualification is less or more than required. *Horizontal mismatch:* the type/field of education or skills is inappropriate for the job.

Way Forward

With the ambitious targets in 2045 and the pandemics, the government needs a bolder reformation and leveraging technology to improve workforce quality. Undeniably, the COVID-19 pandemic has put more pressure on the government to achieve better human development and mastery of science and technology in 2045. The article also emphasises the importance of a skill-formation framework to rethink the government's policy approach. Some of the policy responses from ECED to higher education have been in place across ministries and government agencies. This makes coordination and stakeholder engagement increasingly important to build a future-proof skills development in Indonesia. Digital transformation and harnessing technology are the only way to fast-track Indonesia's workforce's education and skills quality. Otherwise, the aspiration to be an advanced country and the avoidance of the middle-income trap will not be feasible.

First, the government should take affirmative action to tackle the impact of learning loss for short and long term. For example, the pandemic might produce a scarring effect and hurt the human-capital development in Indonesia. Second, bring the business sector closer to the education system. In addition, remove barriers such as foreign-direct investment in the education sector and lower the restrictive flow of high-skilled workers (including lecturers) policy. Third, digital literacy and skills should be included in the basic curriculum to harness digitalization's impact. It should be noted that technology should only be a tool to improve productivity, and changing the mindset to be more adaptive and agile should be the main agenda. Lastly, the government should learn from best practices. For instance, Indonesia can learn how to manage a comprehensive and credible TVET system from Switzerland and how to design incentives so people can invest in lifelong learning from Singapore.

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Appendix A

Kartu Prakerja (Preemployment Card)

To tackle the human development issue related to skill, through the Coordinating Ministry of Economic Affairs, the government of Indonesia launched a breakthrough program called Kartu Prakerja to improve the competency, productivity, and competitiveness of Indonesia's labor force.

According to the OECD/ADB (2020), a well-designed preemployment card can play an essential role in providing training opportunities for the most disadvantaged people. Given the experience of OECD countries with similar financial incentives for training, the instrument should be made more generous for particularly vulnerable groups as well as for training overall.

However, due to the COVID-19 outbreak, this program has evolved into hitting dual objectives. In addition to upskilling and reskilling, the preemployment card is also an instrument for distributing social assistance to workers affected by the pandemic. Therefore, the government doubled the budget allocated for cards to 20 trillion IDR and expanded its reach to more than five million people.

This program, launched in 2020, has provided 1,701 types of training offered by 150 Institutions through seven digital platforms in a year. As of 2020, 43.8 million people have registered, with 5.5 million of them designated as Preemployment Card recipients. The labor force survey found that 89% of recipients said their job skills had improved. Because women make up about 45% of the program's recipients, it promotes gender equality. Furthermore, because it fosters new learning habits such as independent and online learning, this program has led to the increase in digital literacy.

Appendix B

Industry and higher-education collaboration

The link between higher education and industry is important to maintain the relevance of today's skills and knowledge. To strengthen this coordination, several initiatives have been in place in Indonesia. One of the examples is Apple, which opened an Apple Developer Academy in 2017. Since then, the academy already collaborates with two local higher-education institutions, namely, Bina Nusantara University (Jakarta) and Universitas Ciputra (Surabaya). There are more than 450 alumni and 400 registered students coming from 80 different cities to date. The 10-month program's goal is to nurture Indonesia's future developers to empower the country's digital-economy potential, and it focuses on coding, design, and professional skills.

Furthermore, two biggest e-commerce unicorns in Indonesia—Tokopedia and Bukalapak—are also committed to invest in education. Tokopedia and the University of Indonesia launched Tokopedia-UI Artificial Intelligence Center of Excellence at the Faculty of Computer Science in 2019. The center focuses on theoretical foundations as well as useful applications of AI technologies, taking into account both product and human aspect of AI such as digital payments, logistics, and urban mobility. Bukalapak also started an AI center with Bandung Institute of Technology (ITB), called Bukalapak-ITB Artificial Intelligence & Cloud Computing Innovation Center. The center positioned itself as the first research lab made by a local startup and able to utilize 1% of Bukapalak's big data.

Universities also responded to the growing demand of digitalization, such as the Padjadjaran University, which opened its first study program on digital business in 2018 and was followed by other institutions in the later years. The courses are a combination of business, data analytics, and programming. The Faculty of Economics and Business of the University of Indonesia have also established a big-data and cognitive-computation class in partnership with IBM Indonesia. The class also provides system facility and data from IBM Indonesia, in addition to active learning and student-oriented curriculum.

Lastly, the most recent program from the Ministry of Education, Culture, Research and Technology is certified internship under the Kampus Merdeka program. The internship provides an opportunity for students to implement what they have learned in class directly into a real project for one to two semesters and allows them to convert their internship activity into credits (up to 20 SKS). Many multinationals companies, start-ups, and private sectors are already partners for this program.

2

Renovating Education Systems for a New Labor Market

China's Socioeconomic Development Strategy and Its Education Policy

Joseph Yu-shek CHENG

Abstract

This chapter examines China's education policy in the context of its socioeconomic-development strategy. Education is increasingly the engine for economic growth and key to China's superpower dream, and it remains the most important channel of upward social mobility. It is also instrumental in narrowing the urban-rural gap and improving the income-distribution structure (i.e., enhancing social justice). Ideological control, however, may generate a negative impact.

The year 2020 was the final year of China's 13th Five-Year Plan for Economic and Social Development programme and the year of achieving the goal of the comprehensive construction of a *xiaokang* society—that is, a moderately prosperous society, an objective set by Deng Xiaoping in December 1979, when China had been engaging in economic reforms and opening to the external world for a year. In terms of education policy, experts in the field considered that 2020 was the year of reforms, when their core objective began to move from an emphasis on scale to that on quality (Li et al., 2020, p. 75).

The scale of China's education sector is the largest in the world, and at this stage, it is still in the process of expansion. In 2019, its student population was 282 million, 2.4% higher than that in 2018, and full-time teachers numbered 17.32 million, 3.54% higher than those in the previous year (Li et al., 2020, p. 76).

Preschool education has been a priority area because it was much neglected before and because of the rising demand from the expanding urban population with increasing incomes. Preschool education's gross enrollment rate reached 83.4% in 2019, 1.7% higher than in 2018, and the student population amounted to 47.14 million, 1.23% higher than in the previous year.

The state sector offers nine-year free education—six years in primary schools and three years in junior high schools. Student enrollment reached 154 million,

with 10 million full-time teachers, achieving a consolidation rate of 94.8%. Due to the declining birth rates, the number of ordinary primary schools has been in decline in recent years, though the process has almost been completed. This is obviously an area for improvement in quality; hence government statistics claimed that in 2019, the student-teacher ratio was 16.85:1 in primary schools and 12.88:1 in junior high schools.

Another area for improvement has been the provision of free education for the children of migrant workers, who did not enjoy the privilege of free education in the cities because they did not have urban-household registration. In line with the general policies of promoting urbanization and equity in social services between the urban and rural sector, it is reported that in 2019, there were 10.42 million of them who attended urban primary schools and 3.85 million in junior high schools.

Despite the offer of free education in the poor rural areas, children from rural families still face the problems of schools being too far away from their villages; no money for books, uniforms, and other materials; difficulty in attracting teachers to the distant rural schools; the lack of facilities and unsafe buildings in these schools, etc. Subsidies are more available from the central government in support of the poor rural areas, but they are far from adequate.

Special education remains a neglected area, despite the fact that it has been attracting more media attention. In 2019, enrollment of handicapped students in special schools amounted to only 144,200, while enrollment in ordinary schools reached 794,600. The latter included conduct of special-education classes, placement in ordinary classes, and provision of education at students' homes.

Senior-high-school education has been a priority area, despite the fact that it is still not free. Gross enrollment rate reached 89.5% in 2019, including ordinary senior high schools, middle-level technical/vocational schools, and senior high schools for adults. Student recruitment for middle-level technical/vocational schools amounted to 41.7% of total senior-high-school recruitment in the year.

There is an increasing awareness that the economy faces an acute shortage of technicians and a shortage of workers with technical skills. Hence, salaries for these categories of labourers are often higher than those for graduates from average universities. However, there is still a traditional family pride in sending children to the elite universities, and competition for places in top universities remains very keen. Hence, the reluctance in some families in sending their children to middle-level technical/vocational schools has yet to be overcome.

In the tertiary-education sector, total enrollment reached 40 million in 2019, with a gross enrollment rate of 51.6%. In 2020, graduates numbered 8.74 million. The challenges are to improve funding for the average universities and to find employment for the graduates. Chinese leaders fully understand the danger of high unemployment rate for graduates, one of the lessons of the Arab Spring (Li et al., 2020, p. 76–78). The employment scenario for graduates in 2020 was obviously difficult. The authorities refused to give concrete figures. It was reported that the initial employment rate of fresh graduates in 2020 declined because of the epidemic and that their securing of employment was delayed but the situation was stable. In September, the surveyed unemployment rate of those in the 20–24 years old age bracket with tertiary-education and above had dropped 2.4% compared to the previous quarter, and the number of fresh graduates seeking employment in the third quarter of the year had been reduced (Mo & Chen, 2020, p. 44).

In June 2020, the Ministry of Education reported that national funding for education reached 5.0175 trillion CNY in 2019, showing an increase of 8.74% over that in 2018, with 45% going to free education (primary and junior high), 8% to preschool education, 16% to senior high, and 27% to higher education. This funding involved 4 trillion CNY from the government's budget, above 4% of GDP since 2012. The Chinese government also encouraged the development of education provided by the private sector, mainly to reduce its financial burden. In 2019, private schools of various grades enrolled 56.17 million students (Li et al., 2020, p. 78). Apparently there is room for expansion, but the incentives are not clear.

Table 1. Student enrollment in China in 2019

Stage of Education	Student Population (Millions)	Enrollment Rate (%)
Preschools	47.14	83.4
Primary schools and junior high schools	154.00	94.8[a]
Special education		
In special schools	0.1442	n.a.
In ordinary schools	0.7946	n.a.
Senior high school	n.a.	89.5
(Of the above, middle-level technical/ vocational schools)	(n.a.)	(41.7)
Tertiary-education	40.00	51.60
Total	282.00[b]	--

Note: The *Blue Book of China's Society: Society of China – Analysis and Forecast* (2021), the semiofficial publication of the Institute of Sociology of Chinese Academy of Social Sciences, is an excellent source of statistics; this paper relies on it for statistical data.
[a] Reflects the consolidation rate.
[b] Includes all stages of education.

The Socioeconomic Functions of Education in China

Education is increasingly the engine for economic growth as China engages in economic restructuring—that is, the stage of relying on exporting labour-intensive products and replacing infrastructural development with an emphasis on the upgrading of manufacturing industries and the development of the tertiary sector, especially the high value-added services. In 2019, the average length of education for the working-age population reached 10.7 years, increasing from 10.05 years in 2014. Regarding the new entrants to the labour force, their average length of education was 13.7 years, with 50.9% having received tertiary-education (Chen & Tian, 2020, p. 6).

Social status in China today mainly depends on one's education and job; hence, education remains the most important channel of upward social mobility. Here, traditional values coincide with economic reality. Despite the fact that corruption is widespread in China, entrance to universities and the top universities appears to be fair and largely corruption free. Despite education experts' concern that the education system is too public-examination oriented, the society in general accepts the competitive public-examination system.

Social justice remains an issue, though, because educational resources are highly concentrated in major cities, where the best schools, universities, and teachers are. While the Chinese authorities have been aware of the gap between the coastal provinces and the interior provinces and that between the urban and rural sectors, they have been using the payments-transfer method to redistribute financial resources from the prosperous coastal provinces to the interior provinces. This may not be very effective because of the flow of the educated young people from the latter to the major cities in the former. The poorer interior provinces have, thus, been paying for the education of the talents moving to the major coastal cities. In terms of contributing to the central government's budgetary revenues, it receives net transfers principally from the eight provinces and municipalities along the coast, namely, Guangdong, Fujian, Zhejiang, Jiangsu, Shandong, Shanghai, Tianjin, and Beijing.

In the initial stage of the era of economic reforms and opening to the external world, due to the limited availability of resources, the central authorities concentrated their resources on priority universities, and the local authorities (mainly city governments) concentrated their resources on priority senior high schools. There was, thus, keen competition to enter these top universities and senior high schools, and the competition was based on public-examination results. This competition favours students from families with well-educated parents and higher incomes, who can provide for extra tuition and various types of helpful extracurricular activities. The most underprivileged groups are the children in poor rural areas left in the care of their grandparents, as their parents have gone to work in the cities.

Attempts have been made to reform the university-entrance system so that factors other than public-examination results are taken into consideration. Efforts have been made in the past decade, and more by city governments, to randomly distribute junior-high graduates to senior high schools so as to dilute the concentration of the best students in the priority schools. Similarly, arrangements have been introduced to rotate the teachers from the priority schools to other schools so as to achieve a more equitable distribution of resources among schools.

Well-qualified teachers are often perceived as the most important asset in schools. Basic salaries of teachers are quite low, and the differences between teachers in the rural sector and those in the urban sector are not very significant. However, in the poor rural areas, teachers' incomes are mainly limited to their basic salaries, and sometimes local officials may even delay the delivery of those basic salaries because the education budgets have been spent on other

programmes. Teachers in rich cities have access to bonuses, depending on the level of prosperity of the local governments concerned. Above all else, they earn extra income from giving private tuition financed by eager parents, and in some cases, their incomes can be quite attractive. This explains the difficulty of attracting teachers to poor rural areas.

As governments at various levels are ready to spend more on education, the hardware of rural schools has demonstrated considerable improvement in the recent decade. However, migration has generated serious problems. As indicated above, children who are left behind in rural areas by their migrant-worker parents and those who follow their parents to the cities often do not receive a proper education nor well taken care of. Chinese leaders now attach a higher priority to social justice, partly because this enhances their legitimacy and partly because this is also a key to the maintenance of social stability. For decades, education and medical services might not be available to the poor and the rural population; at this stage, the aim is equity in services for the entire population.

In the campaign to eradicate absolute poverty by 2020, which had been accorded considerable policy priority and publicity by Xi Jinping, rural education received more support. In the 13th Five-Year Plan for Economic and Social Development programme (2016-2020), 428,000 teachers were sent to rural schools on a *special posts programme*; and 1.3 million teachers in over 80,000 rural schools in central and western China benefitted from a new livelihood-subsidy policy. About 40 million rural students in public schools were covered by a nutrition-improvement plan, while 85% of the children in the appropriate age groups following their migrant-worker parents to the cities received slots in public schools or enjoyed places purchased by the government. Top universities recruited 520,000 students from rural and poor areas through a special programme (Chen & Tian, 2020, p. 6).

Education was considered an important part of the poverty-eradication campaign (Xi, 2017, p. 10), an important means of terminating the passing on of poverty from one generation to another. In 2019, the central government transferred payments of over 300 billion CNY for the education expenditure of local governments, with over 80% of the funding going to central and western China. The general policy objectives were to improve the education environment of the poor regions, expand the vocational education and training opportunities for young people in poverty, enhance the resources for the education subsidy programmes for poor students, and raise the level of access to education information in the poor regions (Wu et al., 2020, p. 369).

A typical policy tool of encouraging cooperation between the advanced vocational schools in the coastal provinces and the less well-equipped schools in the interior provinces was adopted in the 13th five-year development plan. In 2020, the Chinese authorities claimed to have built or improved school space of up to 224 million sq. m and acquired school equipment and facilities amounting to 100 billion CNY, so much so that 99.8% of the public schools met the basic requirements and conditions. Moreover, 2,717 (92.7%) of the county-level units had passed the state assessment of meeting the basic equity guidelines in terms of developing free education (Wu et al., 2020, p. 369–370).

The priority areas of poverty eradication (i.e., Tibet, southern Xinjiang, and the Tibetan areas of Sichuan, Qinghai, Gansu, and Yunnan) received about 30 billion CNY per annum in the 13th five-year development programme as education subsidy, and another 17 billion CNY for long-term education development (Wu et al., 2020, p. 369). The idea was to ensure the successful completion of the poverty-eradication programme by the end of 2020; however, experts are concerned whether or not the generous funding would continue after the publicity on meeting the program objective.

Student subsidy is related to social justice. In 2020, the Chinese authorities claimed that the national student-subsidy programme would cover all stages of education, public schools as well as private schools, and all students with family economic difficulties. In 2019, the programme helped students of all grades in 106 million student/cases, with subsidies amounting to 212.6 billion CNY ("Report of the national student subsidy," 2020). The pledge was that no student would drop out because of family economic difficulties.

Education informatization and *internet plus education* are priority areas in recent years too, with considerable funding going to rural schools to ensure their access to the internet. The Chinese authorities claimed that through the cooperation between the Ministry of Education and the Ministry of Industry and Information Technology, by August 2020, 98.7% of the primary and secondary schools enjoyed access to the internet, 93.1% of them have multimedia classrooms, and classrooms with multimedia-teaching facilities amounted to over 4 million (Wu et al., 2020, p. 370–371).

In China's modernization efforts, development of advanced technology has always been a top policy goal. This has become more significant in recent years, partly because Chinese leaders realize that at this stage of China's development, it has to secure its own scientific and technological breakthroughs to move to the very front ranks in the global competition. Deteriorations in Sino-American relations and those with Western countries have also exacerbated the Chinese authorities' worry of a blockade of technology transfer from them.

In response, Chinese leaders now frequently appeal to the enhancement of scientific and technological innovations as well as technology import substitution. Funding in support of research and development has been increasing considerably, and basic research has been emphasized too. There is much discussion of securing breakthroughs in the crucial "choking" technologies, reflecting the concern about the Western world attempting to suffocate China's technological advancement (*Bluebook of China's Economy*, 2021, p. 12–13). China's universities naturally assume an important role in research and development.

In 1995, the Ministry of Education initiated Project 211 to channel funding to the key universities, intending to raise their research standards in support of national development. Project 211 refers to the programme of identifying about 100 top universities to face the challenges of the 21st century. It also involved some administrative adjustments; universities previously under various ministries returned to the Ministry of Education, and some tertiary institutions went through an amalgamation process.

In 1998, a similar programme, Project 985, was launched. On May 4, President Jiang Zemin announced during the celebration of the centenary of Beijing University that China would need several world-class universities for the realization of its modernization. In view of the relatively low level of funding for education in those years, there was a tendency to designate priority universities and schools to guide the channelling of funding. As funding became more readily available in later years because of China's development success, this designation and ranking approach was gradually abandoned. In December 2011, the minister of education, Yuan Guiren, announced that Project 211 and Project 985 would no longer admit new universities and a competition mechanism would be introduced (Chinanews.com, 2011). The two projects were formally abandoned in June 2016 and were to be replaced by a World First Class University and First Class Academic Discipline Construction programme, commonly known as the Double First Class.

In September 2017, the Ministry of Education announced a list of 42 world first class (WFC) universities and 465 first class (FC) academic disciplines in 140 tertiary institutions (Ministry of Education, 2017). The programme's objectives were ambitious. It aimed that by 2020, several universities and academic disciplines would enter the WFC ranks; by 2030, more universities and academic disciplines would join WFC ranks and the comprehensive strength of China's higher education would be prominently raised; and by the middle of the 21st century, the numbers of WFC universities and first-class academic disciplines in China, as well as their strengths, would be at the front ranks of the world, and China would be a major power in higher education. Hence, higher education would be

a significant part of the Chinese leadership's grandiose scheme to enable China to become a leading global power.

The challenge is whether the Chinese approach of research and development will be able to demonstrate its superiority. Chinese leaders claim that they can mobilize resources and concentrate on major projects effectively. In research and development, the trusted team of national experts would identify the priority areas and formulate key programmes. The latter would then be made the responsibilities of the national laboratories and top universities, backed by funding and other resources from the state. Under this system, chances for Bill Gates–type of breakthroughs would be rare, if not impossible. China's approach proved to be relatively efficient when China was catching up through imitation and borrowing; whether this approach would be equally successful in securing breakthroughs advancing China to the global forefront remains doubtful.

Though Chinese leaders have been keen on promoting economic reforms and opening to the external world, ideological control remains tight in universities in China. In fact, such control has been tightening since the Beijing Olympics in 2008, and it has been exacerbated in the recent years. In May 2013, the Party Central Office released a document demanding tertiary institutions and the mass media to observe the taboo on the discussions of seven topics, namely, (1) universal values, (2) freedom of the media, (3) civil rights, (4) historical errors of the Communist Party of China, (5) the bourgeois power elite, (6) judicial independence, and (7) civil society (Chan, 2015).

At the same time, the Party Central Organization Department, Central Propaganda Department, and the Party group of the Ministry of Education released another document entitled "Certain Opinions on the Strengthening and Improvement of the Ideological and Political Work Among Young Teachers in Tertiary Institutions" (BBC News Chinese, 2013). Subsequently there were reports of university students informing the authorities of the politically incorrect views of their professors and the latter being sanctioned (Hernández, 2019).

Liberal education workers do not believe that universities can genuinely become world first class with strict ideological control, as the demand for political correctness hinders free discussions and debates, to say the least (Lau, 2016). Chinese leaders disagree, though they do pay attention to the international rankings of universities in China. This concern is eagerly shared by their staff and students too. While ideological control damages the intellectual development of the university community in China, scientific and technological research is mainly decided by the Chinese authorities, which are guided by their trusted advisors in setting priorities and channelling state funding.

Some Further Observations

In studying China's modernization strategy at this stage, experts in China observe that two weaknesses have to be overcome. The first is the urban-rural structure—that is, too many peasants with incomes too low. This, in turn, affects China's regional structure, employment structure, occupational structure, consumption structure, and social-strata structure. It is observed that in most developed countries, reducing the proportion of rural workers in the entire labour force from 30% to below 3% would take 30 years. In 2020, rural workers constituted about 26% of China's total labour force; Li Peilin (2020) assessed that it would take at least two to three decades to reduce this share to 5%. In 2019, the average per-capita income of China's urban population was 2.64 times than that of its rural population, and the average per-capita income of the rural population in the prosperous Zhejiang Province was three times that of the poor Gansu Province. In the agricultural sector in China, 26% of the nation's labour force produced only 7% of China's GDP (Li, 2020, p. 2). Hence, improving education in the rural areas to facilitate the young people there to move out of the primary sector to engage in jobs of higher productivity is important, not only in terms of economic development but also in terms of social justice. It is expected that central-government funding going to rural education will continue to increase in the foreseeable future.

The second weakness is the income-distribution structure—that is, the income gap between the rich and poor is too wide and the proportion of middle-income groups is too small. According to a comparative study on the middle-income groups in China, Russia, and Brazil in 2015, conducted by sociologists from the three countries, it was discovered that the respective proportions of middle-income groups in Russia, Brazil, and China were 56.6%, 43.9%, and 39.1% respectively. In China and Brazil, the proportions of their high-income groups were more than 10% higher than that in Russia, and the proportion of China's low-income groups was more than 10% higher than those in Russia and Brazil respectively (Li, 2020, p. 2). Li Peilin indicated that the Gini coefficient in China had been declining since 2008, but it rose again in the recent years (Li, 2020, p. 2). Education is obviously an important means for the expansion of the middle-income groups in China. As indicated above, China has entered a stage where, instead of concentrating resources in the priority schools and universities, it is now in a position to help the economically less-well-off students and regions.

The two weaknesses are related to some extent. The proportion of rural workers in China's labour force is a few times higher than that in Russia and Brazil and substantially higher than that in countries at a similar level of development. The

flow of migrant workers would unlikely expand in a significant way, large-scale accumulation of arable land is difficult, and prices of agricultural products in China are already higher than international market prices; it is, therefore, very challenging to enable rural labourers to join middle-income groups.

Expansion of middle-income groups contributes to social stability. But the raising of middle-class expectations, if not satisfied, may be destabilizing. In 2019, slightly over 40 million students attended tertiary institutions, but finding them satisfactory employment has been a severe challenge. Chinese leaders are aware of the lessons from the Arab Spring—one of them was that unemployed university graduates could be a source of social and political instability. The Chinese authorities have not neglected the issue, and substantial efforts are usually made. University graduates in China have relatively high expectations; the quality of a considerable segment of tertiary-education, however, is not high. Graduates from technical high schools often manage to secure employment more easily and with better remuneration. Management of expectations and improvement of the practicality of university curricula are some of the solutions.

Education policy has, thus, become a significant part of China's development. It holds the key to raise China's competitiveness and advance the nation to the global front ranks in science and technology. China's progress to become a leading world power depends on the quality of its education sector, and the Chinese authorities understand its importance.

Education is also one of the top concerns of Chinese families with children. Performance in the delivery of education services affects regime legitimacy in the eyes of the people. The latter also perceive education as the most important channel for upward social mobility and the improvement of one's livelihood. Social justice means equal opportunity for individual development and not just the raising of national economic-growth rates.

As the quality of education emerges as a serious concern on the part of both the leadership and ordinary people, ideological control is an issue that cannot be avoided. While top universities in China have secured very respectable international rankings, students and parents still find Western universities as attractive options. Convergence with international norms has been recognized as a key element in economic reforms and opening to the external world, and education cannot be an exception, especially in quality competition.

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Digital Transformation: Exploring the Tertiary-Education Offering in Cambodia

Riccardo CORRADO, Sowinta KAY, and Patchanee TUNGJAN

Abstract

The digital transformation driven by information and communication technology is having a deep impact on many countries, mostly the developing ones like Cambodia. To be ready for the challenges brought by this transformation, it is fundamental for the Cambodian tertiary-education sector to be aligned with the needs of the job market, an alignment that is still missing.

Following the Asian Development Bank (ADB), by 2030, Asia is expected to contribute roughly 60% to the global growth, with the Asia-Pacific region being responsible for roughly 90% of the 2.4 billion new members of the middle class entering the global economy (ADB, 2017). Many factors are rapidly reshaping Asian economies, including strong growth rates, automation, increased urbanization, the growth of the middle class, increased purchasing power, and the rise of the digital economy (Adhikari, 2020). But the economy is not the only aspect that has been directly influenced and disrupted by the new digital wave—a wave that has impacted the entire planet and is changing the way we live our lives in every aspect of it and that is forecasted to continue to change our societies. In the specific, it has been recognized and acknowledged that information and communication technology (ICT) is going to continue to be the major driver in every aspect of the complicated and multifaceted process of building a nation for the decades to come (ASEAN, 2015). One of the Asian regions that is attracting a lot of attention is the Southeast Asian region and more specifically the Association of Southeast Asian Nations (ASEAN). ASEAN is an association consisting of ten countries, namely Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam, countries that are also known as ASEAN member states (AMS).

Accounting for the growing importance of ICT for the region, ASEAN launched the ASEAN ICT Masterplan 2015, with the belief that ICT will be a key enabler for regional social and economic integration (KOICA & KISDI, 2020). Currently,

in ASEAN, almost twelve million people are employed within the growing ICT industry sector, contributing to 3% of the total ASEAN's gross domestic product (GDP) (ASEAN, 2015). This growth is not homogeneous across the region (Machmud et. al, 2021), and several issues are still present, mostly in the less-developed AMS (ASEAN, 2015). Regarding the regional growth, one of the fastest-growing AMS is Cambodia, the relatively small kingdom located in the southern area of the Indo-Chinese Peninsula in Southeast Asia.

Focusing on Cambodia, officially named the Kingdom of Cambodia, in April 1999, the country got admitted as the tenth member of ASEAN following the deferral of two years before, caused by the internal political crisis and granted after years of control by a regional grouping's observer (Pich, 2020). More than 20 years after becoming part of ASEAN, Cambodia has experienced remarkable opportunities and achieved outstanding results, also thanks to the investment inflow and trade between intra-ASEAN countries, as well as from ASEAN's external partners (Pich, 2020). The trade, though, "has not been the only source of Cambodia's economic development, but also the prospect of free movement of labor" (Pich, 2020, p.17). Regarding this, recent economic progress allowed the country to invest in physical and social infrastructure, attract foreign direct investment, create jobs, and lift millions of its people out of poverty (Heng, 2019). Additionally, it is relevant to say that ASEAN Economic Community (AEC) has, in fact, facilitated the movement of people within the region and, with it, supported and even encouraged human-resource-development initiatives, created with the goal of developing competencies and qualifications in the labor force across the region (Pich, 2020).

However, the Job Outlook 2018 study conducted by the National Employment Agency of Cambodia showed that even if ICT is projected to have good job opportunities due to increased labor demand driven by digitalization in the market, recruiting Cambodians for many ICT-related roles is a very difficult challenge due to a shortage of supply of skilled labor (Yang & Sovann, 2019). We need to highlight the fact that after joining ASEAN, Cambodia has relied mainly on garments, rice, tourism, and construction as its growth-supporting industries (Heng, 2019). To be able to sustain long-term healthy growth, the country now needs to diversify and modernize its economy (Heng, 2019) and invest in honing its digitalization skill set. Currently, Cambodia ranks behind in terms of digitalization and digital skills, something proved by its comprehensive low ranking (102nd in the world) in the Digital Readiness Index 2019 of Cisco. It is in this ecosystem that the creation of strong digital foundations, rooted in education, is not only a fundamental step to take, but it also represents a great opportunity to fully explore. Content skills, including ICT literacy; active learning; cognitive abilities

such as creativity and mathematical reasoning; and process skills such as active listening and critical thinking "will be a growing part of the core skills requirements for many industries in the future" (Heng, 2019, p. 9). Cambodia needs to prepare its citizens for the challenge, and it is essential to equip the education sector of the country with the resources and the skills required to drive and sustain the growth of Cambodians' educational attainment, aiming to prepare the new generations for the job market and for the requirements necessary for making Cambodia an active actor in the years to come.

Following this, we first offer a clear idea of the *why* for this research work. Then we offer an overview of the current status of education in Cambodia, focusing on tertiary-education. After that, we dive into the results of our research, outlining the current tertiary-education offering across the country and providing an insightful discussion of the findings, useful elements for policymakers and involved stakeholders.

Education: Volta's Key

The lack of technically skilled workers is a crucial bottleneck for the sustained growth of the dynamic economies of the ASEAN region (GIZ, 2019). Thus, education and workforce preparation represent fundamental factors for a region's growth driven by ICT. Many policymakers and scholars have already expressed their belief that digital literacy and expertise are essential elements of the human-capital competencies for the 21st-century economy (Hsu & Fang, 2019). Digital literacy and ICT education, in the specific, are essential, mostly in developing countries like Cambodia, to avoid the effects that the digital divide could bring to the country. In fact, along with the digital transformation that many countries are currently experiencing, serious risks lie ahead for the labor markets. This is even a greater threat in those developing countries that need the most ICT for growing. But if these risks can represent serious threats to a homogeneous regional development, they can also be seen as opportunities. And Volta's key to transforming challenges into opportunities is represented by education. In this regard, it is important to understand that "sufficient education and qualification in handling new digital technologies are essential prerequisites for all development opportunities" (Hunkin & Schmücking, 2021, p. 20). New technologies, including artificial intelligence, machine learning, and robotics, have already introduced a high degree of automation, which is promising almost unlimited growth in the future. And it is this newly introduced ICT-driven automation that is changing "the overall relationship between industrial employment and labor costs" (Hunkin & Schmücking, 2021, p. 23).

Focusing on the Cambodian scenario, even if the country has experienced an overall remarkable economic growth and also an improvement in its education, a better alignment between curriculum and market demands should be achieved (Corrado et al., 2021). Furthermore, even if the education sector has shown promising improvements, more needs to be done in terms of supporting educators (Corrado & Tungjan, 2019b) and empowering them with the affordances of ICT (Corrado & Tungjan, 2019a). Cambodia, like many other developing countries, finds itself in front of an incumbent pressure to quickly adapt to a whole ecosystem of both technological infrastructure and human force. It is in this ecosystem that the absence of wealthiness and the lack of readiness in the education sector could represent an undermining threat for Cambodia as a developing country. Implementing ICT into the curriculum is important from an early stage (Hatzigianni & Margetts, 2012), but it is at the tertiary level that students can be specifically prepared for the job market and for the high-level challenges demanded by an ICT-driven job market. Thus, to prepare Cambodia for effectively facing the challenges and opportunities offered by a digital transition, we need to tackle the whole educational ecosystem of the country, with a major focus on tertiary-education. In fact, it is at the tertiary-education level that vocational training or university curriculum can prepare students for the demand of the future. Thus, it is fundamental to understand what the current scenario in Cambodia is, with a focus on tertiary-education, including vocational training. Technical and vocational education and training (TVET) is today recognized as an important element in strategies to improve the productivity and competitiveness of AMS and the region as a whole (GIZ, 2019). Because of this, TVET currently ranks high on the political agenda of most AMS. Thus, it is important to account both for TVET and academic programs, where students are prepared for those skills required for the job market, paving the way of a country towards a sustainable development in general.

Currently, Cambodian universities seem to mainly offer nontechnical undergraduate degrees. To prepare the new generations of Cambodian for the job market's demands and for the realization of the vision of the Royal Government of Cambodia (RGC), the tertiary-education sector must be ready and should propose an educational offering in alignment with the new ICT-driven paradigm for the job market. To the best of these authors' knowledge, there is no work in literature offering a complete overview of Cambodian tertiary-education tailored to the availability of ICT-related programs. Thus, the following section aims to offer the reader a clear overview of the current status from the perspective of the availability of ICT-related programs at the undergraduate level.

Education in Cambodia: Current Status

To respond to the current ICT-driven education challenge, the RGC has introduced educational reforms in the last four decades, which can be categorized into four major stages (Dom, 2019). The first and second ones (1980–1987 and 1987–1996 respectively) were focused on curriculum improvement, while the third stage, started in 1996, were drawn instead from ideas and higher-education vision from other more-developed regional countries (Dom, 2019). The fourth stage (2005–2009, then revised for 2010–2014) focused on curriculum development (Dom, 2019). Finally, the last stage (the current one, from 2016 to 2022), which is approaching its end, is again focusing on curriculum development but with a specific goal of meeting the ASEAN demands set in the ASEAN ICT Masterplan 2015 (Dom, 2019).

Regarding the current tertiary-education, in Cambodia, there are two types of higher education institutions (HEIs), *universities* and *institutes*, with two typologies of streams, namely the *academic* and the *vocational* one (Vann, 2012). Additionally, there are three main governmental agencies that coordinate, control, and assist the work of HEIs. These three agencies are the Department of Higher Education (DHE), the Department of Scientific Research (DSR), and the Accreditation Committee of Cambodia (ACC) (Vann, 2012). The role of the first two agencies is to coordinate and assist in the implementation of regulations and directives from the Ministry of Education, Youth and Sports (MoEYS) and in research activities. The ACC's responsibility consists of giving accreditation to the HEIs by examining their governance, physical facilities and equipment, and academic standards (Vann, 2012). In 2019, the MoEYS, in cooperation with ACC, met with every university to provide training on learning theories and provide guidelines on the creation of lessons, courses, and program learning outcomes. Furthermore, the ACC provided guidelines for the creation of a curriculum for each program offered at universities who are trying to align with the requirements of the ASEAN University Networks-Quality Assurance (AUN-QA) assessment at institutional level.

Furthermore, currently, there are 125 HEIs, with 77 private ones, with the majority of them in Phnom Penh and the rest spread across 19 provinces (Sok & Bunry, 2021). Across these HEIs, there are 16,167 faculty and staff, with a 4:1 ratio between male and female faculty and staff (Sok & Bunry, 2021). Between the faculty, roughly 80% of instructors are PhD holders, almost 64% are master's degree holder, and the remaining 28% are bachelor's degree holders (Sok & Bunry, 2021). With a gross enrolment rate of 11.57%, there are 211,484 students, with almost 47% of them being female (Sok & Bunry, 2021). Less than 1% of the

students are studying in a PhD program, a bit more than 10% are enrolled in a master's degree program, a bit less than 80% in a bachelor's degree program, and the remaining (roughly 9%) in an associate degree program (Sok & Bunry, 2021).

In general, there are limited evidential data on what impedes Cambodian academics from creating a more robust response to local and global pressure (Ros & Oleksiyenko, 2018), and it remains unclear what kind of structural factors limit the capacity of Cambodian universities to create environments capable to enable and foster academic professionals to be more competitive not only in the local scene but also on the global stage (Ros & Oleksiyenko, 2018). Currently, the main issues and challenges identified include a lack of mechanisms to capitalize and utilize research funds and financial resources, academic valorization, infrastructure, culture at institutional and national levels (Eam, 2018), and motivation (Corrado & Tungjan, 2019b).

To the best of these authors' knowledge, there is no previous research work investigating the educational offering of Cambodian universities in terms of technical or nontechnical degrees. Thus, this chapter aims to investigate the current universities' offerings in terms of technical or nontechnical undergraduate degrees, relying on the official data from the Ministry of Education, Youth and Sport (MoEYS). This creates a detailed statistic capable to clearly outline the current tertiary-education offering in the country. Additionally, this research work allows policymakers and universities to understand if the current tertiary-education is even offering the foundation for preparing Cambodia for its challenging transition while providing useful insights on how to shape the educational offering in alignment with the new ICT-driven paradigm that is changing the regional job market.

Methodology

The data that we analyzed refers to the 2018–2019 academic year, and the data set contains information on both private- and public-education institutions registered with the MoEYS, providing undergraduate (associate and bachelor's degree) programs. The initial phase consisted of cleaning the data from inconsistencies and entries with no complete information. Furthermore, we performed a categorization of each program between STEM (science, technology, engineering, and mathematics) and non-STEM, and within the STEM category, in ICT and non-ICT. Furthermore, we divided the entries into two main categories, associate and bachelor's degree programs. We also included the TVET programs within the associate degree programs category. As the last step, we classified the entries between programs offered in private and public institutions.

In our analysis, in terms of undergraduate education, we considered STEM-related education as those programs related to topics including natural sciences (biology, physics, and chemistry) and formal sciences (mathematics, along with logic and statistics). On the other hand, as the definition of STEM reports, STEM does not include programs related to social science (psychology, sociology, and political science). For ICT, we refer to all the ICT-related education programs, including electronics, computing, and telecommunications engineering. Below we offer a sample list of undergraduate degree programs classified as STEM majors and as ICT-related majors within the STEM major category.

Table 1. Examples of STEM and ICT programs

Examples of STEM programs	Examples of ICT programs
• Agricultural machinery • Agronomy • Animal science • Animal science and medicine • Architecture • Bio-chem • Biolog • Chemistry • Civil engineering • Computer science • Crop science • Economics and information technology • Engineering-related programs • Genetics and breeding • Information technology • Information technology engineering • Mathematics • Network-related programs • Nuclear engineering • Physics • Soil science • Telecommunication and electronics engineering	• Architecture and urban planning • Business information technology • Chemistry engineering • Civil engineering • Computer network technology • Computer programing • Economics and information technology • Electricity and energy • Electricity and power • Electronics and automatics • Electronics and telecommunications • Food chemistry and engineering • Food science and technology • Geo-resources and geotechnical engineering • Genetics and breeding • Information technology and communications • Information technology engineering • Mechanical and industrial engineering • Mechanics • Nuclear engineering • Software engineering with multimedia • Telecommunication and electronics engineering

Source: Tabulated by authors.

Results

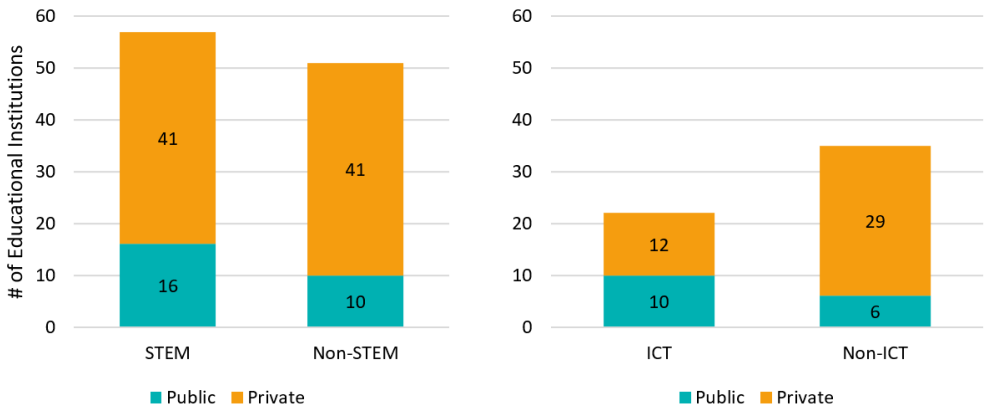
In the following section, we offer an overview of the obtained results, dividing them between associate degree and bachelor's degree programs.

Associate degree programs

Diving into the findings, regarding associate degree programs, there were 167 educational institutions in Cambodia offering accredited bachelor's degree programs in the academic year 2018-2019. In the specific, 59 of the 167 educational institutions do not provide associate degree programs or do not have complete entry, and thus, we excluded them from our analysis regarding associate degree programs. As a result, we considered the remaining 108 educational institutions for our analysis. Among the 108 education institutions, 26 of them are public institutions and 82 are private ones.

Among the 26 public institutions, 16 provide STEM programs, while 10 provide non-STEM programs. Among the 16 that provide STEM programs, 10 of them are ICT-related. The ones that offer ICT-related programs are under the following ministries: 4 under Ministry of Education, Youth, and Sports (MoEYS), 1 under the Ministry of Health (MoH), and 5 under the Ministry of Labor and Vocational Training (MLVT).

Figure 1. Number of educational institutions offering non-STEM and STEM associate degree programs and ICT-related or non-ICT-related STEM programs



Source: Tabulated by authors.

Among the 82 private institutions, 41 provide STEM programs, while the other 41 provide non-STEM programs. Among the 41 that provide STEM programs, 12 of

them are ICT-related. The ones with ICT-related programs are under the MoEYS (10) and MLVT (2).

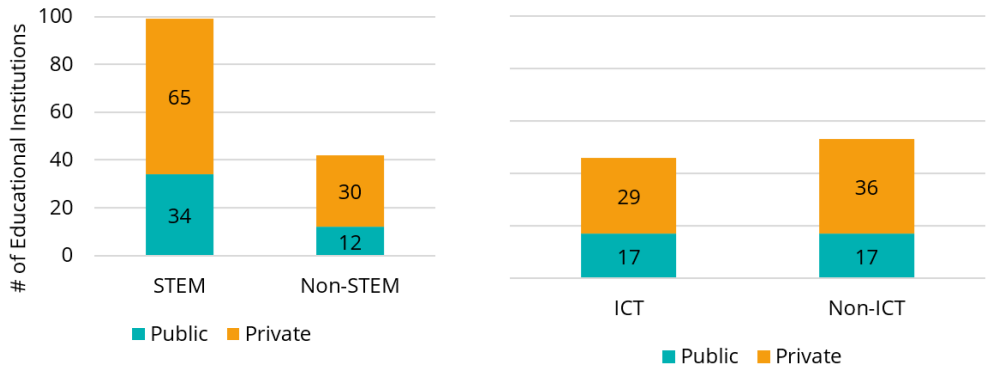
Bachelor's degree programs

When considering the bachelor's degree-programs category, instead, there were 167 educational institutions offering accredited bachelor's degree programs in the academic year 2018-2019. Of these 167 institutions, 26 of them did not report the programs they are currently offering or the data was missing; thus, they were not considered. As a result, we accounted for 141 educational institutions in total for our study, with 46 of them being public institutions and 95 being privately owned.

Among the 46 public institutions, 34 provide STEM programs, while 12 provide non-STEM programs. Among the 34 that provide STEM programs, 17 of them are ICT-related. The ones that have ICT-related programs are under the following ministries: 6 in the MoEYS, 1 in Ministry of Agriculture, Forestry, and Fisheries (MAFF), 1 in the Ministry of Social Affairs Veterans and Youth Rehabilitation (MOSVY), in Ministry of Mines and Energy (MME), 1 in the Ministry of Post and Telecommunication (MPTC), and 7 under the MLVT)

Furthermore, among the 95 private institutions, 65 provide STEM programs, while 30 provide non-STEM programs. Among the 65 that provide STEM programs, 29 of them are ICT-related. The ones that have ICT-related programs are under the following ministries: 27 in the MoEYS and 2 in the MLVT.

Figure 2. Number of educational institutions offering non-STEM and STEM bachelor's degree programs and ICT-related or non-ICT-related STEM programs

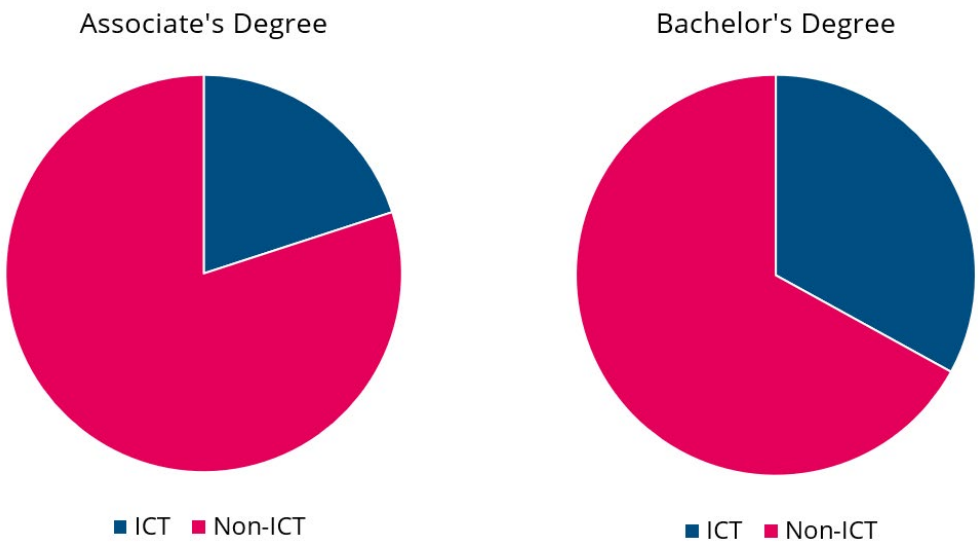


Source: Tabulated by authors.

Discussions

Considering the data reported in the Results section, we can conclude that analyzing the current situation in tertiary-education in Cambodia, it emerges that the number of institutions offering ICT-related undergraduate programs is relatively low compared to the total number of educational institutions operating in Cambodia. In the specific, roughly 20% only of the HEIs within the associate degree-programs category were offering ICT-related majors (at least an associate degree or TVET program with an ICT-related focus) in the academic year 2018–2019, a number that increases at the bachelor's level to roughly 33% (as shown in Figure 3).

Figure 3. Percentage of Cambodian educational institutions offering ICT-related majors at the associate degree and bachelor's degree levels in the academic year 2018–2019



Source: Tabulated by authors.

These findings depict a scenario where the current Cambodian educational institutions' offering seems to not be in alignment with the needs of Cambodia to prepare the new generations of Cambodians for the digital era, mostly when considering TVET and associate degree programs. We need to highlight the fact that the RGC has already initiated projects for enhancing digital culture and awareness on the importance of ICT-related higher education with one of the major steps being represented by the Cambodian National Science and Technology Master Plan 2014-2020 (Corrado et al., 2021), where the RGC placed

a major focus on the importance of ICT and ICT-related education. The MoEYS has also shown support towards those institutions interested in offering STEM education and ICT-related programs, and the MPTC has enlarged its education branch—once called the National Institute of Posts, Telecoms & ICT (NIPTICT), it is now a full academy renamed as the Cambodia Academy of Digital Technology (CADT), defining itself as an arm of the MPTC for elite education, research, and innovation in the field of digital technology. But these frameworks and initiatives should be better supported by tertiary education, with educational institutions shifting more towards an educational offering aligned with the goals and vision of Cambodia. The country, in fact, cannot sustain digital development if not enough skilled Cambodians will be ready for it in the near future.

As the last point, we want to underline the importance of inclusion of digital training in the non-ICT majors, even in those belonging to the category of STEM and the subcategory of non-ICT. Taking into account the increasing interconnection of ICT with every aspect of our life and the pervasiveness of digital technologies, it is fundamental, in fact, to assure the presence of ICT-related training in every curriculum, thus offering to every Cambodian an adequate ICT preparation independent from their major. Digital savviness is no more a luxury for the ICT experts but an essential everyday tool for everyone.

In summary, we can conclude that more universities should shift their educational offering towards a more ICT-related education, mostly considering the desire of Cambodia to be an active player in the digitalization advancement, fostering an inclusive digital economy capable to support the growth of the country and the vision of the RGC to become a developed country by 2050—a visionary goal not possible to achieve unless Cambodia fosters its ICT savviness mostly in the newer generations.

Conclusions

Considering the increasing importance that ICT has already gained across the world and that it has been forecasted to grow even more in the years to come, ASEAN launched the ASEAN ICT Masterplan 2015, with the belief that ICT will be a key enabler for the regional social and economic integration. Currently, in the region, the number of people already employed within the growing ICT industry sector is contributing to 3% of the total ASEAN's GDP, and it is forecasted to grow even more. Thus, to be an active player in the digital growth in the region, Cambodia needs to pave the path towards this vision, starting with educating the newer generations for this challenge.

In this chapter, we investigated the current undergraduate educational offering, accounting for associate and bachelor's degree programs offered by several educational institutions—including universities and institutes—that offer two typologies of streams, namely the academic and the vocational one. We performed a classification between STEM and non-STEM programs, and within the STEM, we categorized the ICT and non-ICT ones. In accordance with the findings, it emerged a relatively low number (roughly 20% of the total) of institutions offering associate degree programs with a focus in the ICT field, depicting a scenario of the tertiary education in need of enhancing the education offering necessary for preparing the new Cambodian professionals. The number of ICT-related educational programs increase promisingly at the bachelor's level (roughly one-third of the total), but it is still not enough to sustain the creation of skilled labor in ICT for the Cambodian vision to be an active player in the digital growth of the region. The recent growth of bachelor's degree programs with an ICT orientation may be the result of the past year's campaign of the MoEYS to enhance the offering of undergraduate programs in Cambodian universities, but more still needs to be done.

Finally, it is also important to highlight the fact that in this paper, we focused on exploring the quantitative offering of programs and not on their quality. The Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH, often shortened to GIZ, stated that "TVET but also university graduates, often fail to live up to the demands of business and industry with respect to technical expertise and practical competencies. The consequences are unemployment and additional training costs for enterprises" (GIZ, 2019). This is another area that should be explored beyond the number of offered degrees. ACC has already started a process of review and accreditation of the different programs and universities, but the process was abruptly interrupted by the pandemic that impacted the entire world, Cambodia included. Thus, the reader needs to take this into consideration, and more research should be done to investigate not only the quantity but also the quality and the effectiveness of the current programs.

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The Future of Jobs and Education: The Role of STEM Uptake and Employability in Penang

Ong Wooi LENG, Lee Siu MING, and Ng Kar YONG

Abstract

This study employs a two-pronged approach to analyse the future education and jobs in Penang. First, we analyse students' preferences over future education. Biological sciences were the top pick compared to future-of-work courses, while nonsciences proportionately preferred digital/technology-related courses. Second, we examine the employability patterns among fresh graduates. While fresh graduates are in demand in Penang's industries, underemployment persists. Salary signals the growing demand for engineering and computer sciences that will shape the future jobs in Penang.

Disruptive technologies change the global landscape of future jobs. Job displacement and skills deficiency are critical concerns, and how the employability of science, technology, engineering, and mathematics (STEM) graduates will shape future jobs becomes vital to ponder. As digitalisation is shaping the work in future, the future job functions will change in accordance with tasks that can be digitalised, performed remotely, and are highly automatable. The realisation of this essentially depends on the rapid shift in education and digital adoption in organisations. According to McKinsey (2020), Malaysia might increase services-oriented and nonroutine jobs or net new jobs by 2030 caused by automation if the right investments are in place along with the required skills to thrive (Koh & Manuel, 2020).

Penang is a rapidly industrialising state in Malaysia, driven primarily by electronics manufacturing. Electrical and electronic (E&E) and optical products constituted an increased share of Penang's GDP from 27.5% in 2015 to 30.8% in 2020, and the state produced the largest E&E output in Malaysia, accounting for about 35% of the total E&E output in 2020. Over the years, the local and foreign manufacturing industries are adopting the elements of the Fourth Industrial Revolution (4IR

or Industry 4.0) into manufacturing process and production. Be that as it may, the success of this adaptation relies heavily on the availability of a future-proof human capital that supports the industry needs.

Experienced and highly skilled workforce are often high in demand in Penang (Penang Institute, 2017). In a constrained labour market, the shortage of skilled workforce is a much-debated issue, and this is present along with a high rate of graduate unemployment. This raises the question of the severity of skills mismatch and the relevance of skills equipped from university to jobs among fresh graduates (Lacmanović et al., 2016). Undergraduates face a dilemma when training received now would become less relevant upon graduation. The relevance of skills will be further exacerbated by the country's multiple lockdowns implemented in response to the coronavirus pandemic, where the lockdowns have resulted a 0.35-1.1% increase in employment loss for every 1% increase in the lockdown measures (Habibullah et al., 2021).

Understanding student's motivation in STEM courses along with the employability of fresh graduates is imperative to shed light on the policy challenges in STEM uptake and graduate employability that will help shape the future jobs and education. The main concern lies in the ability of the education system, whether the knowledge of the current state of the digital revolution are part of the learning mechanism in schools. The question arises on how education is to adapt to the future jobs and to create future-ready graduates that can elevate Penang's economic and technological growth to the next level.

This paper aims to analyse the future education and jobs in Penang's employment market. This study employs a two-pronged approach. First, this study investigates students' preferences for future education and their interest in STEM courses. Second, we examine the skills utilisation and availability patterns among fresh graduates.

The next part of this paper summarises the current employment landscape in Penang. The analysis of upper-secondary students' motivation and perception of future jobs and the analysis of skills utilisation and availability patterns among the fresh graduates follow this. Next, this paper discusses the implications of future education on Penang's industrialisation. Last but not least, the last chapter will be the policy recommendations.

The Employment Landscape in Penang

Penang's total workforce made up 7% of the entire workforce in Malaysia, with its labour force participation rate (LFPR) rising to 68% in 2020. A majority of its workforce consisted of the prime-age working population aged 25-44, standing at over 80% LFPR.

While Penang's services sector represents the largest share of employment, E&E manufacturing remains the driving catalyst of Penang's economic growth. The share of employment in the manufacturing sector shrank gradually by 6.7% from 42.7% in 2000 to approximately 36% in 2020. This indeed shows that the manufacturing value chain is progressing towards technology- and knowledge-driven activities in the areas of research and development, design and development, software development, and business management. Meanwhile, the key subsectors with the largest employment in the services sector are tourism related, which are (a) wholesale and retail trade and (b) accommodation and food services activities, which respectively accounted for 15.8% and 8.3% of the state's total employment.

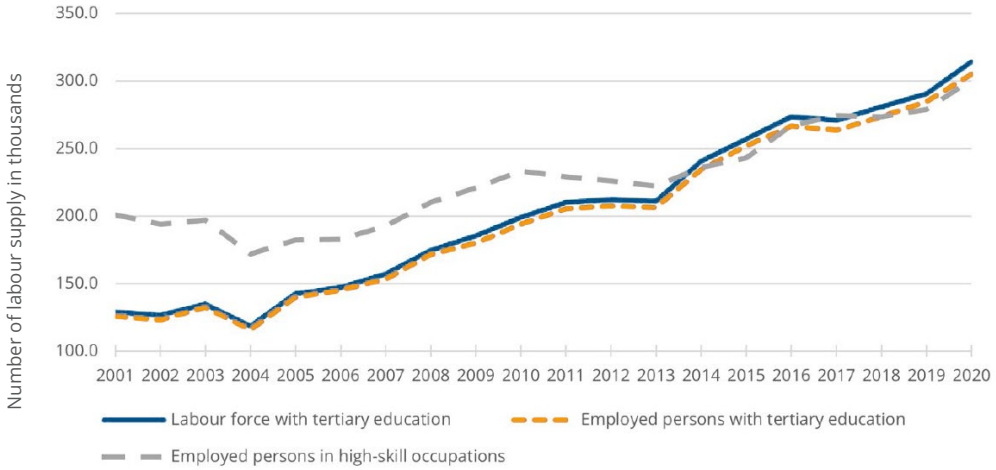
Mid-skill employment made up the largest percentage of Penang's workforce (38.6%), closely followed by high-skill employment (36.2%) and low-skill employment (25.3%). Based on our knowledge, no specific study has looked into the tasks that are at risk of automation in Penang's context. According to the Organisation for Economic Co-operation and Development (OECD), a substantial routine, mid-skill jobs are likely to be substitutable by automation. For educational attainment, Penang is relatively a highly educated state, with its share of tertiary-educated workforce soaring more than twofold from 15% in 2001 to 36.4% in 2020. Noticeably, the tertiary-educated workforce grew at a faster pace than the workforce without tertiary-education. It expanded by 4.8% annually from 129,200 persons in 2001 to 314,300 persons in 2020 compared with a negative growth of 0.5% for the non-tertiary-educated workforce for the same period.

Two labour market constraints are observed. First, the presence of oversupply of the tertiary-educated workforce. The excess supply of tertiary-educated workforce had widened since 2014 and peaked in 2020 because of the effect brought on by the COVID-19 pandemic. This means that the average number of unemployed graduates increased from 3,000 persons for 2001-2008 to 6,100 persons for 2009-2020, rendering the skills mismatch.

Second, there is a slower rate of job creation for high-skill occupations. Prior to 2014, tertiary-educated employed persons had increased in tandem with the employed persons in high-skill occupations (Figure 1). However, the trend

for the latter has fluctuated since then, indicating that some tertiary-educated workers are now engaged in non-high-skill employment. This causes skill-related underemployment, albeit being insignificant.

Figure 1. The excess of labor supply for tertiary level of education in Penang



Source: Labour Force Survey, Department of Statistics Malaysia.

Malaysia's graduate unemployment is discipline based. Compared to STEM-related programmes, non-STEM programmes consistently record a higher percentage of graduates being unemployed over the years, with arts and humanities being highly affected (Ministry of Education, 2021). This mismatch is increasingly alarming if the graduate unemployment persists. Additionally, the lack of high-skill jobs available in the state could also lead to talent loss. As seen in Figure 1, the number of employed persons in high-skill occupations has grown at a much slower pace than the workforce with tertiary-education (2.2% versus 4.8% annually from 2001 to 2020), signalling the slowdown in jobs creation.

Penang's economic growth and the area of work of the future, at least in the short run, noticeably is driven by (1) the continued manufacturing and adjacent-services investment in promoted sectors and (2) the continued efforts of the state government to elevate the state's industrial-related and global business services (GBS)-purposed office infrastructures. Penang's manufacturing investment recorded about 15.5% of Malaysian investment, creating 13,268 employments in 2020. However, this has also increased worker mobility within the same industry, as envisaged in the previous study of Penang Institute, where the job vacancies replaced employees who have left the positions (Penang Institute, 2017). Amid

COVID-19 pandemic, while retrenchment of workers is on the rise because of various phases of movement-control orders implemented in the country, Penang's job market remains cautiously optimistic. There were 65,629 vacancies posted on MYFutureJobs from June to December 2020, garnered by the Social Security Organisation (SOCSO).

Preferences and Motivation of Students in Future Jobs

A future-ready talent pool to fit prospective jobs is predominantly associated with students' preferences and motivation in digital-related or future-of-work courses in tertiary-education. To understand a student's study motivation, we investigate students' preferred postsecondary courses and the hurdles faced by students that deter them from having an interest in science-related subjects among upper-secondary students in 17 schools in Penang through a cluster random-sampling method. A total of 956 science and nonscience students responded to a closed-ended questionnaire through a computer-assisted self-administered survey.

Students' preferences in future of work courses

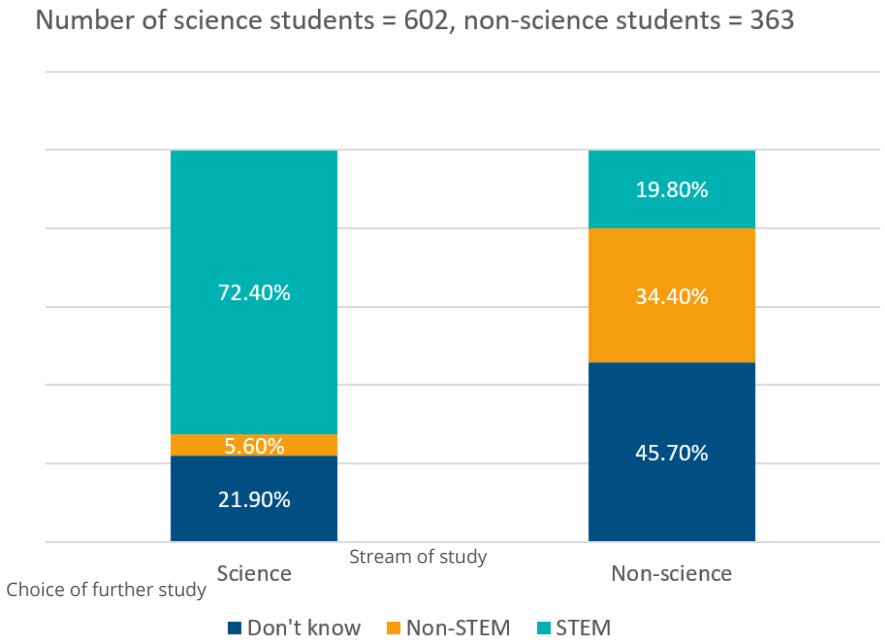
Students' choice of future study provides some clues to the preferred jobs that they will engage in the future. Our survey results found that a majority of science students expressed their interest to pursue STEM-related course[1] for post secondary studies, whilst only a small percentage of science students revealed interest to drop out of science (5.6%) (Figure 2), where a majority of them indicated interest in finance, banking, and accounting. Importantly, although a large percentage of nonscience students would pursue non-STEM-related courses after secondary education, nearly one-fifth of them intended to pursue STEM-related courses despite enrolling in nonscience classes during secondary education. This indicates that nonscience students should also be given priority for STEM-related courses in tertiary-education.

There was a considerable proportion of science (21.9%) and nonscience (45.7%) students being uncertain of their future study pathways. This calls for the need to update students with the latest development and requirements of skills in schools. Specifically, career counseling and handholding support from schools are imperative to develop students' interest in digital technology. In an era with the growing Industry 4.0, learning science courses may not necessarily enable one to meet the future skills requirement. It should be noted that artificial intelligence (AI), data analytics, and digital technologies have

1 This study defines future-of-work courses as part of STEM courses.

become solutions to many hard-science problems, including biotechnology, renewable-resource management, and environmental threats (Penprase, 2018). An extensive integration of AI in the 4IR workforce is urgently required to ensure a pool of future-ready graduates available for the jobs. This will intrinsically shift the demand for education.

Figure 2. Distribution of students' intentions to pursue STEM courses at tertiary education



The type of STEM courses that upper-secondary students planned to pursue provides an indication to students' study motivation and knowledge of industry needs. Interestingly, students did not show significant interest in pursuing physical sciences compared to life-science-related courses, although the former offers more jobs than the latter in Penang's job market. Among the science students, medicine and biology were the top-pick courses compared with future-of-work courses (Figure 3). This represents approximately 40% of science students, and only about 15% of them were intending to learn AI.

It is also a predicament to achieve the government's target of 60% science graduates. Essentially, some students are qualified to study science stream but choose to study arts stream (Ministry of Education, 2013). Our survey results found that about 46% of nonscience-stream students indicated their interest in science but they enrolled in arts classes because arts subjects are easier to

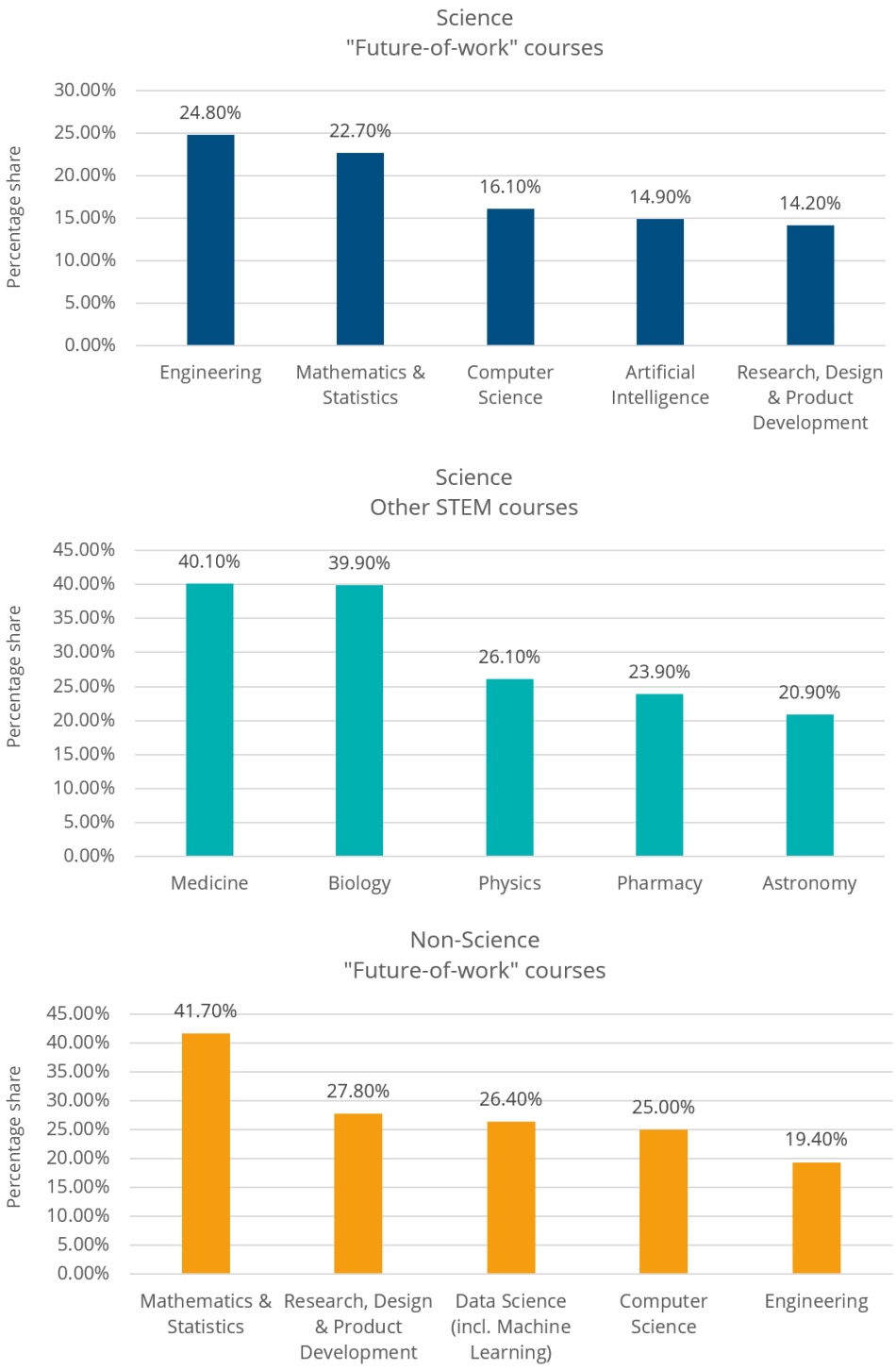
understand compared to science subjects. To these students, science subjects are difficult to understand, attributable to too many theories and formulae that require memorisation. Poor results in science subjects further discourage students from learning science.

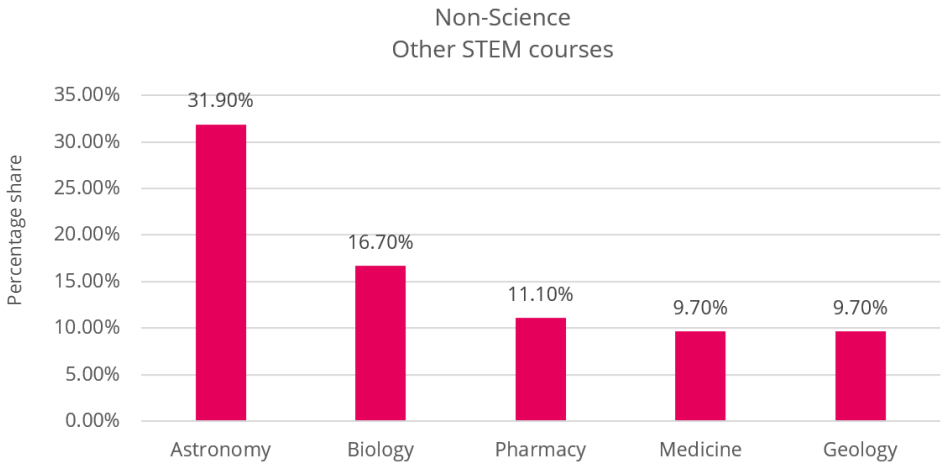
Compared with the science-stream cohort, students from the nonscience stream proportionately preferred digital-related courses, which are closely associated with the skills required for future jobs. As seen in Figure 3, all courses categorised under future work were generally more favourable among the nonscience students compared with science students. Nearly 42% of the nonscience students expressed their interest to pursue mathematics and statistics, followed by research, design, and product development (27.8%) and data science, including machine learning (26.4%). It is worth noting that nonscience students should also be the central focus in the education system to introduce more digital-technology-focused classes during their secondary education. Interested students with poor academic results should consider learning coding, computer science, and software development. But this is dependent on the constant support from the education ecosystem.

Notably, students may not essentially be required to study science subjects to be software developers or IT specialists. Only a small number of nonscience students surveyed were aware that learning physics, biology, and chemistry would not help them achieve this ambition despite having interest in science. Therefore, nurturing interest among upper-secondary students in the fields of data science, computer science, and mathematics and statistics across science and nonscience students is more imperative to the demands of future employment.

While the country's education system aims to increase STEM graduates for the economy, students' interest in science subjects (biology, physics, and chemistry) are weak. While nearly 85% of the science students indicated an interest in science, about 22% of them were uncertain whether to pursue STEM courses after secondary education, as can be seen in Figure 2. Meanwhile, some students who are disinterested in sciences still enroll in science classes because of more options available in higher education. This reflects that these students have possibilities to pursue computer science or information technology courses in the future.

Figure 3. Top 5 students' choices of future study for science and nonscience students in Penang





Note: The sum of percentages within science and non science students may exceed 100% because one student can select more than one course.

Teachers play a vital role in the students' study motivation. In Malaysia, teacher-centred pedagogical approach is widely debated, which has caused science classes being exam- and textbook-oriented, on top of the lack of innovation and creativity in science teaching. Inadequate teaching time is another barrier preventing teachers from engaging lessons more effectively. In times of coronavirus, online learning becomes essential and students face challenges getting connected to online classes due to poverty and poor internet networks. In Penang, 13% and 27% of urban and rural households do not have computers in 2020. Despite 95% of the households having internet access, the quality of the internet connection requires improvement (Department of Statistics Malaysia, 2020). Beyond COVID-19, teachers should optimise the utilisation of the *21st century learning*[2] as the future of teaching approaches. According to OECD, digitalisation is predicted to increase demand for jobs that require skills to solve unstructured problems, which need critical thinking (OECD, 2016).

Additionally, the lack of qualified science and mathematics teachers is a critical concern. The shortage of subject specialists who are equipped with the latest subject-matter knowledge in Industry 4.0 could be devastating. Teachers require long-term professional development throughout their careers. On one hand,

2 The *21st century learning* focuses on a student-centric learning, which comprises five main elements: communication, collaboration, critical thinking, creativity, and values and ethics (Julaihi & Hamdan, 2020).

this is to ensure that up-to-date tech knowledge can be transferred to students. On the other hand, IT-training courses should be made available for teachers to sharpen their digital skills. Nevertheless, a conducive learning environment equipped with modern teaching technology is necessary to motivate students in all aspects of learning.

The rapid change in technology requires a coherent shift in education too. Education system has not caught up with the changes in the job market. The impact brought on by the coronavirus will further widen skill mismatches. Graduates are expected to take longer to be employed if continued upskilling initiatives do not take place concurrently. To prepare for future-proofing employment, secondary schools should increase industry engagement as part of school activities to enhance students' exposure to the future work.

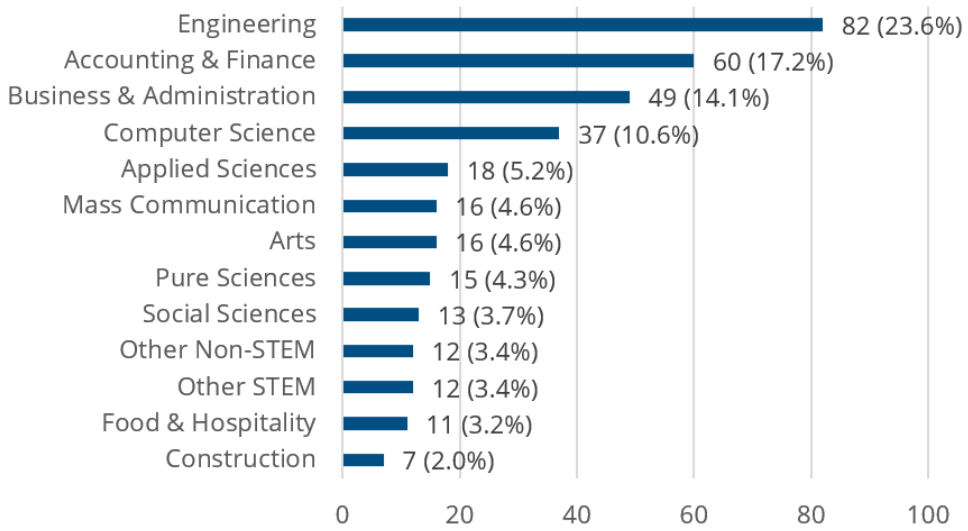
Skills availability and utilisation patterns among fresh graduates

In higher education, graduate employability is often regarded as a measure of university's success in graduate outcome. Job-readiness skill—or the right skills equipped in university together with a set of competencies and attitudes—is crucial to enhance the employability of fresh graduates. To gauge the graduate employment situation in Penang, we examine how employable the fresh graduates are for different disciplines and how skills are being utilised in Penang's job market. A snowballing sample of 348 fresh graduates[3] was collected primarily from the public and private higher-education institutions in Penang.[4] Of this, about 51% and 49% were non-STEM and STEM graduates, respectively, with engineering and computer science graduates forming nearly one-third of the entire sample (Figure 4).

3 This refers to graduates who completed their courses from 2019–2021.

4 This also includes a small number of fresh graduates who either reside or work in Penang but have not graduated from Penang during the survey.

Figure 4. Distribution of respondents by fields of study



Note: "Business & Administration" include management, administration, and marketing.

Employability patterns of fresh graduates

Amid the 4IR, STEM graduates inevitably become more sought after than their non-STEM cohorts. In Penang, there are different levels of employability within the STEM disciplines. The results of our survey show that not all STEM graduates possess equal employment opportunities. With about 77% of graduates who gain employment during the survey, only graduates with technological skills have higher employability than others. A majority of computer science and engineering graduates have higher employability, taking less than six months to get a job, compared with graduates from other STEM disciplines such as applied science and pure sciences (Figure 5). Computer science graduates had the highest employment share at 94.6%, followed by engineering at 80.7%. This situation reflects the high demand for engineering and computer science graduates in Penang.

Comparing this with non-STEM graduates, accounting and finance remain as the most sought-after disciplines in Penang, with greater employability than graduates from other non-STEM courses. With a large percentage of them mainly employed in global business services (GBS) and E&E, a majority of the graduates took less than six months to get the jobs. Meanwhile, Penang has a low demand for arts and social science graduates, with only less than 60% of

them securing a job during the survey. This is in line with Malaysia's share of graduate unemployment, recording the highest across all disciplines, leading to a possible oversupply of university's degrees for such disciplines.

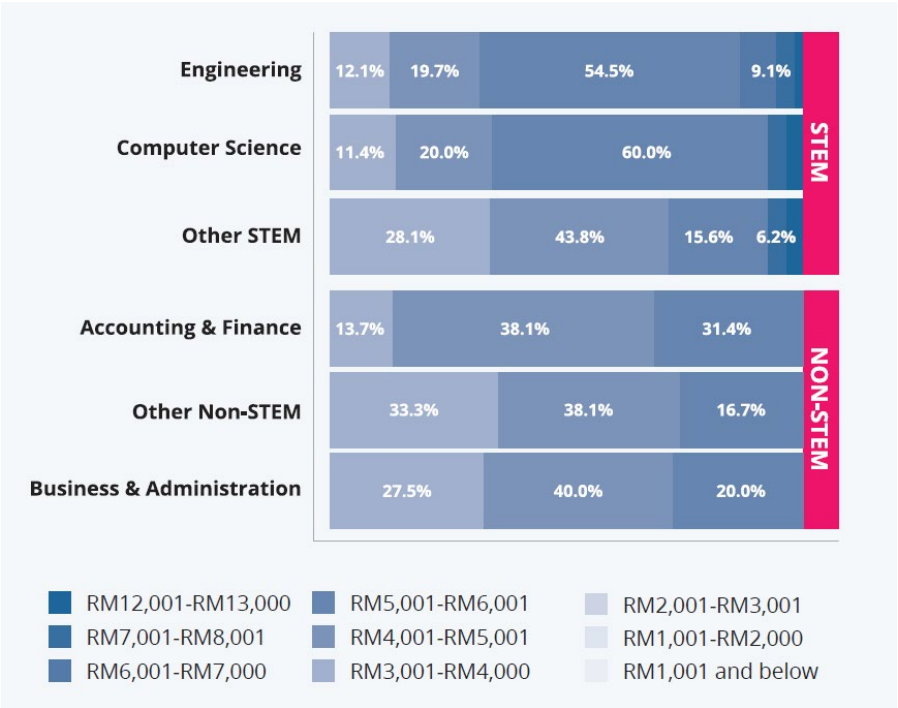
Adopting an earlier study's view that in-demand highly skilled workers are paid above the rest (Korn Ferry, 2018), engineering and computer science graduates are more in demand compared with other graduates in Penang. More than half of the engineering and computer science fresh graduates earned between 3,000 to 4,000 Malaysian ringgit (MYR) (Figure 6), the group with the highest proportion earning this range. This is mainly attributed to the highly sought-after and hard-to-fill jobs, particularly with Penang's industrialisation landscape. Meanwhile, the accounting and finance cohorts are mainly making a salary between 2,001 to 3,000 MYR monthly. This group is making lower monthly salaries than the former cohort because of the fact that the vacancies that require such disciplines are not difficult to fill from the graduate market despite being the highly sought-after disciplines.

Figure 5. Percentage Share of Graduates Being Employed Within Six Months vs. Employment Share

Note: The *x*-axis refers to the number of employed graduates (out of the total employed graduates). The *y*-axis refers to the number of graduates employed within six months (out of the employed graduates). Only fields of study with at least five employed graduates are shown. The size of the bubble indicates the number of graduates surveyed in a specific field of study. The dotted lines are the weighted averages of both shares.

In recent years, accounting and finance graduates are increasingly part of the human capital for the GBS in Penang. Unlike other hubs in this region such as Singapore and Kuala Lumpur (Poon et al., 2017), Penang has limited comparative advantage in finance and banking. Nevertheless, Penang's future jobs will likely be driven by technological changes in the E&E industry and related services such as back-end and front-end semiconductor manufacturing equipment, integrated circuit (IC) design, deep technology, and internet of things, and the state's progression towards higher technology and knowledge-based GBS. From 2011 to 2020, E&E investments accounted for about 53.4% of Penang's 82.2 MYR billion aggregate investments. This, in turn, induced the demand for engineering and computer science graduates compared to other graduates.

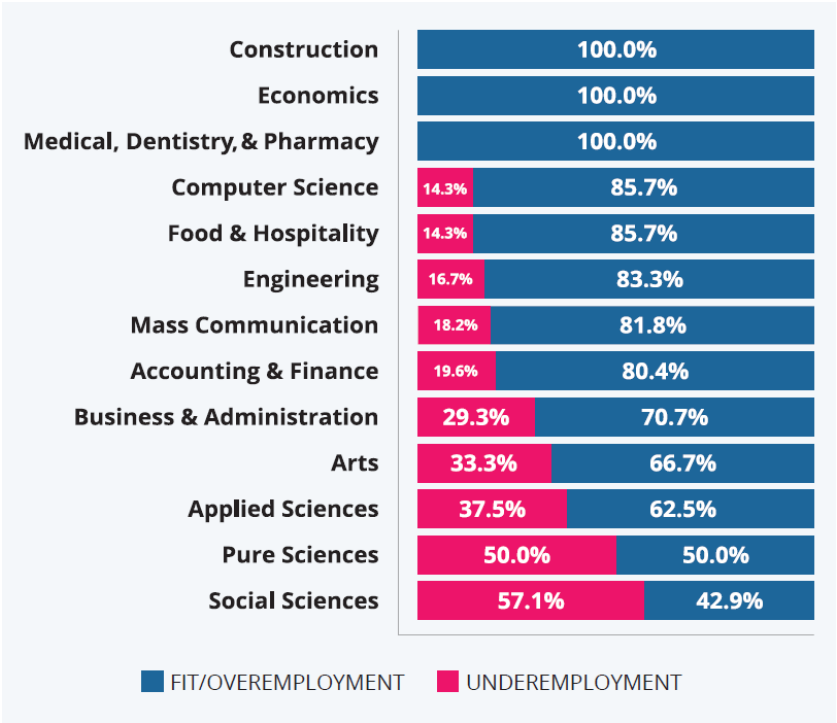
Figure 6. Salary ranges of employed fresh graduates by field of study in Penang



Note: A respondent who makes a monthly salary of RM15,001 and above is excluded from this sample.

As industry progresses towards automation and digitalisation, graduates, despite their qualification, may face underemployment. Some anecdotal arguments suggest that the industry needs to invest resources to train fresh graduates to meet industry requirements. In our survey, graduates who reported underemployment are mixed, ranging from STEM and non-STEM fields of study (FOS), except for dentistry, medical, and pharmacy, where mandatory service with government health departments is required (Figure 7). While 22.5% of the respondents reported their employment requiring lower education qualifications, the underemployment situation is more prevalent among social sciences, pure sciences, applied sciences, and the arts. Conversely, more than 80% of graduates from engineering, computer science, and accounting and finance are employed in jobs that match their education levels. They are able to apply what was learnt in university. The issue of underemployment is not only because of fresh graduates being paid inadequately or being employed fewer hours than the worker is willing and able to, but it could be a symptom for depreciated education, which will inflame graduate underemployment if the future talent requirements are not met.

Figure 7. Proportion of over/underemployment among employed fresh graduates by FOS



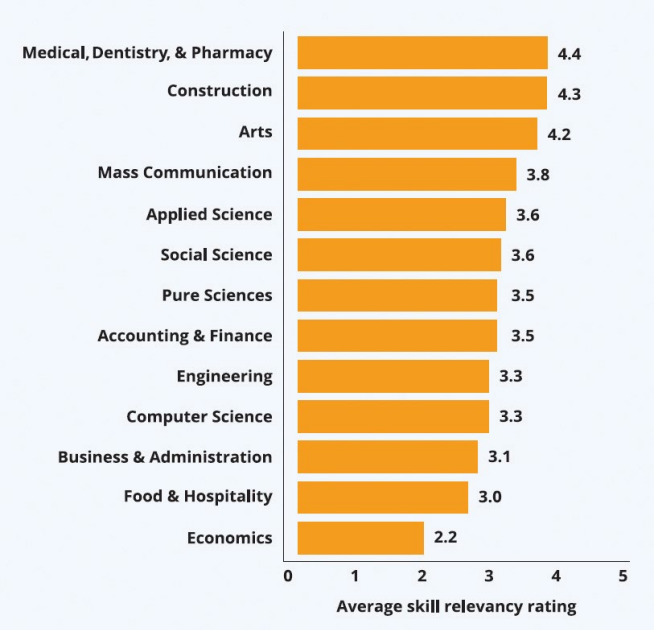
Note: Only FOS with at least five employed fresh graduates are shown.

Skills relevancy to jobs

As Penang progresses beyond half a century of industrialisation, the state's workforce needs to transform the existing skill sets to navigate towards future needs. Intriguingly, engineering and computer science graduates, on average, rated somewhat relevant for skills learnt in university and current jobs at 3.3, despite being an important component of the state's skilled workforce (Figure 8a). When analysed based on occupations (Figure 8b), there are different magnitudes of perception towards their job–skill relevancy. Within engineering professionals, mechanical engineers perceived their skills with the highest rating of 4.1, compared to E&E engineers (3.5), industrial and production engineers (3.5), and other engineering professionals (3.0).

Education courses most relevant within Penang's development, driven mainly by E&E, ancillary manufacturing and supporting services, and GBS, are in the fields of engineering,[5] computer science, and accounting and finance. Our survey findings show that the major groups of engineering, computer science, and accounting and finance graduates mainly flow to the occupations of accountant and auditor; engineers, software developers; and finance, investment, and credit analysts respectively.

Figure 8a. Perceived skill relevancy to the current job by FOS



Note: Only FOS with at least five employed fresh graduates are shown. Skill relevancy rating: 1-Highly irrelevant, 2-Irrelevant, 3-Somewhat irrelevant, 4-Relevant, 5-Highly

5 Malaysia Standard Classification of Occupations 2020.

relevant

Figure 8b. Perceived skill relevancy to the current job by MASCO1 Occupation

Note: Only occupations with at least five fresh graduates are shown. Skill relevancy rating: 1-Highly irrelevant, 2-Irrelevant, 3-Somewhat irrelevant, 4-Relevant, 5-Highly relevant

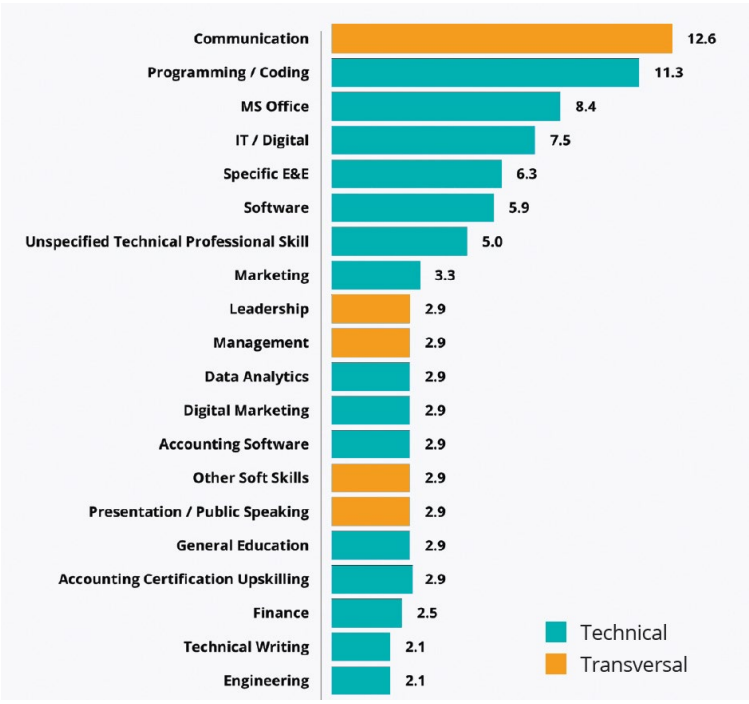
Skills upgrading as a necessary agenda towards future work

In facing the work of today and of the future, continued skills upgrading is necessary. Upskilling/reskilling are not only significantly desired by government and employers (see review by Wilson [2008]), but also increasingly well received by employees. Around 18% of respondents (including non-STEM fields) felt that programming and IT-related skills are important to futurise their career. Technical courses are highlighted by 90.4% respondents, while 32.6% mentioned the need of transversal skills.

Besides that, additional upskilling programmes are needed upon graduation to close the growing skills gap in the 4IR workforce. Communication skill (transversal) (12.6% of 239 respondents) is the top highlighted skill broadly in line with Green (2008), followed by the technical skills of programming/coding (11.3%), and Microsoft Office (8.4%) (Figure 9). Most non-STEM graduates stated MS Office and IT/digital as courses beneficial to them, while STEM graduates wanted programming-related courses.

In Penang's and Malaysia's context, the following are ongoing trends that hint at future directions. First, fresh graduates are still in demand especially in major industries in the local economy, but underemployment persists in an almost-full employment environment. Second, salary is one of the signals indicating the growing labour demand for specific occupations now and into the future. Third, upskilling/reskilling is necessary and IT-related skills are no longer limited to technical professionals, as it becomes more common across different spectrums of occupations and fields.

Figure 9. Desired reskilling/upskilling courses by fresh graduates



Note: Upskilling/reskilling courses listed by at least five respondents are shown.

Implications of the Future Education on Penang's Industrialisation

As a state with scarce natural resources, Penang's growth engine should be driven by a high-skilled, future-ready talent pool. It is a concern that slow-evolving and less-adaptive teaching and learning in the existing academic tracks potentially pose a threat to Penang's development, and Penang may not play catch-up with the velocity of changes at work and technological transformation. Furthermore, upskilling/reskilling the existing workforce may be constrained by situations where workers cannot afford to leave their jobs to partake in courses to upgrade themselves.

New modules of learning in Penang's education inevitably should incorporate tech education most required by the local industry and relevant soft skills (earlier addressed in Section 4). Some disruptors have emerged to address this issue in the local scene, such as Forward School and ViTrox Academy. Forward School is a future-skills school that aims to equip aspiring tech professionals with industry-ready skills. Meanwhile, ViTrox Academy is the education arm of ViTrox Technologies, one of Penang-headquartered large companies, and focuses on industry-driven technical training and soft-skill training programs.

For a fast-growing industrialised state like Penang, a conventional medium of education is obsolete due to slow transformation. To complement the existing education system, the Penang state government, together with the local and international industry players, established Penang Science Cluster (PSC) to inspire students from primary and secondary schools in science and technology. This is part of a bigger state mission to build a talent pipeline in tech-driven industries for the future of Penang and Malaysia, offering tech mentorship programmes in LEGO robotics, coding, embedded systems, agrotech, and radio astronomy. These programmes offer practical skills, such as programming, prototyping, and electronics to solve real-world problems. Beyond this, PSC also capacitate schoolteachers through tech-related skills development and provides support for hardware and equipment that are necessary for teaching and learning STEM subjects.

Given the strengths of Penang's industries in semiconductor manufacturing, the presence of the life science industry remains limited. With a substantial number of students having strong interest in biological sciences, talent outflow will remain a key problem for the state due to the lack of job opportunities in pharmaceutical and biotechnology industries in Penang. Additionally, pure and applied science graduates take a longer period to get employed compared to other science graduates in medicine, engineering, and computer science. In fact, knowledge in software, hardware, and algorithm technologies are also required

for the future professions in biological science and biotechnology (Massabni & da Silva, 2020). As such, the risk of talent scarcity increases if continued investment and innovation are absent to support skill transitions that meet the demand of future skills.

The future of work enables companies to enhance their competitive advantage in search of a talent pool. With work-from-home mandates now set in stone, forward-looking companies are to search further afield for the best talent with the right skills to fill the tech-advanced roles globally. The new norms of work will cause international remote workers to increase, as reported by half of the companies surveyed by PwC globally (PwC, 2020). Considering the shortage of talent among locals, Penang's industries, especially the multinational manufacturers and GBS, can now tap into the global talent pool to fill highly in-demand positions that the local workforce cannot fill. The local graduates could be at risk and become less competitive if continued education upgrade is not strategically in place.

Policy Suggestions for Future-Ready Graduates at Workplace

This article argues for a gigantic scale needed to future-proof the workforce in Penang by enabling a strategic multistakeholder cooperation, involving federal and state governments, industry and employees, public- and private-education institutions, and future graduates. This collaborative effort should complement each other at all levels in a coordinated way within the ecosystem of work, education, and lifelong learning. Most importantly, a holistic transformation and constant upgrading through integrated education policies addressing skills mismatch between Malaysia's education system and future skills are urgently necessary to increase graduate employability. Industry members should be given greater opportunities in curriculum design and the qualities/training envisioned by employers to develop students' capacity in 4IR skills such as data science, AI, and robotics. It is worthwhile to consider developing a 4IR-oriented STEM curriculum within the traditional science subjects—physics, chemistry, and biology—and making computer science a compulsory subject. Reviewing the curriculum periodically is also imperative to ensure skills trained in universities remain relevant upon graduation. The outcomes of industry-academic collaboration can be further enhanced by involving industry as panel members in university. Essentially, educational institutions not only partner with the industry for hardware partnerships (such as lab establishments, equipment share-use) but also to tap into real-world experience and expertise.

Besides that, increased cross-border university engagement should be enhanced to elevate the quality of education. Universities in Penang and Malaysia are

recommended to create more online courses in partnership with international universities for local graduates. This will also allow for greater relevancy of courses, especially in technology-related fields, and Penang can align the knowledge flow with institutions from the same host countries of the top multinationals in Penang. To increase the quality of faculty on the latest technologies, universities should hire visiting professors from high-ranking universities globally to conduct lectures and research work with the local universities. For future universities and colleges, a designated 4IR hub within university campus will be required to enable 4IR skills and environments.

Rapid technological change requires continued learning initiatives to be greatly promoted in the form of lifelong education. Opportunities for students to reengage with technical courses in university are imperative to provide platforms for updated skills that can help shape technological progress. This will certainly increase marketability and employability of the workforce. To accommodate the needs of the workforce, online-learning platforms should be vastly made available for students to attend flexible and short-term courses. During the COVID-19 pandemic, the Human Resource Development Corporation, a government agency in Malaysia, introduced the e-LATiH platform in efforts to upskill workers. Large corporations also allow workers to access international e-learning portals for self-development.

However, more initiatives should be undertaken locally to ensure that workers from small and medium corporations have access to e-learning platforms participating in suitable upskilling courses. Credit vouchers by the government would be a useful targeted measure to democratise access to workers, especially when a large segment in the skilled workforce are interested in upskilling/reskilling (discussed in Section 4). Members of the workforce will also be empowered to select the areas of interest to reskill/upskill, especially when it involves an area outside of the current employer's focus.

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Advancing Knowledge Capital in Transforming the Future of Work in Southeast Asia

John Paolo R. RIVERA and Eylla Laire M. GUTIERREZ

Abstract

With globalization, education and skills have to be enhanced towards adaptability and competitiveness. As such, knowledge capital has to be built. This begins with educators being experts in their fields, as evidenced by their contributions to knowledge creation that are grounded on current realities. This facilitates an economy's growth of research capabilities that improve ways of doing things through higher levels of knowledge and competencies that create inventions and innovations.

The rise of the knowledge-based economy emphasized the significant link between economic growth and knowledge capital. We define *knowledge* or *intellectual capital*, following Tracy (2020), as an intangible asset comprising valuable ideas, methods, processes, and other intuitive talents that an organization or a nation possesses. This definition is closely linked to Furman & Hayes (2004) defining knowledge capital as higher levels of competencies resulting to growth of research capabilities of an economy through creation of new innovations.

Furthermore, because knowledge is comprised of experiences, understanding, and comprehension of the issues in an environment that warrant economic agents to respond accordingly (McQueen, 1999), it has become the basis of competitive advantage and the fundamental driver of value (Fong et al., 2011; Bock et al., 2005). Likewise, because it is also a collection of framed experiences, values, contextual information, and expert opinion, it supports a framework for assessing and incorporating recent information (Ipe, 2003).

These are consistent with how the seminal study of Romer (1983), which gave rise to new growth theory (i.e., theory of endogenous technological change), asserted the role of knowledge in economic growth (Jones, 2019). That is, while traditional factor inputs, namely land and capital, demonstrate diminishing returns, knowledge does not—it exhibits increasing marginal productivity (Romer, 1986). Hence, through the creation, processing, distribution, and management of

knowledge, an economy can create more value added and experience steeper and unconstrained growth trajectories and enhanced living standards (Romer & Kurtzman, 2004). Indeed, as established by Kahin & Foray (2006), Hudson (2007), Švarc & Dabić (2015), Mikhailov & Kopylova (2019), and Unger (2019), knowledge and technology are essential factors that enhance productivity and economic advancement.

According to Porter (1998), economies have become more dynamic, thereby requiring continuous innovation in enabling factor inputs to be more productive. Thus, learning from the success of developed economies, Mikhailov & Kopylova (2019) emphasized how these economies put premium on information and knowledge in driving growth and development through the efficient utilization of its factor inputs, particularly labor. Hence, we underscore the kind of skills required by a knowledge economy from its labor force—specialized skills such as computer proficiency, data analytics, programming, model building, innovating processes and systems, among others (Unger, 2019; OECD, 2001). Such facilitated the emergence of careers in science, technology, engineering, and mathematics (STEM) that enhanced skills, upgraded technology, integrated disciplines thereby catalyzing a modern economy (Bibri, 2019; Porter, 1998).

Thus, because we have seen that knowledge is a key driver of unconstrained economic growth and development, the movement towards a knowledge economy will certainly raise labor-force requirements because of the change in the way work is done. We then argue the need for economies to focus on creating it and expanding their knowledge base—thereby deviating from intensively using physical resources. We call for establishing mechanisms and systems that will support institutions in developing and disseminating knowledge. Our discussion is particularly addressed to both government, private sector, and academe.

University Research and the Production of Knowledge Capital

Higher educational institutions (HEIs) are platforms for knowledge creation and dissemination towards economic growth and development. According to Hanushek & Woessmann (2008), "The magnitude of change needed makes clear that closing the economic gap with developed countries will require major structural changes in schooling institutions" (p. 607). In the process, economies can create a solid foundation for economic success and shared prosperity (Garcia et al., 2016) by investing in human capital through expanded access to high quality education (Berger & Fisher, 2013). As a result, it will expand economic opportunity for the population and strengthen economic health. Moreover, Hanushek & Woessmann (2020) reviewed the role of education in promoting

economic growth, with emphasis on the role of knowledge capital (i.e., an economy's aggregate skills). They found evidence that the population's cognitive skills (i.e., more than school attainment) are linked to long-run economic growth.

Other than skills training, HEIs are also at the forefront of knowledge creation through the conduct of research (i.e., basic and applied). As emphasized by Korfgen et al. (2018) and Mistry et al. (2020), the basic and applied research conducted by these institutions allow for the achievement of goals that bridge societal needs and technologies. Equally, according to Viale & Etzkowitz (2010), "The scientific knowledge contained in a publication generates technological applications represented by patents, and technological exploitations generates scientific questions and answers" (p. 4), which facilitates wealth creation (Stewart & Ruckdeschel, 1998; Jana, 2016). Beyond publication purposes, research facilitates creation of new designs, concepts, innovative ways of doing things (Liamputtong, 2017), and continuous learning (Homden, 2019). For faculty members, engagement in research projects is critical in ensuring that educational programs are adaptive and reflective of current realities. To an extent, without research, textbooks used by faculty members will remain outdated and rigid (Rivera et al., 2019). Thereby, through research, cutting-edge education is ensured because it is delivered only by expert faculties who have updated knowledge and who are very much involved with recent developments in their fields.

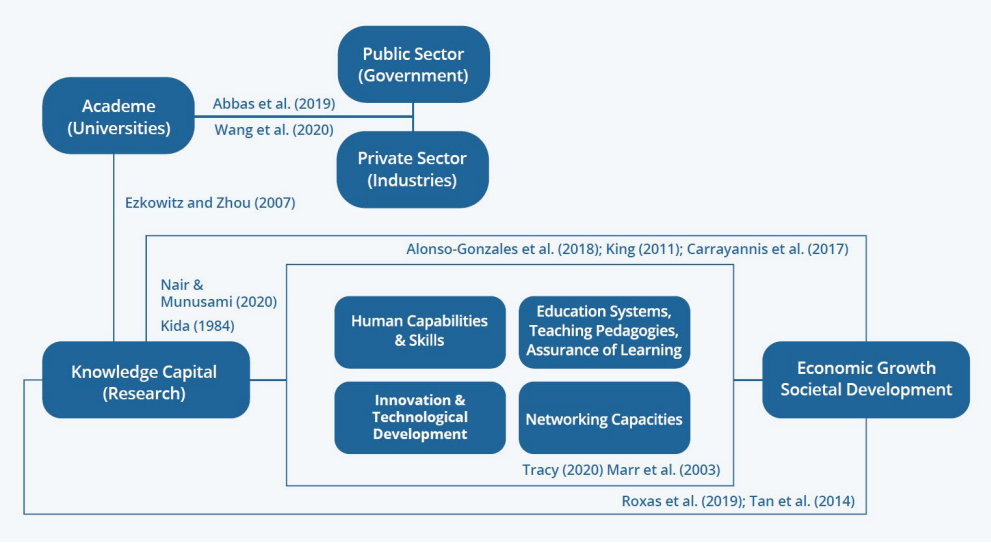
Of equal importance, HEIs also play a significant role in promoting societal development and growth (Ahmad et al, 2018). As argued by Ferraris et al. (2020) and Gibbons (1998), HEIs are characterized as *open organizations* that interact with a variety of stakeholders to facilitate the transfer of knowledge to local communities and societies, which contributes to local dynamism (Ahrweiler et al., 2011). Beyond its role in fostering innovation through research and teaching (European Commission, 2003), HEIs are considered pillars of the *third mission* (Laredo, 2007)—conduct of collaborative research that connects HEIs with external stakeholders (Nicotra et al., 2017). While it may seem that the research carried out by HEIs are disjoint from their teaching mandate because of impracticality and intangibility, it creates impact for everyone in the long run (Homden, 2019). Hence, we surmise from our discussion that economic growth and development are the rewards to investments in educational quality and knowledge creation through research.

Bridging Research and Societal Development

Knowledge capital through research is considered a venue where the diffusion of knowledge to society takes place. We conceptualize the process of bridging research and societal development and vice versa in Figure 1, suggesting that knowledge creation is not a linear process (Wang et al., 2020). While knowledge creation facilitates improvements in the education system because of the opportunity to review and improve the practice of teaching and the learning environment (Nair & Munusami, 2020; Kida, 1984), knowledge creation may also drive overall economic growth and development due to its spillover effects (King, 2011).

Following this logic, a virtuous cycle, or a reinforcing loop, may exist. As knowledge creation engenders better education systems, the enhanced education system will also have a multiplier or accelerator effect on knowledge creation (Tan et al., 2014). That is, knowledge creation through research not only contributes to improved theories, methodological foundations, and pedagogies in teaching and assurance of learning but also cycles back to better and greater knowledge creation. This virtuous cycle may be observed after going through the cycle of knowledge creation and enhancement of education systems multiple times (Roxas et al., 2019).

Figure 1. Bridging knowledge capital and societal development



Source: Constructed by the authors.

For this to accrue, governments must play a key role in providing financial support for HEIs to undertake research projects (Abbas et al., 2019). In return, HEIs must provide education and knowledge that can help address pressing societal problems (Etzkowitz & Zhou, 2007). In cases when government financial support is unavailable or inadequate, industry can support by providing funding (Wang et al., 2020).

As emphasized by Alonso-Gonzales et al. (2018) and Carrayannis et al. (2017), through research, innovative strategies may be developed to achieve sustainable growth. Following Marr et al. (2003) and Tracy (2020), knowledge capital (research) can contribute to the achievement of sustainable competitive advantage by enriching three essential aspects of growth and development—human capital (human capabilities), structural capital (innovation), and relational capital (networking capacities) formation.

Augmenting human capabilities and skills

The conduct of research may contribute to the development of new capacities among individuals (Oliver, 2004). Research and development are further assumed to continuously enhance the productivity of human capital since it will create spillover effects that will benefit firms because of the enhanced supply of human capital, particularly graduate students with specialization in science and technology (Salter & Martin, 2001). As argued by Małajowicz et al. (2019), while acquired knowledge from HEIs do not necessarily translate to career success, engagement in research may enhance skills, thereby improving employability. Moreover, Tracy (2020) emphasized that created knowledge through research generates significant competitive advantages because it is difficult to copy. In the long run, research can be used to empower individuals to engage in networks existing in societies (Sagor, 2000).

The spillover effects of research and development on the labor force will diffuse to affect the growth of an economy. This has been established by the study of Tullao et al. (2010), wherein they found a significant link between university research and productivity growth, particularly in developed economies. It reinforced the studies of Lynch & Aydin (2004) and Frenkel & Leck (2006), wherein university research served as one of the forces behind the development of the United States by allowing the development of knowledge for the creation of new technology to aid the country to lead in digital information. Furthermore, Pande (2003) and Shamounki & Orme (2003) revealed that East Asian economies (i.e., China, Japan, and South Korea) have demonstrated sharp increases in their aggregate income and standards of living because of increased investment in education, research for skills development, and technology adoption. Indeed, education is a viable

investment for an economy's future (Brandt, 2015) and for preparing workforce to be adept in the continuously advancing workplace.

Enhancing networking capacities

Characterized as open organizations, HEIs are identified as facilitators of increased interactions between diverse sets of actors across society in the form of networks (Ferraris et al, 2020; Gibbons, 1998). The establishment of these networks with nonacademic actors may also be identified as the third mission (Frondizi et al., 2019, p. 2) of HEIs, wherein knowledge exchange between industry and academic institutions can help improve practices in private organizations. At the core of knowledge transfer is the importance of the partnerships and relationships built by HEIs with nonacademic actors in societies (Ramírez-Córcoles et al., 2012; Guthrie et al., 2015). Thus, the collaboration between researchers, companies, industry organizations, and governments can arguably result to a positive impact in communities and societies (Paoloni et al., 2020).

In expanding HEIs partnerships with local communities, these enhanced networks then accelerate learning processes and knowledge-creation mechanisms in societies (Carayannis et al., 2000). Arguably, increased networking venues positively contributes to the economic development of a company along with the communities surrounding it (Bramwell & Wolfe, 2008). Consequently, the collaboration between firms and HEIs advances knowledge application (Lavie & Drori, 2012). As emphasized by Mindruta (2013), "University-based technological opportunities are often exploited through joint corporate and academic entrepreneurship activities such as university–industry research collaborations" (p. 644).

As examined by Ankrah & Al-Tabbaa (2015) and Pinheiro et al. (2015), industry-university collaborations have assisted economic growth in knowledge-based societies including the United States, the United Kingdom, Italy, Spain, China, Japan, among others (Rybnicek & Königsgruber, 2019). This is furthered by the work of Kneller et al. (2014) that suggested the positive impact of industry-university collaborations in Japan, Canada, the United Kingdom, and the United States in improving the competitive advantages of their respective industries. Arguably, the success of such interactions has led other countries to follow suit, as shown in the case of Kazakhstan (Jonbekova et al., 2020), Turkey (Guimón, 2013), Thailand (Brimble, 2007), among others.

In harnessing these networks, however, social trust and connectedness between HEIs and communities must be encouraged to facilitate knowledge sharing (Santoro & Bierly, 2006).

Facilitating innovation and technological development

Through increased collaborations between HEIs, governments, and industrial partners, innovation diffusion may be achieved (Ahrweiler et al., 2011). Through the HEIs' third mission, they can serve as sources of innovations in industries where knowledge-exchange processes are encouraged (Martinelli et al., 2008). Thus, with increasing network interaction between HEIs and external actors from society, innovation may be promoted (Gachie, 2020). HEIs can act as knowledge hubs that facilitate the incubation of knowledge that can further contribute to societal improvement (Rubin et al., 2015). For these to accrue, increased interaction between HEIs and their localities and communities must be present—thereby aligning HEIs' research agenda with practical concerns of societies and communities (Cricelli et al., 2018).

In further facilitating this, governments play a vital role in enabling knowledge creation through research in their respective jurisdiction. Most often, through increased public funding for research and development (e.g., training, incentives for research production) at the national and local levels, governments are able to encourage the conduct of research (Hale et al., 2019). The same case is seen in the experience of most OECD-listed countries that allocate grants for research aimed at further improving institutional research (Aldrich, 2012). Likewise, by positioning knowledge creation as a public innovation project that serves as the source of learning, it fosters a strategic renewal that facilitates sensemaking and sense-giving for stakeholders, particularly policymakers (Brix, 2017). Similarly, governments can also facilitate the conduct of research and development through policies. According to Bernanke (2011),

> Economic policy affects innovation and long-run economic growth in many ways. A stable macroeconomic environment; sound public finances; and well-functioning financial, labor, and product markets all support innovation, entrepreneurship, and growth, as do effective tax, trade, and regulatory policies. Policies directed at objectives such as the protection of intellectual property rights and the promotion of research and development, promote innovation and technological change more directly. (para. 1).

Hence, by creating and providing a good and conducive policy environment, big, new, and novel ideas that are beneficial to the economy and society can materialize from well-executed research activities.

For example, in following the *triple helix* collaboration model, knowledge created by universities are commercialized in a highly competitive market. As in the

case of China, where the government spends huge amounts of its earnings to fund HEIs research, industry players are compelled to pay for commercialized knowledge to remain competitive. In this model, governments play an important role not only in producing knowledge but also in mediating the commercialization and diffusion of knowledge created by HEIs (Hanel & St. Pierre, 2006). In some cases, HEIs can also facilitate the commercialization process of the knowledge products they create, although it is considered a complex process and a separate skill to be learned by academic researchers themselves. But as seen in some of the experience of Malaysian academic researchers, it can be done gradually with the help of an external support that focuses on the management of commercial transactions between universities and industries (Ismail et al., 2015).

Among developed economies, the United States is an example of having a dedicated research-and-development agency that is responsible for the development of emerging technologies for military use but has evolved to be an agency that collaborates with academia, industry, and government partners to formulate and to execute research and development projects that will expand the frontiers of science and technology, often beyond military requirements (Colalat, 2015). Some of these projects in which the Defense Advanced Research Projects Agency (DARPA) can claim at least partial credit include weather satellites, global positioning system (GPS), drones, stealth technology, voice interfaces, digital computer, internet, and Moderna's COVID-19 vaccine (*Economist*, 2021). Hence, DARPA is one of the leads many governments look up to in enabling their respective research and development agendas because of its proven track record of boosting socioeconomic growth and development.

Likewise, according to Deolalikar (1997), South Korea is unique among developed economies as it has nearly five times as many research-and-development scientists and technicians per capita as the other economies in the region. Santacreu & Zhu (2018) explained that for them to promote growth, South Korea pivoted towards technological development and innovation by enacting policies incentivizing investment in innovation and spending the largest share of its gross domestic product (GDP) on research and development relative to the United States and Japan. According to Domínguez & Srinivas (2016), this is the key factor that secured South Korea's export competitiveness and fueled their unprecedented economic transformation and growth from an agriculturally based to a highly industrial and technologically driven economy. As such, we accentuate that research and technological development are critical contributors to economic growth, efficiency, productivity, and competitiveness.

While we have seen that theoretical and empirical economic studies concur that research and development, educational outcomes, and innovative activities

are essential for economies to achieve sustainable growth and development, developing or middle-income economies in Southeast Asia are constrained by their limited resources and innovation capabilities and persistent sociopolitical-economic problems that warrant immediate priority (Ambashi, 2018).

Developing economies can learn from the experience of Singapore. Other than continuous industrial restructuring, business-oriented government policies, and effective macroeconomic management, their rapid economic development is also credited for their national innovation policy towards technological development, coupled with educational and skills upgrading. Lim (2018) discussed that Singapore's significant progress in developing its science, technology, and innovation capabilities is due to their (1) investment in human resources to allow them to swiftly absorb and exploit new technologies, (2) facilitation of indigenous research and development, and (3) augmentation of innovation capabilities through an evolving national system that attracts and leverages multinational companies to transfer increasingly advanced technological operations to their economy. Of equal importance, through their Research, Innovation and Enterprise 2025 Plan (RIE2025), they are investing 25 billion SGD (approximately 18 billion USD; 1% of Singapore's GDP) in research, innovation, and enterprise for the next five years (Co, 2020). This will include expansion of research and development in priority areas (i.e., manufacturing, trade, and connectivity; human health and potential; urban solutions and sustainability; and Smart Nation and digital economy). This will also include a new national research program to prepare for future epidemics—a proactive approach in preparing for another likely global health crisis.

As shown in the various experiences of economies fostering knowledge capital, its formation through innovation, research, and technological development can facilitate international competitiveness that contributes to productivity growth (Laperche, 2013). Evidently, economies that engage in technology-oriented curriculum as a subset of an export-led development strategy are able to manage the increasing skill requirements in order to continuously enhance competitiveness.

Knowledge Production in Southeast Asia

There is concurrence in the literature and among experts that knowledge is essential in charting an economy's future. In illustrating an economy's productive capacities in creating knowledge, we follow Rivera et al. (2021) in using the total number of Scopus-indexed journal publications as metric. We tabulated in Table 1 the knowledge production of Southeast Asian economies as well as selected Asian

economies for the period 2011-2020. Because these figures may be a function of population, per-capita income, and other economic and noneconomic factors, we express research productivity in terms of growth rates for the purposes of comparability, as seen in Table 2. However, these figures are not meant to rank economies according to research productivity but to open perspectives on how each economy can augment further their knowledge creation through research.

Table 1. Metric of knowledge-capital production in Asia - actual (all disciplines, 2011–2020)

Economy	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Brunei	178	255	299	395	453	565	547	605	609	759
Cambodia	222	265	274	328	365	419	460	522	539	588
Laos	159	216	208	218	258	275	249	313	361	348
Indonesia	3,529	4,239	5,449	6,910	8,575	12,701	21,549	34,918	47,432	50,145
Malaysia	20,828	23,119	25,648	29,048	28,202	30,660	33,656	34,924	38,228	39,166
Myanmar	168	120	118	155	227	327	465	602	787	1,044
Philippines	1,654	1,792	1,992	2,257	2,823	3,167	3,722	4,035	5,888	6,185
Singapore	16,823	18,487	19,480	20,128	20,917	22,039	24,559	24,769	25,537	27,909
Thailand	10,910	12,415	12,537	13,721	13,261	15,010	17,137	19,466	20,629	22,273
Timor Leste	5	23	16	28	27	29	38	43	40	44
Vietnam	2,420	3,167	3,767	4,018	4,513	5,855	7,034	9,182	13,068	18,886
Hong Kong	16,276	17,269	18,395	19,122	19,343	20,441	23,052	24,543	26,001	28,221
India	98,568	109,361	117,642	133,067	144,419	155,763	163,040	187,780	206,648	217,771
Japan	132,608	135,403	137,265	132,565	129,630	132,501	141,532	145,124	144,883	147,341
Macao	720	952	1,295	1,500	1,797	2,291	2,541	2,651	2,378	2,830
China	394,181	415,988	456,485	488,988	464,400	500,228	553,919	627,450	716,540	788,287
South Korea	66,869	72,107	75,510	79,222	82,495	83,641	87,172	90,291	94,142	98,796
Taiwan	43,482	43,744	44,252	42,241	39,025	38,237	38,826	38,558	40,516	43,317

Unit: Total number of published documents
Source: From "SJR International Science Ranking" by Scimago Journal & Country Rank. (n.d.). https://www.scimagojr.com/countryrank.php. Copyright 2007-2020 by Scimago Lab.

Table 2. Metric of knowledge-capital production in Asia - growth rates (all disciplines, 2011–2020)

Economy	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
	%									
Brunei	40.16	43.26	17.25	32.11	14.68	24.72	-3.19	10.60	0.66	24.63
Cambodia	12.69	19.37	3.40	19.71	11.28	14.79	9.79	13.48	3.26	9.09
Laos	16.06	35.85	-3.70	4.81	18.35	6.59	-9.45	25.70	15.34	-3.60
Indonesia	20.61	20.12	28.54	26.81	24.10	48.12	69.66	62.04	35.84	5.72
Malaysia	31.67	11.00	10.94	13.26	-2.91	8.72	9.77	3.77	9.46	2.45
Myanmar	44.83	-28.57	-1.67	31.36	46.45	44.05	42.20	29.46	30.73	32.66
Philippines	20.82	8.34	11.16	13.30	25.08	12.19	17.52	8.41	45.92	5.04
Singapore	6.41	9.89	5.37	3.33	3.92	5.36	11.43	0.86	3.10	9.29
Thailand	6.52	13.79	0.98	9.44	-3.35	13.19	14.17	13.59	5.97	7.97
Timor Leste	150.00	360.00	-30.43	75.00	-3.57	7.41	31.03	13.16	-6.98	10.00
Vietnam	11.21	30.87	18.95	6.66	12.32	29.74	20.14	30.54	42.32	44.52
Hong Kong	4.33	6.10	6.52	3.95	1.16	5.68	12.77	6.47	5.94	8.54
India	21.53	10.95	7.57	13.11	8.53	7.85	4.67	15.17	10.05	5.38
Japan	2.07	2.11	1.38	-3.42	-2.21	2.21	6.82	2.54	-0.17	1.70
Macao	18.23	32.22	36.03	15.83	19.80	27.49	10.91	4.33	-10.30	19.01
China	14.51	5.53	9.74	7.12	-5.03	7.71	10.73	13.27	14.20	10.01
South Korea	9.02	7.83	4.72	4.92	4.13	1.39	4.22	3.58	4.27	4.94
Taiwan	6.68	0.60	1.16	-4.54	-7.61	-2.02	1.54	-0.69	5.08	6.91

Source: Tabulated by the authors.

We can see that most developing economies in Southeast Asia have steeply increased their knowledge-capital production through the years (e.g., Indonesia, Myanmar, Philippines, Vietnam). This can be ascribed to their initiatives in following the leads of developed economies by investing in facilities, incentives,

and opportunities for researchers, experts, scientists, and academe to contribute more to the formation of knowledge capital. While we recognize that these figures on publication success are also a function of a variety of factors such as availability of better research facilities, greater financial support to conduct research, more incentives for producing publishable materials, stock of scientists, among others, these figures continue to call for a renewed viewpoint and focus on the value of research as well as alleviation of constraints in research and publications.

Research constraints include institutional support to conduct research, monetary and nonmonetary funding, and the scarcity of scientists in an economy (Erfanmanesh et al., 2017). On the other hand, publication constraints fundamentally arise from research constraints exacerbated by getting accepted in journals indexed in Clarivate Analytics and/or Elsevier Scopus, most of which have a very low acceptance rate; securing funding; reaching a wider readership and citations; achieving higher impact factors; and competing for slots in journals due to increased submission of manuscripts from all over the globe (Tecson-Mendoza, 2015). These constraints require attention for authorities and policymakers to warrant action that will create a conducive and facilitating environment for the creation of knowledge.

Hence, given the varying research capabilities among economies and the different research constraints each economy is faced with, the value of creating knowledge together through research collaboration has become more pronounced. Because ideas transcend borders and no economy has monopoly of the market for ideas, international or regional research collaboration brings benefits such as economies of scale and scope in the use of laboratories, tools, data, divisibility in research-design implementation, and access to a broader perspective and understanding of problems and varied approaches to problem solving (Owens, 2018). For Scarazzati & Wang (2019), collaboration effects across regions at various capability levels manifest. Specifically, scientifically weak economies benefit from more concentrated collaboration with advanced economies. Meanwhile, scientifically strong economies can benefit from a centrally located position in a broader collaboration network. However, international research collaboration does not come without issues such as dependence on individual capacity, politics, finding collaborators, varying work ethics, among others (Owens, 2018). While these constraints seemingly outweigh the benefits of research collaboration, Scarazzati & Wang (2019) argued that being part of a broad network structure can help increase an economy's and a region's knowledge-creation frontier as well as generate learnings from other economies' experiences.

Conclusion

In responding to the challenge for universities to lead the creation of tomorrow's civilization, HEIs play an increasingly important role in taking in more responsibility to facilitate "the total learning process" (Boulding, 1967, p. 483) in societies in the postpandemic scenario. The drastic changes posed by Industry 4.0 (i.e., automation of traditional manufacturing and industrial practices), the emergence of Industry 5.0 (i.e., people working together with robots and machines), and the COVID-19 pandemic necessitated the need to further bridge HEIs and communities through knowledge capital. We argue the need to rethink, reassess, and reimagine the conduct of research to ensure that it adapts to the recent changes brought about by globalization, technological advancement, and the unprecedented challenges of societal recovery amidst the pandemic.

We espouse that an effective approach in forming a stronger skill base for an economy is through knowledge creation via research that stimulates technological development, creates new practices, and upgrades industry practices. Similarly, knowledge creation and technological development are essential in enhancing the conduct of education, training, and industry practice. Thus, we emphasize that although not all research is practical, it has the power to generate patents, innovations, and new techniques that allow society to continuously develop.

As highlighted by the framework we have developed, HEIs' knowledge-capital production through research can assist economic growth and societal development by augmenting human capabilities and skills, enhancing networking capacities, and facilitating innovation in societies. In advancing this, governments play a critical role in setting a conducive environment and providing support to universities while also facilitating its relationship with industry players. Support may come in the form of financial aid but may also be in the form of expanding the skills of academic researchers to engage in the commercialization and dissemination of knowledge to industries and the larger society. At the core of our argument is the role of HEIs in aligning its research agenda with current societal needs. However, at the rate at which developing economies in Southeast Asia are going with respect to knowledge creation, greater efforts are still required in utilizing knowledge capital in harnessing human capital in the continuously evolving future of work.

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Employability Gaps of the Future Vietnamese Workforce in the Digital Era

Giang Hien TRAN, Oanh Thu Thi NGUYEN, and Trang Huyen DANG

Abstract

There is a concern among Vietnamese young people that new technologies may take away their jobs. This study explores perspectives of employers on young workers' skills, their future hiring plans, and their desired skills in the context of the Fourth Industrial Revolution, then proposes solutions to bridge the employability gaps.

Technological advances, present in such fields as automation, robotics, artificial intelligence, machine learning, the internet of things, and blockchains, are leading to the creation of entirely new industries, jobs, goods, and services and an increase in overall productivity. The advances will transform the labour market and particularly affect the opportunities and challenges faced by young workers. By employing a mixed-method design with a participatory approach, the research collects information on enterprises' assessment of young workers' skills and their future hiring plans, as well as desired skills in the context of the Fourth Industrial Revolution (4IR).[1] Based on the findings, the research proposes a number of solutions to bridge the employability gaps of the future workforce and enable them to access decent work opportunities.

Literature Review

Vietnamese youths are highly optimistic about the impact of technology on their job prospects and incomes, according to World Economic Forum's 2018 survey of 64,000 youths aged 15-35 years old from six countries in the Southeast Asian (ASEAN) region including Vietnam. There are 51.5% and 72.8% of the respondents

1 The authors are grateful to United Nations Children's Emergency Fund (UNICEF) and Vietnam Chamber of Commerce and Industry (VCCI), under The Project "Promotion of Children's Rights and Business Principles among Enterprises in Vietnam," for funding the data collection.

who said technology would increase the number of jobs and improve their earning power, respectively (World Economic Forum, 2018).

However, there was evidence that technological advances such as automation might reduce the employment share of low-skilled workers. Given that Vietnam's economic growth has depended on a wealth of low-skilled manufacturing workers for the last 25 years or so, this skill-based tendency of technological change is worrying. A 2016 International Labour Organization (ILO) report on automation estimates that 70% of all current employment in Vietnam is at a high risk of automation, the highest in the ASEAN region. Notably, the report points to the garment industry as being most vulnerable to automation in Vietnam, with 86% of wage workers employed in the sector at high risk of automation (Chang & Huynh, 2016).

Young people are among the most willing to embrace new technologies, as illustrated by internet and smartphone usage trends. According to Pew Research Centre (2018) data, 88% of Vietnamese people aged 18-36 reported using the internet or owning a smartphone, compared to the 38% reported by people aged 37 and over (Wike & Stokes, 2018). Thus, the wide gap between the two age groups reflects a digital divide between generations. Even so, being tech savvy does not necessarily translate to having automation friendly skills. Using data from Vietnam's 2013 Labour Force Survey, ILO (2016) estimated the probability of occupying a high-risk automatable job by youth relative to adults and found that young Vietnamese workers aged 15-24 have a higher probability than adults aged 25 and over (Chang & Huynh, 2016).

The anxieties among young workers about job loss due to technology are even growing in the context of a possible mismatch between qualifications they achieved and what employers are seeking. Data from 2018 Labour Force Survey conducted by General Statistics Office (GSO) show that young people with tertiary-education or higher made up only 11% of the total youth workforce, but up to 20% of those unemployed. Meanwhile, people with secondary education or lower made up almost 60% of the youth labour force, but only about 43% of all unemployed young people (ILO, 2019). While this phenomenon might suggest oversupply, or the fact that more educated youths can afford to be pickier in their employment, it also points to a possible skills/qualifications mismatch. Using data from the ILO's 2013 school-to-work-transition survey with 2,722 youth participants aged 15–29 in different geographical areas in Vietnam, Tran also found a widened gap between education and learners' needs and interests (Tran, 2017, p. 59).

The fact that a large percentage of young workers are exposed to nonstandard, informal, and less secure forms of employment also contributes to provoking

their anxieties over the job loss due to technologies. According to ILO's *2016 Report on Informal Employment in Vietnam*, even though the percentage of workers having informal employment in the 15-24 age group has been decreasing over the years, it still stood at about 60.2% in 2016. The ILO report also highlights a negative relationship between qualifications and engagement in informal employment, in which workers without qualifications, also known as untrained workers, are most likely to engage in informal employment (GSO & ILO, 2016).

With a view to identifying the desired skills on the global job market under the impacts of automation, ManPower Group, in a 2019 study entitled "Humans Wanted: Robots Need You," surveyed 19,000 enterprises in 44 countries. The study found out that human skills (social and emotional soft skills) are put at a higher priority than technical skills since machines are often better at performing routine tasks. The study also introduces a list of seven soft skills that are most difficult to find yet regarded as the highest desired ones, in which communication, collaboration, and problem solving are among the top three in the ranking. In addition, the study pointed to the global shortage of high-skilled labour, especially in the information and communications technology (ICT) sector (ManpowerGroup, 2019). These findings are of great importance to the research, as it has been proven that Vietnam is not exempt from the global trend in terms of jobs and skills demand among young workers.

Methodology

The research employs a mixed method design with a participatory approach.

Quantitative method: Online firm survey

An online survey was conducted with businesses to identify gaps in knowledge, skills, and attitude among employees; current training programs that are implemented by the businesses; and projected needs in terms of skills for future jobs. In the survey, a scale of 1-5 was used, in which 1 is *very poor* and 5 is *very good*.

The sampling frame is sourced from the GSO's 2018 Enterprise Census and focuses on three "automation sensitive" sectors, namely apparel and footwear, ICT, and travel and tourism. The survey sought businesses that could provide data on jobs and employment turnover by occupation type for the previous 24 months and provide a rough estimate of future skills demands for the next 12 months. Out of 825 eligible enterprises which received the invitation, 169 firms filled the survey. Travel and tourism enterprises make up 36%, followed by ICT enterprises with 33 %, and apparel and footwear sector constitutes 31%.

Qualitative methods: Key informant interviews and focus-group discussions

The qualitative component complements further knowledge and information collected from the quantitative component by gathering in-depth information about the obstacles faced by youth during professional development and job-search journey. Findings from the qualitative study also help propose recommendations to upskill and provide decent work opportunities to young workers. The research uses semistructured, open-ended questions in both key informant interviews and focus-group discussions. Key informant interviews (KII) were implemented with important stakeholders, including government offices, business associations, businesses, and universities/colleges with linkage (internship or youth programs) to businesses.[2] Focus-group discussions (FGD) were carried out with young people in a job search.[3]

Key Findings

Evaluation of hard skills and soft skills of the young workforce

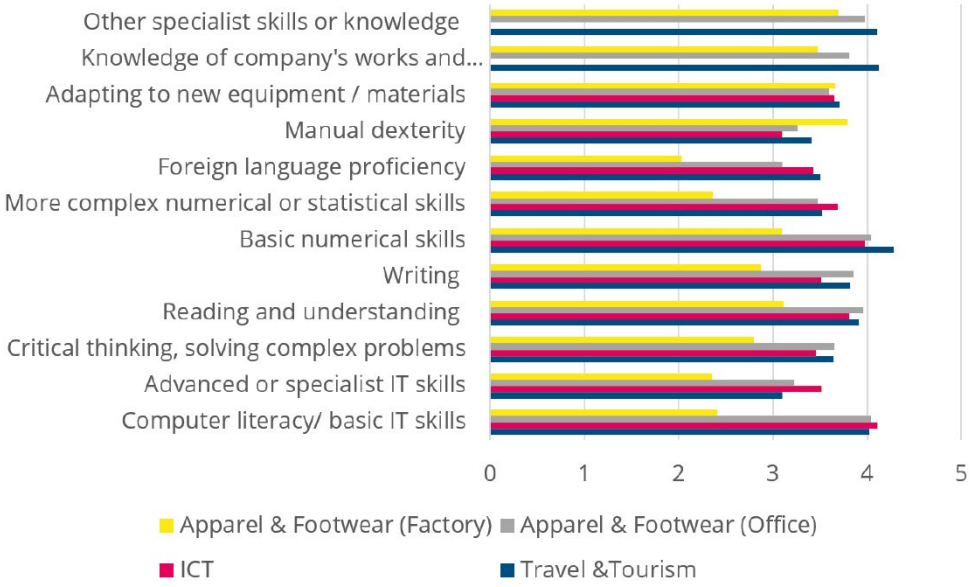
1. Hard skills

Figure 1 indicates that across all three sectors, employers are generally satisfied with their young employees' hard skills, including basic literacy, numerical, and computer skills.

2 In total, 21 interviews were conducted, with one representative from the Department of Vocational Education (Ministry of Labour, Invalids and Social Affairs), four representatives from NGOs/ Social Protection Center), one representative from business association, six representatives from enterprises, three representatives from youth-based organizations, and six representatives from universities/ colleges.

3 In total, eight focus-group discussions were conducted, with participants coming from the following groups:
Group 1: In-school adolescents aged 15-18
Group 2: In-school youth aged 19-24
Group 3: Out-of-school adolescents aged 15-18
Group 4: Out-of-school youth aged 19-24

Figure 1. Young workers' hard skills assessed by employers



Source: Authors' online firm survey.

Apparel and footwear sector. Apparel and footwear enterprises evaluated their factory and office workers' hard skills separately. Particularly, all companies assessed their office staff's skills higher than that of their factory staff. The best performance (4 out of 5) falls evenly to computer literacy/ basic IT skills, reading and understanding instructions, basic numerical skills, and other specialist skills/knowledge. Meanwhile, the lowest marks for both factory and office workers go to foreign-language proficiency.

> English is essential for garment students because there is a lot of technical documentation in English. However, despite having English training at schools, very few garment students are good at English compared to other sectors. If technical students were good in English, they would be attractive to employers and have potentially higher salaries. Their future career would be very good, but few of them meet this. (KII with a representative of a garment enterprise).

ICT sector. For young workers in ICT, basic hard skills such as computer literacy or basic IT skills or basic numerical skills stand well with a good mark (4 out of 5). Meanwhile, other hard skills, especially advanced or specialist IT skills, manual dexterity and critical thinking, solving complex problems, still have room for improvement, as these are marked below 3.5 out of 5 on average.

Travel and Tourism Sector. In the travel and tourism sector, basic numerical skills and understanding of young employees are best evaluated by employers (4.3 out of 5). The second best performance is given to both (1) specialized skills/knowledge and the (2) knowledge of company's works, products, and services (4.1 out of 5). Computer literacy/ basic IT skills are ranked the third place at 4 out of 5. Meanwhile, the lowest performance is placed for specialist IT skills (3.1 out of 5).

> The first required characteristic in tourism work must be hard-working. The second is basic skills such as computers literacy, foreign languages. The third is perseverance and softness because this is a service job that encounters many annoyances. These are the requirements of the job. (KII with a representative of a tourism firm).

2. Soft skills

In all three surveyed sectors, employers evaluate teamwork as the highest rank in their young employees' soft skill (as shown in Figure 2) and customer handling as the second highest rank.

Figure 2. Young workers' soft skills assessed by employers

Source: Authors' online firm survey.

Apparel and footwear sector. Customer-handling skills and teamwork are young employees' strongest aspects in the apparel and footwear sector, while their speaking skills need to be improved the most (2.9 out of 5).

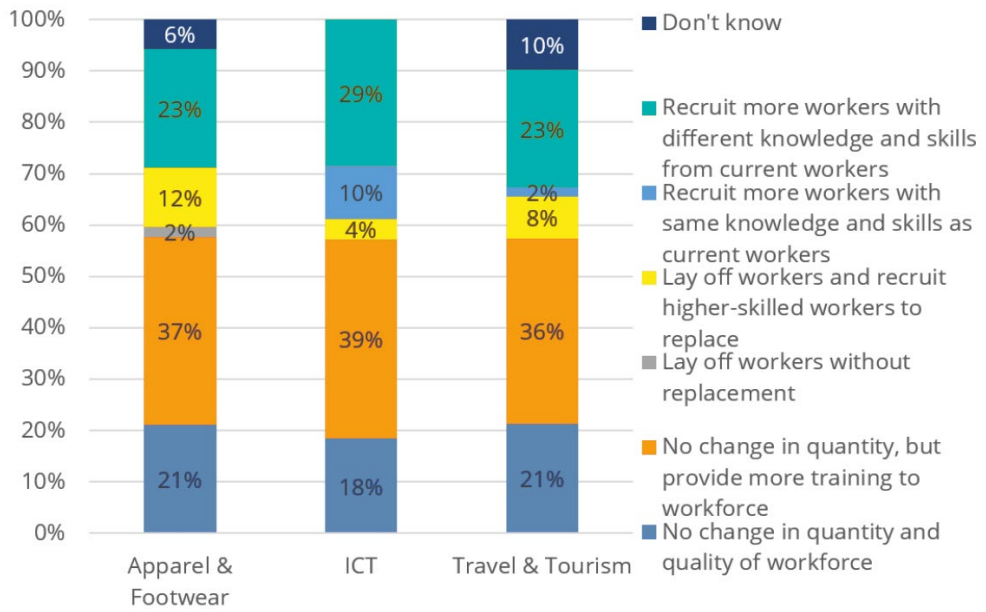
ICT sector. Generally, young workers' soft skills in ICT sector are assessed with lower marks than their hard skills' performance. The skill of teamwork is evaluated as the highest, with 3.9 points out of 5. The second place is shared by creativity and customer-handling skills, which are both evaluated at 3.6 out of 5. The lowest assessment is given to sales skills, which are marked just at 3.2 out of 5.

Travel and tourism sector. Surveyed employers in the travel & tourism sectors are most contented with their employees' customer-handling skill (with 4 out of 5). It could be explained that this sector is service oriented, so people working in this industry are expected to be adept at dealing with clients' inquiries and related situations. Teamwork is assessed as the second best performance, with 3.9 points out of 5. The travel and tourism industry is quite distinct from other industries, as it is rare for customers to deal with one person only. Then it is important for people working in this industry to have effective teamwork skill.

Impact of the Fourth Industrial Revolution on workforce

When being asked about human-resources strategies in the next three years in response to the global complex and unpredictable atmosphere, more than one-third of surveyed enterprises in all sectors planned to upskill their current staff by providing more training instead of recruiting new workers (see Figure 3). Meanwhile, more than one-fifth of the enterprises chose to recruit workers with different knowledge and skills from current workers. This implies enterprises' desire for knowledge and skill diversification, including those within and beyond the scope of the current professional training program delivered to the workforce.

Figure 3. Enterprises' Employment Planning



Source: Authors' online firm survey.

Notably, a small percentage of them, at approximately less than 10%, would recruit more workers with the same knowledge and skills as current workers. It means that current employees are expected to strive for better performance, while those unemployed or fresh graduates who plan to enter the labour market with the same knowledge and skill sets as the current workforce might find it hard to secure a job.

Apparel and Footwear Sector. Approximately 12% of enterprises working in the apparel & footwear sector would lay off workers and recruit higher-skilled workers to replace them. According to the research "Impacts of the Fourth Industrial Revolution on Vietnam's Leather and Footwear Industry: Strategic Directions, Policies and Solutions for the Development of the Industry Until 2030" conducted by Vietnam Leather, Footwear and Handbag Association, the redundant workers from the automation line should be retrained to perform new jobs (Vietnam Leather and Shoes Association, 2020).

ICT sector. In comparison with the other two sectors, the ICT sector demonstrates the lowest percentage of enterprises planning to lay off workers. No surveyed firms would lay off workers without replacement, and about 4% would replace the laid-off workers with higher-skilled ones. This finding is understandable given

that this sector acts as a pioneer in technological advances, which, as a result, leads to a more promising recruitment strategy.

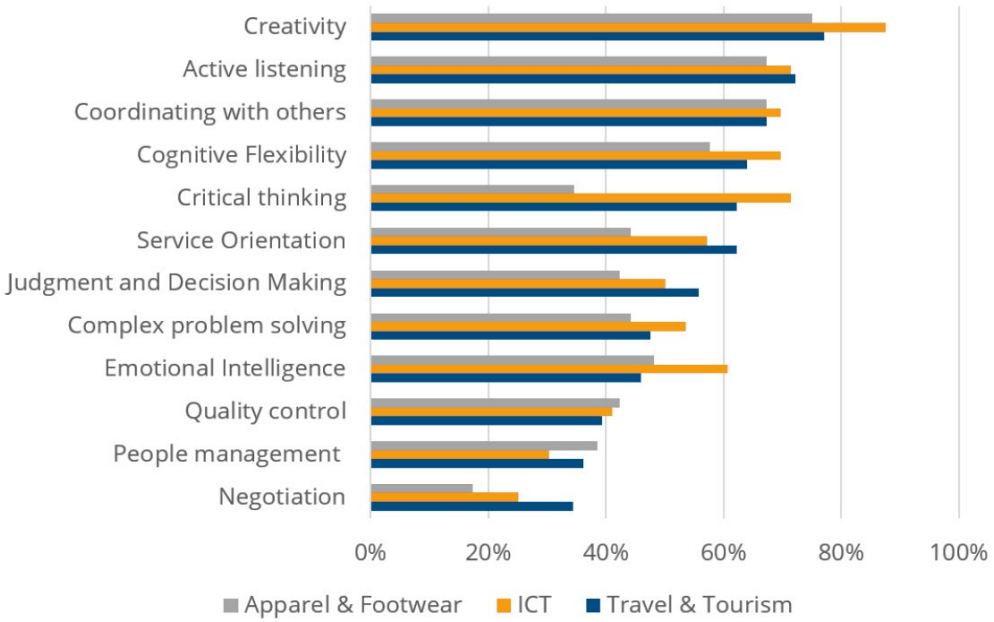
Travel and tourism sector. An interesting finding is that 10% of the surveyed tourism and travel firms were unsure about their recruitment strategy. This ambivalence could be partly explained by the impacts of the COVID-19 pandemic as the sector has been heavily affected, disrupting firms' future hiring plans.

Arising skills in the context of the Fourth Industrial Revolution

The 4IR creates new job opportunities and requires workers to gain new and specialized skills to adopt. Vikram Mansharamani, the author of the book *Think for Yourself: Restoring Common Sense in an Age of Experts and Artificial Intelligence*, generalizes that the critical skill of the future is not exactly a skill but rather an approach or a way of thinking (Mansharamani, 2020). Indeed, since machines have been taking over more and more technical and repetitive operations, humans will be needed to handle much more complex work. The ability to thrive in ambiguous and poorly defined situations will be crucial for employability, as these are skills that machines hardly possess and replace people.

The survey's result (see Figure 4) shows that creativity is the top skill demanded by employers across three sectors, apparel and footwear (75%), ICT (88%), and travel and tourism (77%). Active listening and coordinating with people, respectively, are the second and the third skills needed, with around 70% of employers looking for these skills in their young candidates. These are aligned with findings from global surveys that transferable skills, including soft skills, are expected to be in higher demand than technical skills.

Figure 4. Proportion of enterprises expressing their desired skills in young labor



Source: Authors' online firm survey.

Apparel and Footwear Sector. KII with the Vietnam Textile & Apparel Association (VITAS) representative provides insights on the impact of the 4IR on the general trend of labour in the industry. The labour need would be shifted towards groups with medium- or higher-level skills, while low-skill jobs will gradually decrease. According to VITAS, the new knowledge and skills arising in industrial sewing are the ability to prepare for smart production using programming machines, design samples, sewing lines using digital and 3D technology and perform intelligent quality control. These all require much more specialized skills among young employees.

> Textile and apparel businesses cannot stand apart from the fourth industrial revolution. The future trend is that businesses will use modern machinery and equipment to replace unskilled labour. Current tasks that are repetitive are sure to be replaced. As such, labour must be of higher quality and have specialized skills. (KII with the representative of VITAS).

ICT sector. ICT competencies are considered the roots of the 4IR (Bettiol et al., 2020). Hence, ICT must be the technologically focused field. According to the survey's results, ICT employers in Vietnam are relatively satisfied with the advanced or specialist IT skills of young workers, rating them 3.5 out of 5 points.

Besides teachable technical skills such as coding, network configuration, and database management, soft skills are equally critical. In identifying the soft skills that youngsters should improve to land a job in this tremendous job growth sector, the research found consistently that the top needed skills are creativity and active listening. Critical thinking reaches the third important position. The qualitative interview with a director of an IT company below may complement insights explaining why the skills are needed.

> It's human skills. It doesn't matter what difficulties they have. They have to do human thinking that AI cannot do. They have to think realistically, solve problems, be creative, and can find information. I think that it's about critical thinking. When they have the critical thinking, they can solve the problem themselves. (KII with a representative of an IT firm).

Travel and Tourism Sector. As a service sector, automation is expected not to replace the sector's employment, unlike in the ICT and apparel and footwear sectors. However, the technology-influenced social and economic transformations have formed new business models, altered value-chain structures, and affected the demand-supply dynamics of the industry. These may be due to the drivers for arising skills of the sector being consistently the same as in others. The survey results align with the findings in a 2019 policy paper by the World Travel Organization (UNWTO) on the most prioritized skills in the travel and tourism sector in the coming years, which highlighted the critical competencies in the industry as customer focus, creativity, and innovation (UNWTO, 2019).

> This is a service job that encounters many annoyances and requires perseverance and softness. These are the requirements of the job…All of which is a process that requires constant study and progress to strive forward. (KII with the representative of a tourism firm).

Recommendations and Conclusions

Recommendations

The research proposes the following solutions to bridge the employability gaps of the future workforce.

Business associations should (1) strengthen their facilitation of industry-wide youth-employment initiatives and partnerships between enterprises and other stakeholders, (2) increase awareness and cross-firm learning through conferences and workshops on enhancing youth employability, and (3) collaborate with

relevant stakeholders to develop training programs on improving the capacity of young workers.

Government agencies, including tertiary and vocational-training institutions, as well as the state training- and education-management agencies, should (1) integrate soft-skills education and career guidance with a hobby-oriented approach into formal schooling's curriculum as early as primary school, (2) reinforce the role of vocational training to reduce pressure for higher education and provide more inputs for the job market, and (3) strengthen collaboration with enterprises and business associations to build course contents and allow extended apprenticeships as critical components of study course.

Youth themselves should be tech savvy and well aware of the impacts of new technologies on the labour-market demand to adapt. They should improve their foreign-language skills to informally learn from massive, open online-course platforms, which offer a vast number of training courses tailored to learners' needs.

Conclusions

By incorporating findings from existing literature, online firm survey, and qualitative study, the research has depicted a picture of employability skills in the context of 4IR and identified skills gaps among young Vietnamese people. Specific hard and soft skills that young Vietnamese workers have sufficiently satisfied the job requirements include reading and understanding documents, basic numerical skills, computer literacy/basic IT skills, and teamwork. On the other hand, hard skills such as specialist IT skills or foreign-language proficiency are regarded as young employees' weakest skills. In the context of the 4IR, firms put great expectations on creativity, active listening, and teamwork as potential employability skills of future candidates. When it comes to future employment plans, most firms choose to improve the quality of their current workforce by providing more training, whereas a number of enterprises express their interest in recruiting more workers with different knowledge skills from the current ones. Key findings reaffirm the central assumption of this research—explaining the faltering position of youths in the job market is grounded in an apparent mismatch between what young workers are offering and what firms are demanding. The shift towards greater globalization, digitalization, and automation results in greater demands for soft skills. Given that these skills also bear a strong resemblance to the global list of the most-requested competencies, it can be implied that the Vietnamese job market is dealing with a worldwide issue of skills scarcity.

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Same Technology, Different Impacts for Sectors and Labor-Market Subgroups

Working in Policy: The Shift of Labour Structure Towards Service-Sector Employment in the Age of Digital Expansion in Vietnam

Nguyen Thanh TRUNG and Quan Thu HUYEN

Abstract

The study analyses Vietnam's sectoral employment and labour shifts with rising trends in the new categories of labour towards service jobs. The authors want to discuss specific ways in which the impacts of regulations and institutions in digital transformation may have on business activities of companies in the service industry as well as the inevitability of business transformation based on digital technologies.

Since Doi Moi in 1986, the service sector of Vietnam has been developing rapidly in terms of GDP contribution and job creation. The growth of the service sector has been considered essential to the sustainable development of Vietnam. A qualitative growth in financial services, education and training, science and technology services, and business services has had a highly value-added contribution to the overall economy. Although manufacturing was still focal in the national economic plan, hence occupying most of the workforce along with agriculture, employment growth in service was significant. Between 2000 and 2002, the sector recorded an average rate of 150% in terms of job creation (United Nations Development Program Vietnam, 2005).

However, incompetent sectoral productivity and insufficient skilled-labour supply hold back its growth potential. Alejandro et al. (2012) examines the overall outlook of the five key service industries in Vietnam—banking, education, logistics, retail, and telecommunications—that receive policy attention for significant development. There is a shortage in labour supply for skill-intensive services due to the mismatch in the education provided and the employer demand, which has hindered its advancement. The International Labour Organization (ILO) and

the Institute of Labour, Science and Social Affairs (ILSSA)'s 2014 policy brief that highlights the crucial role of skilled labour for national sustainable development also shares this notion. In addition, according to the report, skilled labour concentrates on predominantly public sectors such as education and training (30%), state administration and defence (19%), and healthcare and social works (8%), those that are on top of the agenda of the program for the national digital transformation (ILO, 2014).

In 2020, the Vietnamese government specified objectives for the national digital transformation until 2025, emphasising its significance in pursuing the United Nations Sustainable Development Goals (Government of Vietnam, 2020). The programme aims at technologically upgrading sectors that are indispensable in daily life, including health, education, banking and finance, agriculture, transport and logistics, energy, natural resources and environment, and industrial manufacturing. The government introduced the General Strategy for Development of Vietnam's Service Sector for 2021 to 2030, With a Vision to 2050, the first ever economic agenda that is solely about the service sector to date (Government of Vietnam, 2021). The essence of the agenda focuses on applying technological advancement to accelerate the sectoral growth and productivity, as well as prioritising industries that are technology and knowledge intensive.

As Vietnam recalibrates its economic concentration to more advanced technological application, the service industry opens up to the digital adoption so as to meet future needs. The development of digital transformation has the most significant impact on the transformation of the service sector, allowing an increase in efficiency of service and a decline in prices for services both in consumer services (transport, education, healthcare, tourism, banking and finance, etc.) and transaction costs. Beyond its much-lauded impacts on economic growth and productivity, digital transformation will also create broader benefits to society by enabling government at all levels to deliver public goods and launch a supportive policy framework.

The major source of data used for the analysis in this paper is extracted from the General Statistics Office (GSO), which offers the most recent database available that covers all sectors of Vietnam's economy. For deeper investigation into Vietnam's readiness level for digital transformation, we collect data from World Bank for further examination of Vietnam's digital inclusion relative to other countries.

Our paper seeks to explore the impacts that technological integration has on the service sector, specifically through digital expansion. The study first seeks to assess the labour situation in Vietnam with available aggregate measures.

Then it analyses sectoral employment and labour shifts with trends in the new categories of labour towards service jobs. We assess the advantages that digital transformation would have on this new phase of economic development and its impacts on employment. Finally, we will look at the potential for growth of digital-enabled services in Vietnam.

The Impacts of Technological Advancement on Employment

Employment in Vietnam's service sector can be seen as part of the structural and digital transformation of the Vietnamese economy. The literature on the impact of digital expanse on jobs and labor productivity is very positive. Nguyen et al. (2016) runs the Hansen test to determine the effects on employment brought about by technological upgrading of firms in general in Vietnam. The results suggest that technological upgrading does not influence the general demand for skilled labour, as large enterprises still look to leverage the cost benefit from hiring low-skilled labour. However, the reverse happens to SMEs, as investment in technology accompanies hiring high-skilled labour. Therefore, SMEs are the driving force for skill upgrading in the labour market in Vietnam in the long term. However, the test only discovers the impact on the overall labour market, with more emphasis towards the manufacturing sector. ILO (2018) analyses the employment trend of Vietnam in the period 2011-2017. The international organization of labour presents the policy implication on shifting towards industry and services due to their prevalent labour productivity in comparison to that of agriculture.

Digital adoption also transforms the structure of employment in the service sector. Fang & Herrendorf (2021) introduces an account to investigate the reason behind the low proportion of high-skilled labour in the service industries of China, despite the advancement of technology and education, in comparison to other countries with the same GDP per capita. Results suggest that the high level of distortions hindered the development of high-skilled sectors in China, proposing two possible explanations: (1) the prevalent employment of high-skilled labour in state-owned enterprises and (2) the relatively low productivity of these enterprises. Since China and Vietnam share relatively similar patterns in socioeconomic progress (Kerkvliet et al., 1998; Malesky & London, 2014) as well as

the targeted service categories, which are highly state owned,[1] this account gives insights into the current plan of digitally transforming these sectors in Vietnam.

Digital adoption also has a bigger impact on service-based countries. Baldwin & Forslid (2020) denote that the expansion of digitech would allow emerging economies to prosper from the service-led pathway, utilising their low-cost labour given the competitive productivity. The authors nominate India as a quintessential success in leading the service-based national economic transformation instead of the traditional industry-led model of China. Both suggest that labour productivity is the prerequisite factor to determine the level of impact brought by digital transformation to national economic growth.

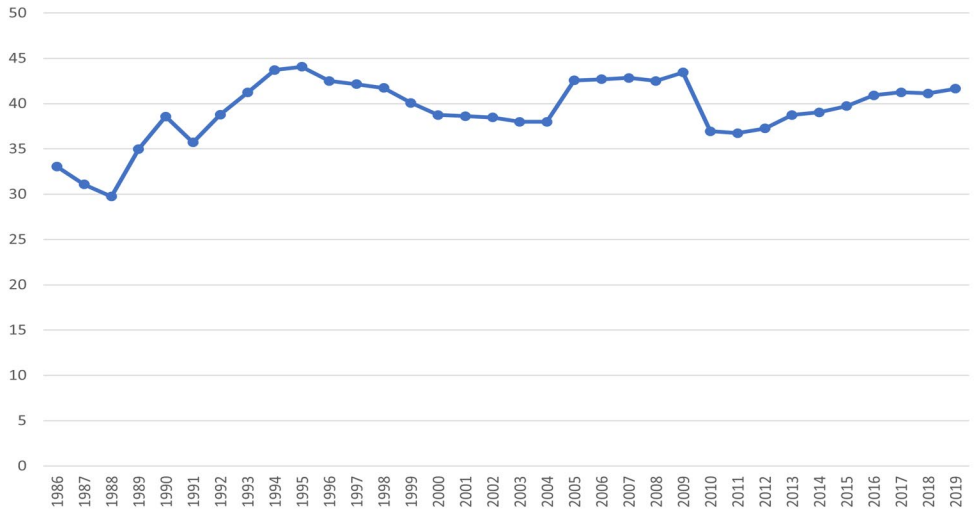
The Role of Service Sector in Vietnam

Service sector's contribution to Vietnam's GDP

Vietnam's services have increasingly played an important role in contributing to economic growth and employment creation. As seen in Figure 1, the GDP contribution of the service sector increased by almost 8.5% from 33.06% in 1986 to 41.64% in 2019. It peaked at two different eras in 1995 (44.06%) and 2009 (43.44%) just before the most drastic decline in 2009 to 2010, as a repercussion of the 2008 financial crash. However, in comparison to the economic growth rate over the same period, Vietnam's services sector trails behind. It is necessary for the Vietnamese government to unlock the enormous potential of the services sector and enhance it, generate employment for a rapidly growing labour force, facilitate trade, and boost overall economic efficiency.

1 Fang & Herrendorf (2021) specifies the high-skilled sectors investigated include business and repair services; finance, insurance, and real estate; professional and related services; and public administration, which are compatible with those highlighted in the Decision 749/QD-TTg 2020, introducing program for national digital transformation of Vietnam.

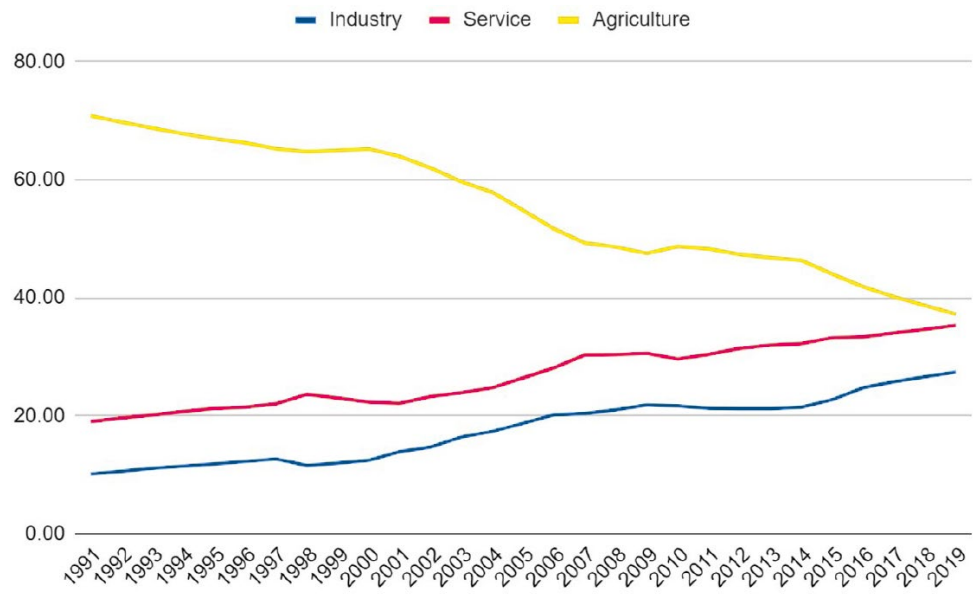
Figure 1. GDP value added by the service sector, 1986-2019 (%)



Employment in the service sector

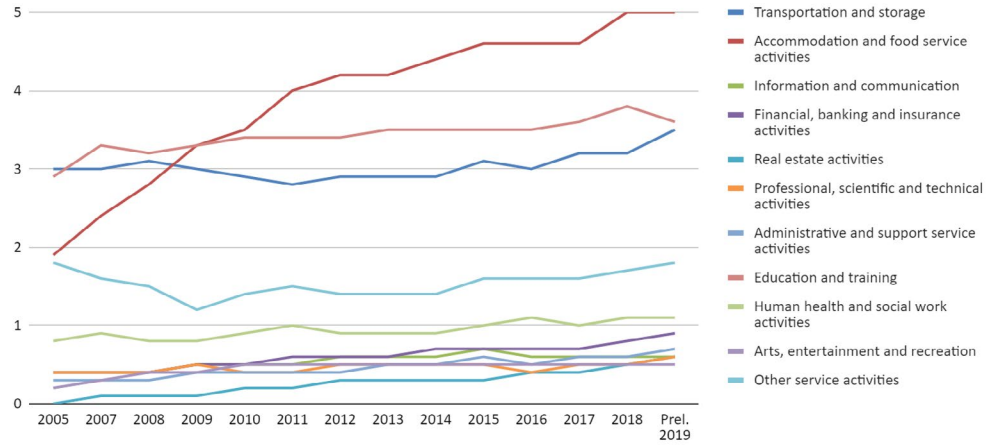
The employment share of the service sector has doubled to reach almost 40% in 2019 since Doi Moi, sharing almost the same growing degree with that of industry. With the government's series of economic reforms, the labour market has shifted, following its orientation of deviating from agriculture and being more towards industry and services. The proportion of employment in agriculture was reduced in half in nearly three decades. Observations from industrialised countries show that while there has been a decline in their share of manufacturing, that of services, especially the business and professional categories, increases over time. This provides insights into the possible future of Vietnam's economic structure gradually shifting towards services as its industrial growth reaches a plateau (Stehrer et al., 2014). The expansion of the service sector also means the displacement of the labour-force structure towards it. It is noted that the proportion of manufacturing employment is also rising.

Figure 2. Employment share by economic sectors (%)



With respect to employment share by service activities, (1) accommodation and food service, (2) education and training, and (3) transportation and storage are the three groups with most service jobs. However, only the first group, accommodation and food service, records a significant growth from 2005 to 2019. The rise of the employment share in accommodation and food service is associated with the rapid expansion of the tourism sector. This suggests both the disparity and the room for growth in the overall sectoral and economic transformation of Vietnam. Sectors that usually require standardised qualification such as healthcare, finance and banking, information and communication, and professional services see a mild growth in employment. Among these, only the education and training group contributes a considerable proportion of the overall labour force.

Figure 3. Employment share by service activities (%)



Source: GSO database (2021).

The Institutional Reforms and Response to Digital Transformation

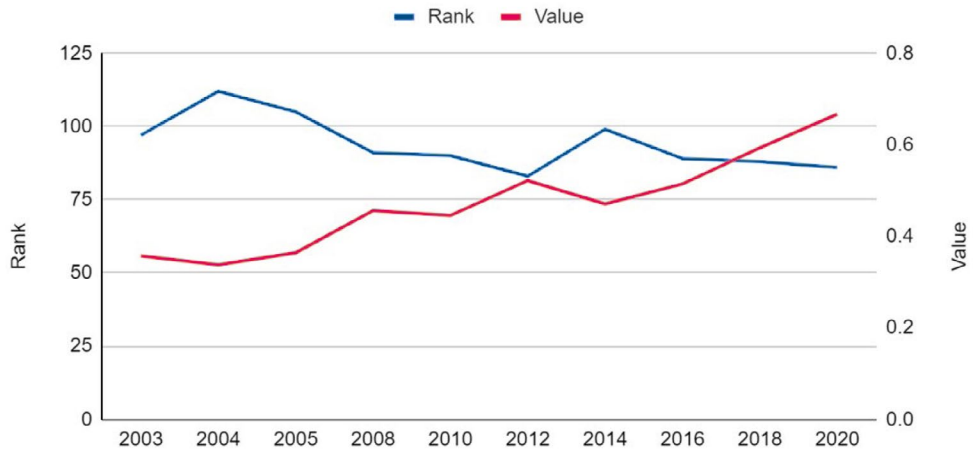
Institutional reforms for digital transformation

Modernising the economy has been on the agenda of economic policy discussion over the years in Vietnam. However, it was not until 2020 that the government issued the first thorough programme for the national digital transformation until 2025 and towards 2030. Vietnam's digital transformation is expected to be conducive to productivity growth, efficiency, high competitiveness, and innovation. The programme specifies targets in three realms: digitising the government for better efficiency, expanding the digital economy for higher competitiveness, and developing the overall digital infrastructure (Long, 2021).

To determine the prerequisite for the transformation, we base on the report conducted by the Commonwealth Scientific and Industrial Research Organisation in collaboration with Vietnam's Ministry of Science and Technology, first published in 2018 and updated annually (henceforth referred to as the CSIRO paper) (Cameron et al., 2019). The report proposes four scenarios determined by two elements: whether the country is on the buying or selling side of digital output and whether the national level of digital integration is high or low. According to the model, if a country is highly digitally adapted and a net seller of digital products or services, it is considered digitally transformed. Vietnam is obviously not at this stage yet; hence, the programme was introduced. We seek to relatively locate the current Vietnam across the two axes with available statistics and information.

In 2020, the Vietnamese government issued the master plan for National E-Commerce Development 2021-2025, and the National Strategy on the Fourth Industrial Revolution to 2030 provided detailed guidelines to achieving the goals set out in the National Digital Transformation programme. The former aims to maximise the e-business dynamic in the economic powerhouse locations, (e.g., Hanoi, Ho Chi Minh City), and utilise this as the driving force to elevate e-commerce outlook in other municipal units. The latter facilitates initiatives, reinforces cybersecurity, and endorses innovation. In addition, new agreements including the EU-Vietnam Free Trade Agreement (EVFTA), Regional Comprehensive Economic Partnership (RCEP), along with Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), are all committed to foster e-commerce trade upon taking effect. So far, there has been a coherence in the regulatory updates domestically and multilaterally.

Figure 4. E-Government Development Index, Vietnam



Source: World Bank, retrieved from United Nations.

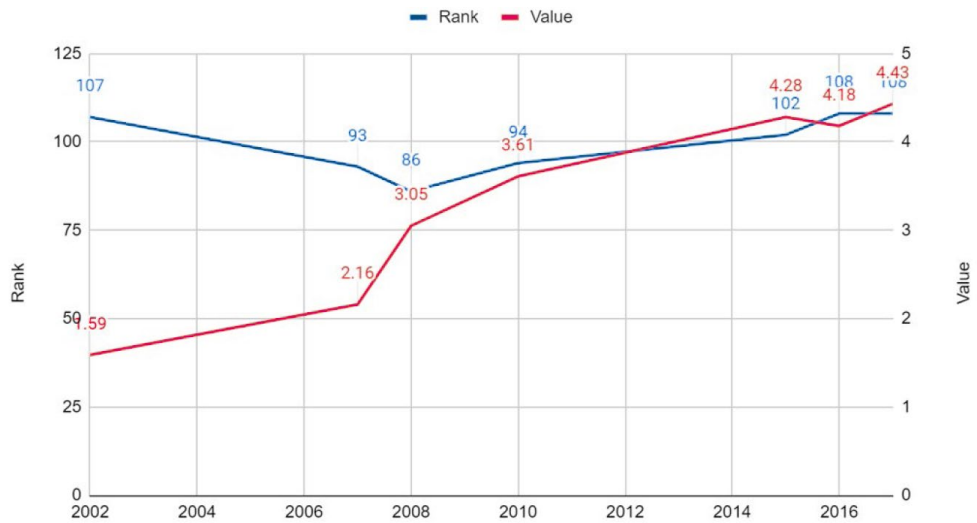
The first objective of the Digital Transformation Programme is to develop a digital government with the target to be in top 70 as of 2025 and top 50 as of 2030 in the World Bank E-Government Index (UN, 2020). Past figures show that in 17 years, from 2003 to 2020, the country made up 11 positions from 97th to 86th in the league, but the progress is not consistent, notably the lag behind during 2012-2014. The index value also records a growth across the period despite the same fall during 2012-2014. However, the overall progress is rather modest.

The second objective of the programme is about digitising the economy. It sets out targets for a set of measurements including ICT Development Index (IDI), Global Connectivity Index (GCI), and Global Innovation Index (GII). IDI was last updated

in 2017 and put on hiatus since there was a need to revise its methodology on assessing broadband and mobile-network coverage, of which the importance has been highlighted as one of the crucial elements for a digital transformation (ITU, 2020). Its updated rubric was introduced in late 2020, in which broadband coverage is accounted for by population instead of households. This might result in the update of the same change in the third objective of the programme. Since other elements were kept almost the same, the former series until 2017 shall be adequate for insights. IDIs of Vietnam during 2002-2017 show that despite the increase in value and a period of improvement (2002-2008), the country fell behind in ranking overall at 108th place in 2017, one position back compared to that in 2002 (107th) (ITU, 2017). This implies that the progress Vietnam has made during the last two decades is not sufficient for it to catch up with the global growing speed.

Some possible explanations for this tardiness include the overreliance on technological solutions catered to by overseas tech giants and a lingering neglect towards research and development of prominent domestic ICT corporations. The ICT sector growth in the past two decades in Vietnam largely attributed to manufacturing and export, instead of ICT services and media (Duc & Linh, 2020b). ICT manufacturing made up 52.8% and 67.1% of the total sectoral output in 2007 and 2016, respectively (Duc & Linh, 2020b, p. 313). This, albeit the increased output value, did little to boost the sophistication of the sector.

Figure 5. ICT Development Index, Vietnam

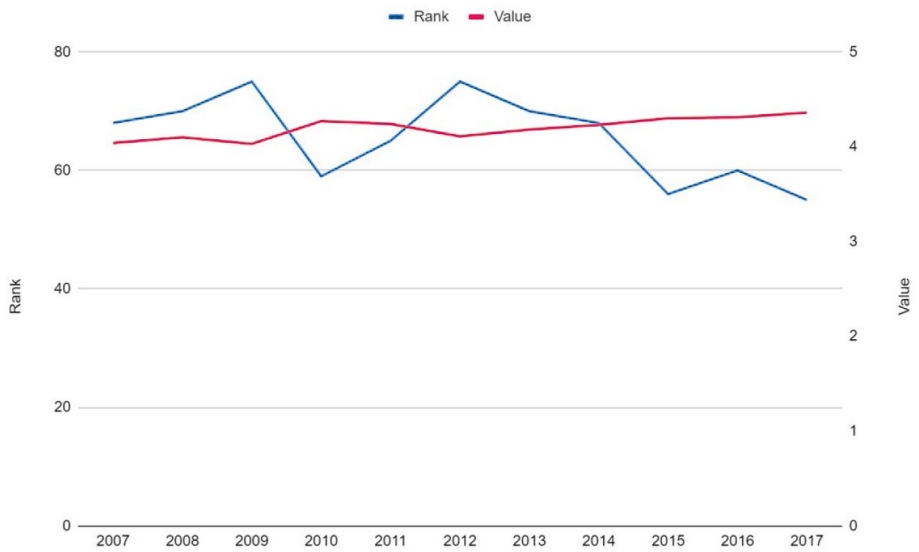


Source: International Telecommunication Union.

Despite the decline in its growth rate and the considerable increase of ICT media and content throughout the period, the development speed of ICT manufacturing remains rapid, provided its already prevalent constituent. On the other hand, state investment made up roughly 70% of the overall ICT investment (Duc & Linh, 2020a, p. 35), with top enterprises such as Viettel or FPT primarily state owned. Although mandated as one of the key sectors in the economic policies since 1993, national investment into ICT dropped acutely from 5% in 2000, down to 1.38% in 2018 (Duc & Linh, 2020a, p. 36). Lately, the private sector entered the market with more disposable financial resources, most notably VinGroup, the biggest private business entity in Vietnam. Still, VinGroup's approach has been following the fast-track solution, largely inheriting available technologies that have been developed by international firms, and the company is yet to establish a clear plan for research and development.

Regarding the Global Competitiveness Index, the World Bank provides two versions of the concept. In 2017, GCI 4.0 was introduced. According to this updated version, Vietnam's ranking is very much behind in comparison to the original. The country made up seven places from 2017 (74th) to 2019 (67th) but with a setback, however, in 2018. The lack of consistency in the country's relative productivity progress remains unchanged despite versions. From 2018 to 2019, Vietnam made up 10 places, putting itself among countries with the most progress. Overall, the country has the advantage in the ICT market size; however, skills, governance, and complex business legislation are aspects that need improving (Pritesh, 2019).

Figure 6. Global Competitiveness Index, Vietnam



Source: World Bank.

Vietnam finished at the 42nd place among 131 countries assessed in the Global Innovation Index, considered the most innovative among its lower-middle-income counterparts and exceeding the expectation for the country's current level of development (Statista, 2020; Ministry of Science and Technology, 2021). Vietnam performs well in four out of seven pillars, which are *market and business sophistication*, *knowledge and technology outputs*, and *creative outputs*. Nevertheless, it needs considerable improvement in the input pillars, which are *institutions*, *human capital and research*, and *infrastructure*, which are expected to improve significantly from the deployment of the newly introduced national strategies (Cornell University et al., 2020).

The third objective focuses on alleviating the digital disparity within the country by ensuring the accessibility to digital infrastructure including fibre-optic broadband, 4G/5G mobile-network service, and online-payment account. Online payment has received considerable attention as a crucial element for expanding the e-commerce sector. The criterion has been added to the human resource and information technology pillar of Vietnam E-Business indices series (VECOM, 2021, p. 48). Due to the COVID-19 pandemic, the year 2020 experienced a drastic increase in the number of online-payment transactions and their value, with 185% and 200% growth, respectively, in comparison to those of 2019 (VECOM, 2021, p. 11). This creates a strong momentum for the goal of having half and up to 80% of the population owning online-payment accounts in 2025 and 2030.

Table 1. Service industries highlighted in the General Strategy for Development of Vietnam's Service Sector for 2021-2030, With a Vision to 2050

Categories in Focus	Other Categories
• Tourism industry	• Scientific and technological services*
• Logistics and transport services	• Distribution services: traditional and e-commerce
• IT and communications services*	• Healthcare services
• Financial - banking services*	• Business support services*
	• Educational and training services

**Digital-enabled services categorised by BEA.*

Digital-enabled service-sector growth in Vietnam

The Vietnamese government specified the service industries in the General Strategy for Development of Vietnam's Service Sector for 2021-2030, With a

Vision to 2050. Vietnamese leaders are committing to a more proactive opening-up strategy in key services sectors such as tourism, logistics and transport, IT and communications, and finance. Although only four out of nine categories fall into the definition of *digitally enabled services*, all of them benefit from the digital integration. Efforts will be put into a more systematic organization of action plans.

Table 2 provides digital-related action plans for each industry as quoted directly from the strategy discourse. The need to digitally modernise each economic activity has been addressed and specified throughout this document. As mentioned, in order to achieve the adequate foundation for the digital transformation, it requires solid preparation regarding skills, infrastructure, and industrial transformation. Vietnam has only seen significant growth in finance, banking, and insurance activities, which also ranks third among sectors with the most ICT-specialised workforce, behind arts/entertainment and information/communications (VECOM, 2021, p. 28).

Table 2. Digital-transforming plans for each service activities as mentioned in the General Strategy for Development of Vietnam's Service Sector for 2021–2030, with a Vision to 2050

Service Industries	Action Plan
Tourism industry	• Increase IT application in tour booking and room booking services, payment via applications, e-wallets, etc., • Complete the tourism statistical system • Supervise and mitigate risks and incidents based on application of modern technology, science and digital technology platforms
Logistics & transport services	• Promote operation standardization such as invoicing, technology standards, etc., develop EDI, e-logistics, logistics information portals, etc.

IT & communication	• Develop services of 5G and following generations • Encourage enterprises to expand high-speed high-bandwidth internet connection • Build an internet highway for services such as public administrative services, healthcare services, educational services and other services • Establish international IT service centres in large cities • Maintain Vietnam's position in the top 10 providers of software and digital content processing services; • Be able to develop and produce IT - communications products and services meeting domestic and international demand • Ensure information safety and digital sovereignty • Enhance online provision of public services related to economic activities • Increase IT application to public administrative procedures
Banking & finance	• Enhance IT application • Provide products and services via digital platforms • Focus on development of electronic payment • Increase connection between electronic payment infrastructure of the banking system and payment infrastructure of other units
Scientific and technological services (information and statistics)	• Develop the iTriThuc system to establish data sharing, big data and platform infrastructure that support national digital transformation • Develop modern and diverse national scientific and technological information and statistical infrastructure • Facilitate development of services related to intellectual property and protection of intellectual property

E-commerce	• Complete institutions, mechanisms and policies for digital economy development and application • Complete the legal framework for e-commerce with a legislative document system • Develop digital technology solutions and products • Support enterprises with use of such products and solutions in each stage of the business process • Develop integrated services based on smart card technology, Blockchain technology and entity and barcode identification technology
Healthcare	• Build an internet highway for healthcare services • Apply science, technology and IT advancements to medical examination and treatment • Increase IT application in disease management, prevention and treatment and health improvement • Apply AI in healthcare
Business support services	• Boost provision of level-4 online public services
Education & training	• Focus on training technical workforce, technology management workforce • Promote IT application in teaching and learning management and activities in vocational education; • Upgrade data integration centres; systems supporting teaching and learning in vocational education; and information systems and databases used for vocational skill assessment

Although that of professional, scientific, and technical activities—and healthcare category is outstanding from the remaining—the progress is still rather humble. Activities that are the primary components of the tourism industry, the sector occupying the largest proportion of service exports of the country, namely (1) accommodation and food service and (2) transportation, persist at the modest growth, as most of others. The low productivity in education and training leads to the skill mismatch in other industries, which is the chronic issue specified by high-skilled and high-paying employers (Baum, 2020, p. 12). From 2018 to 2020, more enterprises have reported struggling to recruit skilled workers in e-commerce and IT (VECOM, 2020, p. 28). The most up-to-date survey conducted by PwC about Vietnam's readiness for digital transformation reveals that only 14% of respondents show confidence that they have been well equipped for

Industry 4.0. The rest express the need for a guideline for competence building (PwC, 2021, p. 8).

In 2020, the Asian Development Bank (ADB) provided a detailed assessment of the technical and vocational education and training (TVET) system of Vietnam. The report identifies several shortcomings regarding governance, content, and geographical coverage that need to be improved (ADB, 2020, p. xi). The incomprehensive personnel delegation and assessment procedure in TVET initiatives, the detachment of TVET curriculums from the reality of industries, the mismanagement of resources and fundings, and the imbalance coverage of qualified TVET institutes nationwide are the primary problems.

Headhunters specify that the incompetent English proficiency and problem-solving skills among Vietnamese students lowers the candidates' chances in skill-demanding sectors (Gia & Âu, 2018). Educators share the concern over the sustained use of outdated and general training contents used by all levels of educational institutions instead of designing stipulated programmes that catch up with the rapidly changing time (Gia & Âu, 2018).

In addition, policy efforts have been continuously made to upgrade the sector. The most updated national plan, TVET Reform and Quality Improvement Until 2020 With an Orientation to 2030, aims to tackle these limitations. There are political and institutional commitments from the government leaders, but more resources need to be invested in. Otherwise, another national plan will become futile.

Other services also keep pace with the upward pattern of the industry thereof, signalling the growing economic dependency on it. It is also compatible with the government's strategy on Vietnam's tourism development between 2011 to 2020, with the vision to 2030, to make tourism a key economic sector with expanding GDP proportion and influence on the overall socioeconomic transformation (*Strategy on Viet Nam's tourism development*, 2011). However, tourism sector is structurally prevalent to other high value-added industries (Fang & Herrendorf, 2021) that could elevate the export values, while the sector itself has not yet developed to its potential due to several infrastructure, human resources, and development disparity issues (Gregg & Vinh, 2016, p. 2).

According to the Travel & Tourism Competitiveness Index by the World Economic Forum, for half of the last decade, Vietnam stayed at the latter half of the 140 countries surveyed—ranked 80th in 2013 (Blanke & Chiesa, 2013) and 75th in 2015 (Crotti & Misrahi, 2015, p. 13)—and recorded the most significant improvement in 2017 by moving up to 67th and 63rd positions in 2017 (Crotti & Misrahi, 2017) and 2019 (Calderwood & Soshkin, 2019) respectively. The narrowed service-

trade deficit since 2017 (Figure 3), therefore, might be the manifestation of this progress. This also suggests that competitiveness is strongly associated with income generating and that there is room for significant growth of several service industries in Vietnam.

Solutions for such mismatch in education and training have been emphasised in the strategy, which focuses on teaching quality control, engaging with private sectors and enterprises for practical insights and qualification benchmark, diversifying training delivery by utilising IT applications, as well as obtaining international standards in reform and planning of training curriculums. Infrastructure is the decisive element that enables digital transformation. Therefore, IT and communication is required to be the precursor in preparation for the coming progress from the rest of the economy, as seen from its extensive agenda in Table 2. These bullet points are also the key objectives set out by the Digital Transformation Programme. So far, we observe the coherence in the policy reform in the period 2020-2030 and the interwoven supportive relationship between sectors.

In terms of GDP composition, education & training and healthcare, which are predominantly state owned, have experienced noticeable increase throughout 2005-2019 (GSO, 2021a). However, in education and training, for instance, the level of ICT integration for educational purpose remains limited. A 2010 quantitative study on this aspect in teacher training reveals that access to ICT facilities is not the hindrance to the application of technology in teaching (Peeraer & Petegem, 2010). In fact, it is primarily related to the psychological aspect. Teachers' lack of self-confidence leads to their reluctance to utilise modern techniques to optimise learning experience (Peeraer, & Van Petegem, 2010). That kind of perception may be explained by their low computer literacy and the absence of digital equipment in the educational institutions, especially in rural areas. The need to embed technological advancement into education is recognised by practitioners and relevant institutions, but there is a long way to help teachers overcome their perceived fear of technology.

The government also managed to enlist corporate support to address the issue. Microsoft Corporation is instrumentally pioneering to help Vietnamese students with free access to Microsoft package in preparation for their adequate ICT skills (Gia & Âu, 2018).

On the other hand, remaining sectors only record minor fluctuation. In addition, information and communication even went through a steep downward plunge from 2009 and has not recovered since. Once again, we notice the long-lasting imbalance in the level of development between segments, which is hardly

mentioned in the strategy, as it provides solutions separately to each type of service. On a brighter note, the digital evolution, once fully embraced, would help alleviate this disparity since it would unleash the full potential of each industry, as well as facilitate service trade of high-value segments between Vietnam and other countries, instead of being so far singlehandedly in charge of tourism and transportation.

Labour shifts towards service jobs in the digital-transformation era

There are several aspects to consider when referring to the change of the labour structure in the age of constant digital transformation, which could be reduced to the positive changes it brings and the challenges it poses. Since we have recognised the vast potential for growth of the sector in the previous sections, this one will discuss the opportunities the digital age would bring to the table, whilst acknowledging that digitisation is inevitable and presents institutional challenges to be tackled.

Estimation from the CSIRO paper shows that the "digitally transformed" scenario will result in the most occupation displacement by 2045, accounting for 38.1% of the current total number of jobs (Cameron et al., 2019, p. 6). The labour force participating in fields that are at the higher risk of automation are often those with low skill or education qualification (Georgieff & Milanez, 2021, p. 53).

On the other hand, it also means that not all jobs are at risk of being displaced (Øvretveit, 2019, p. 334), especially those with labour-intensive nature such as hospitality, catering, healthcare and social works, and business-consulting service, etc. In addition, positive signs regarding the labour force's willingness to adapt to the changing time reinforce the positives generated from the digitising process. Eighty-four percent of the total respondents to the latest PwC survey state that they are ready to obtain new skills or entirely "retrain" to consolidate their occupation prospects (PwC, 2021, p. 12). The impacts of digitisation on both primary and emerging service segments currently in Vietnam can be seen through the examples of the tourism and business-consulting sectors respectively.

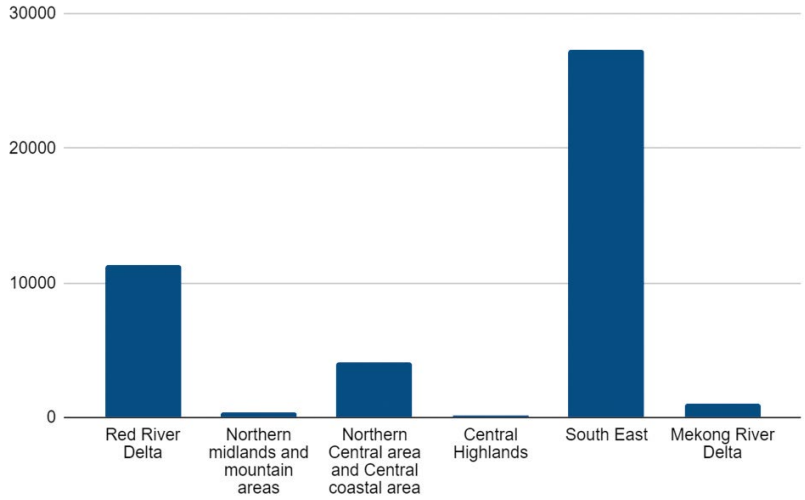
Digital transformation contributes to the current tourism dynamic of Vietnam in two main manners. First, as mentioned, booking and reservation accounts for a significant part of the industry; however, it is largely occupied by international platforms. Digitisation helps enhance the competitiveness and catalyse growth of domestic brands, allowing them to keep pace with the technological adaptation of foreign agencies in approaching the potential market and facilitating booking experience whilst utilising their advantage of local exposure. Growing share in the domestic market, later on expanding to the regional and global scale, would

create new jobs with higher value generation, as well as increasing the export volume for the sector.

Second, the digital transformation of the governmental institutions would systemise the tourism landscape of the country, which, in turn, improves customer experience and hence the returning rate. Estimation from the Pacific Asia Travel Association in 2016 suggests that only 6% of first-time tourists from overseas revisited the country, which is supported by the vice chairman of the Vietnam Tourism Advisory Board, although the figure is hugely distant from the one published by the Vietnam National Administration of Tourism (Dien, 2017). Improving this would involve upgrading the public-transport system and its accessibility through online portals.

Furthermore, with a more centralised database management and easier access to the international market through online channels, the promotion for domestic destinations will be more well organised and efficient. This will help diversify the tourist-attraction checklist, creating more employment opportunities for the local communities not only in the tourism practices but also the vocational-training activities, alleviating the sectoral-wide earning gap between regions as well as easing the pressure. It would also allow a more thorough supervision over service providers and their compliance with national and international standards. This, in turn, encourages the closer linkage between businesses and vocational-training institutions to ensure the graduates are equipped with adequate knowledge and skills for advanced tourism.

Figure 7. Turnover of travelling at current prices by regions in billion Vietnamese dong



Source: GSO, 2021.

Another note is that consulting service is a high value-added category but occupies just a limited proportion of the overall service capacity. From the general sector perspective, digitisation brings firms the opportunities to enrich their consultative portfolio by providing solutions to the digital integration of businesses (Larsson, 2019, p. 326). Moreover, technological advancement enables consultants to approach larger data sets and more advanced analytical tools, which reinforce their abilities to tackle more complex corporate issues (Larsson et al., 2019, p. 261). In addition, the consulting outlook in Vietnam is bending towards the importing of consulting services and is largely dominated by a handful of prestigious foreign firms, limiting the employability of a growing group of competent manpower.

In 2019, the professional, scientific, and technical segment only recruited over 310,000 in Vietnam (GSO, 2021b). According to Statista, from 2016 to 2019, there were around 300,000 new university graduates on average each year, and the number of university students in 2019 is 1.67 million (Statista, 2021), not to mention a growing number of advanced-studies enrolment and returning graduates from developed countries. The Vietnamese government is advised to develop the digital skills of the workforce to help push the country towards the digital economy. The drive to lure top talents in digital technology has sparked a lot of dynamics in the market, with companies offering attractive salary packages compared to other jobs.

Conclusion

Digital expansion is deemed the driving force for the enlargement of Vietnam's gig economy, in which employees are contracted on a demand basis by various domestic and international firms, thanks to the removal of the geographic barrier. The General Strategy for Development of Vietnam's Service Sector for 2021-2030, With a Vision to 2050 considers service-sector development as a priority, acknowledging the importance services can play in enhancing overall productivity and driving growth. In addition, it is advisable to recognize that the development of high-quality tertiary sector, to be more competitive, has to be associated with the digital transformation of the Vietnamese economy.

It can be seen that digital transformation brings about a positive shift to the whole of Vietnam's employment outlook in multiple ways. It also helps strengthen the competitiveness of the sector, expanding the business scale and creating more work opportunities, whilst improving the value of the output. Competition gets tense not only in the labour market but also in the market for well-trained employees. The consequence is greater innovation and higher quality. In addition, firms could also capitalise on the transforming progress by offering support

to businesses to better adapt with the evolution. It serves as the platform for the domestic high-skilled workforce to discover their employability beyond the geographic border. In addition, the COVID-19 pandemic really accelerates the pace of Vietnam's digital adoption in the service industry, especially financial and banking sectors, becoming a business mandate. Hence, Vietnamese policymakers should be aware of the adverse effects and implications of employment in small, less digital-savvy companies.

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The Impact of Automation on Jobs in the Agriculture Sector in Malaysia

Negin VAGHEFI

Abstract

This study assesses what types of occupations in the Malaysian agriculture sector have a high probability of being automated by applying the Frey & Osborne methodology. It is estimated that more than half of all the agricultural activities could potentially be automated in the next one to two decades. In transition to digital agriculture, policies should support further workforce upskilling and the expansion of digital skills in order to protect the workforce.

As the country develops, the share of GDP in agriculture declines, and the workforce tends to shift out of farmwork into more stable and high-paying jobs in industry and services. In Malaysia, the agricultural employment share has dropped from 31.2% of the total national workforce in 1982 to 10.5% in 2020 (Figure 1). Although the changes in concentration of economic activities is the main driving force behind the decline in agricultural employment, mechanisation and technological progress can also be a possible explanation for this reduction. Over the last decades, Malaysian agriculture started to transform from a labour-intensive industry and mechanisation towards digitisation. Computers have substituted, either partially or completely, for a number of jobs, including the functions of tractor driver, irrigator, and pest-and-weed-control workers. The quest for productivity enhancement, product-quality increase, cost optimization, and environmental protection have mainly led to the adoption of new technologies in this sector.

Figure 1. GDP per capita vs. share of agricultural employment to total labour force, Malaysia, 1982–2020

Source: Department of Statistics, Malaysia.

The pace and extent of automation depends on the technical feasibility, the cost of technology, labour-market dynamics, regulatory and social acceptance, among others (Manyika et al., 2017). Taking these factors into account, the adoption of digital technologies in Malaysian agricultural sector has been slow and less extensive as compared to other economic sectors. The biggest challenge in a traditional industry like agriculture is to convince farmers to adopt new technology and apply new farming methods. Statistically, most farmers in Malaysia are relatively elderly, and the rate of technology adoption among them has been very low (Vaghefi, 2020). Second, the process of implementing digital technology is expensive and best suited for large-scale producers—majority of farmers in Malaysia are smallholders (Arshad, 2016). Broadband infrastructure is a third issue—many rural areas receive limited mobile signal and landline internet connection, which are prerequisites for digitisation. Finally, the availability and quality of the data is often poor. There is an increasing need for data and information that is generated on farm in its local-specific context, which is needed as an input in digital-farming systems. Despite its challenging and slow progress, automation continues to be the dominant focus of development efforts in the Malaysian agriculture sector. In Malaysia, advanced technologies have been mainly applied in large-scale production as well as vertical farming.[1]

1 *Vertical farming* refers to the practice of growing produce on vertically stacked layers in a closed and controlled environment. This type of farming is usually associated with urban farming, as it takes up less space and use less water.

In fact, automation enables the agricultural labour force to become more efficient and remain competitive across various sectors. It also saves time and cuts down the cost of production (Saiz-Rubio & Rovira-Más, 2020). For example, jobs that are performed by a number of people now can be replaced by one person just operating a machine. Moreover, innovative technologies overcome critical human constraints, such as the ability to operate in tough agricultural environment, and have the potential to minimise the impact of physically demanding, routine, and difficult jobs.

Malaysia's agriculture sector is heavily dependent on agricultural labour. For many years, labour shortage has been one of the main challenges in this sector, largely due to the shift of agricultural labour to other high-productivity sectors (Vaghefi, 2020). Agricultural automation is, in fact, a promising way to reduce labour dependency and enhance agricultural productivity in the country. Yet technology adoption might come along the sacrificing of certain jobs, temporary or otherwise.

Routine vs. nonroutine and manual vs. cognitive tasks

Distinguishing tasks can provide better insights into the specificity of occupations in the agriculture sector rather than classifying them as high-, middle- and low-skilled occupations, which are normally based on education levels of workers. Previous studies identified four main types of job tasks, namely (1) routine manual tasks, (2) routine cognitive task, (3) nonroutine manual tasks, and (4) nonroutine cognitive tasks (Chang & Huynh, 2016; Lewandowski, 2017). Routine manual tasks can relatively easily be codified and replaced by automation. Examples in the agriculture sector include agricultural-machine operators and farm labourers. However, nonroutine manual tasks are often difficult to automate. These tasks need situational adaptability, visual recognition, and physical ability. Harvest workers and fruit pickers are among these occupations (Table 1).

Like routine manual tasks, routine cognitive tasks can be easily performed by machines or computers. For instance, tractor drivers and pest controllers are highly suffused with these tasks. However, nonroutine cognitive tasks need workers with analytical and problem-solving skills as well as creativity. Indeed, computers can be complementary to nonroutine cognitive tasks as they can improve the productivity of workers performing these tasks. Agricultural managers and agronomists are occupations that are highly saturated with these tasks.

In other words, automation can be either a complement or a substitute to human workers. A machine can basically substitute for human labour when it

has the ability to produce more than or as much as the worker for the same cost or a fraction of the price, mostly workers in routine and codifiable[2] tasks. Automation can complement labour when it improves worker's productivity but cannot directly and fully replace the worker, mainly workers in nonroutine tasks (Autor, 2015). It means that routine tasks provided by robots complement the nonroutine tasks that are mainly carried out in high-skill occupations.

A good example of complementarity between human and machine in the agriculture sector is the implementation of machine-learning approaches on different cognitive tasks, including yield prediction, disease detection, weed identification, crop-quality estimation, and soil-condition identification. However, the human-skill requirements to support this collaboration are increased in terms of cognition capabilities, and therefore, more training and education might be needed. These raise important questions about the implications for diverse agricultural workers and future jobs in this sector, which is heavily based on manual work. This study, therefore, examines the potential impact of automation on jobs and employment in the agriculture sector in Malaysia and discusses policies and strategies to support the agricultural workforce.

Table 1. Classification of sample occupations in the agriculture sector by spectrum of tasks

		Ease of automation	
		High (Routine tasks)	**Low (Nonroutine tasks)**
Ease of complementarity	**Low (Manual tasks)**	• Machine operators • Farm labourers	• Harvesting workers • Fruit pickers
	High (Cognitive tasks)	• Tractor drivers • Pest controllers	• Agricultural managers • Agronomists

Source: Author's adaptation of Chang and Huynh (2016).

2 Codifiable tasks are those activities that the instructions for the tasks can be translated into code for a computer to carry out.

Methodology and Data Sources

This study applied the Frey & Osborne (2013) approach to categorise occupations in the Malaysian agriculture sector (farm and nonfarm agriculture-related jobs) according to their susceptibility to computerisation[3] and to estimate the probability of automation for each of them. Frey & Osborne developed a methodology to quantify the extent to which occupations in the United States can be replaced by advanced technologies. Their study estimated that almost every occupation can be automated within the next two decades, except those that involve high amounts of three broadly defined activities, namely (1) creative intelligence, (2) social intelligence, and (3) perception and manipulation. In other words, occupations more aligned with these types of tasks are less likely to be subject to direct substitution by computers and more subject to complementarity. Frey & Osborne codified the occupation's probability of computerisation in terms of the extent to which they need these three non-automatable tasks. The same methodology has been applied by various studies to examine the impact of automation on certain occupations in developed and developing countries (Brandes & Zobrist, 2015; Chang & Huynh, 2016; Ng, 2017).

In order to assess the automation risk for the occupations in the agriculture sector, the Malaysia Standard Classification of Occupations (MASCO) 2020 (four-digit and six-digit occupation levels) and the Standard Occupational Classification (SOC) employed in the original Frey & Osborne study were matched according to their code and title. MASCO has been developed in accordance with International Standard Classification of Occupations (ISCO).[4] Jobs in the Malaysian agriculture sector were, therefore, categorised into 44 occupational groups, subject to data availability.

Occupations were first matched based on occupation titles, if possible, then the same probability to the ISCO occupations were applied. In cases where the job title was not fully matched, estimates needed a matching of its corresponding detailed tasks' descriptions as well. This process was based on careful examination of the jobs and tasks descriptions listed in their respective occupation manuals. For those occupations that could not be matched by either the occupation title or detailed description of tasks, the ISCO occupation was linked to the corresponding

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3 *Computerisation* refers to job automation by means of computer-controlled equipment.

4 MASCO 2020 is aligned with ISCO-08. The SOC to ISCO-08 crosswalk file is available at the U.S. Bureau of Labor Statistics website, https://www.bls.gov/soc/soccrosswalks.htm

SOC category for "other" or "not elsewhere classified." In cases where an ISCO occupation was linked to multiple SOC occupations and different automation probability estimates, the simple unweighted average of all the automation probabilities for that occupation was applied.

Each occupation was therefore classified as having *low* (less than 30%), *medium* (30% to 70%), or *high* (more than 70%) risk of automation based on their estimated probabilities. It should be noted that the methodology applied only provides an approximation, not a prediction, due to the data limitation.

Results and Discussion

Agricultural occupations and probability of computerisation

Results indicate that more than half (approximately 60%) of total occupations in the Malaysian agriculture sector are in the high-risk category (Table 2), meaning that associated occupations are potentially automatable, perhaps over the next 10 to 20 years. Across all agricultural occupations, jobs with high capacity for automation are agricultural technicians, inspectors, crop growers and animal producers, subsistence farmers/fishermen and gatherers, fumigators, pest and weed controllers, and labourers. Being highly automatable does not mean that the job will be entirely disappeared. In fact, these occupations will most likely be redefined, and new skills will be required in the future. For instance, an agricultural technician may need to work at a lab developing new technologies alongside scientists or in the field with green-energy solutions for farms. They will still be called agricultural technicians, but they will be doing different tasks. Most of highly automatable jobs are jobs that mainly require routinized physical activity. Yet the nonroutine cognitive jobs such as agricultural managers and agricultural scientists seem to be less automatable.

Table 2. Occupations in the agriculture sector in Malaysia at risk of automation

Skill level	ISCO Code	Occupation	Probability	Risk of automation (%)		
				Low (<30%)	Medium (30% -70%)	High (>70%)
Skilled*	1311	Agricultural and forestry production managers	0.05	4.7		
	1312	Aquaculture and fisheries production managers	0.05	4.7		
	2132	Farming, forestry, and fisheries advisers	0.01	1.2		
	2133-02	Agronomist	0.02	1.6		
	2133-03	Crop research scientist	0.02	1.6		
	2133-04	Agricultural scientist	0.02	1.6		
	2133-06	Horticulturist	0.02	1.6		
	2133-08	Pomologist	0.02	1.6		
	2133-13	Soil scientist	0.02	1.6		
	2144-26	Agricultural engineers	0.49		49.0	
	2145-09	Fertilizer engineers	0.02	1.7		
	3115-09	Mechanical engineering technician, agriculture	0.38		38.0	
	3119-45	Agro-based biotech research technician	0.61		61.0	
	3119-46	Aquaculture biotech production technician	0.61		61.0	
	3142	Agricultural and livestock technicians	0.97			97.0
	3144	Fisheries technicians	0.97			97.0
	3719-07	Agricultural inspector	0.94			94.0

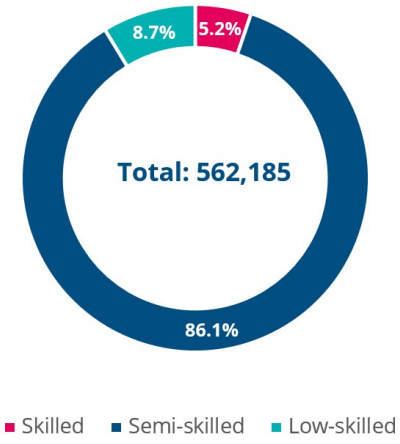
Semi-skilled	6111	Field crop growers	0.72			72.0
	6112	Shrub crop growers	0.72			72.0
	6113	Gardeners, horticultural and nursery growers	0.72			72.0
	6114	Mixed crop growers	0.72			72.0
	6115	Vegetable growers	0.72			72.0
	6121	Livestock and dairy producers	0.76			76.0
	6122	Poultry producers	0.76			76.0
	6123	Apiarists and sericulturists	0.76			76.0
	6129	Animal producers and related workers not elsewhere classified	0.76			76.0
	6130	Mixed crop and animal producers	0.80			79.7
	6221	Fishery and aquaculture producers	0.76			76.0
	6222	Skilled inland and coastal waters fishery workers	0.70		70.0	
	6223	Skilled deep-sea fishery workers	0.70		70.0	
	6224	Hunters and trappers	0.77			77.0
	6311	Subsistence crop farmers	0.80			80.0
	6321	Subsistence livestock farmers	0.80			80.0
	6331	Subsistence mixed crop and livestock farmers	0.80			80.0
	6341	Subsistence fishermen, hunters, trappers and gatherers	0.80			80.0
	7233	Agricultural and industrial machinery mechanics and repairers	0.62		62.2	
	7634	Fumigators, pest and weed controllers	0.73			73.3
	8341	Mobile farm and forestry plant operators	0.79			79.0

Low-skilled	9211	Crop farm labourers	0.87			87.0
	9212	Livestock farm labourers	0.87			87.0
	9213	Mixed crop and livestock farm labourers	0.87			87.0
	9214	Garden and horticultural labourers	0.91			91.0
	9216	Fishery and aquaculture labourers	0.85			85.0
	9219	Agricultural, forestry, farming and fishery labourers not elsewhere classified	0.87			87.0

Source: Author's estimation based on Frey & Osborne (2013) and MASCO (2020). Six-digit code is presented for some skilled occupations as their four-digit codes composed of both agricultural and nonagricultural occupations.

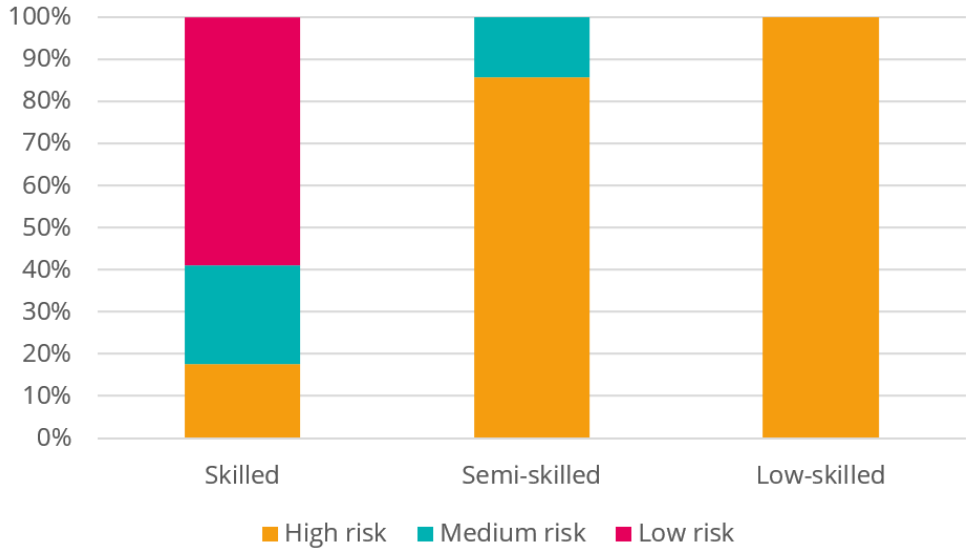
The risk of automation in the agricultural labour market also depends on the employment structure as well as the skill level of jobs in this sector. Based on the latest annual economic statistics for agriculture, in 2017, semiskilled workers made up about 86% (484,129 persons) of the workforce in the Malaysian agriculture sector followed by low-skilled (8.7% or 48,802 persons) and skilled workers (5.2% or 29,254 persons) (Figure 2). This shows that semiskilled and low-skilled occupations account for a sizable share of employment in this sector. Results reveal that while very few skilled occupations can be automated entirely, more than 80% of semiskilled occupations and about 100% of low-skilled occupations in the agriculture sector have potential to be fully automated (Figure 3).

Figure 2. Percentage share of employed person in the agriculture sector in Malaysia by skill level, 2017



Source: Annual economic statistics 2018, Agriculture, Department of Statistics, Malaysia.

Figure 3. Agricultural jobs at risk of automation by skill level



Source: Author's calculations.

It means that more than three-quarters of all employment in this sector fall into the high-risk category of technology substitution, and if technological

displacement happens, the agricultural labour market could face unprecedented stress.

Moreover, results suggest that there is a possible overlapping between the routine and the skill content of occupations. Basically, high-skilled workers tend to specialise in nonroutine tasks, while more routine intensive tasks tend to need less skills (ILO, 2012; Marcolin et al., 2016). However, some low-skill tasks can be complementary to high-skill ones.

As per Frey & Osborne approach, the occupations that are most resistant to computerisation are those that have three characteristics of creative intelligence, social intelligence, and high degree of perception and manipulation. For instance, the low susceptibility of agricultural managers and scientists to computerisation is mainly due to the high degree of creative intelligence they require. Therefore, while it is evident that computers are entering the domains of science, there are strong complementarities between computers and labour in science and management occupations, even though it is likely that computers will completely substitute for labours in these occupations in the long term.

The susceptibility to computerisation is highly in line with the technological trends in the automation of knowledge work. For example, the study found that crop growers are in the high-risk category. At the same time, agricultural production managers, which rely on input from crop growers, are in the low-risk category. Thus, for the work of agricultural production manager to be fully automated, creative- and social-intelligence bottlenecks will need to be overcome, indicating that the computerisation of operations such as preparing the soil, sowing, planting, and harvesting of crops will complement the work of production manager perhaps in the medium term.

Polarisation in the agricultural labour market

Automation can influence the demand for specific types of labour and can trigger occupational changes. Results suggest that there is a high possibility that majority of middle-skilled workers performing routine work, both manual and cognitive, may be displaced by changing skills needs in the future. Employment statistics in Malaysia shows that labour demand[5] for skilled agricultural workers increased by about 20% in 2019 compared to 2015, while the middle-skilled labour demand grew by only 2% (Department of Statistics Malaysia, 2021). This is actually the period when the Malaysian agriculture sector saw an intensive

5 Labour demand comprised of filled jobs and vacancies.

application of robotics and technologies such as drones, internet of things, and artificial intelligence. Although increased automation level in a production process requires high-skilled labour, there is still the demand for low-skilled workers for the execution of the residual activities in routine tasks undertaken by machines, hence leaving less space for middle-skilled workers.

The displacement of routine, middle-skilled occupations will indirectly increase the supply of workers who previously would have held middle-skilled jobs willing to take up low-skilled jobs, which are concentrated in nonroutine manual tasks. Consequently, the phenomenon of *job polarisation* occurs. Job polarisation refers to the simultaneous growth of high-skill (high-wage) jobs and low-skill (low-wage) jobs at the expense of middle-skill (middle-wage) jobs (Heyman, 2016).

In fact, the main contributor to the agricultural labour-market polarisation is the automation of routine tasks. This will indeed generate *wage polarisation*. It means that labour-market polarisation might pose even more serious problems in the agriculture sector, as the growth of the share of high-paying and low-paying jobs at the expense of middle-wage jobs would contribute to an increase in income gap in the sector. As a result, in the long term, the shift in the occupational composition might affect the economic growth of the sector if no recovery plans for the affected middle-skilled labours are implemented. Vocational education and training might be needed to improve employment opportunities for middle-skill workers.

Conclusions and Policy Measures

Automation and technological progress will undoubtedly have effects on the agricultural labour market, yet the magnitude of their impacts and the speed at which those will be felt are uncertain. The extremely routine and manual nature of agricultural work may put a higher share of workers in this sector at high risk of automation. In the medium to long term, majority of middle-skill tasks in the agriculture sector will most likely be substituted as a result of the reduction in demand for routine intensive work. Hence, we will see a shift from routine jobs towards nonroutine jobs in the sectoral composition as well as in the occupational composition. The pattern of polarisation depends on the ability of workers switching out of routine jobs. For instance, low-ability routine workers are more likely to switch to nonroutine manual tasks, while high-ability routine workers are most probably to switch to nonroutine cognitive tasks (Cortes, 2016).

However, it is important to note that although many jobs in the agriculture sector might be affected by automation, the risk of complete job displacement

is probably lower. This is mainly because automation basically targets particular tasks than occupations themselves. Indeed, the nature of work will most likely be reshaped as their associated tasks become automatable. Workers will need to acquire new set of required skills and adapt to working alongside machines. This would put additional pressure on the already-existing skills-shortage challenge in the agriculture sector. Automation, therefore, presents both challenges and opportunities for the agriculture sector. It is important to make sure that the policies that are in place enable workers to weather these technological changes with the least disruption possible, while maximising the potential benefits offered by the automation.

A key challenge, moving forward, will be worker retraining or reskilling, not only for technological skills but also for higher cognitive skills linked to creativity, complex-information processing, and problem solving. Investment in these skills will, therefore, be essential. While educational achievement is undeniably important, since demand for high-skilled workers continues to increase, it is also vital to focus on training for nonroutine skills because they will be also in high demand in the future as technology automates routine tasks.

In order to protect agricultural workforce, skills policies should focus on preparing future farmers for the future jobs in this sector and giving existing farmers the opportunity to continuously maintain their skills, upskill, and/or reskill. Adaptability and continuous learning will, therefore, be the keys to success in digital transformation of agriculture.

Limitations of the study

Data needed to better interpret the findings and to examine the employment by occupation, skills, and educations were limited. Microlevel labour statistics are not published in Malaysia. Surveys are required to quantify the actual content of occupations, skill requirement, and routine vs. nonroutine jobs in the Malaysian agriculture sector.

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Formalizing Informal Work: Case Study of Street Vendors in Hanoi During and Beyond the Pandemic

Trang Vu HONG

Abstract

Street vendors are among the hardest hit groups by the COVID-19 pandemic in Vietnam. Semistructured interviews with 11 female street vendors offering different services in Hanoi were conducted in 2021 to examine how top-down reactive and proactive state measures have impacted their livelihoods. While the central government pledged to provide relief package to affected freelancers, as well as initiate training programs as part of career-transformation schemes for informal workers, those policies are deemed by street vendors as toothless and unfeasible.

Vietnam's digital economy, described by Google in 2018 as "a dragon being unleashed," is now at the forefront of Southeast Asia (Google Temasek, 2018). However, the breakneck digitization in the country that embarked on marketization with state management and socialist orientation in the late 1980s has left many vulnerable groups behind, including those in the informal sector.

By and large, informal economy plays second fiddle to formal economy in both quantitative and qualitative terms (Elgin, 2020). Since it is not recognized, registered, and regulated, despite playing a significant role in mitigating poverty, be it legal and illegal, participants in informal economy often escape detection and inclusion in the GDP (Nguyen, 2019). Informal employment is at odds with the Vietnamese common pursuit of a secure and stable career. As part of the diverse and dynamic informal economy, street vending has long made an important contribution to the cultural, economic, and social landscape of Vietnam, albeit hard to quantify since the sector escapes formal measurement. Nevertheless, those involved in street vending constitute intersectionally diverse vulnerable groups of people, particularly women migrant workers and low income earners (Turner & Schoenberger, 2012).

Rural people were further marginalized due to the urban sprawl, which led to the loss of farming as their main ways of sustenance (Lincoln, 2008; Turner & Schoenberger, 2012). Those who have lost their lands have turned to the cities for survival and found their way to informal workforce with or without internal migration. The responses to new policies vary from individual to individual. The growing consciousness of safety among consumers even put both mobile and stationery street vendors further at a disadvantage. In addition, local authorities have been finding ways to limit activities of informal traders.

Despite increasing restrictions and insecurities, street vending is still viable, vibrant, and visible from morning to midnight in the capital city. Furthermore, this industry, which offers a way of living for underprivileged populations who lack the skill sets to enter the formal sector, is highly staffed and specialized (Lincoln, 2008). Unhygienic, undisciplined, unproductive, and untaxable businesses of informal traders have fallen into disfavor with local authorities, who are in charge of ensuring a more efficient, civilized, and elegant capital city *(thành phố thủ* đô *văn minh, thanh lịch*) (Agergaard & Thao, 2011). In 2020, amid the ongoing COVID-19 outbreak, a TV anchor of a Vietnamese national channel had to publicly apologize for likening street peddlers to parasites on the streets of major cities, which stirred a heated public debate in Vietnam on the structural discrimination against self–employed marginal people in the society (Tuoi Tre News, 2020). The mishap became viral, bringing the viewers' attention to the vulnerabilities of street vendors, whose lives have been marginalized on different levels against the backdrop of further urbanization, modernization, and globalization in Vietnam, especially in big cities such as Hanoi and Ho Chi Minh City.

No study has been conducted on the Vietnamese policies on transforming careers for participants in the informal economy in general and street vendors in particular. This qualitative study seeks to respond to the question, how have top-down reactive and proactive state measures impacted the livelihoods of subgroups of street vendors during and beyond the pandemic?

Street Vendors in Vietnam

In Vietnam, street vendors are categorized as unregistered traders or freelance laborers (*lao động tự do*). In other words, they do not have a legal space or a license to sell their produce, even though they are not completely prohibited to provide services. Vietnam embarked on a top–down set of socioeconomic reforms (the renovation), known in Vietnamese as *đổi mới,* metamorphosing from a centrally planned to market–based and multisectoral economy. The

A fixed-stall seller in Hanoi

watershed transformation resulted in the expansion of the informal sector that employs the nonagricutural workforce and the growing chasm of income between rural and urban areas.

Akin to other countries in the Global South, street vendors face increasingly restrictive policies due to the top-down modernization process (Siu & Unger, 2020). Street vending is seen as unhygienic, unsafe, obsolete, and, thus, out of step with the modernized society (Brown, 2006). Instead of tackling the root causes of the informal economy, particularly public-sector corruption, poor legal system, and unfavorable business conditions, the Vietnamese government came up with makeshift measures that took a toll on the livelihood of street vendors (Nguyen, 2019). Since July 2008, street vendors are banned from designated areas, including 62 streets, 48 public spaces, etc., since street vending is seen to be out of line with state modernity discourse (Turner & Schoenberger, 2012). It was the time when the state expanded the official land of Hanoi with a view to transform the city into a super economic hub.

Street vendors, as a result of a swift and sweeping modernization mandate, are more likely to face state surveillance. Having no labor union to protect their rights, itinerant vendors are more likely to form groups to support each other, especially among those renting the same places. In a restrictive country that offers little room for citizens to contest and even protest against discriminatory state policies that prioritize the mobility of the elite, the slow–moving and highly mobile marginalized workforce tend to find their own ways to negotiate and navigate the system in defense of their own livelihoods (Turner & Ngô, 2019).

Top–Down Career-Transforming Schemes

Even though Vietnam has made significant strides in improving overall living standards, the social-assistance system fails to keep up with the swift development of the country. In particular, the country provides very limited protection for the vulnerable populations (Kidd et al., 2016). Disparities in socioeconomic well–being are a growing cause for concern in the low–middle-income country. The career-transformation programs are tailored to those who originally made their

living as farmers but lost their lands due to the top–down confiscation. Article 20 of Resolution 47/2014 only stipulates the eligibility for career–transforming support for those whose agricultural lands were confiscated by the state yet fails to clarify what the state support constitutes. However, the onus is onto local authorities to implement the state policy in keeping with specific local contexts and in consultation with the job seekers.

Career transformation for freelance laborers is no longer a priority against the backdrop of the pandemic. Even though Vietnam was hailed as a success story in handling the outbreak until mid-2021, it is estimated that 31.8 million laborers in all sectors were hurt across the country (GSO, 2021). In Hanoi, only those with Hanoi household registrations would be eligible to apply for the career–transforming schemes, which include loans, training, and access to alternative jobs in the city (Xuân, 2008), which would exclude migrant workers, particularly itinerant sellers. Furthermore, the government is unable to offer any financial support for those willing to take training programs, which last from three to six months. On top of that, trainees are likely to lose their relatively stable income from street vending for a few months while still unsure whether the training course will end up bringing them any secure employment (Tuoi Tre Online, 2017). As a result, an acceptance to take part in the training is tantamount to taking a risk to change the course of the career. However, the amount of material and technical support provided by local authorities hinges on the amount of farming-land applicants' claim to lose (Kawarazuka et. al, 2018).

The career-transforming activities for women were led by Vietnam Women's Union, a state–affiliated women's mass organisation in cooperation with the Ministry of Labor, Invalid and Social Affairs. However, the local authorities were not actively involved (Vietnam Women's Union, 2008). These groups are the most vulnerable but also the hardest to help since there is hardly any statistics (VietNamNet, 2021).

Methodologies

As few scholarship can be found on the topic, the study conducted in-depth interviews in Vietnamese language, both in person or by phone calls or online messaging apps, with street vendors and one former civil servant who used to work for the career-transformation program. In addition, a wide range of media reports were also analyzed. Due to constraint of resources, the researcher only focused on street vendors providing services in urban Hanoi. Efforts to reach out to officials were not meet with success. On-site interviews were only possible before July 20, 2021, due to mobility restrictions.

Convenience sampling via snowballing was employed to seek informants from diverse backgrounds. Snowballing proves to be an effective sampling technique that allows researchers to locate hard–to–reach populations through social networks to unearth sensitive matters (Waters, 2015). While street vendors are highly visible, it is challenging to approach them for research purposes since the group is numerically small (compared to the general population), geographically scattered, and socially stigmatized (Heckathorn & Cameron, 2017). Through this informal networks, the researcher was first introduced to a street vendor, who then helped connect other street vendors in her circles. Furthermore, the Vietnamese society places a high premium on connections (Luong, 2016). The process of snowballing exemplifies a trust-building process.

Informed consent, confidentiality, and anonymity were communicated to all informants. All the interviewees were middle-aged women between age 50 to 63 and married with children. Even though no attempt to select female samples was made, street vendors are predominantly female, a reality in line with previous literature on the topic (Turner & Schoenberger, 2012).

One-hour conversational interview with one respondent at a time for several times is reasonable to avoid fatigue for both interviewers and interviewees (Adams, 2015). Furthermore, individual interviews helped remove the peer pressure in interviewing a group (Adams, 2015). These questions were not sent in advance to interviewees. Almost every informant expressed their preference to verbal over written conversations. Furthermore, all conversations started with questions on positive experiences before delving into less-positive aspects. The author sought to be in touch with interviewees on Facebook or phones for further post-interview queries.

The purpose of an interview is not only to fathom out what is to be said but also why it is said (Salmons, 2014). Interviewers seek to understand beyond what interviewees agree to disclose, the story behind their experiences, their perspectives and preferences. Telling stories is essentially a meaning-making process (Saarijärvi & Bratt, 2021). Interviews tend to cover both fact and meaning level (Kvale, 1996). The author is also well aware of personal biases and seeks to eliminate it by cross-checking prepared interview questions with fellow junior scholars.

The fieldwork took place in person in May 2021 and turned online in July 2021, where there was a surge in community transmissions, which made both the interviewer and interviewees expect an imminent period of social distancing. That is why efforts were made to keep in touch with street vendors in case in–person interviews would be interrupted.

A life-history approach was also adopted to understand their goals, aspirations, and achievements (Ribbins, 2007). After all, life events are interconnected. Participants were invited to recount their life stories through memories to the present day. Life-history approach enables a deeper investigation into how individuals coped with societies throughout their lives (Harris & Rhodes, 2018). On top of that, the life-history approach is apt to glean information from a small sample of informants who were willing to provide detailed responses to open–ended questions.

A data–driven, inductive, thematic analysis by dint of manual coding is utilized in order to identify themes, patterns among responses to open–ended questions without attempting to fit in any predetermined coding frame grounded on a researcher's preconceptions (Braun & Clarke, 2006). Coding allows researchers nuanced access to study informants' thoughts (Williams & Moser, 2019). Themes are accordingly defined and refined after interview transcriptions are read and reread. Interviews were conducted in Vietnamese, and only selected quotes in this paper were translated verbatim into English by the author.

Theoretical Framework

Intersectional analysis is employed in this study. Intersectionality is moving beyond thinking different elements of identities as mutually exclusive. Simply said, one issue should not be investigated singularly or unidimensionally. Individual subjects should not by any means be subject to homogenizing views from monocategorical approaches. Intersectionality recognizes that people's identities and social positions are shaped by multiple interlocking factors.

Intersectional approach can be traced back to the late 1980s and early 1990s, even though similar concepts had been developed previously, such as "double jeopardy," "interactive oppressions," "multiplicative effects," "interlocking oppressions," "triple oppression" of race, class, and gender (Anthias & Yuval-Davis, 1983; Staunæs & Søndergaard, 2010). Kimberle Crenshaw, an African American lawyer and feminist scholar, is widely credited for coining the term in her early scholarly work, deriving from her activism in the United States in integrating both women and people of colour in antidiscrimination fight. It came into being as a critique of second-wave feminism's concept of "universal sisterhood," which, in fact, focused on white middle-class women and glossed over the issues often confronting people of minority racial and socioeconomic backgrounds (Crenshaw, 2012).

More than the collection of identity categories, intersectionality provides an analytical tool that links particular identities and conditions to "structures of

power." Intersectional analysis offers a greater insight into experiences of struggles and stigma due to belonging to different social categories (Williams & Fredrick, 2015). In other words, people from different backgrounds are differently disadvantaged, if not multiply burdened. Furthermore, people should be seen as passive bearers of social categories rather than active creators of these groupings (Prins, 2006).

Findings

Table 1. Demographics of interviewees

Respon-dent	City of Origin	City of Resi-dence	Category	Level of Education	Prod-ucts	Full Time/ Part Time	Age in 2021	Active Years as Street Vendor
1	Hanoi	Hanoi	Fixed stall (in front of a primary school)	High school & vocational training	Sticky rice (xôi)	Part time	59	30
2	Hanoi (peri-urban)	Hanoi	Commuting Seller	Secondary school	Toufu	Full time,	50	21
3	Thai Binh	Hanoi	Itinerant seller	Primary school	Sweet cakes	Full time	53	21
4	Hanoi	Hanoi	Itinerant seller (by bike)	Secondary school	Porridge	Full time	51	Undis-closed
5	Hanoi	Hanoi	Fixed stall	Secondary school	Rice noodle	Full time	63	40
6	Hung Yen	Hanoi	Itinerant seller (by bike)	Secondary school	Porridge	Full time	46	10
7	Hanoi (peri-urban)	Hanoi	Commuting Seller	Secondary school	Poultry	Part time	60	32
8	Hung Yen	Hanoi	Itinerant seller (by bike)	Secondary school	Cakes	Full time	59	28
9	Hai Phong	Hanoi	Itinerant seller (by bike)	Secondary school	Rice noodle	Full time	55	21
10	Nam Dinh	Hanoi	Itinerant seller (by bike)	Secondary school	Vegeta-bles	Full time	61	31
11	Ha Nam	Hanoi	Itinerant seller	Primary school	Crunchy cookies	Full time	46	17

Diversity of street vendors

In addition to the two major groups described by existing literature, namely fixed-stall sellers and itinerant sellers, there is another group of street vendors who do not sell products at a fixed place or constantly move around Hanoian streets all day long. They are commuting sellers who live in the outskirts of Hanoi and drive their products to clients' places by their own vehicles, then go back to their homes on the same day, unlike migrant sellers who experience split households and only return home once every few weeks. These commuters, who receive orders for their products mostly via online channels and by word-of-mouth all year round, depend on regular customers within the city. Upon coming home, they carry on with agricultural production together with their family members. However, these commuting sellers do not ship other types of agricultural produce on behalf of any other seller nor sell their own products to random clients who do not make any order in advance. In the case of respondent #2, she has to set off for Hanoi as early as 4:00 a.m. in order to reach the city at 6:00 a.m. to make sure that her merchandise are still fresh by the time they reach her clients. The delivery is a tough job, given that street gangsters are visible and their harassment is not uncommon. However, she has to do the job, even though it is considered less respectable, since her husband is unwilling to do so.

Out of nine cases, only two women did not have any choice—a single mother and a woman with a chronically ill husband who could not go to work at all. For the rest, it was the negotiation within family members, particularly with husbands, to decide who would work as a street vendor. All of them never went through any food-safety training programs or received relevant instructions.

The background differences also led to their varying strategies in resource mobilization and mobility. Fixed–stall sellers and commuters depend increasingly on social media to reach out to their customers. For itinerant sellers, they either walk around the city carrying two baskets with a bamboo pole or drive around a motorbike or bicycle, renting a room in the city and returning to their hometowns every now and then to see their families and/or help out with farming work. All of them only serve their clients during the day, whether on a full–time or part–time basis. There are only a few itinerant sellers of dry products such as cookies.

Street vendors are a heterogeneous and hierarchized group. Not all street vendors are migrants from rural areas. Those residing in Hanoi and in possession of Hanoi-based household registrations are deemed as having more advantages than those travelling outside the city (Turner & Schoenberger, 2012) since they have access to a certain degree of social welfare within the capital. Many Hanoi

residents insist on their rights to do informal businesses within their household addresses (Turner & Schoenberger, 2012).

Challenges during the pandemic

Hanoi imposed social-distancing policies twice, in late March of 2020 (from March 23 to April 7) and in late July 2021 (starting on July 24), both at a very short notice, catching both non–street vendors and street vendors off guard. The former period was essentially a preventive measure, while the latter was more or less a reactive step, given a spike in community transmissions in Ho Chi Minh City since the National Reunification Day on April 30, 2021.

Nine out of 11 street vendors have never participated in the formal economy; thus, they were hardly aware of social-protection policies associated with employees. As required by the local government, all the informants' services were discontinued. Attempts to stealthily sell their produce were subject to heavy fines and confiscation. However, while the short-notice announcement of social-distancing measures took many street vendors by surprise, they associated these as part of their expected precarities. Envisaging that changes might come, they all have had their own plans. For migrant itinerant vendors, they turned to farmwork and sold fruits within their villages. For commuters, they continued selling different produce in the city or stayed home. For fixed-stall sellers, staying at home during the social-distancing period was the only alternative.

All the informants experienced a steep income drop or even complete income loss and resorted to personal savings or family support during the social-distancing periods. Fixed-stall sellers were not allowed to open, as they were not registered convenience stores or supermarkets, as mandated by local authorities. For commuters, the COVID-19 outbreak hit their services to a lesser extent. While mobility was discouraged during social-distancing periods, the fact that they carried necessities into the city made it possible for them to deliver their products to their clients and pass police checkpoints throughout the city.

For the fixed-stall sellers, they had to close their services, as only registered services were allowed to open. In the case of respondent #8, who was selling her merchandise in front of her house, clients found her and brought her products as take-aways. They eventually had to go back immediately to their hometowns, where there were few social-distancing measures. They said that while taking a break in their hometowns, they were exploring other possibilities to make money. All of them sell their products to individual clients.

While fixed–stall sellers had the choice of closing their space and resting at home, some itinerant sellers met more challenges. For example, products of respondents #3 and #5 were confiscated. Furthermore, they did not have the chance to go back to their hometown as long-distance bus services were suspended during the social-distancing periods. Also, stigma increased against itinerant sellers who returned to their hometowns, as they were seen by their neighbors as transmitters of the virus due to their mobility.

Against the backdrop of an unprecedented health crisis, 10 out of 11 informants found themselves short of any health insurance. The street vendors were not cognizant of the importance of health insurance and were against purchasing one, a common reality shared among nonsubsidized informal workers (Castel, 2014).

Financial relief during the pandemic

All the respondents were hit hard by the state restrictions on mobility. Since they were independent laborers (*lao động tự do*), there was no communication channel conveyed to them when their services could resume. In July 2020, the government announced its unprecedented financial support for freelance laborers. However, the amount of support vary according to localities. According to the Government Resolution 68 NQ-CP, street vendors, though not falling into any group of registered businesses, are still eligible for a lump-sum aid of 3 million Vietnamese dong (VND), or around 130 USD (Kim, 2021).

Of all the informants, only one person registered for the financial relief of 1 million VND (or almost 50 USD) and already received it two months after her application, though it was promised in the beginning as 1.5 million VND (or almost 70 USD) in July 2021. She received her second installment of 1 million VND in August 2021. Two other people from Hanoi had applied for the aid and were still waiting at the time of the interviews.

The rest have not heard, and even expressed doubt, about any potential top–down support. In addition, all informants were conscious of potential bureaucratic barriers to obtain support from their own local authorities, given that they were freelance laborers and would not be able to provide evidence of income loss. Due to their limited education, these street vendors articulated their reluctance to deal with paperwork and communicate with local administrators over a limited sum, which would be time-consuming, stressful, and even humiliating.

> Respondent #10: "It is not worth filling endless papers, queuing for hours, going back and forth for days just for a tiny sum of financial aid. I would rather work harder to make up for the cash loss than implore them."

Albeit hard hit by COVID-19, none of them has taken the initiative to seek any financial support from the state since they are not defined as "poor households" by local standards. In addition, as a general rule, freelance laborers are not eligible for unemployment benefits; hence, they do not expect any assistance. Having not followed mass media, they have not received information on to how to access aid or whether any aid would be available for them.

State support for career transformation

With the keywords *hỗ trợ chuyển nghề* and *chuyển đổi nghề nghiệp*, or career transformation support, most of relevant media reports in 2008 pointed to the state's struggle in implementing career-transformation training programs (GCL, 2021). According to Ms. Nguyen, a former civil servant working to support career transformation from self–employment to wage work in Hanoi, the policy was very tokenistic, citing the lack of goals and guidelines on the implementation of the policy. As a consequence, local authorities were at a loss on how to actually carry it out.

None of the 11 informants have heard of the career-transformation schemes by the government at the time of the interviews. In addition, they voice their misgivings about the feasibility and popularity of those programs, especially when it was not mandatory. The length of their participation in street vending has proven to be an impediment to their transition to a formal sector. Upskilling them is a bane rather than a boon to their livelihood since they are not technically and mentally ready for an unhoped-for formal career in increasingly competitive and complex job markets that tend to favor tech–savvy youths.

These informal workers do not have any intention of participating in the formal economy. Given their very limited education (most of them only finished up to secondary school), unwillingness to be in a formal sector, and advancing ages, all of them could foresee the enormous challenges in taking part in training programs. On top of that, all informants did not envision or expect any job switching or being put in a classroom setting, as reflected in their responses below:

> Respondent #10: "I do not want to start a new career when others begin to retire."

> Respondent #6: "I am too old to learn anything now. I cannot catch up with the young people, let alone compete with them."

Moreover, the distrust in the so–called transformative impact of the program in particular and the government's policies in general is commonly felt among informants. For all informants, it is impractical, if not impossible, to change a decade–long career within a matter of months on the grounds of general training programs.

> Respondent #9: "The government has not been able to even guarantee employment for my university educated sons. How do they make sure that I will get a decent job after that program?"

> Respondent #2: "I can sell whenever I want, until I die. Which companies would hire a 63-year old like me?"

> Respondent #11: "I do not want to wait for the state to save me. It is better to be autonomous."

> Respondent #10: "I am old and slow, I do not think I can make it [to the training program]."

In addition, seven out of 11 informants are already past the retirement age for women in the formal sector, which is 55 years and 3 months old as of 2021. As a consequence, even if they do participate in the state career transformation, the likelihood of being part of a formal sector is very slim. Itinerant sellers who are not from Hanoi are adamant that formal-employment opportunities would not tilt in their favor due to both lack of skills and lack of household registration in Hanoi, revealing their deep–seated sense of inferiority.

> Respondent #6: "I am from the countryside, and without much schooling, who would take me?"

> Respondent #8: "I know who I am...I am fated to struggle like this."

> Respondent #11: "How can I compare with the Hanoian residents here?"

Street vendors are aware of their own positions in the growing market and their clientele. They perceive their merchandises to be fresher, more affordable, and more accessible compared to what can bought at convenience stores and supermarkets.

> Respondent #1: "My produce will always be needed because it is a breakfast snack. Students need non–expensive breakfast."

> Respondent #3: "There are still people who eat my food. Every day, my food is sold out. As long as there are still people who will buy my food, I will still sell it."
>
> Respondent #3: "I serve those just like me."

While street vendors and fixed-stall sellers are more visible to police and security forces and thus unable to operate during the social-distancing periods, commuting sellers had more leeway to provide their services since they carry a certain amount of food per day.

Self–appointed alternative livelihoods

All interviewees have expressed their agency and autonomy in survival mechanisms. Fixed-stall sellers, who had little to worry about their residence and space to vend their produces, emphasize renting their places to street vendors as alternative sources of income in case of inability to continue street vending on their own. However, according to the respondents, the implementation of the law has not been constant and consistent, leaving them with hope for more possibilities to survive on street vending, despite acute awareness of its precarity. Informants consider their own livelihoods as precarious yet thankfully autonomous.

Solidarity is a critical survival tactic. Contacting each other about police's presence is crucial to avoiding fines. Most of them have sought to build a good relationship with local police if they tend to sell products at one stable place or to escape them, especially among itinerant sellers. At the same time, they have made efforts to improve the quality of their services. Connections are viewed as resources to mobilize economic sources as well as mitigate uncertainties that are deemed as inherent to street vending.

Agriculture–based livelihood is a backup plan for both commuting and migrant sellers, while early retirement was the only option for fixed-stall sellers in Hanoi. For them, the security is associated with a group of regular and reliable pool of customers that they are acquainted with during their active years and by word-of-mouth.

Their strategies include diversification of sources of income, also in the informal sector, in order to avoid overdependence on street vending. For example, respondent #1 makes available additional dishes to be eaten with sticky rice for breakfast and works as a cleaning lady on weekends. Respondent #4 works as a scrap collector when she is done with street vending. Respondents #5 and #9 serve as cooks for big family gatherings in the city. However, no termination of

street-vending work is in sight. Despite the precarity, they still associate street vending with a certain degree of stability.

Unlike common perceptions of informal work as low–paid and irregular (ILO, 2021), all the respondents acknowledge being able to make ends meet, thanks to street vending. For itinerant sellers, street vending provided opportunities for them to be an earner instead of being jobless by staying in their hometowns (Ngo et.al, 2019). Self–employed informal work, though offering limited financial returns, provides workers with a sense of autonomy and fulfillment (Markussen et al., 2018).

Their hope is to earn as much money to the best of their ability as street vendors in order to survive and to sustain their children's education, which, in turn, becomes a source of upward mobility in the future. In other words, investment in children's education represents their only hope for social upward mobility. In addition, all interviewees expect to have a break once they have grandchildren in order to take care of them while their children are at work.

The social connections that the street vendors have established open up different nonwork opportunities. For example, thanks to her student clients, respondent #1 became knowledgeable about affordable tutoring sessions that could help her children perform better at schools in Hanoi. Some street vendors have also worked as temporary helpers or cleaners for some of their regular clients. Connections are an indispensable and influential dimension of Vietnamese society. As a Vietnamese saying goes, "Connections is nothing but capital" (*Ngoại giao là vốn để dành*). Vietnamese people from all walks of life depend on social connections, to a varying extent, for personal and professional success (Luong, 2016).

Mobility does not only provide them with income but also things to kill time and see the life *(đỡ nhàn, nhìn đời).* All informants express disbelief in the consistent execution of state policies regarding street vending:

> Respondent #5: "They said they would ban us but have never really banned us. They seemed to be strict initially but then ease their control later."
>
> Respondent #8: "There are so many of us out here. They cannot ban all of us. Nor can they ban our clients from buying our produce."
>
> Respondent #1: "It is tough, but it is still doable."

Digital devices are essential in promoting their services, though their work is still strongly associated with their informal networks. All informants use mobile phones, yet only commuters and fixed-stall sellers are frequent internet users and have made use of digital contacts to promote their services to maintain contacts with their customers. Only three itinerant sellers kept in touch with their close clients via mobile phones.

Adherence to gender norms

Occupational sorting in Vietnam is strongly linked to traditional gender roles. For Vietnamese women, professional decisions are shaped both by economic needs and caregiving burdens (Chowdhury et al., 2019). All informants made reference to work and care as two pillars of their personhood. Even though their street vending is an arduous task and constitutes their main source of income, most of them refer to it as "odd jobs" or "running errands" (*việc vặt*), which they should do instead of their husbands, who are supposed to be in charge of bigger burdens (*việc lớn*) such as presiding over the household, contributing to communities, etc. This reveals the internalization of Confucian values, in which women are supposed to take a back seat to men within families.

However, the street vendors also embrace the state–constructed ideal of womanhood and motherhood, which emphasizes that women should fulfill the roles of both a resourceful worker and a caring mother. Since 1989, a state slogan was released, which still remains active in the state media, "Phụ nữ Việt Nam đảm việc nước, giỏi việc nhà" (Vietnamese Women: Accomplished at Public Work and Adept at Housework). Gender expectations play a role in their decisions to opt for street vending and even proceed with it in the long run. Itinerant sellers take a long break to go home to see their children; fixed-stall sellers emphasize that the ease of work–life balance speak volumes about their adherence to social norms of womanhood and motherhood. The flexibilities of informal work allow them to fulfill multiple gender–related responsibilities. Much of informants' income from street vending is spent on their children's education.

> Respondent #1: "I work like this as long as God allows me to, to feed my children and my grandchildren."
>
> Respondent #7: "This work suits me and allows me to raise my children. When I am sick, I can just spend time with them. If I work for a factory, I might be fired."

Some of the street vendors used to be breadwinners, but later on, this responsibility had been taken over by their children as they grew up and made

a greater contribution to the family households by participating in the formal workforce.

Conclusion

Precarity is the cause and consequence of informal work in general and street vending in particular. Deemed as unfit for the modernization vision of the city, street vendors have already been discriminated by the state even prior to the pandemic. In particular, they are excluded from operating their unregistered businesses at designated urban spaces, attending food safety training programs, and availing of social-protection policies. Despite the top–down restrictions on street vending, street vendors still found ways to ply their trade in the capital city and even consider their job relatively stable prior to the COVID-19 outbreak. Even though the state maintains a strong hand in individual liberty and livelihood, street vendors still found their own freedom and flexibilities in their uncertain informal self–employment.

The pandemic since 2020, with strident state directives to stay home, has put street vendors further at a disadvantage since their services have been completely stalled or suspended, with the exception of commuters who have been allowed to deliver food according to the city's guidelines. Itinerant sellers face more challenges due to restrictions on both intra– and intercity mobility. However, all street vendors perceive pandemic–induced restrictions as inherently part of the precarities that would become of them sooner or later.

Before and during the pandemic, the street vendors had strategized to navigate challenges. In order to sustain the jobs, they had unceasingly moulded, mobilized, and managed their social connections. By their own admission, they had been unable and unwilling to have their informal career formalized by the state. In fact, they did not even expect the government to play an active role in changing their lives for the better.

This study echoes previous studies—the precarity of street vendors in both low-income and social status. The street vendors were far from a homogeneous group. Instead, they were diverse and differently disadvantaged during and beyond the pandemic. Itinerant sellers turned out to be the most disadvantaged subgroup of street vendors since their services had been suspended and their return to home villages were not guaranteed while rent still had to be paid. As a result, they came up with differing choices of agricultural produce, location of service, and even customer base.

Owing to limited access to information, the street vendors, who had been always independent in financial terms, were largely oblivious to the state's relief package for freelancers during the pandemic in particular, as well as social-protection schemes available to them in general. Despite the pandemic–induced predicaments, they still insisted on proceeding with street vending since they were aware of their clients' needs as well as their ability to meet those needs.

Top–down career-transforming policies are largely stagnant and toothless, which street vendors refer to as "unrealistic," "inattentive to their needs," and "unsustainable" in the long term, given their age and inability to adapt to a fast–changing work environment. All of them foresee mounting challenges in getting back to work once the pandemic is over, yet they do not expect to rely on state support due to general lack of confidence in government policies. They do not possess the educational, monetary, and mental wherewithal to have their livelihood formalized by the state. On the one hand, informal workers were convinced that they could carry on to make a good living with street vending and were reluctant to embrace new skills. Nonetheless, they were well aware that local authorities had been slow in translating policies into action. All the street vendors had invested in their children's education in the hope of having a more secure future.

Limitations

This study is solely confined to female street vendors who provided varying services in the capital city, Hanoi. As a result, it is intersectional with female perspectives. Besides, due to the limited samples, it is difficult to claim any scientific representativeness. In addition, this study offers a retrospective rather than a prospective lens. It delineated street vending prior to and during the pandemic. This study is hence far from a predictor of whether policies towards street vendors will remain static in the years to come or whether street vendors will just continue to stay in the informal economy despite their claims.

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Required Skills for the Future Work of Persons with Disabilities: Perspectives of PWDs in Cambodia

Ponleu SOUN

Abstract

One of the megatrends of the Fourth Industrial Revolution that shape the future of work is new skills that need to be required. However, the extensive research on the future of work has paid little attention to the potential required skills for persons with disabilities. This study identified key required skills and barriers for the future work of persons with disabilities and examined the way in which they can realize those skills.

Technology has been heavily developing and evolving in the last decade, which hugely transformed the world. As a result of Industry 4.0, the digital economy—the full range of economic, social, cultural activities supported by the internet and related information and communication technology—is becoming common in developed and developing countries (OECD, 2012, p. 23). One of the megatrends of the Fourth Industrial Revolution, together with the digital economy that shapes future work, is new skills that need to be required (ILO & Fundación ONCE, 2018, p. 14). It is safe to say digitalization disrupted the job market by creating new jobs, destroying old ones, and altering the composition of existing jobs. Workforces who are quick to embrace digital skills have benefited from the trends. But workforces who are not connected to digital skills have lost out in the job markets (Manyika, 2017).

The required skills for future work in a digital economy have been extensively studied, but not the potential skills needed for the future work of persons with disabilities (PWDs). PWDs are among the most vulnerable groups whose employment rate is only half of the persons without disabilities (United Nations, 2019, p. 152). Access to secure, safe, and dignified employment is associated with social inclusion, social value, and greater quality of life for PWDs and their households (United Nations, 2018, p. 36). However, the division between the

digitally connected and disconnected workforces would further amplify social and economic inequalities in Cambodia.

Together with the ASEAN community, Cambodia has shown her commitment to increasing participation of women, people with disabilities, elderly, and youth in, including but not limited to, science, technology, engineering, and mathematics, or STEM-related careers by adopting policies, initiatives, and training on technological skills and digital platforms for these groups to facilitate their access to decent work (ASEAN, 2019).

However, little effort is seen to ensure that PWDs can be equipped with the required skills for their future work. This study is aimed at identifying key required skills for the future work of PWDs in the Cambodian context to gain a better understanding of disability employment in Cambodia and the changes needed to create a more inclusive future. At the same time, it is aimed at examining how PWDs can realize those new required skills. This research aims to contribute to a debate on a more inclusive approach to human-capital development to prepare for a digital economy from the perspectives of PWDs in Cambodia. This research gives voice to the experiences, knowledge, and observations of PWDs through in-depth semistructured interviews in an attempt to gain insight into their perspectives on required skills for the future work of PWDs in Cambodia.

Research questions

In essence, the research addressed the following questions:

- What are the skills needed for the future of work in a digital economy from Cambodian PWDs' perspectives?
- What are the barriers that PWDs face when seeking new skills for future work?
- How have PWDs addressed the barriers that they face when seeking new skills in preparation for a digital economy?

Disabilities definition

The United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) defined *disability* as an evolving concept that resulted from the interaction within persons with impairments and attitudinal and environmental barriers that hinders their full and effective participation in society on an equal basis with others (United Nations, 2008). *Impairment,* thus, refers to the physiological component (difficulties in mobility, seeing, hearing, and thinking for example) upon which attitudinal social and environmental barriers are constructed.

Methodology

This research employed a qualitative-research methodology, drawing on the combined strengths of desk-research review for secondary data mining and semistructured interviews with persons with physical disabilities in Cambodia. An extensive review of the existing report and literature was conducted to understand the required skills for the future of work in the digital economy and to inform the interview design. The review also allowed the researcher to learn the skill sets needed in a digital economy in a global and national context and the situation of PWDs in Cambodia in acquiring education and skills development for the future of work in a digital economy.

The purposive-sampling technique was used to select respondents who were interested in this project based on two main criteria, either (1) being a student or trainee who is currently studying/acquiring skills or (2) being an economically active person (either being employed or looking for employment opportunities). For these reasons, the majority of respondents tended to have an undergraduate degree or vocation training, which differs considerably from the PWD population as a whole. Due to time constraints and other limitations, this study only focused on the perspective of persons with difficulties in moving and seeing. There were 20 respondents who had common types of physical impairments, including loss of limbs, post polio condition, spinal fracture, gradual vision loss, and blindness. Respondents were found by asking each respondent if they could recommend persons with physical disabilities who might be interested in the project. This paper does not purport to represent the perceptions of the whole population of PWDs to required skills; however, it hopes to provide some insights from the in-depth interviews conducted and open a pathway for future studies.

The data collections from phone and Zoom interviews were conducted in the Khmer language. Each interview was recorded and then transcribed verbatim. It comprises four main sectors, which included the respondents' (1) awareness of the digital economy, (2) perspectives on skills needed for their future work, (3) perspectives on barriers in acquiring new skills needed, and (4) strategies in addressing those barriers from PWDs' perspectives. Key required skills identified by PWDs, barriers faced by PWDs in seeking new skills, and strategies to acquire new skills mentioned by respondents were examined through descriptive analysis.

The majority of respondents have difficulty in moving. Only eight of them are either holding or taking an undergraduate degree. It is worth mentioning that respondents who are either holding or taking undergraduate degrees have received the opportunity through scholarship supports (NGO, governmental, and

university scholarships) that cover tuition fees while living costs and other expenses were their responsibilities, respectively. Only four respondents have received vocational training. Moreover, seven respondents either received no formal education or quit primary school. The number of undergraduate respondents is large, given that the researcher received support and recommendation from different NGOs in the disabilities sectors to interview their staff who mostly enrolled in university.

What are the potential skills needed in the future?

According to the World Bank (2021), individuals will need four sets of skills to function productively in the economy of the future:

1. Cognitive skills, which encompass the ability to understand complex ideas, adapt effectively to the environment, learn from experience, and reason. Foundational literacy and numeracy as well as creativity, critical thinking, and problem-solving are cognitive skills.

2. Socioemotional skills, which describe the ability to navigate interpersonal and social situations effectively, and include leadership, teamwork, self-control, and grit.

3. Technical skills, which refer to the acquired knowledge, expertise, and interactions needed to perform a specific task, including the mastery of required materials, tools, or technologies.

4. Digital skills, which are crosscutting and draw on all of the above skills, and describe the ability to access, manage, understand, integrate, communicate, evaluate, and create information safely and appropriately.

According to the *Future of Jobs Report* (2020), the top skills and skills groups that employers see as rising in prominence in the lead-up to 2025 include groups such as critical thinking and analysis as well as problem-solving, which have stayed at the top of the agenda with year-on-year consistency. Newly emerging skills in the 2020 report are skills in self-management such as active learning, resilience, stress tolerance, and flexibility. In essence, below are the top 15 skills and their potential jobs for 2025 (World Economic Forum, 2020, p. 36):

- Analytical thinking and innovation
- Active learning and learning strategies
- Complex problem solving
- Critical thinking and analysis
- Creativity, originality, and initiative
- Leadership and social influence

- Technology use, monitoring, and control
- Technology design and programing
- Resilience, stress tolerance, and flexibility
- Reasoning, problem-solving, and ideation
- Emotional Intelligence
- Troubleshooting and user experience
- Service orientation
- Systems analysis and evaluation
- Persuasion and negotiation

In Cambodia, the lack of skills in the labor market has risen steadily in recent years in the digital era. Based on the employer-to-skills-needed survey conducted by the National Employment Agency (NEA) in 2018, 47.5% of employers stated that they experienced recruitment difficulties (NEA, 2018, p. 25-33), of which around 53.1% was caused by a low number of applicants with required skills and the lack of work experience or qualification (World Economic Forum, 2020, p. 36-41). A job seeker who does not possess the skills demanded by employers will find it particularly difficult to find a job, whereas improving the skills that employers are looking for will increase the possibility of getting jobs.

Dr. Heng's study on "Preparing Cambodia's Workforce for a Digital Economy" identified many skills needed in the digital economy in Cambodia, including content skills (ICT literacy and active learning), cognitive abilities (creativity, logical reasoning, problem sensitivity, and mathematic reasoning), process skills (critical thinking), and social skills (persuasion, emotional intelligence, and teaching other) (Heng, 2019, p. 9).

His study also shows that 71% of the surveyed firms say their staff have good technical skills but only 30% and 20% can say the same thing for soft skills and ICT skills respectively (Heng, 2019, p. 20). *Technical skills*, in his study, is referred to as the core competency of the staff for an accountant, teaching ability for a teacher. *Soft skills* are the personal attributes (interpersonal skills, problem-solving, teamwork, etc.) employees need to succeed in the workplace, while *ICT skills* are skills needed to use efficiently the elementary functions of information and communication technologies to retrieve, assess, store, produce, present, and exchange information and to communicate and participate in collaborative networks via the internet. Almost every employer acknowledges that searching for and hiring people with good soft skills and ICT skills is challenging.

Additionally, the surveyed firms believed analytics, online collaboration, and managing online-information skills would be important for their staff in the next

10 years regardless of their positions (Heng, 2019, p. 21). *Analytics skill* refers to the ability to develop, format, modify, and represent data using advanced spreadsheet formulas and functions to extrapolate trends and patterns. *Online collaboration skills* refer to the ability to use tools such as cloud storage, productivity applications, calendars, and web meetings. Whereas, *managing online-information skills* refers to the ability to search for, identify, evaluate, and communicate online data.

What is the current situation of PWD jobs and skills in Cambodia?

Although the statistics on job displacement of PWDs are neither available nor internationally comparable, it is fair to say that the labor-market participation rate of PWDs is significantly lower than that of persons without disabilities. PWDs are more likely to be in vulnerable employment, their jobs are very likely to be displaced, and they are likely to face difficulties in acquiring new skill sets for the future of work. In Cambodia, as in the case across ASEAN nations, PWDs have poor educational attainment, which restricts them to the unskilled and low-skilled segments of the labor markets. The rate of school enrolment of children with disabilities is half that of nondisabled children, which in the long term means they are less competitive as an employee (Kalyanpur, 2011).

The report on *Achieving Disability Inclusive Employment in Cambodia* in 2016 demonstrated a clear relationship between education level and type of employment of PWDs in Cambodia (Gartrell et al., 2016, p. 33-34). PWDs with incomplete or no primary-school education performed unskilled, poorly paid, or home-based work. For example, men with no education at all did unpaid agricultural work like farming or raising animals, home-based domestic work, or unskilled physical work in construction. Women with disabilities with no education were employed or worked as agricultural laborers. PWDs who had completed secondary school or high school were engaged in semiskilled work such as in handicraft work, in business, or in the service industry. University graduates were employed in skilled, wage-based work. For example, a man with visual disabilities is a government employee working as an English-language translator. Education level is a key determinant of access to professional, skilled, wage-based employment.

Findings

PWDs' awareness of digital economy

In general, respondents are aware of the digital economy that is happening within the country and around the world because digital transformation is self-evident, in which they have seen, engaged, and worked with in their daily lives. Additionally, in one way or another, respondents are also aware that digital transformation is causing old-skills loss, current-skills changes, and new-skills adoption for the future of work. As technology is moving forward, respondents in this research have felt the impact of the digital transformation on the lives and careers of PWDs in Cambodia. Many respondents observed that unskilled and semiskilled labor in the country have lost their sources of income because of the rapid growth of technology and expanded globalization, and PWDs are among the most vulnerable groups whose careers and skills will be likely to be of no use shortly. A former electronic-maintenance trainer in a vocational training center of PWDs in Cambodia shared the following observation:

> In the last 10 years, the majority of PWDs would rather go to NGOs providing vocational training for informal education rather than public school. Women would be equipped with handicraft skills, while men would be equipped with electronic maintenance skills including repairing Television, Radio, and Telephone. But now most of those skills are not used. People now just throw the broken device away and buy a new one because the cost of repairing is almost the same as buying a new one.

However, respondents who have been working in a social enterprise in the area of the handicraft sector felt optimistic about their current skill sets even though their products need to compete with imported ones, which are relatively cheaper. An owner and founder of a social and environmental enterprise with all its employees having physical impairments shared his view:

> I don't think the handicraft skills of PWDs will be in danger; instead, PWDs will be getting more convenient and productive in performing their tasks, producing their product, and engaging with customers. As an environmental and social enterprise, the majority of our customers are foreigners who give high value to handmade and PWDs' works. With the help of technology, we can extend our market to foreign countries.

Regardless of his optimism, the question still arises whether the career of PWDs in the handicraft sector will last when handicraft is their only skill while technology has been heavily shaping the world of work very fast from time to time.

PWDs' perspective on the skills needed for the future of work

The respondents have identified many skills needed for future work, including but not limited to English language skills, digital-related skills, ICT skills, computer literacy, online sale/marketing/advertising, entrepreneurship skills, etc. English language and digital-related skills are mentioned by the majority of respondents and are considered as accelerators in boosting productivity and ensuring the sustainability of other skill sets that PWDs are currently obtaining. A director of a local NGO working on the independent living of PWDs believes that PWDs who could equip themselves with the English language and digital-related skills will not be cut off from the future of work, saying that:

> The English language is used internationally. For example, if a car repairer can use English language and has a sense of digital literacy, he can keep on improving his ability of car maintenance through self-learning from YouTube and other platforms despite the ongoing car evolution. The same thing goes to PWDs in the handicraft sector, they can learn a lot from YouTube and other platforms if they know English and can take advantage of digital technology.

The positive perception of PWDs in acquiring English and digital-related skills for future work is also drawn from the fact that most of the work nature in Cambodia now has been transformed into a digital world as a result of the COVID-19 pandemic. The program manager of the above-mentioned organization shared her experience working with PWDs during the pandemic:

> I think PWDs in Cambodia need to acquire English languages and digital-related skills. When they have these skills, they can use Zoom meeting, Google Drive, and Google Meet which is very common now because of COVID-19. I think the ability to use English and digital technology can also help them to become, for example, data entry clerks, security camera checks, and control centers.

While English and digital literacy are generally viewed as ground-based essentials, respondents also see the importance of combined strength of computer literacy, online sale/marketing/advertising, and entrepreneurship skills, given that owning an SME or online business is the most ideal goal from their perspectives. Being an entrepreneur has been viewed widely and differently, ranging from being self-employed to owning a business and starting up small-medium enterprises (SMEs). An IT-major sophomore with difficulty in seeing shared his plans:

> I am looking forward to acquiring online sale/marketing/advertising and entrepreneurship skills [ability to manage a business] so that I can import technologies and electronic products and devices and start an online business which is very popular in the present and in the future.

It is worth mentioning that small online business is quite popular in Cambodia currently, given that the government has not yet strengthened the business registration and taxation laws in the digital market. Nevertheless, the government of Cambodia is currently drafting the law on online business, so another question arises whether PWDs will be better off in acquiring those skills and starting an online business in the long run.

In addition to the above-mentioned skills, there are particular skill sets that respondents believe are needed for the future work of PWDs in Cambodia. These skill sets include ICT literacy, apps control, program control, data control, page control, internet of things (IoT), sales and marketing, videography, translation, management, law, mechanics, and information technology. A group of soft skills such as interpersonal skills, self-confidence, leadership, and communication is also believed to be very important for PWDs to obtain for future work. A project manager of a disability organization with 10 years of experience working on developing skill sets for PWDs in Cambodia said,

> The very first thing I want to see from PWDs at the grassroots is confidence. PWDs seemed to have less self-confidence and leadership for their own lives. They do not believe in themselves, and they depend on their family [members] for their livelihood. In the future, I still believe confidence and leadership skills are very important for PWDs to get good jobs.

Barriers in acquiring new skills needed for the future of work

Based on the semistructured interviews conducted, there are various barriers identified by respondents that PWDs are facing in seeking skills and acquiring new skill sets for the future of work. Difficulty in enrolling in formal education, poverty, and lack of information are among the most common barriers faced by respondents regardless of their physical-impairment types. Because of the poor infrastructures, including inaccessibility to public transportation, lack of disability-friendly school buildings, and limitation of an inclusive education system, PWDs need to put extra effort and require a helping hand from their family so that they can go to school. A fresh graduate majoring in accounting and administration recalled her experience while studying:

> I have a severe physical disability type [calcium deficiency in bones and polio] in which I cannot move without a wheelchair. My father was the one who brought me to school, carried me to class, and picked me from school from when I was young until I graduated with a degree. [Compared to other PWDs] I am the lucky one, but I think this difficulty is still a barrier to the majority of PWDs in Cambodia.

Below is a sharing from a program officer who did not hold any degree in formal education yet received a scholarship to study leadership skills in Japan for one year in the last 10 years:

> The hardest decision that I have ever made in my entire life was to stop going to school after I finished primary school. It was because school [secondary and high school] was too far from my home, and my parents needed to work so that they could not bring me to school. So, I decided to quit and did the housework.

These might explain why the majority of PWDs tended to have maintenance, handicraft, and other semiskilled labor provided by NGOs and development partners. Banteay Prieb and Watthan Artisans Cambodia, for example, provide vocational training in various areas ranging from handicraft to technical skills to PWDs every year. After one or two years of training, a trainee would become a member of the semiskilled workforce so that they could work on their own. However, there are very few organizations and centers that are still providing semiskilled training to PWDs, and there are not so many organizations and training centers that provide transferable digital and technical skills to prepare PWDs for the future of work.

In addition to the above multifaceted barriers that constrain vulnerable groups of PWDs from receiving formal education and seeking skills needed for their profession, discouragement, lack of emotional support, poor and expensive internet service, and limited opportunities are identified by respondents as major barriers that needed to be addressed to create an inclusive society for everyone. Encouragement and emotional support from family play a very significant role in pushing PWDs to go forward with acquiring skill sets and aspiring for a career; however, PWDs are often discouraged, victimized, and traumatized that they lack confidence in realizing their full potential. A woman who has worked for a social enterprise where she got trained from expressed that the "lack of emotional support is one major challenge I have faced, my parents and relatives usually said even if I had a degree, there would not be any institutions that need me to work for them."

In addition to poor barrier-free physical infrastructure, Cambodia has high internet prices yet poor internet service compared to other countries in the region. An IT student from Kampong Cham province who has been using YouTube to learn some new skill sets, including videography, English language, and online sale/advertisement/marketing, talked about his difficulty in paying for internet service fees, "My major challenge now is internet expense. Given the situation of learning from home [because of the pandemic], I need to spend up to USD 15 for internet service fee every month."

Another student majoring in IT from the same province shared his experience in having limited opportunity to obtain soft skills in the area of leadership, networking, and management:

> There are a lot of learning opportunities in Phnom Penh [capital city]. But it is very limited in the province. Because of COVID-19, there are quite many webinars, workshops, and training on soft skills conducted online, some of them are free, some are not. So sometimes I can join and learn, but sometimes I cannot.

Strategies used to address barriers

Despite the above-mentioned barriers, there are certain strategies used by respondents that they believe could help PWDs acquire new skill sets and upskill their competencies. Those strategies included, but were not limited to, working for tacit knowledge, joining PWDs self-help groups, doing an internship, and seeking support from a disabilities support organization.

The owner and founder of a handicraft enterprise shared his positive perception towards "working for experience" and believe that it would always be helpful and useful for PWDs in acquiring new skills needed for future work in the digital economy:

> I have received handicraft training from a local social enterprise working for PWDs in Cambodia called Watthan in the last 15 years, then I worked for them for five years to gain experience in the handicraft sector and to earn some skills such as entrepreneurship, marketing, and sale. The same thing goes to youths today who wish to gain their aspired skills and career, they should find a good place where they can work at the same time gain knowledge and skills they want if they could not receive formal education.

A project assistant of an independent-living organization shared her experience and belief that a self-help group of PWDs is very important for her in gaining

knowledge and skills that she did not receive from the school. She also believes that she would gain other skills needed in the digital economy through self-help groups. "Through disability networks and self-help groups, I got to learn public speaking, debate, and leadership skills. Now, we are looking forward to improving our digital skills with the support of local NGOs and development partners."

An internship is known as a very professional strategy in acquiring skill sets for future employment and in preparing PWDs for the work market. It demands companies to give competent graduate PWDs an opportunity. However, employer recruitment decision making in the hiring process focuses on competency, skills, and ability. PWDs thus need to have relevant skills, knowledge, and education as the foundation of labor-market competitiveness. If any potential employee—with or without disabilities—does not offer a particular skill set to an organization, they are not attractive to employers. However, another question arises—what would happen to PWDs who do not have the competency, education, and ability to be attractive to employers? Will they need to be trapped in unskilled and semiskilled work?

Conclusion

In conclusion, there are many potential skills needed for the future work of PWDs identified by respondents with physical difficulties in Cambodia in which those skill sets ranged from technical skills to digital-related and soft skills. English language, online sale/marketing/advertising, digital literacy, and entrepreneurship are believed to be very useful for their future career and business in one way or another. Though acquiring new skill sets may cost them something more than effort, the majority of them have identified and explored many possible ways.

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Appendix A

Table 1. Demographic characteristic of study sample

Respondent demographics		Frequency
Gender	Female	12
	Male	8
Age	18 – 24	5
	25 – 34	8
	35 – 44	6
	45 – 54	1
Type of physical disability	Difficulty moving	16
	Difficulty seeing	4
Respondent's location	Phnom Penh	10
	Kandal	6
	Kampong Cham	4
Education background	Graduate degree	1
	Undergraduate degree	8
	High school	0
	Primary school	5
	Vocational training	4
	No formal education	2
Current occupation workplace	Student	5
	SMEs (handicraft)	5
	NGOs	8
	Business corporation	2

A Work Style Revolution in Japan: The Case of Fujitsu

How the Shift Away From Office-Based Work as a Result of the COVID-19 Pandemic Impacted the Corporate Culture in Japan

Martin FRITZ

Abstract

The paper will examine the initial impact of this digital transformation on Japanese IT-services provider Fujitsu's work performance and work-life balance. One question will be whether and what new skills are required from employees and managers. Based on selected interviews with employees and managers, the paper will analyse the advantages or disadvantages of the transformation for employees as well as for managers and the company. Finally, the article will attempt to judge whether Fujitsu's shift to working from home could provide a model for a general improvement of working style and work-life balance in Japan.

A Pandemic Shock

Starting from spring 2020, several waves of infections with the new coronavirus SARS-CoV-2 forced the central government of Japan to repeatedly declare a state of emergency. Besides the voluntary measures in public spaces like wearing face masks, measuring body temperatures at entrances, and increasing the use of disinfectants, the government relied on two main strategies to limit the spread of the virus. One, bars and restaurants had to close early and to not serve alcohol. Two, companies were asked to introduce work-from-home arrangement and to increase the share of employees working remotely.

The sudden demand for more *telework*, known as *remote working* or *work-from-home,* in Japan sent shockwaves through the corporate world of the nation. Many companies struggled mentally and technically with this sudden and radical change

of work style. Unsurprisingly, the official goal that 70% of all companies had teleworkers was, therefore, never within realistic reach. The Tokyo Metropolitan Government even aimed at a 75% reduction of the number of commuters. Nevertheless, according to surveys, up to 25% of all companies and up to 48% of large enterprises had at least some employees working from home.

However, some companies utilized the pandemic as a catalyst to modernize their internal processes. One of the most radical examples was set by the IT-services provider Fujitsu Group. Since the introduction of a reform program called Work Life Shift in July 2020, the 80,000–group employees in Japan work mostly from home. Consequently, Fujitsu plans to reduce its office space by half until March 2023.

The company conducted several internal reviews and surveys among employees to analyse the actual behavioural changes, assess the degree of contentment among employees, and adopt working conditions accordingly. This paper presents some preliminary results of the reviews and examines Fujitsu's pioneering experiences. The analysis justifies the conclusion that Fujitsu may have set a beacon example for Japan's corporate world on how to revolutionize the working style smoothly and successfully.

Traditional Office Workstyle

The scale of the transformation caused by the pandemic should not be underestimated because the corporate culture in Japan basically offers almost no room for working from home. Traditionally, managers and workers in Japan strongly believed that work has to take place in the office to be considered "proper" work. Consequently, companies correlate the diligence of their employees to the amount of time they spend at their office desk. This thinking causes employees to accumulate huge amounts of overtime but without higher productivity. As one expatriate manager put it, "The process is more important in Japan than the result." Also, most employers reimburse the expenses for the train commute to the office. Due to this policy and the huge size of the metropolitan areas, Japanese employees spend on average 80 minutes per day traveling to the office and back.

Additionally, the traditional employment style in Japan is based on the expectation that an employee stays with an employer until retirement. This custom also impedes telework, particularly at large enterprises—they hire new employees as generalists and rotate them for on-the-job training around different departments every three or four years, which requires physical presence. Often, such employees are temporarily transferred to other branches within Japan not for operational reasons but just to gain more experience within the company.

Japan's work style is characterized by the strong conviction that all business requires personal relations and thus needs to be conducted with physical presence. One formal expression of this belief is the ritualized exchange of business cards at the beginning of meetings. Another outcome of the Japanese office culture is that documents are printed out, faxed, rotated around all involved workers, and stamped by them with a personal seal called *hanko*. During the pandemic, even employees working from home had to commute to their downtown office at least once a week to put their hanko on the documents they were supposed to see.

The Work-Style Reform

Already several years before the pandemic, the Japanese government had concluded that the working population has to grow to maintain the national wealth level and the living standard. This new thinking was caused by the quick ageing of the population and the accompanying shrinkage of the workforce. A higher employment ratio, even without higher productivity, would stabilize the gross national product and support the social security coffers. The strategy consisted of two elements: (1) more women and more senior citizens have to go to work and (2) 345,000 working visas for 14 industries will attract foreign labourers to Japan.

During the 2010s, these changes were already taking place. The rate of female employment rose steadily and reached records, but the level is still below Western Europe. Also, more employees stayed in the workforce beyond their company's pension age (currently often at 60 years but rising) and beyond the state pension age (which slowly rose from 60 to 65 years until 2020). Besides, the number of working foreigners increased by about 50%.

But the government realized that the traditional work environment and style limited further growth of female, elderly, and foreign employment. For example, mothers cannot work until late evening as they have to tend after their children. Thus, work surrounding needed to become more attractive and convenient. Also, about 40% of all workers are employed on a contract or part-time basis with a much lower pay than fully salaried employees. Housewives with grown-up children would not join the workforce for such little pay. As a result of these insights, parliament passed a package of laws called *work style reform* (*hataraki kata kaikaku*) to remedy these shortcomings of the labour market. The provisions of the law package started to come into force from April 2019.

One law limits the overtime to 720 hours per year and obliges companies to ensure that their employees take at least five vacation days. Companies that fail to

abide by this rule will be fined up to 300,000 JPY per employee. The changes were seen as a major step forward in a country notorious for exhausted salarymen and even death from overwork, known as *karoshi*. Another law introduced the general rule "Equal pay for equal work," intending to reduce the dichotomy of the labour market in salaried and contract workers. Employers must now treat both groups equally and explain the existing differences to their temporary workers.

However, this ambitious work-style reform never challenged the belief that work has to take place in the office, although telework would make joining the workforce easier and more attractive. That this idea never came up illustrates the strength of belief into office-based work. Even after more than one year into the pandemic, no politician of the two ruling parties had ever suggested legal measures in favour of more work from home. Instead, Prime Minister Yoshihide Suga preferred to speed up digitization. A new agency for digitization to be set up in autumn 2021 will be in charge to create an online version of most public services. Most requirements for the use of hanko stamps will be abolished, and digital seals are to be approved. The Suga government may hope that an improvement of digital infrastructure would create the foundation for more employees working remotely. But it never made such a statement. Hence, the task of shifting to telework has been entirely left to private enterprises.

The Case of Fujitsu

Fujitsu describes itself as "the leading Japanese information and communication technology (ICT) company" and employs about 130,000 people worldwide—80,000 of them in Japan—with consolidated revenues of 3.6 trillion JPY (27.7 billion EUR) in the fiscal year 2021. Already before the pandemic, CEO Takahito Tokita had announced plans to transform Fujitsu from an IT company into a DX company. DX stands for *digital transformation*. The company introduced remote working in principle in 2017 and started to develop and offer the necessary digital solutions and tools also for customers.

The restrictions on working life due to the pandemic accelerated the implementation of this transformation. In July 2020, Fujitsu announced the ambitious campaign, Work Life Shift, to redefine working styles for its employees in Japan. The company promised a "more empowering, productive, and creative experience for employees to realize their well-being." The press release stated the target clearly, "This latest initiative will mark the end of the conventional notion of commuting to and from fixed offices, while simultaneously granting (employees) a higher degree of autonomy based on the principle of mutual trust."

Fujitsu pursues three objectives with this transformation: (1) a fundamental shift to remote work should lead to a more productive working style with increased business competitiveness and even new service and product offerings, (2) a redefinition of work from "spending time at a desk in the office" to a performance- and result-based concept of work, and (3) a transformation of corporate culture from the traditional hierarchy to a more Western management style.

Smart working

Since July 2020, about 80,000 Japan-based employees (excluding those in manufacturing) do not have to go to the office, with flexible working hours for everybody. The support for commuting expenses was reduced, whereas remote work received additional financial help. The previous practice of sending employees to other locations, which resulted often in their separation from partners and family, was being replaced as far as possible by teleworking and business trips. Fujitsu also allowed employees to move to faraway locations if they have personal reasons such as family care or the transfer of a spouse.

Borderless office

Instead of working from a fixed office, Fujitsu is introducing a seamless system that allows employees to freely choose the place they want to work, including from home, hub, or satellite offices, depending on the type of work they do. Hub offices are being set up in different areas of the country with each office having a defined main function such as the demonstration of cutting-edge IT systems, showcases or collaboration with customers. Satellite offices were upgraded with multisite video-conference systems by September 2021. By March 2023, the company will completely switch to a *hot desk* system and reduce its office footprint by about 50%.

Culture change

Fujitsu aims for a new style of management "based on employee autonomy and trust to maximize team performance and improve productivity." The company promises to optimize working styles by continuously listening to the voices of its employees. It will also leverage a digital platform that visualizes and analyses working conditions. Also, Fujitsu will implement a job-based personnel system for regular employees and train all employees to enhance one-to-one communication between supervisors and subordinates.

Fujitsu facilitated the shift to telework with the introduction of new technologies. All group employees utilized communication tools like Microsoft Teams and the

internal social media software Yammer. The Workplace Innovation Zinrai for 365 Dashboard displays work content using artificial intelligence to facilitate further improvements in productivity and the quality of work. A location-based platform that uses internet-of-things technology visualises the movement of people and objects.

Results of Internal Reviews

Corporates and media in Japan reacted overall positively to the Work Life Shift initiative of Fujitsu. More than 150 Japanese companies and organizations, among them Asahi, SMBC, Kao, Mitsui, NTT, and the Ministry of Justice, made inquiries at Fujitsu about the promotion of telework and experiences with the new policy. The huge public interest led to 32 interviews and 23 lectures by company representatives, according to the company's count.

The implantation of remote working went well. At the start, Fujitsu abolished the concept of a core working time during which all employees had to be on duty. In most offices, this core time used to be fixed at 10:00 AM to 2:00 PM. "Setting a core time makes flexible working hours impossible," explained Manabu Morikawa, head of the Corporate Human Resources Office (CHRO). By October 2020, only three months after the reform, the share of employees who did not observe any core work hours had jumped from 65% to 94%. At the same time, 88% of all employees cancelled their monthly rail pass for the commute between their home and the office, and only 12% kept their pass.

Before the pandemic, already 48% of Fujitsu employees were at least partly working from home. During the first state of emergency in April and May 2020, this share doubled to 90%. Just 10% of all employees showed up at the office. After several more state of emergencies, the teleworker share evened out at 80% by summer 2021. Asked about the development after the pandemic, Morikawa said that Fujitsu expects a permanent teleworker proportion of 60%.

Another interesting development concerned employees working and living separately from their families due to a temporary transfer within the company. Under the Work Life Shift program, they were allowed to return to their home base and work remotely from there, with regular brief business trips to their former office if they wished so. Within six months, 574 out of 1,909 such employees at the core Fujitsu company shifted to working from home. By June 2021, about half of them had returned.

For the 4,292 such employees within the whole Fujitsu Group, almost 19%, or 810, opted for telework in their home by the end of 2020, increasing to 1,000, or

22%, by June 2021. “We were surprised by the fast change, especially considering the preparation time for moving back,” Morikawa commented. In an ideal environment, the number of such transfers would be reduced to zero, but some jobs are not suitable for telework and have to be conducted on location, he added.

According to a survey from November 2020, among 28,910 Fujitsu employees, 27% felt that work from home had increased their productivity, 47% saw no change, and 25% said they were working less productive than before. “We judge these results as a confirmation of our reform because only a quarter of questioned employees see a deterioration of their performance,” said Morikawa.

To put these data into perspective, Fujitsu conducted the same survey among the employees of several other companies that had switched fully to work-from-home. Only 18% of their employees called this shift an improvement, 34% saw no change, and 48% noticed a deterioration, almost twice the ratio than at Fujitsu. “We explain this significant difference by the fact that Fujitsu had started to introduce telework already in 2017,” Morikawa argued. “Employees had already made some telework experiences.”

Nevertheless, Fujitsu’s HR managers feared an unhealthy increase in overtime as a result of working from home because employees may feel under pressure to work more. But compared to May 2020, before the reform, the average monthly overtime increased only by 0.9 hours, or 3%, to 27.5 hours. “We think that some employees had to develop new working methods, for example in sales or research and development,” Morikawa explained the increase. Hence, he hoped that their overtime will decrease in the future.

However, he mentioned managers as an exception. In the survey from November 2020, 19% of managers reported an “increase” and 20% a “slight increase” of their hourly workload. In comparison, only 9% of regular employees talked of an “increase” and 16% of a “slight increase” of overall working hours. Fujitsu has not identified a clear cause for this difference because the trend persisted unabated into 2021, according to the supervision dashboard for managers introduced in January 2021. (The software calculates the workload of managers through computer log-on and log-off times.) “We suspect that the introduction of anti-pandemic measures forced managers to work more,” Morikawa said. For example, the management was in charge of the company-vaccination program for employees. Thus, the workload of managers may only decrease after the pandemic, he suggested.

Two case studies

Ms. Yuka Ogisho (31), married, mother of a two-year old girl, tells her Fujitsu telework story in her words:

> I was among the early adopters when Fujitsu introduced working from home. The start was quite slow because managers considered organizing teleworkers as difficult. Things moved quickly, though, as the pandemic demanded drastic measures. I was surprised: If something really has to be done, it will work out. Now, I am visiting "my" Fujitsu office only once a month. My workday is quite simple: My daughter spends her day in the child care centre, my husband works in the office and returns home in the evening. We talked a lot during my short maternity leave and decided to evenly share household work which is still quite rare in Japan. Initially, I felt telework a little stressful. In the office, no manager and supervisor checks what you are doing on your laptop. But as a teleworker, I thought I needed to make my performance visible. But Fujitsu uses many IT tools like group chatting and time management. Such applications help me to manage and schedule my tasks. At the same time, we can see what the others are doing with their worktime. The big advantage of telework is that I do not have to commute to the office anymore. These two hours which were lost before I now use to work, do household chores, and play with my child. It is really a "Work Life Shift". The biggest disadvantage seems to me that you have to organize a discussion. In the office, it happens more spontaneously. Finally, some improvements are also possible. For example, we are still mainly busy with shaping work instead of focussing how to improve the lives of employees without giving a bad influence on the team and customer relations. Finding this balance still seems to be quite a challenge.

Mr. Shohei Inoda (36), married with two children (five and seven years old), describes his telework experiences as mostly positive:

> Only every two weeks I spend a day in the company office. Now, I spend more time with my family, the work-life balance improved. My productivity has increased. I have no statistical proof but without the daily long commute, I feel less stress and have more energy and concentration to focus on my tasks. I have adapted to the "strange" situation that me as the husband is at home, although working, whereas the wife, traditionally located in the house, is working outside. I consider these circumstances to be very good. My role model as a male Japanese has not really changed. Fortunately, I had worked some time in Australia

and experienced there that it does not matter whether the husband or the wife runs the household and raises the children. My wife and myself already shared all household jobs among us even before the two children were born. Now, that I am much longer at home than her, I can even more flexibly contribute to the household chores. One small problem was that we only have three rooms besides dining area and kitchen. We solved this that we as parents sleep together with the kids. This means that one room is reserved for my work. Normally, I finish work at 6 or 7 pm, do some households stuff, eat with the children and put them to sleep. If there is any work left for the day, I return to my home office by 9 or 10 pm to finish the job. Of course, we would be in space trouble if my wife also had to work from home. Finally, I noticed two challenges with telework: One, there are fewer opportunities for gossip and conversations which sometimes create new work-related ideas. Second, no commute also means that you do not walk. You have to compensate for this by consciously doing some physical exercises.

Analysis of Fujitsu's Experiences

The survey results and employee testimonies indicate a success of Fujitsu's Work Life Shift program. "By choosing this term, we wanted to go beyond just improving the 'work-life balance' and emphasize the shift from work to life," Morikawa explained. The CHRO head voiced optimism for the future, "As telework pioneer in Japan, Fujitsu wants to enable employees even to live in rural communities outside of the Tokyo area. The location and timing of work will become more flexible, and with such trends, society will also change."

However, other companies may not be able to easily replicate this success. One cannot ignore the fact that conditions and circumstances at Fujitsu were especially conducive and favourable for telework. First, Fujitsu easily mastered the technical challenges because it had the necessary resources as an ICT company. Personal laptops, wireless networks, videoconferencing systems, and other infrastructure were already mostly in place when the program began in July 2020. Other companies have to build this infrastructure from scratch.

Second, Fujitsu began to introduce telework three years ahead of the pandemic. Therefore, employees already viewed this shift as a principal company policy and not as a temporary emergency measure caused by the pandemic. As a result, they were more willing to accept and embrace the shift to telework and the changes coming with it.

Third, Fujitsu adopted telework not only to improve the general working conditions of employees but with the strong intention to develop and commercialize new services, products, and technologies for digital transformation. Fujitsu's widespread telework application and experience are supposed to improve the quality and scope of such services and products. From the viewpoint of customers, the company's experience with telework increases the credibility and trustworthiness of such products and services.

Outlook for Japan

Will telework become a permanent feature of the post pandemic new normal in Japan? Some examples of large companies seem to confirm such a prediction. For example, the desks at Mitsubishi Chemical's new head office are now only sufficient for 60% of all employees. The tire-maker Bridgestone slashed its office attendance rate to 30% and started consolidating its offices in Japan from 47 to 34. The carmaker Honda introduced work-from-home allowances and abolished monthly commuter-train stipends. Hitachi allows employees to come to the office just two or three days a week. Yahoo Japan, operator of the largest search and services web gateway, vacated 40% of its Tokyo office space by November 2021. During the pandemic, 90% of Yahoo's staff worked remotely.

In a survey by the human-resource tech company Ashita-Team in January 2021, as reported by the *Nikkei Asia* magazine, 74% of 300 questioned employees of small and midsize companies said they would prefer to continue working remotely. But 41% expected that telework would not continue in 2021. This prediction came partly true—data of the Japan Productivity Center showed that the proportion of teleworkers between January and March 2021 remained at around 20% despite a second state of emergency. At the end of the first state of emergency in May 2020, this share had stood at almost 30%.

The forces of resistance are multiple and strong because, as explained earlier, telework is hardly compatible with the traditional work style in Japan. "Managers, especially those who are aged and allergic to tech operations, respect in-person communication," said Ashita-Team's CEO Hiroyuki Akahane. The background: these managers began their working life in the "demographic dividend phase" (1960s to 1980s), when labour was plentiful and cheap, and the longer employees worked, the more money the company could make.

Anecdotal evidence seems to prove that "patchy" teleworking—some employees work at home, but others stay only at the office—did not last long in many companies. Some remote-working employees felt sidelined and started to return to their office desks. Strong feelings of attachment to their company

and the longing for the former togetherness with colleagues also seem to have caused many employees to give up remote working once the pandemic pressure decreased.

"Japanese work processes are based on rigid protocols, personal interaction, constant training on the job, and group communication, all of which more suits in-person works," Parissa Haghirian, a management expert at Tokyo's Sophia University, told *Nikkei Asia*. Besides, many companies lack the tools to organize larger projects with many teleworkers and call them back to the office. Often, small and midsize enterprises, which dominate the corporate landscape in Japan, do not introduce telework at all because of the high costs of mobile tools, software, and training.

However, the widespread telework experiences during the pandemic may still have a lasting impact on Japan's work culture. For example, the use of telework might mitigate the practice of transferring employees regardless of their family needs to far away offices for several years. More importantly, by offering a choice of work style, including the option of telework, companies may gain an advantage when competing for talented staff in a labour market with many job vacancies. Many employees have now experienced a work life without daily long commute and may switch jobs to companies offering the option of telework.

Already, a trend to "Japanize" telework can be observed. Traditional behaviour in business and office is being transferred to the virtual world—for example, the exchange of business cards. Participants of video conference can superimpose a QR code to their background image that contains the equivalent contact data of a business card. The other conference participants scan the QR code to store this virtual card on their smartphones. Also, the software FAM Office of developer Fujisoft simulates the classic communication in the Japanese office, where employees sit very closely to each other. The software displays a virtual copy of the company's office layout. Each employee is represented through an individual avatar who can chat with its neighbours as if everybody is sitting in the office.

Future research may have to assess the middle- and long-term impact of more telework on the labour-market segmentation. During the pandemic, salaried and temporary staff were often both allowed to work from home. But in the coming new normal, work from home may either lessen or aggravate the gap between the two groups. These developments will probably depend on whether and how companies are reorganizing their workforce. Additionally, the pandemic delayed and distorted the work-style reform mentioned above. Hence, there has been no clear indication so far whether the law package will drive female, elderly, and foreign employment further up and in which way telework may influence these trends.

The Real Fujitsu Lesson

Despite such trends supporting the spread of telework after the pandemic, Japan's corporate world may need to learn the real lessons taught by the Fujitsu strategy. The telework pioneer has mainly succeeded in its goals because it viewed the introduction of telework not as a logistical or technological but as a managerial issue. Put in another way, Japan's office-based corporate style and telework are incompatible to such a large extent that management basics have to change for a successful switch to telework.

This insight caused Fujitsu, as already described further above, to simultaneously switch from a spending-time-at-the-office-desk to a performance- and results-based concept of work and to introduce a more Western-style management. Only under such changed circumstances can managers rely less on in-person contacts and "grant employees more a higher degree of autonomy based on the principle of mutual trust," as Fujitsu officially stated.

Consequently, in April 2020, Fujitsu introduced job descriptions for 15,000 of its management-class employees. "Bosses have to know in advance what responsibility and output can be expected of each staff member," Morikawa explained. So far, job descriptions are almost nonexistent in Japanese companies. The work area of employees often overlaps with others. This fosters team unity but causes mutual reliance at work. By defining responsibilities more precisely, employees will achieve their work goals more independently without as much communication as before. This change facilitates telework.

Hence, the lesson of Fujitsu reaches far beyond the high proportion of teleworkers. Rather, the introduction of telework demands a fundamental rethinking of the traditional management style. This insight is the real reason why Fujitsu may become a beacon for Japanese corporates on how to modernize their management and work style through telework.

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