Chapter 32

How Technology Affects Jobs: A Smarter Future for Skills, Jobs, and Growth in Asia

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Jobs are in a constant state of evolution. Today's labor markets are far different from those of decades past. The types of jobs workers need to sustain their livelihoods, the industries that power economic growth, even the societal expectations of what a job represents are all subject to constant change. At present, there is nothing more transformative concerning the nature of jobs and the future of work than the Fourth Industrial Revolution (4IR)—a new era built on the use of more sophisticated robots and computing power and the automation of tasks once thought to be uniquely human (ADB 2018). In this essay, we examine the literature on how the 4IR is changing the demand for jobs and explore the implications of new technology on jobs in Asia and the Pacific.

Throughout history, humans have always endeavored to produce things better, faster, and cheaper: from the use of water and steam power to mechanize production in the First Industrial Revolution, to the use of electric power for mass production in the Second Industrial Revolution, to the use of electronics and information technology to automate production in the Third Industrial Revolution, and to the extreme automation, connectivity, and the wider implementation of artificial intelligence in the 4IR. Just like the industrial revolutions preceding it, the 4IR will profoundly affect people's lives.

As the 4IR unfolds, some types of jobs will disappear, while many others will be created. Recent studies, discussed below, show that new technologies will result in higher productivity. While displacing some jobs in their wake, new technologies will simultaneously unleash countervailing forces that generate more jobs, and the net effect at the aggregate level will be positive.

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263

Issues and Challenges

The Asia and Pacific region is home to more than 60% of the global working-age population, and six out of ten young people in the world today live in this region.¹ The future of work globally is tied to labor market outcomes in Asia and the Pacific—in fact, there is no other region in the world that highlights the challenges and opportunities that stem from the 4IR better than Asia. There is one question that is on everyone's mind when it comes to the 4IR: Is this time different? As new technology allows us to automate increasingly complex tasks, should we finally be worried that “technological unemployment,” as was warned by luminaries such as David Ricardo, Karl Marx, and John Maynard Keynes, would be borne out in the near future?

As computing capacity improves and becomes cheaper, its usage in production and delivery of services will spread across industries. For example, blockchain, which is “a digital, distributed ledger that keeps a record of all transactions across participating peer-to-peer networks,” is set to transform businesses worldwide. But, is it different compared with technological innovations in the past? Economic history tells us that the invention of electricity and computers impacted all sectors and industries and spread across the globe. They gave rise to occupations that did not exist before, such as electricians, electrical engineers, computer engineers, software developers, website designers, etc. The technology of today will have similar effects; it is not evident why things would be different this time. But there is one aspect of the 4IR that is different than before: Increasingly complex tasks can now be automated (Autor 2015, Acemoglu and Restrepo 2018, ADB 2018). But this is to be expected, as technology has evolved from electricity and computers to quantum computing and artificial intelligence (AI). Should we be surprised that humans have invented increasingly complex machines to make production more efficient and cheaper? With each generation of technological breakthroughs, this is to be expected, as that is the very definition of human progress. It also gives rise to new types of jobs—from auto repair workers in the past to computer engineers and web developers in the present.

Moreover, it is important to keep in mind that not all technology displaces human labor. For example, magnetic resonance imaging (MRI) or X-ray machines in hospitals perform functions that humans cannot do, but they complement human labor in the delivery of medical care. Should we be worried about these types of technological advancements? No. This phenomenon has been described as “deepening of automation”: when technological improvements increase the productivity of capital in tasks that have already been automated (Acemoglu and Restrepo 2018). Furthermore, with sophisticated medical technology, nurses can perform tasks typically performed by doctors. Also, these types of technologies have had the fastest adoption rates, as they are used in the delivery of services such as medical care that are in high demand. Breakthroughs in biotechnology do not destroy jobs, but they augment the value of human labor. Similarly, technological advancements in the delivery of public

¹ Youth population refers to people between the ages of 15 and 24.

services such as health, education, and social security do not necessarily destroy jobs but enhance the quality and provision of these services.

History suggests that technological advancements have raised labor productivity, lowered prices for consumers, increased demand, raised incomes, and underpinned economic growth and job creation. This time should be no different. However, displacement of workers from jobs that are being automated is real and has consequences on their future employability, income, and living standards (ADB 2018). Indeed, if history is any guide, the introduction of new technology during the first industrial revolution led to rising labor demand and wages, but this came after a protracted period of stagnant wages (Acemoglu and Restrepo 2018). This phenomenon has been dubbed “Engel’s pause” or the “living standards paradox.” As in the past, labor regulation and social policy can play a critical role in breaking out of the “Engel’s pause” such that wages rise with increasing productivity. Technology is partly responsible for rising income inequality in recent decades (Autor Levy and Murnane 2003), and whether new advancements in automation will slow this trend depends critically on whether technology complements or substitutes human labor. If labor gets substituted in a greater number of occupations than before, then income distribution depends on whether labor has the bargaining power to reap the benefits of productivity gains. The role of labor market institutions and skills of the workforce is key in understanding how wages evolve and whether workers can transition smoothly to new tasks and occupations.

Recent Evidence

As big data and AI make possible the automation of even highly complex manual and cognitive tasks, there is increasing public concern that new technologies will soon take over everyone’s jobs. Further fueling concerns are estimates indicating that more than two-thirds of jobs in various economies of developing Asia are at risk of automation. Will automation lead to widespread job displacement, with robots taking on the role of human workers across industries? How bad is this going to be?

Industrial robots, used largely in manufacturing, have become much more powerful and sophisticated due to technological advancements in AI and computing capacity. In recent years, the use of industrial robots has increased considerably: Between 2010 and 2015, the stock of industrial robots in Asia increased by 70% to 887,400 units (ADB 2018). The People’s Republic of China (PRC)—the largest market for industrial robots—accounts for about 43% of all sales of industrial robots to Asia and the Pacific. Another 24% of sales is accounted for by the Republic of Korea, followed by 22% by Japan.

So, do robots displace human workers? According to Acemoglu and Restrepo (2017), the use of industrial robots in the United States between 1990 and 2017 was negatively associated with employment and wages. They found that an additional robot reduced employment by six workers, and one new robot per thousand workers reduced wages by 0.5%. They also found that the negative effects of robots on labor

market outcomes were more pronounced in the manufacturing sector and in routine, manual, and blue-collar jobs. A study by the United Nations Conference on Trade and Development (UNCTAD) (2017)—which included a sample of 64 countries between 2005 and 2014—also found that increased robot use was associated with a slight decline in the share of manufacturing in total employment and in real wage growth. Further, robots displaced routine tasks usually done by workers on the middle rungs of the pay scale.

In contrast, Graetz and Michaels (2015) found that industrial robots increased labor productivity, total factor productivity, and wages in a sample of 17 developed countries, including 14 European countries, Australia, the Republic of Korea, and the United States. They showed that robotics accounted for 10% of gross domestic product growth, 16% of labor productivity growth, and wage growth within industries with higher robot density. In line with the result of Acemoglu and Restrepo (2017), they found that robotics reduced the employment of low-skilled workers and, to a lesser extent, middle-skilled workers, but had no significant effect on high-skilled workers.

Automation is set to replace more jobs in developing countries than in developed ones, according to a recent study by Frey and Rahbari (2016). They estimate that the share of jobs at risk of automation is about 77% in the PRC, 69% in India, and 85% in Ethiopia. This proportion is lower in Organisation for Economic Co-operation and Development (OECD) countries, averaging about 57%. Similarly, a recent report by Chang et al. (2016) showed that new technology poses both risks and opportunities for the Association of Southeast Asian Nations (ASEAN) countries. Several sectors with high value-added and providing employment to a large part of the population face risk of digitization and automation. For instance, in the auto sector alone, more than 60% of salaried workers in Indonesia and about 73% in Thailand face automation risks. In the case of Viet Nam, about 75% of workers in electronics 86% in apparel and footwear are at risk of automation.

However, the overall picture is not too grim. ADB (2018) finds optimism in developing Asia's job prospects based on the following four observations: First, new technologies only automate certain tasks but not the entire job. In fact, the automation of routine and manual tasks frees up human work toward more complex tasks. Second, job automation occurs only when it is both technically and economically feasible—a requirement met mostly in capital-intensive manufacturing, where, according to the report, employment shares were already low in 2015. Third, rising demand offsets or compensates for the job displacement effect of automation. Finally, technological change and economic growth create new occupations and industries, offsetting the displacement effect of automation.

When new technologies make possible the production of goods using fewer workers, the job displacement effects are often countered by other forces at play, with the net effect at the aggregate level being positive. For instance, the study by Bessen (2017) finds that computer use in the United States between 1984 and 2007 was not only associated with job losses in manufacturing industries but also with employment growth in nonmanufacturing industries. In particular, computer use was associated with a 3% per year job loss on average in manufacturing industries, but a

1% per annum faster employment growth in nonmanufacturing industries. Moreover, according to the McKinsey Global Institute (2017), automation at the aggregate level could raise productivity growth by 0.8%–1.4% annually.

As some jobs are made obsolete by new technologies, entirely new categories are emerging. An analysis of occupation titles in India, Malaysia, and the Philippines found that 43%–57% of new job titles that emerged in the past 10 years are in ICT (ADB 2018). For instance, in India, new jobs were driven mainly by different types of specialized technicians needed to work with computer-controlled machines. Many more new jobs will arise in healthcare and education and in finance, insurance, real estate, and other business services. Further, a recent study by Khatiwada and Veloso (2019) also find evidence that new jobs provide higher wages than old jobs.

Implications for the Future

While we should not necessarily be worried about massive job losses in Asia and the Pacific due to automation, it is becoming clear that shifts in the demand for workforce skills require adequate skills development or retraining and that workers with weaker foundational skills will face hurdles in seizing the opportunities that new technologies provide. The 4IR is expected to increase the demand for nonroutine cognitive tasks as well as generate new jobs that pay better wages. However, taking advantage of these developments requires a supply of agile and competent workers.

Indeed, as some jobs become obsolete, entirely new categories of jobs are emerging. According to ADB (2018), demand for jobs is shifting towards those that require nonroutine cognitive, social, and information and communications technology (ICT) (ICT) tasks. An analysis of four economies in developing Asia shows that over the past decade, employment in nonroutine cognitive tasks expanded 2.6 times faster than total employment (Figure 32.1, Panel A). Moreover, wages have also grown faster in nonroutine/cognitive types of jobs than those for manual jobs (Figure 32.1, Panel B).

ADB (2018) also finds that most new job titles have emerged in the cognitive and nonroutine category, with as much as 82% of new jobs in Malaysia in this category, and around 60% in India and the Philippines. A recent study by Khatiwada and Veloso (2019) categorizes new occupation titles by skill level. The authors find that majority of new work requires high skills: 62% of new job titles in India, 82% in Viet Nam, 80% in Malaysia, and 61% in the Philippines (Figure 32.2).

Khatiwada and Veloso (2019) also find evidence that new jobs pay better than old jobs. For instance, they find that in Viet Nam, across all industries, average monthly wages in new jobs are higher than those of old jobs. The wage gap is most apparent in mining, manufacturing, and construction. Even in agriculture, where wages have been persistently low, new jobs pay much better than old jobs. On average, new jobs pay 1.5 times more than old jobs in Viet Nam.

Panel A: Annual Growth in Employment of Wage Workers by Job Type (%) **Panel B: Change in Average Monthly Wages, constant prices (in US\$)**

Note: The time frames vary across countries, with Viet Nam the shortest (2007–2015), followed by Thailand (2000–2010), India (2000–2012), and Indonesia (2000–2014). Asia refers to the four countries included in this analysis.
Source: *Asian Development Outlook 2018: How Technology Affects Jobs*.

Figure 32.1 Change in Employment by Task Intensity of Work: Nonroutine Cognitive versus Manual Work. *Note* The time frames vary across countries, with Viet Nam the shortest (2007–2015), followed by Thailand (2000–2010), India (2000–2012), and Indonesia (2000–2014). Asia refers to the four countries included in this analysis. *Source* Asian Development Outlook 2018: How Technology Affects Jobs

Conclusion

The Fourth Industrial Revolution provides a unique opportunity for the region to create new high-quality jobs and vastly improve the job quality and productivity of existing work. However, capitalizing on new opportunities in promising sectors will require strengthening and reforming national education and training systems and equipping workers with the qualifications and skills to compete for emerging jobs.

Policymakers should enhance the quality of available technical training programs and ensure that they meet the current and future labor market needs. The inclusion of technical training in secondary education by developing technical and vocational

Note: This follows Autor's (2014) classification of skill levels based on the International Standard Classification of Occupations (ISCO) Divisions.

Source: Khatiwada and Veloso (2019).

Figure 32.2 Share of New Job Titles by Skill Level. *Note* This follows Autor's (2014) classification of skill levels based on the International Standard Classification of Occupations (ISCO) Divisions. *Source* Khatiwada and Veloso (2019)

education and training (TVET) hybrid models should be strengthened. High-income countries are increasingly characterized by knowledge rather than means of production. Countries in Asia and the Pacific must also ensure that their workers have the skills to thrive in the knowledge economy. Delivering TVET through quality apprenticeships will benefit both workers and potential employers. Moreover, direct industry involvement in curriculum development and quality assurance ensures that TVET is in line with labor market demands.

There is also a need to increase the use of ICT in education. Policymakers should take advantage of the scalability of ICT by making it an integral part of education delivery. Using ICT can help deliver TVET to a wider audience, create a more open and flexible learning environment, and allow access to enhanced learning through interactive content. Such flexibility will produce TVET that is more responsive to the labor market's needs.

Link to the presentation material: <https://events.development.asia/materials/20171213/jobs-and-technology-implications-education-and-skills-development>.

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