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Fukunari Kimura, Rashesh Shrestha, and Dionisius Narjoko

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The Digital and Fourth Industrial Revolution and ASEAN Economic Transformation

Fukunari Kimura,
Rashesh Shrestha,
Dionisius Narjoko,
Economic Research Institute for ASEAN and East Asia

The vision for the Association of Southeast Asian Nations (ASEAN) economy in 2040 is one of a competitive, integrated, and digitally interconnected ASEAN characterised by (1) widespread adoption of modern technologies, including by micro, small, and medium-sized enterprises; (2) cross-border collaborative production networks supplying goods and services globally; (3) productive, innovative, and modernised agriculture, manufacturing, and services sectors; (4) a highly skilled and adaptable workforce; and (5) a flexible labour market, all of which is enabled by advanced infrastructure and smart regulations.

I. Implications of Modern Technology

Technology is rapidly transforming the economic landscape around the world and in ASEAN. As always, we should welcome new technologies as a blessing rather than a curse and utilise them effectively for our economic development. In developed countries, the 'disruptive' nature of technologies tends to be emphasised. People worry about a situation in which machines would substitute humans in various economic activities. With slow economic growth, industrial adjustments and labour

replacements may well be costly in developed countries. But ASEAN is different. The economies of the ASEAN Member States (AMS) are steadily growing. Most of the AMS still have a young population who are growing up in a technological age. People do not have to stick to their current jobs and are willing to switch to better jobs. We can think of growth rather than adjustments. Our strength resides in our adaptability.

We cannot predict exactly what would happen by the year of 2040: there is much uncertainty about the advancement of new technologies and its consequences. And we must realise that most of the AMS are not at the very frontier of technological innovation. Thus, the question for us is how to utilise new technologies for our economic development and accelerate our catching-up.

Broadly, AMS will need to enhance their existing comparative advantage by encouraging purposeful adoption of technology, which will generate high-value employment. For AMS with high wages, this means aggressively switching to labour-saving technology, retraining their workforce, and moving up the value chain. Others need to continue infrastructure development, domestic reforms, and trade liberalisation to attract labour-intensive production processes, while gradually modernising the production processes by adopting Industry 4.0. At the same time, they can also exploit the potential of third unbundling to create dynamic modern sectors.

Concurrently with technological changes, the ASEAN economy itself continues to grow. With higher incomes, consumers demand greater variety and higher quality goods and services. Modern technology, coupled with greater physical connectivity, will enable them to source these goods from anywhere in the world. The challenge will be to ensure that ASEAN producers are positioned to meet these demands cost-effectively by producing innovative products and adding greater value. Micro, small, and medium-sized enterprises, the mainstay of the ASEAN economy, will need to adopt new technology to improve their productivity and remain competitive. This will require concerted efforts

to counteract the increased competition from early adopters of modern technology.

These new technologies will impact all aspects of the ASEAN vision that has been articulated in the AEC Blueprint 2025. The AEC Blueprint 2025 envisions a 'highly integrated and cohesive economy' characterised by a 'seamless movement of goods, services, investment, capital, and skilled labour', with the goal to 'enhance ASEAN's trade and production networks' and 'establish a more unified market for its firms and consumers'. As technology will make geographic proximity less relevant in many areas of trade and production networks, institutional coordination and collaboration across AMS will be crucial to maintain a cohesive ASEAN economy. ASEAN will need to move strategically to harness the opportunities afforded by new technology while also meeting the challenges posed.

Furthermore, technology will directly challenge one of the key pillars of ASEAN community: leaving no-one behind. While the fear of widespread job losses may be exaggerated, it is clear that the future ASEAN economy will inevitably require greater human capital. The relative demand for skilled workers will naturally increase wages for skilled workers, incentivising greater efforts towards acquiring skills. But the region needs concrete steps to increase access to skills training for everyone within ASEAN by developing modern educational infrastructure. There may still be some part of the low-skilled population unable to respond to the slower growth in low-skilled jobs, which will require designing social protection policies.

II. Two Faces of New Technologies

Information technology (IT) and communication technology (CT) comprise two facets of technology. Although both come from the same technological resources, their implications for the international division of labour may differ widely. Aghion, Bloom, and Van Reenen (2014) originally proposed the concept of IT and CT to understand the internal organisation of firms. Baldwin (2016) adapted the concept so it could

be applied to the coming transformation of the international division of labour. We further apply Baldwin's idea to the situation in the AMS.

Information technology includes artificial intelligence (AI), robotics, data processing, and machine learning that can be applied in the production of goods and services. IT permeates through all aspects of production, from marketing, research, and design to industrial processing, to inventory management. These basically speed up data processing, economise the process of production and distribution, reduce the number of tasks, and thus may generate a concentration of forces in economic activities. For example, in the future, a large proportion of manufacturing activities may go back to a few specific developed countries such as Germany.

IT applied to the production process of existing industries can improve productivity by reducing the number of tasks and substituting human labour in conducting many routine non-cognitive tasks more efficiently. On the one hand, lower cost of production will make firms more competitive, and make goods available at lower prices for consumers. On the other hand, some jobs may become obsolete: There has been much discussion about the 'future of work' in light of current technological changes.[1] The McKinsey Global Institute (2017) estimated that as much as 50% of jobs are technically feasible for automation, but only 15% of jobs may actually be replaced due to economic feasibility. IT also enables creation of new products and services in data-driven analytics and management.

Communication technology such as Internet and smartphone connect people and overcome distance. Internet, smartphones, and soon coming 5G represent CT. CT lowers the cost of communication and reduces distance. Face-to-face interaction, usually requiring physical movement of people, can now be done virtually due to expanding broadband connectivity and availability of low-cost smartphones, allowing ideas to be shared over longer distances in real time.

[1] Asian Development Bank (2018) and World Bank (2018) are two examples.

From a production perspective, the ability to coordinate tasks from afar allows production processes to be further subdivided and distributed across space, creating opportunities for finer degrees of specialisation. CT tends to encourage the division of labour, both domestically and internationally, and generate dispersion forces in economic activities. Matching costs in business to consumer (B-to-C) and consumer to consumer (C-to-C) transactions or communications are now drastically reduced, which generates various new businesses in both developed and developing countries. Domestic and global value chains of production and consumption could be further expanded and deepened with CT. Services would be detached from a firm and be outsourced with CT, which may eventually lead to the third unbundling (Baldwin, 2016) or cross-border service outsourcing. Differences in economic conditions such as wage levels and specialised skills may be further exploited in the international division of labour.

These technologies will continue to become cheaper for both producers and consumers, leading to greater proliferation. Concentration forces and dispersion forces – which would be dominant in the future? We cannot be sure right now, but what the AMS have to do is obvious: think of various applications of IT while aggressively utilising CT to generate new businesses. As with any new technology, IT and CT create opportunities for innovation that lead to creation of new goods and services, new markets, new methods of production, new combinations of factors of production, and new markets. These imply that new industries and jobs will be created. At the same time, existing industries will be transformed and made more productive.

III. Economic Landscape

A. Information technology and the Fourth Industrial Revolution

A good framework to understand what lies ahead is to remind ourselves about where technology fits in the overall organisation of production and consumption. Numerous books have been written on the topic of technological revolutions. In a recent book on Artificial Intelligence, the authors note that new technologies will continue to emerge, but the economic fundamentals will not change much. Reminiscing about the

hype surrounding the expansion of the Internet in mid-1990s, Agarwal et al. (2018) wrote that

> '[Economists] did not see a new economy or a new economics. To economists, this looked like the regular old economy. To be sure, some important changes had occurred. Goods and services could be distributed digitally. Communication was easy. And you could find information with the click of a search button. But you could do all of these things before. What had changed was that you could now do them cheaply.'

In the context of economic transformation, perhaps the most pertinent question to ask of new technology is: what sort of costs are reduced by new technology? This in turn determines how businesses of the future are going to employ new technology. Current thinking on this topic is varied, but there are some fundamental principles at play (Agarwal, 2018). The adoption of any given technology by firms depends on how it changes the cost, assuming that demand conditions do not change. First, processes that are directly relevant to the technology are affected. Second, other processes are modified to make greater use of cost-saving technology. Third, use of complementary processes is expanded, and substitute processes are discarded.

In other words, the biggest economic consequence of modern technology is its widespread use where it is economically feasible. Production processes themselves will undergo massive changes in the next few decades. As much as new types of products and sectors are created, traditional sectors can also benefit from application of modern technology. Farmers can obtain precise information about markets, soil quality, and weather through their smartphone, use sensors to monitor their crops, and sell directly to consumers over the Internet. Better inventory management will lower the cost of producing and delivering perishable agricultural products by decreasing waste. Farmers can also use self-driving tractors to harvest quickly and efficiently.

Factories will become a lot more automated, with robots performing almost all the routine tasks and production taking place through 3D printing. Entrepreneurs will be looking for better ways to organise production in light of modern technology. These may include increasing the share of tasks performed by machines. In developed countries, the substitution of machines and human beings has already started and its possible implications have been a cause of great concern. The applicability of machines occurs at the micro level, and thus accurate predictions are difficult to make. Even though new technology emerges rapidly, its adoption in ASEAN will depend on trends in wages and availability of human resources.

Basically, manual and/or routine jobs are first replaced by machines, and the middle range of human capital, rather than the high or low range, seems to experience some negative effects. A report by the Asian Development Bank (2018) cites examples of the apparel and footwear industry – a mainstay in ASEAN manufacturing – that is already experimenting with automated production. However, at the same time, net loss of jobs does not seem to be large, at least so far. Rather, many new jobs are created, and there may in fact be net gains generated in the numbers of jobs (Autor, 2014). In newly developed and developing countries, the replacement of labour by machines seems to come at a slower pace than in developed countries because relatively low wage levels reduce the substitutability (Hallward-Driemeier and Nayyar, 2018; ADB, 2018). As routine low-skilled tasks get substituted away, demand for cognitive and non-cognitive skills will rise.

It may not be easy for the AMS to compete at the very frontier of IT development in the short run. The development of IT is costly and highly human capital-intensive, requiring the accumulation of research and development (R&D). International competition is harsh. Therefore, from the viewpoint of newly developed economies, rather than infusing our precious resources for R&D into such competition, we may want to follow the advancement of IT closely and concentrate on its applications. A wide range of applications of piecemeal technologies must be possible. It should be noted that technology-intensive production processes may need to be organised differently than traditional production processes, requiring process innovation.

B. Communications Technology and the Third Unbundling

Baldwin (2016) provides a useful way of thinking about impact of technological changes on economic globalisation, which determines the geographic structure of production and consumption. The author views historical trends in globalisation as progressive reductions in the costs of moving goods, ideas, and people. The first phase of globalisation, 'the first unbundling', was a consequence of declining transport cost, which made moving goods across countries profitable. Still, production was concentrated within the same country (or regions within a country) due to coordination cost.

Since the 1990s, improvement in information and communication technology reduced the cost of moving ideas, so that production processes could be linked, and therefore dispersed, across longer distances. One distinguishing feature of globalisation during the second unbundling is the mixing and matching of national competitive advantages led by multinational firms looking for the most cost-effective way to combine various production-related tasks. Firms in developed countries off-shored the labour-intensive parts of the production process to low-wage countries. Baldwin (2016) deemed this the 'second unbundling'. Many countries in ASEAN were direct beneficiaries of such production fragmentation. However, coordination still required movement of people during this phase, which limited the extent to which production would be fragmented. Geographic proximity still mattered, limiting offshoring largely to nearby countries.

The current frontier of technology is the reduction in cost of moving people (virtually). With modern technology making face-to-face interaction cheaper across longer distances, physical movement of people may no longer be necessary. As such, the production process can be further decomposed and combined across countries. The result will be a 'third unbundling', where tasks that comprise a smaller part of production may be performed in different locations. One important consequence of the third unbundling is that a country's comparative advantage may lie in a small part of the production process, which can be combined with advantages of other countries in complex ways.

Although the development of technologies is mostly done in developed countries, the penetration of CT-related businesses is worldwide, including newly developed and developing countries. Thanks to the lenient regulatory framework, the introduction of new businesses is sometimes quicker in the latter than in the former. Various business models are already in the AMS and are rapidly growing. CT affects the way producers and consumers interact to buy and sell goods. E-commerce, already representing a growing mode of acquiring goods and services, will proliferate as more producers sell their goods over the Internet directly to customers. This has the potential to expand the reach of small retailers to not only other locations within the country, but also to foreign consumers.

Platformers, which provide platform websites for search engines, social media, provider-consumer matching, e-commerce, e-payments, and others, include both international giants and domestic players. On platforms, various applications are developed by a lot of foreign and domestic start-ups. New participants in matching services and e-commerce, both providers of goods and services and buyers of them, have come into markets. Gaps between urban and rural are much smaller than in traditional communications and transactions though it is probably biased towards the young population rather than the established old generation. CT provides a new scope of equitable development.

Most of the new businesses are categorised as services. However, the manufacturing sector and even more traditional industries such as agriculture and fishery have started using piecemeal communication technologies and have tried to transform their businesses. For example, CT helps improve B-to-B coordination in domestic and global value chains in machinery industries. Even agriculture and fishery have a lot of potential to upgrade their activities with smartphones. Furthermore, the nature and ingredients of the manufacturing sector and others become more service-intensive, which is sometimes called 'servicification'. Both IT and CT accelerate such transformation of industries.

In applying CT, there is no fundamental difference between domestic and cross-border transactions. Indeed, communications and transactions

already go beyond national borders, with some friction and regulatory restrictions. Baldwin (2016) predicted that the reduction in face-to-face costs would soon develop a new form of international division of labour, i.e. the third unbundling or cross-border service outsourcing. In the second unbundling, we had the task-wise international division of labour. Now in the third unbundling, one task may be fragmented to individuals located in different countries. The level of human capability may not differ much even if a person lives in either a developed or developing country. On the other hand, wage gaps between developed and developing countries may remain in the near future. Once matching costs in service outsourcing are further reduced due to efficient platform services, translation software, and e-payments, the international division of labour at the individual level may develop as one of the major forms of international transactions.

AMS should take advantage of CT much more aggressively. Although the usage of CT has so far advanced mainly with private activities, the government of AMS must play a supplementary role in further exploiting opportunities provided by CT for economic development. Key policies are threefold.

The first is the infrastructure provision for digital connectivity. Many people worry about the digital divide between urban and rural areas and between rich and poor people. Such concern must be addressed. However, as for the digital connectivity, we observe that disparity can be much smaller than what other types of physical connectivity would generate. Even people in rural areas would like to have a smartphone, and many of them already have one. CT may be a powerful tool for promoting inclusiveness. And, actually, the deployment of digital connectivity can be mostly done by private investment rather than by huge public expenditure. The role of the government may be limited to providing trunk lines and activating private Internet providers properly. Now most of the AMS are in the process of expanding 4G to the whole country. The next challenge is to upgrade the digital connection to 5G. It is an already established technology, and the AMS must prepare for it urgently. It is important to catch up with or even lead the worldwide shift to 5G.

The second is policies on jobs and human capital. To aggressively utilise CT, we certainly need computer programmers, computer engineers, and entrepreneurs for new businesses, and thus it is obvious for the government to expand the high education programme to meet such demand for a new set of human capital. On the other hand, platform users may not be college graduates, which may make another possible channel for inclusiveness open. Impacts of CT on the demand for human capital may be much more unpredictable and complicated. This suggests that the upgrading of general education is continuously important for taking advantage of CT.

Third, most importantly, the government must provide a proper regulatory framework for the private dynamism of the CT usage. To further activate new businesses, the government may want to help start-ups, at least not bother them.

And the policy environment for 'almost' free flow of data with 'minimal' restriction must be achieved. Free flow of data, both domestic and cross-border, is crucial for invigorating CT-related businesses. However, the flow of data cannot be completely free. We have to take care of a series of people's concerns. With proper back-up policies, we can take advantage of the advancement of CT.

C. Structural Change

As the ASEAN economy grows, it will continue to undergo structural transformation away from agriculture towards the services sector. The role of the services sector will expand – both as consumption goods and as inputs to agriculture and industry – where many of the workers will be employed. This is generally the case at higher levels of economic development, but due to the consequences of technological change, this process is likely to be different from earlier periods. Early industrialisers in ASEAN like Malaysia and Thailand were able to create low-skilled manufacturing jobs that allowed workers to transition directly from agriculture, enabling low- skilled workers to earn higher wages outside agriculture. Such transition is going to be more difficult as new technology shrinks the availability of low-skilled jobs. Workers will need

to develop higher levels of skills beforehand to succeed in the new labour market.

As its employment share increases, the services sector will also feature greater use of modern technology. For example, self-driving cars that are currently under development will revamp the transportation industry. Greater utilisation of modern technology will increase productivity and allow service providers to reach customers easily. Human capital development will again be an important policy priority area to manage the structural change in an era dominated by technology.

D. Gig economy

Improvements in CT has also enabled proliferation of new forms of employment, broadly called the 'gig economy'. Ride-hailing services such as Uber, Go-Jek, and Grab are popular examples. These services provide a platform for customers and service-providers to interact over the Internet and perform specific tasks. The workers are essentially 'freelance' workers and paid according to tasks performed. These types of task-based hiring are appealing due to its flexibility and ease of use. Thus, this form of labour relation is likely to expand in the future.

This allows for more flexibility, but also brings with it more challenges. It is harder to enforce labour laws as these workers are classified as contractors rather than employees. The security and pensions that comes with traditional forms of employment are no longer available. Governments need creative solutions to ensure that vulnerable employees are adequately protected, and their future secured, without stifling innovation.

IV. ASEAN During the First and Second Unbundling

Since technological change has been occurring at different speeds throughout history, it is instructive to analyse how ASEAN fared during earlier periods of globalisation. ASEAN was conceived during an era of

globalisation when import-substitution and domestic industrialisation were the popular domestic strategies to foster economic growth.[2] At its conception, ASEAN was predominantly a platform for political cooperation and fostering peace in the region. During this time, tariffs were high and the political attitude was protectionist, so production mostly took place for home consumption with exports as an added bonus. The size of the home market was a crucial determinant of production. The emergence of the second unbundling coincided with the success of export-led economic growth strategy in East Asia, market-oriented reforms in many countries of the region, and expansion of ASEAN from five to 10 members by 1999.

Economic development strategy in the region during the second unbundling period was designed to attract foreign direct investment in the labour-intensive manufacturing sector. Many ASEAN Member States transformed themselves into a manufacturing base. Thailand, Viet Nam, Malaysia, and to a lesser extent, Indonesia, took advantage of low-cost labour to attract foreign, mostly Japanese, businesses to establish labour-intensive manufacturing processes in their countries. Since distance mattered a lot during the second unbundling due to the cost of moving people, ASEAN countries had the advantage of proximity over Japan and the Republic of Korea, which allowed them to be a primary destination for FDI from these early industrialisers in Asia (Baldwin, 2016). This was enabled by trade and investment liberalisation, domestic policy reforms, and special incentives to attract foreign businesses in strategic sectors. The rapid growth and economic transformation of the region since the 1980s is a manifestation of the second unbundling. ASEAN economies are participating in international production networks to varying degrees.

Reductions in tariffs were pushed to expand foreign markets for domestically produced goods. Liberalisation of international trade complemented the fragmentation of production process enabled by technology. The ASEAN Free Trade Area (AFTA) was signed in 1992. This was also a time when ASEAN looked to expand integration with rest of Asia, forming ASEAN Plus Three with China, Japan, and the Republic of

[2] Baldwin (2016) dated the periods of the first unbundling from the start of industrial revolution in Europe during the 1800s to the 1980s.

Korea in 1997, then expanding it as ASEAN Plus Six to include Australia, India, and New Zealand. Much effort has been made to foster closer economic ties in the region, with the ASEAN Economic Community (AEC) established in 2015 and the launching of free trade area negotiations amongst the ASEAN Plus Six members, called the Regional Comprehensive Economic Partnership (RCEP).

The pace of growth in AMS during this period was uneven. As a result, some AMS are currently in a better position to adopt digital technology due to their deeper engagement in the current technology frontier, partly arising from their different levels of engagement with global value chains. Agriculture remains an important sector in Lao PDR and Myanmar, employing over 50% of the workforce in 2017. These countries need to focus on using new technology to upgrade these primary sectors, while looking for ways to manage their transition into modern sectors. Countries like Thailand and Singapore have already initiated forward-looking responses to new technology in the form of 'Thailand 4.0' and 'Singapore Mobility 2030'. Others are still focused on adopting the opportunities afforded by the first and second unbundling. Such differences across economies are likely to persist.

V. Challenges for ASEAN

A. Growth Strategies of First and Second Unbundling Are No Longer Sufficient

Since the mid-1980s, the AMS have aggressively taken advantage of the second unbundling or the task-wise international division of labour, particularly in the machinery industries, in their development strategies. From now on, to maintain international competitiveness and climb up the value chain ladders, the partial application of new technologies such as robotics, 3D printing, and the Internet of Things (IoT) cannot be avoided, even though replacement of the entire production by machines may not occur any time soon. Various IT technologies must be applied in the service industries.

The new industrial revolution requires taking a fresh look at what policies are effective. As Baldwin (2016) pointed out, high tariffs on imports made logical sense in an environment characterised by the first unbundling, where entire production process took place within the same country. But the second unbundling rendered this counterproductive as high tariffs would make imported parts and components more expensive for domestic producers. Policymakers now embrace trade liberalisation as a way to enhance the competitiveness of their own economies. Today, policymakers are still reluctant to liberalise the services sector or reduce barriers to movement of skills. This could prove to be anachronistic in tomorrow's world defined by widespread access to technology and deep people-to-people connectivity. Therefore, reconsidering the role of services liberalisation and skills mobility in the future growth of the ASEAN economy will be important.

It will be more difficult to identify winners and losers from globalisation, and therefore even harder to adopt protective economic policies that purport to protect specific groups. As the international production networks become more complex, policies that made sense during the second unbundling, such as Special Economic Zones, would be far from sufficient. The third unbundling reduces governments' ability to target specific sectors or groups with their industrial policy, for example by providing tariff reductions for certain 'priority' goods and services. Rather, a whole-of-economy approach to make the country business-friendly will be necessary. Competitiveness will be determined by cross-cutting economic and policy environment fundamentals rather than incentives provided in certain sectors. As businesses look to lower cost by allocating tasks across countries, people-to-people, greater connectivity (physical, institutional and people-to-people), and cooperation and coordination across countries will be necessary.

Related policies are twofold. First, the introduction of new technologies and capital investment must be mildly promoted. The most serious market failure is incomplete information in which proper technologies may not be known amongst entrepreneurs and thus chances for their timely introduction tend to be lost. The government and public research institutes should play an active role in disseminating proper information on new technologies. In addition, some AMS have already started

applying a subsidy or tax reduction for promoting the introduction of robots. It may make sense to countervail market failure in the form of dynamic economies of scale or incomplete information. However, too strong government intervention would become distortive for a good balance between labour and machines. It is in any case necessary to promote capital investment in general.

Second, related to human capital, it is clear that computer programmers, computer engineers, and entrepreneurs will be in high demand. Upgrading higher education, both in quantity and quality, is essential. Beyond that, what sort of human capital would be complementary with machines? Although it is difficult to predict how the substitution of labour by machines will proceed, manual and routine jobs seem likely to disappear sooner, whereas cognitive, non-routine, flexible, multi-task jobs would survive. Formal education, on-the-job training, and adult education may need to be redirected to smooth out labour supply adjustments and fill the demand for new businesses.

While it is important for all AMS to recognise the importance of digital technology, some will have to focus on closing the gap with current frontier technology. This means adopting a gradual development strategy: further developing traditional industries with comparative advantage, removing domestic barriers to sectoral connectivity, creating linkages with existing production networks, and applying institutional reforms. Nonetheless, exploring ways to inject the latest technology into these areas will help the process along. At the same time, there is no reason to believe that some AMS cannot 'leapfrog' by directly adopting the most cutting-edge production methods and technologies, or by gradual step-by-step upgrading (Kimura, 2017).

B. Technology Adoption

Innovation will be a key feature of the new industrial revolution. Businesses will need to compete with one another by lowering cost and improving efficiency in the use of technology. Some examples include using big data to research consumer demand and computers to manage inventory. Businesses will have to constantly experiment and adapt,

requiring good entrepreneurial skills. AMS must strive for an economic environment where businesses and individuals are applying their creativity to solve problems and discover new ideas. While improvement has been steady, technology adoption is vastly different across ASEAN. For example, 80% of individuals in Singapore used the Internet in 2015, compared to 20% in Lao PDR.[3] At the same time, Asia is at the forefront of technology usage. For example, 65% of industrial robots are in Asia.[4] The region is also at the forefront of technology production, with Japan and the Republic of Korea leading in robotics.

Adoption of new technology is not merely a matter of substituting some human-performed tasks with computers. It also requires the entrepreneur to rethink the business strategy. Currently, only large firms are adopting modern technology such as digital technology[5] and artificial intelligence[6] in ASEAN.

During the second unbundling, ICT innovation allowed the production tasks to be dispersed geographically. This required a different type of production process – one that allowed various parts to be seamlessly assembled. For such innovation to be possible, it is necessary to have an adequate supply of human capital comfortable working with technology. As such, it will be important for an economy to provide opportunities and incentives to improve people's skills. The essential elements include education infrastructure, on-the-job training, and entrepreneurship.

A good policy environment becomes indispensable for a modern economy characterised by the third unbundling and industry 4.0. Because everything is moving faster, policy bottlenecks can be detrimental to innovation. Therefore, AMS governments should aim to reduce transactions cost associated with rules and regulations, and make the

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3 http://asean.org/storage/2017/09/Ch.2_The-Future-of-Technology-Opportunities-for-ASEAN-in-Digital-Economy.pdf

4 https://www.weforum.org/agenda/2018/09/chart-of-the-week-invest-in-robots-and-people-in-asia

5 https://www.businesstimes.com.sg/top-stories/smes-can-lift-asean-gdp-by-us11t-with-tech-adoption-bain

6 https://www.computerweekly.com/news/252444634/Indonesia-leads-ASEAN-region-in-AI-adoption

government nimble, ready to adapt to changing circumstances. This has to be balanced with the importance of policy innovations in the areas of consumer protection and data privacy.

C. Ensuring Dynamism of Small and Medium-sized Enterprises

Small and medium-sized enterprises (SMEs) are the backbone of ASEAN economies, employing a large fraction of its workforce. At the same time, they are usually lagging in technology adoption and innovation, which has mostly come from large multinational enterprises. SMEs face additional opportunities as lower cost makes technology more accessible to all, including small enterprises. Additionally, CT also makes engaging in international value chains easier by connecting small businesses across space. At the same time, changing patterns of demand from consumers and increased competition in an integrated global economy will make technology adoption indispensable for small firms to thrive.
ASEAN countries must ensure that its SMEs are utilising the latest technology to upgrade their production process and expand their market. Singapore is already experimenting with grants to encourage SMEs to adopt new technology – albeit to address the issue of labour shortage. AMS can expand such efforts to achieve a wider set of economic objectives such as making SMEs a dynamic growth centre of the ASEAN economy.

D. The Future of Work

With technology adoption and economic growth, the structure of labour demand will change. The changes include creation of new jobs and the obsolescence of some existing jobs, and relatively greater demand for skilled workers. One major concern about new technology is the increasing automation of tasks performed by labour. The increased competition with automation will lead to absolute or relative decline in wages of workers. To prepare for the upcoming changes to the labour market, it is important for policymakers to understand how technology will affect labour markets. Replacement of human labour by technology does not necessary lead to unemployment, as predicted during earlier waves of technological changes (Acemoglu and Restropo, 2018).

Nonetheless, it is clear that new jobs will require use of higher-order cognitive capacities rather than manual labour, and this set of skills is largely acquired rather than naturally endowed. This brings the focus squarely on the education system that is preparing workers for the technological changes. The implication is that some segments of the population may be left out, which calls for a strong social protection.

Another change is in the relation between employers and employees. With the rise of the 'gig economy', traditional employment relations will no longer be the norm in the labour market. This requires some changes in labour market policies as well. Workers need a flexible work arrangement coupled with opportunities for upskilling. AMS should aim for labour regulation that strikes a balance between protection and flexibility.

The Human Capital Index (HCI), newly launched by the World Bank, attempts to gauge the amount of human capital children born today can expect to achieve when they are 18 years old, relative to the ideal scenario of full education and health. The index comprises of indicators of mortality, education quality, and health. For Southeast Asia, the index ranges from 0.45 for Lao PDR to 0.88 for Singapore and correlates with the level of economic development. This is interpreted to mean that given the current provision of health and education, the productivity of a child born today in Lao PDR is expected to be 45% of the ideal condition. This indicates that much needs to be done by ASEAN countries to ensure that workers of the future are prepared for the new economic conditions that they will face.

VI. Way Forward

With the help of modern technology, ASEAN has the potential to become a dynamic growth region supplying goods and services globally and generating fulfilling jobs for its workforce. ASEAN in 2040 should aim for a wide adoption of the new technologies to upgrade their economies. It is also possible to modernise traditional industry by use of technology. Any development strategy will require connectivity through improvements in soft and hard infrastructure. Some mild industrial policies may be

necessary to put ASEAN on the correct path, particularly to help SMEs adopt new technologies.

For this vision to be realised, AMS need to improve the skill base to suit the needs of new industry so that everyone can participate in the new economic structure. Success in the technological era requires entrepreneurial spirit and cross-border flow of ideas and information, workers with cognitive and non-cognitive ('soft') skills, a workforce comfortable with using modern technology, and connectivity within and between AMS enabled by a fully developed IT infrastructure.

The costs of technology have come down very rapidly, following breakthroughs that allowed for more powerful technology in low-cost consumer devices. The share of the population using the Internet was below 40% in Singapore in 2000; now it is above that in six of the 10 ASEAN countries. Widespread adoption enables innovation to come from any corner and synergies to be formed between any two entities. To take advantage of these, growth strategies have to be adjusted. Liberalisation of services has moved slowly, and skills mobility remains weak. Both of these will be crucial during the third unbundling.

ASEAN's movement towards a technology-dominated economy has to be supported by a regulatory environment that provides a conducive legal and institutional environment that encourages innovation but protects consumers and producers. So far, back-up policies for CT-related businesses are highly fragmented across countries. It is even difficult to find best practices in the world. However, the stocktaking of back-up policies should certainly be useful for the policymaking of AMS. The logic of regulation must be clarified to avoid inefficient and excessive regulation. Otherwise, the introduction of CT would be delayed by redundant regulations.

Moreover, a policy environment for an 'almost' free flow of data with 'minimal' restrictions must be achieved. Free flow of data, both domestic and cross-border, is crucial for invigorating CT-related businesses. Yet, the flow of data cannot be completely free as a number of people's

concerns have to be taken into account. Back-up policies include consumer protection; privacy protection; the 'general exceptions' such as culture preservation, public morals, and public health; intellectual property protection; non-discrimination and tariffs; and cyber-security. In a wider scope, competition policy, taxation, and statistics may also need to be adjusted for the CT-related activities. To take advantage of CT, the proper level of regulation, rather than too lenient or unnecessarily excessive, is crucial.

So far, back-up policies for CT-related businesses are highly fragmented across countries. Even worldwide, it is difficult to find best practices. However, the stocktaking of back-up policies should certainly be useful for the AMS in their policymaking. The logic of regulation must be clarified to avoid inefficient and excessive regulation. Otherwise, the introduction of CT would be delayed by redundant regulations.

The fragmented regulatory regime is costly particularly for countries small in size. International cooperation and rule-making are very important. International organisations and various economic gatherings such as the World Trade Organization (WTO), United Nations (UN), Asia-Pacific Economic Cooperation (APEC), and others have recently been seeking a common denominator for a desirable regulatory framework in the era of the digital economy. But such efforts will take considerable time and effort to bear fruit. Even the United States and the European Union cannot easily reach agreement on a number of important issues, let alone some of the big newly developed economies such as China and India. Thus, ASEAN can be an important forum to take stock of the current fragmented policies and come up with best practices to boost the digital economy for AMS.

ASEAN should harmonise regulations, accelerate service liberalisation, and foster greater regulatory cooperation to leverage economic diversity into competitiveness through closer integration. Exchange of information through the ASEAN Single Window and a liberal services trade and investment regime will be key ingredient for success.

ASEAN Member States will achieve middle- and high-income status in the next 2 decades. In addition, the region enjoys proximity to the rapidly growing economies of China and India, which can serve as a large consumer base for Southeast Asian products and services. Therefore, a closer economic integration will generate opportunities for producers in ASEAN. ASEAN will have to accelerate coordinated reforms to develop itself as a single production base in the era of the third unbundling through technological connectivity across member states. This will be crucial for maintaining ASEAN centrality.

Going forward, existing differences across ASEAN Member States need to be taken into account, as these differences have implications for countries' economic policy. Diversity in ASEAN could be a source of competitive strength. Lagging countries could focus on the labour-intensive part of the production process and gradually improve their technology. In some areas, they can cooperate with technological leaders to move ahead faster. Finally, AMS should work together to manage anti-globalisation sentiments by ensuring that the benefits of new technology can be felt by the entire population.

References

Aghion, P., N. Bloom, and J. van Reenen (2014), 'Incomplete Contracts and the Internal Organization of Firms', *Journal of Law, Economics, and Organization*, 30(Suppl.1), pp.37–63.

Agrawal, A. (2018), 'The economics of artificial intelligence', *McKinsey Quarterly*. Retrieved 28 May 2018 from https://www.mckinsey.com/business-functions/mckinsey-analytics/our-insights/the-economics-of-artificial-intelligence

Agrawal, A., J. Gans, and A. Goldfarb (2018), *Prediction Machines: The Simple Economics of Artificial Intelligence*. Boston, MA: Harvard Business Review Press.

Asian Development Bank (2018), Asian Development Outlook 2018: How Technology Affects Jobs. Retrieved from http://dx.doi.org/10.22617/FLS189310-3 (accessed 21 May 2018).

Autor, D.H. (2014), 'The History and Future of Workplace Automation', *Journal of Economic Perspectives*, 29(3), Summer, pp.3–30.

Baldwin, R. (2016), *The Great Convergence: Information Technology and the New Globalization*. Cambridge, MA: Belknap Press of Harvard University Press.

Bughin, J., E. Hazan, S. Lund, P, Dahlström, A. Wiesinger, and A. Subramaniam (2018), Skill Shift: Automation and the Future of the Workforce. McKinsey Global Institute Discussion Paper May 2018. Retrieved 28 May 2018 from https://www.mckinsey.com/featured-insights/future-of-organizations-and-work/skill-shift-automation-and-the-future-of-the-workforce

Hallward-Driemeier, M. and G. Nayyar (2018), *Trouble in the Making? The Future of Manufacturing-Led Development*. Washington, DC: World Bank Group.

Kimura, F. (2017), 'Unbundlings' and Development Strategies in ASEAN Old Issues and New Challenges. *Journal of Southeast Asian Economies*, 35(1), pp.15–23.

World Bank (2018), World Development Report 2019: The Changing Nature of Work. Washington, DC: The World Bank.

McKinsey Global Institute (2017), Jobs Lost, Jobs Gained: Workforce Transitions in a Time of Automation.