KEY POINTS

- As COVID-19 drives economies into recession, many jobs are at risk. However, not all jobs are equally affected—some industries and jobs are more severely affected than others. Without conscious effort and effective policies, the unequal impact of COVID-19 on jobs will hit the most vulnerable individuals and communities.
- COVID-19 effects are further exposing the trend of job polarization and widening wage inequality among employees. A large share of informal employment is in sectors that are relatively more vulnerable, such as manufacturing, wholesale and retail trade, transportation and storage, and accommodation and food services. The situation is often worse among women, youth, and rural workers.
- COVID-19 will likely spur digital transformation of work and the workplace. Policy makers should adopt appropriate policy strategies and options to help mitigate the impact of the postcrisis structural changes, by investing in digital readiness, developing skills for the digital economy, and strengthening social protection.

COVID-19, Technology,
and Polarizing Jobs

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As the coronavirus disease (COVID-19) drives economies into recession, many jobs are at risk. The Asian Development Bank (ADB) estimates that the COVID-19 pandemic could cost the global economy from \$5.8 trillion in a 3-month containment scenario to \$8.8 trillion in a 6-month scenario, with Asia and the Pacific accounting for about 30% of global economic losses (ADB 2020). These estimates also suggest that the equivalent of 158 million to 242 million full-time jobs (6.0% to 9.2% of total employment) will be lost globally in the two scenarios, with job losses in Asia and the Pacific accounting for about 70%.¹

However, not all jobs are equally affected—some sectors are thriving or even growing faster in the pandemic. Global tech giants, such as Microsoft, Apple, and Amazon, were among the top-10 stocks by market cap in mid-April, pushing their share of the S&P 500's total value up by 25%. Other firms are also performing strongly and hiring. These are firms using innovative technologies such as online retail and food delivery with contactless delivery options, 3D printing companies for personal protective equipment, and video conferencing applications such as Zoom (Mirza 2020).

Amid the rapid technological changes and increasing automation, however, job polarization and widening wage inequality among employees have occurred as these trends have put manual and routine jobs at higher risk of being displaced (Goos, Manning, and Salomons 2014; Autor 2015). Indeed, COVID-19 effects are fueling trends that had already been exposing middle-skill workers to displacement and lower working hours and incomes. As digital transformation accelerates, old skills are likely to depreciate and become obsolete faster. Aging workers risk falling into low-skilled, low-paying jobs (Lovász and Rigó 2013; Ilmakunnas and Maliranta 2016).

¹ Separately, the International Labour Organization (2020) warned of the loss of 6.7% of working hours worldwide, equivalent to 195 million full-time jobs by the second quarter of 2020. The estimated job losses are sobering, compared with about 22 million full-time equivalent job losses during the Great Recession of 2008–2009 (ILO 2020a).

Without conscious effort and effective policies, therefore, the unequal impact of COVID-19 on jobs will hit the most vulnerable individuals and communities. They will continue to face greater risks of unemployment, financial losses, and health hazards, exacerbating socioeconomic inequalities and undermining inclusive growth efforts. To break and reverse the vicious cycle, it is essential to understand the relationship between technologies and job polarization, how COVID-19 exposes middle-skilled workers to job displacement and aggravates job polarization, and what the policy priorities should be for the post-COVID-19 era.

TECHNOLOGY AND POLARIZATION OF JOBS

Technology and its net impact on jobs have generated heated debate since the first industrial revolution (of the 18th and 19th centuries). Technological advances increase both productivity and output, but people disagree on whether they create or displace more jobs. Rapid industrialization in the 1960s replaced jobs in the agriculture sector with machines but created jobs in other sectors. Fourth industrial revolution technologies similarly increase output and productivity of capital and labor and allow substitution between the two for certain tasks (Acemoglu and Restrepo 2019).

Fear of losing jobs to machines and automation started in 1900 as farms mechanized and farmers' share of employment fell from 41% to 2% in the United States (US) (Autor 2014), as well as in Japan in the 1960s when it was economically feasible (Hayami and Kawagoe 1989). However, technology did not eliminate work completely even as it replaced some jobs (Bowen 1966). Rather than displacing jobs altogether, automation steered labor away from agriculture into nonagriculture sectors. Similarly, the adoption of industrial robots has had positive and negative effects on employment and wages. Between 1970 and 2007, an increase in productivity was associated with an increase in employment across 19 Organisation for Economic Co-operation and Development (OECD) member countries (Autor and Salomons 2017). Robot adoption in 17 countries from 1993 to 2007 was associated with higher annual labor productivity growth and no impact on hours for low-skilled labor (Graetz and Michaels 2018).

However, demand for labor declined, particularly for physically demanding, repetitive, and cognitively monotonous labor. In the US from 1990 to 2007, greater use of industrial robots had negative impact on both employment and wages, mostly in manufacturing (Acemoglu and Restrepo 2018). Frey and Osborne (2017) estimate that 47% of US jobs will be automated by 2033, affecting jobs in transportation and logistics and office and administrative support. They predict wages to decrease with jobs lost to automation. For developing countries in Asia, ADB (2018) shows that technological progress alone led to a 66% decrease in employment between 2005 and 2015, while holding other technological impact constant (such as income and market expansion).

Earlier economic literature investigated the possible causes of job polarization and suggested a hypothesis of skill-biased technical

change. Such change implies that technological advances have boosted the productivity of skilled labor relatively more than that of unskilled labor, benefiting skilled workers more than unskilled workers. The evolution of new technologies—such as information and communication technologies—have increased returns from skill (See Autor and Katz [1999] for a survey of the skill-biased technical change hypothesis).

Later, Autor, Levy, and Murnane (2003) note that skills and tasks are distinct. They argue that while some tasks can be easily displaced, codified, and automated, it is more difficult for other tasks. In fact, some argue that the earlier estimates of job losses due to automation are biased upward as they consider occupations as a whole and that most workers are already in jobs that are difficult to automate (Arntz, Gregory, and Zierahn 2016, 2019). Using a task-based approach, Arntz, Gregory, and Zierahn (2016) estimates that only 9% of jobs are at risk to automation across 21 OECD countries.

Tasks can be categorized as “cognitive” (analytical or interactive) versus “manual” and “routine” versus “nonroutine.” Jobs that are at-risk tend to be a combination of “manual” and “routine” tasks, while jobs that remain are (i) “manual” and “nonroutine”, typical of the service sector; and (ii) “cognitive” and “nonroutine”, often found in managerial, professional, and creative occupations. This so-called routine-biased technological change hypothesis suggests that technological change leads to polarization of low and high-skilled jobs and hollowing out of middle-skilled ones, typically of a routine nature, such as clerical and administrative occupations.

Job polarization displaces middle-skilled workers into lower-paying work, which drives wages of low-skilled workers even lower, while widening wage gaps between high-skilled and low-skilled workers. The phenomenon of job polarization is not limited to developed countries. Maloney and Molina (2016) show that middle-skilled occupations (intensive in routine cognitive and manual tasks) have decreased across developing countries. Fleisher et al. (2018) find evidence of job polarization in the People's Republic of China from 1995 to 2013. Dao et al. (2017) argue that developing countries with higher routinization of tasks and greater participation in global value chains experience more declines in the labor income share of medium-skilled workers.

Acemoglu and Autor (2011) note that the recent phenomenon of job polarization cannot be explained by the skill-biased technical change model. Instead, they use the task-based model of labor demand and supply to explain job polarization. They claim that the evolution of technology in recent years has substituted machines for certain tasks previously performed by labor in the middle of the skill spectrum and routine-based middle-skilled jobs are lost.

While job displacement was a concern with automation, automation takes over certain types of jobs or specific tasks for each job type. In the meantime, new industries and new jobs have been created. Workers who retain their jobs may also be assigned

to new tasks. As automation changes the task composition of jobs, new skills are required for jobs more in demand.

Even as the relative supply of more skilled workers has increased since the mid-1980s, demand for skilled labor has increased even more because of technological change, which raised returns to skill. Autor, Levy, and Murnane (2003) show that information technology alone can explain between 60% and 90% of the estimated increase in the relative demand for college-educated workers from 1970 to 1998. Autor (2015) also argues that automation increases the value of tasks that only humans can do. ATMs in the 1970s, for example, which did not fully displace bank tellers but shifted their work from routine cash-handling tasks to creating and managing relationships with customers (Bessen 2015). This human aspect of bank tellers is one of many tasks that will continue to be valuable and difficult to automate or to computerize (Autor, Levy, and Murnane 2003). In addition to emerging jobs relating to technology, higher incomes can increase demand for leisure such as personal care services or dining out.

However, Acemoglu and Restrepo (2019) show that in the US, despite continually rising automation, productivity and labor demand have become stagnant, attributed to the slow creation of new jobs. Therefore, the net positive impact of new technologies on jobs is not preordained. In fact, it is hard to

predict whether a new wave of technologies will create more new jobs than it will destroy.

COVID-19 AND UNEQUAL IMPACT ON JOBS

This pandemic and stringent containment measures to stop its spread have affected all jobs, but some industries and jobs more severely than others. Several factors seem to be at play, such as labor intensity (traditional services such as restaurants and retail shops and labor-intensive manufacturing sectors), low skill (manual and routine) jobs, and informality (inadequate employment protection).

The International Labour Organization (ILO) confirms the hardest hit industries by the COVID-19 crisis are accommodation and food services, manufacturing, wholesale and retail trade, and real estate and business activities (ILO 2020a). In Asia and the Pacific, prolonged and extended lockdown measures have hit wholesale and retail trade, accommodation and food services, and transportation sectors severely—these sectors account for 14% (1.9 billion workers) of total employment. Manufacturing (16% of total employment in the region)—such as automobiles and textiles, clothing, leather, and footwear—has also suffered severe domestic and global value chain disruptions.

Figure 1: Employment Sectoral Distribution by Subregion, 2019

Source: International Labour Organization. Employment by Sex and Age — ILO Modelled Estimates. ILOSTAT database. <https://ilostat.ilo.org/data> (accessed 25 June 2020).

Figure 2: Share of Nonagricultural Informal Employment in Nonagriculture Sector (%)

Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.

Source: International Labour Organization (2018).

Estimates based on the different measures implemented by the Republic of Korea and the United Kingdom also show that low-skilled work, where face-to-face interaction is unavoidable (i.e., service sector and retail), were hardest hit by blanket lockdowns (Aum, Lee, and Shin 2020). Developing countries, where 50% to 90% of total employment is in the informal economy (Figure 2)² (Loayza and Pennings 2020), will also be hard hit because of lower health care capacity, poor governance, and less fiscal space.

On the other hand, employment in some sectors, particularly in the tech and pharma industries, has held up relatively well. Since the outbreak early this year, many employees in Facebook, Google, and other tech giants have been working from home. A recent study in the US, in the context of COVID-19, show that 37% of jobs can be done at home. However, these vary significantly across location and industry. The top five includes (i) educational services; (ii) professional, scientific, and technical services; (iii) management; (iv) finance and insurance; and (v) information. The bottom five includes (i) transportation and warehousing; (ii) construction; (iii) retail trade; (iv) agriculture, forestry, fishing, and hunting; and (v) accommodation and food services (Dingel and Neiman 2020). These results are consistent with US Bureau of Labor Statistics data on the labor market, in which over 20 million lost employment in April.³ While some parts of the US

economy have opened up, seen by an increase in employment in June by 4.8 million, the net loss relative to 2019 employment is 12.9 million, largely outweighing the gains.

Recent studies in the US also show how income was highly correlated with the ability to stay at home during COVID-19. Chiou and Tucker (2020) find that those living in high-income regions with access to high-speed internet are less likely to leave their homes after stay-in-place orders. Low-skilled work also faces both higher risks of infection and a lower likelihood of being transitioned to remote work (i.e., work from home) (Aum, Lee, and Shin 2020). This correlation between jobs retained through work-from-home initiatives and skill level implies that the COVID-19 impact will be higher for low-skilled jobs.

Along with digital technologies, automation also gains prominence in addressing supply chain disruptions arising from pandemic-induced mobility restrictions. In the People's Republic of China, Cadillac had already begun fully automating its car welding and painting production lines (Baker McKenzie and Oxford Economics 2020). Automation of some jobs may be accelerated as the coronavirus continues to spread (Semuels 2020). Companies will increase the use of robots and minimize dependence on workers. While automation and increased use of robots have generally not been economically feasible for developing countries, the pandemic may force increased adaptation as firms and people continue to comply with social distancing in the coming months.

As automation happens for routine and manual jobs, workers who do not have the skills for the nonroutine and nonmanual jobs will be at greater risk. Khatiwada and Maceda Veloso (2019) use models to determine who is more likely to be successful in emerging new jobs associated with new technologies. They find that males, tertiary education, the urbanized, and those working in the service sector have an advantage, consistent with the finding of Egana del Sol (2020) that people with higher levels of education face lower risks from automation. On the other hand, most workers in developing Asia are low-skilled (50%–80%) and have at most primary education (30%–65%) (ILO 2018).

Demand for robots to do certain jobs will also continue to rise. As the coronavirus spreads, companies' reliance on nonhuman labor will likely grow, while e-commerce and e-business models based on digital platforms continue expanding rapidly. Robotics are also likely to be used more for public health in a wide range of tasks, such as disinfection or measuring vital signs, while protecting frontline health care workers (Yang et al. 2020).

Automation, along with increased reshoring induced by containment policies due to COVID-19, may similarly accelerate structural change in developing countries. This puts service sector jobs, which are offshored in low- and middle-income countries equally

² They are typically paid by the day and do not have unemployment and health insurance.

³ See U.S. Bureau of Labor Statistics. Employment by Industry, Monthly Changes, with Confidence Intervals. <https://www.bls.gov/charts/employment-situation/otm-employment-change-by-industry-confidence-intervals.htm> (accessed 6 July 2020).

at risk (Schlogl and Sumner 2020). Muro, Maxim, and Whiton (2020) indicate that low-skilled workers will be more vulnerable. Transitioning from one job to another is easier if someone has the same set of skills or has the required skills, and that it is difficult for workers, especially low-skilled, to switch occupations.

Informal workers are at particular risk. A large share of informal employment is in sectors that are relatively more vulnerable, such as manufacturing, wholesale and retail trade, transportation and storage, and accommodation and food services (Figure 3). Informal sector employment features low skills, low productivity, and low capital investment and is subject to a higher risk of job losses. And workers in the informal sector typically earn low wages and have little access to social protection coverage. ILO (2018) reports that 1.3 billion people work informally in Asia and the Pacific—65% of the world's informal employment. Around 7 in 10 workers in developing Asia are in the informal economy. Informal employment accounts for the highest share of total employment in South Asia (89%), followed by Southeast Asia (76%) and Central Asia (70%). For example, almost 9 in 10 workers are in informal sectors in Bangladesh, India, and Nepal.

Informal sector workers tend to have low educational attainment and limited access to formal education and training (Fluitman 1989; Lautier 2000). Indeed, recent data reveal that 22.7% of informal sector workers in Asia and the Pacific did not receive any education at all. The statistics show that 4.5% of informal sector workers in the region had completed postsecondary or tertiary education while 22.3% of formal workers attained more than 12 years of schooling (Figure 4). In Bangladesh, 35.9% of all informal sector workers have not received any training at all, followed by India (26%) (2011–2012).

The situation is often worse among women, youth, and rural workers. Women make up a larger share of the informal economy in low- and lower-middle-income countries, at 92.1% and 84.5% respectively (versus 87.5% and 83.4% for men) (ILO 2018). They also have less education and lower incomes than men. In developing countries, only 32% of the female workforce is in the formal economy, compared with 36% of the male counterpart (Figure 5). The difference is highest for South Asia and Africa, with 26% and 31% more men in the formal sector, respectively.

Figure 3: Informal Employment by Sector in Select Asian Countries (%)

Source: Asian Development Bank calculations based on country microdata: Labor Force Surveys for Bangladesh (2016), India (2011–2012), Indonesia (2017), Thailand (2018), and Viet Nam (2016).

Figure 4: Educational Attainment of the Informally Employed (%)

Source: International Labour Organization. ILOSTAT. <https://www.ilo.org/ilostat/> (accessed May 2020); and Asian Development Bank's calculations based on country microdata.

POLICY IMPLICATIONS FOR THE POST-COVID-19 WORK AND WORKPLACE

COVID-19 will likely spur digital transformation of work and the workplace. Country experiences underscore the importance of technology in mitigating the effects of COVID-19, not only on health, but also on economic outcomes.⁴ In particular, the use of medical and new technologies such as artificial intelligence, big data, drones, 5G, robotics, automated vehicles, and blockchain have emerged as winners during the pandemic. In the post-COVID-19 era, digital tools and technologies will be further prioritized in schools, workplaces, and across different sectors.

As more organizations and people began regularly using digital tools and technologies to connect during the pandemic, the post-COVID-19 world will likely rely more on digital solutions than before the crisis. However, as digital transformation accelerates, job polarization and displacement of middle-skill workers are raising concerns about income polarization, inequality, and inadequate social protection.

The trend of job polarization indicates that a significant reallocation of jobs could occur in the coming years, increasing the urgency for job training programs and appropriate labor policy. Indeed, the trend could worsen inequality and skill-bias, with still worse impact on old workers, who are typically low skilled and do routine jobs (Lewandowski et al. 2017). Past experiences in developed nations also suggest developing countries need to prepare for labor market disruptions coming from increasing automation and a reduction in offshored jobs (Das 2018).

Policy makers should adopt appropriate policy strategies and options that help mitigate the impact of these postcrisis structural changes on the workforce and the most vulnerable, who deserve timely and human-centered attention.

Invest in digital readiness

Digital readiness has proved a crucial factor in allowing some economies to successfully contain the spread of the virus and others to continue normal activities (or as close as possible to normal) during the pandemic. Developing the enabling infrastructure, nurturing cooperative ecosystems, and building digital skills and education are all critical for digital transformation.

A recent study by the United Nations Conference on Trade and Development noted significant gaps in digital readiness across borders, with the least-developed countries lagging considerably behind (UNCTAD 2020). Individual access to the internet in Asia and the Pacific, at 48%, is only slightly below the global rate of 53.6%, but disparity across economies is stark, with the lowest access in Afghanistan at 13% and the highest in the Republic of Korea at 96% (Figure 6). Gaps range from information and communication technology (ICT) infrastructure to online platforms, mobile payment

Figure 5: Regional Average Share of Formal Employment to Total Employment by Gender (%)

Source: International Labour Organization (2018).

Women are also often overrepresented in low-skill services such as housekeeping, wholesale and retail trading, agricultural activities, and labor-intensive manufacturing sectors. Women typically earn much less than men. In addition, a considerable share of women are engaged in family employment, working for no pay at all, either caring for family members or as their unpaid employees.

⁴ The Republic of Korea is often cited as a successful case of using digital technology to contain the pandemic by contact tracing; see Development Asia. <https://development.asia/explainer/what-we-can-learn-korean-response-covid-19>.

solutions, skills, and legal and regulatory frameworks. The digital divide also remains significant between rich and poor, urban and rural, young and old, and men and women in many developing countries, posing a meaningful social challenge. Affordability and availability of ICT access remain significant barriers to use of computers and the internet and vary significantly across borders and even within countries.

With the advent of telecommuting, online meetings and classes may become part of the new normal as economies recover. Therefore, the gap in digital readiness and various forms of the digital divide can have longer-term and lasting impact on inequality among individuals and in social groupings and countries. Public investment in ICT and digital infrastructure, digital skills development, and in the regulatory framework will be critical to bridge the gap in digital readiness and facilitate digital transformation (Chinn and Fairlie 2007).

Public and private partnerships are essential for building digital readiness. Digital and ICT networks should be regulated and at least partially under public control given the risk of cybersecurity, requiring both private and public participation. In cases of last-mile connectivity to rural and remote areas as well as socially excluded groups, private investors may underinvest due to high costs and low returns. Governments in developing countries (with support from multilateral development banks) should ensure adequate public investment in high-speed broadband and fiber networks and design appropriate regulatory regimes with the proper incentive structures and governance mechanisms.

Develop skills for the digital economy

Skills development programs can help the low-skilled unemployed find work once countries open up. Prolonged unemployment is a serious challenge, especially for low-skilled workers, although it will affect workers of all skill levels. Some countries have increased their investment in skills development of people unemployed and furloughed due to the pandemic. These programs include upscaling of digital skills, vocational training, or basic skills training for the unskilled in the worst-hit industries. In Indonesia, as millions filed for jobless allowances, the government allotted \$227 million for upskilling programs through vocational training on digital platforms and some allowance (Listiyorini and Suhartono 2020). This preemployment program is targeted for displaced workers with no formal education. Similarly, Nepal provided informal sector workers the opportunity to take part in public works projects for subsistence wages (IMF 2020). The ILO (2020b) also recommends subsidies to lower the cost of mobile calls and internet access to encourage informal workers to access training using digital tools to either continue or start small businesses.

The COVID-19 impact on education also has implications for the future workforce. With school closures, e-learning has increased substantially. While this offers opportunities to develop or deepen digital skills, not every student is capable of going online. Moreover, online education and training programs may not fully substitute for actual school- or work-based learning. They will also certainly not compensate for the pre-COVID-19 challenges in existing education systems. Many students were not acquiring the fundamental skills needed for life or skills demanded by a changing job environment. These challenges have important social and economic implications. Despite the noticeable improvement in digital skills education, the pandemic has thrown a spotlight on the key constraints in current education systems, including lack of digital curriculums, teaching tools, and materials. More importantly, digital competences are lacking among teachers and trainers. Reforms and policies related to digital technology in the education system are needed to integrate ICT into teaching methods. They are also needed to give teachers ICT skills and reshape their roles, helping them to become facilitators of knowledge, to nurture digital capability and competency among students, and to promote creative and innovative ideas in classes. At the same time, policy makers should not lose sight of the groups often falling behind and excluded, such as the elderly, poor, and rural communities. It is important to provide targeted support to enhance digital literacy and reduce digital exclusion.

A lifelong learning approach should help future workers adjust to coming technological changes. This will prevent the high social costs of the complex and disruptive changes of digital transformation and allow society to maximize positive economic effects. In the education and labor market reform agenda, authorities should design and implement concrete steps to achieve the right of all to access formal and nonformal lifelong learning.

Figure 6: Individuals Using the Internet in Asia (%)

Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.

Note: 2018 data for Cambodia; Hong Kong, China; Indonesia; Iran; Japan; Republic of Korea; Macau, China; Malaysia; Mongolia; Singapore; Taipei, China; Thailand; and Viet Nam. The rest is 2017.

Source: International Telecommunication Union <https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx> (accessed 2 July 2020).

Strengthen social protection for the unemployed and vulnerable

The COVID-19 pandemic has exposed serious gaps in social protection systems in many developing economies. Effective social protection systems are essential to support the unemployed and vulnerable, especially during crises. However, national systems often remain limited in coverage and efficiency of delivery. They need significant upgrading to respond effectively to a crisis like COVID-19.

Developing economies can explore targeted or semi-targeted policies, according to risk, as economies reopen. In the pandemic context, Acemoglu et al. (2020) suggest that optimally targeted policies—such as limiting strict lockdowns to older populations, allowing the less vulnerable to rejoin the economy gradually—can reduce both mortality and economic damage more than policies that apply to everyone can. Public policy responses should also limit the impact of unemployment on workers and their families by providing temporary income support (i.e., unemployment insurance systems, redundancy payments, and social assistance programs) and employing active labor market policies (i.e., labor exchanges or mobility assistance, education and training, and business support or subsidized employment) (Schmillen 2020). According to IMF (2020), at least 20 countries have provided targeted support to the informal sector or the self-employed.

Rapid digital transformation is also changing the way people work and the nature of employment. More people are having multiple careers in their lifetimes, working in several jobs across various industries and jurisdictions, and spending significant time on reskilling. Social protection systems need to be adapted to reflect such changes and provide adequate and appropriate worker protections. Many regulatory loopholes in the digital labor market have also created substantial challenges to traditional social protection systems. Digital employment is weakening the participation of employees in formal social security systems and unemployment insurance as well as employer compliance with labor market regulations. Therefore, social protection systems and policies require new thinking and reconfiguration of institutional settings to address these rising social security and unemployment risks in the digital era.

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