TAPPING TECHNOLOGY TO MAXIMIZE THE LONGEVITY DIVIDEND IN ASIA

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ASIAN DEVELOPMENT BANK

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6 ADB Avenue, Mandaluyong City, 1550 Metro Manila, Philippines
Tel +63 2 632 4444; Fax +63 2 636 2444
www.adb.org

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FOREWORD

Aging has become one of the key policy concerns in the Asia and Pacific economies. Policy makers in the region urgently need to understand the scale of demographic changes, their impact on productivity and growth, and the underlining mechanisms behind the aging and growth nexus.

Indeed, Asia and the Pacific is graying rapidly. From 2020 to 2050, the region's share of the senior population (age 65 years and over) is expected to double from 9.2% to 18%, exceeding the 16% global average in 2050. Some countries face a surge in their senior populations while their economies undergo structural transformation to reach high-income status. Compressed and premature aging raises concerns that some countries may struggle to provide adequate social services and income support programs for the elderly while continuing to stimulate economic growth through large-scale investments in infrastructure and human capital development.

Technology and innovation can help reignite productivity and growth by augmenting the working life span of aging populations and enhancing their contribution to human capital. While the negative aspect of population aging tends to draw much public attention, longevity and resulting longer working lives can offer new prospects for business and motivate technological innovation. For example, automation and artificial intelligence (AI) supplement and complement labor, as well as making jobs and tasks physically less demanding. New technology can also provide novel tools for improving health conditions, upgrading skills, and matching these skills to jobs.

This monograph aims to draw upon existing knowledge and evidence to elucidate the role of technology in addressing the economic and labor market opportunities and challenges posed by aging. By doing so, policy makers in the region can develop and deliver solutions to harness technology for productive silver years to maximize the gains from longevity dividends. I sincerely hope that this publication encourages further research and contributes to policy making across the region.

YASUYUKI SAWADA
Chief Economist and Director General
Economic Research and Regional Cooperation Department
Asian Development Bank

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HIGHLIGHTS

Aging and Demographic Transition in Asia: Impact on the Workforce

- Asia and the Pacific is aging at a fast pace. The population share of seniors increased from 6% (209 million) in 2000 to nearly 8.3% (349 million) in 2017 and is projected to reach as much as 18% (870 million) in 2050. Countries experiencing surge in the share of seniors toward 2050 include the Republic of Korea (14% in 2017 to 35% in 2050), Singapore (13% to 34%) and Thailand (11% to 29%) while that of the People's Republic of China (PRC) is expected to grow from 11% to 26% in the same period.

- Rapid aging will leave its mark on the workforce population. The share of working-age population (15–64) in the region will no longer grow and plateau at around 67% from 2017 to 2030. Economies likely to see a large contraction of working-age population during this period include Hong Kong, China (10.4%), the Republic of Korea (10.3%), and Japan (8.7%). The region's working-age population itself is graying and its average age is expected to rise from age 37 in 2015 to 40 in 2050.

Aging Workforce, Productivity, and the Role of Technology

- As much as a third of the East Asian miracle has been attributed to favorable demographics, and the same dividend is enjoyed by developing Asia. Progressive aging in the region raises concerns over the capacity to grow as populations become increasingly aged. Evidence is mixed on the impact of aging on worker/firm productivity as the effects seem to vary across sectors and tasks and according to the criteria used to measure productivity. However, seniors today are healthier and better educated than in the past, and many are willing to work beyond the current retirement age.

- Experience from "aged" countries suggests that technology plays an essential role in providing solutions to the aging of the workforce. The role of technology can be broadly categorized into: (i) improving health and longevity, (ii) transforming work and workplace, and (iii) assisting workers and creating supportive labor market infrastructure.

  » Technology for health and longevity: Advancement in medical sciences and biotechnology contribute to longevity and longer healthy life spans, in turn leading to longer and healthier working lives. For example, estimated work capacity of adult men (ages 55–69) has extended by 3.2 to 8.4 years in Organisation for Economic Co-operation and Development (OECD) countries between 1977 to 2010. Evidence shows healthier workers have higher productivity.

  » Technology for work and workplace: Technology that transforms work and the workplace encourages labor participation of seniors and improves their productivity. Automation has transformed jobs by reducing manual and physically demanding jobs. The adoption of industrial robots in the region has increased rapidly and is projected to grow 120% from 2016 to 2020. Technology also allows firms to implement flexible work practices.

- » Technology for workers and supportive labor market infrastructure: The application of technology to job-matching and training services has great potential to bring seniors into the workforce and improves their job skills. Innovative, customized, and interactive training using modern technology helps build skills.

Maximizing Gains from the Longevity Dividend

- While technology can harness the longevity dividend, the gains are not automatic. Technological innovation and adoption must be promoted through sufficient funding of research and development activities, along with the development of human capital and resources in targeted sectors and industries. Amid the increasing pace of technological change, workers—including seniors—need to undergo lifelong training to upgrade and relearn skills. The effort to bridge the "gray divide" can be strengthened by taking account of seniors' specific needs and concerns.

- The diversity of population profiles in Asia and the Pacific presents a source of growth beyond national demographic changes or the longevity dividend by tapping complementarity. To gain mutual benefits from diversity, countries in the region can jointly invest in connectivity and human capital development and in facilitating the cross-border mobility of workers.

INTRODUCTION

The demographic landscape of Asia and the Pacific is shifting rapidly toward aged societies. With fewer births and longer lives, the share of seniors (people of age 65 and older) has grown by 67% (from 209 million to 348.9 million) from 2000 to 2017. It is expected that one in every five people in the region will be a senior by 2055.

Aging and demographic change have profound implications for the speed and ability of Asia to achieve and sustain growth and development. The end of rapid population expansion that accompanies the shift toward an aging and shrinking workforce can be a source of economic stagnation as it drags down productivity growth and technological adoption (Feyrer 2007, Maestas et al. 2016, Tang and MacLeod 2006, Wasiluk 2014). The key to overcoming the challenge seems to lie in the region's ability to maximize the opportunity presented by longevity and longer working lives.

Technological advancement can provide solutions and open new opportunities for the countries that are having to deal with demographic challenges. Technology can save on labor inputs, boost productivity, and enhance employability regardless of age.

As more countries in the region must soon face the consequences of progressive population aging, it is essential to document how countries that have already had the experience have dealt with its effects on their economies and productivity. Understanding of the parts played by innovation and policy in countries that have been through the frontier of aging will be useful for those that anticipate dramatic shifts.

While Asia is aging, many countries in the region will continue to experience moderate growth in the share of their working-age populations over coming decades. Given the diversity of demographic profiles across Asia and the Pacific, there is significant scope for regional cooperation in managing human capital and resources and facilitating cross-border labor mobility.

This monograph presents evidence on the state of demographic transitions and their implications on labor force participation, productivity, and growth. It explores the role and potential of technology to harness gains from the longevity dividend and draws together national and regional policy recommendations for countries in Asia and the Pacific.

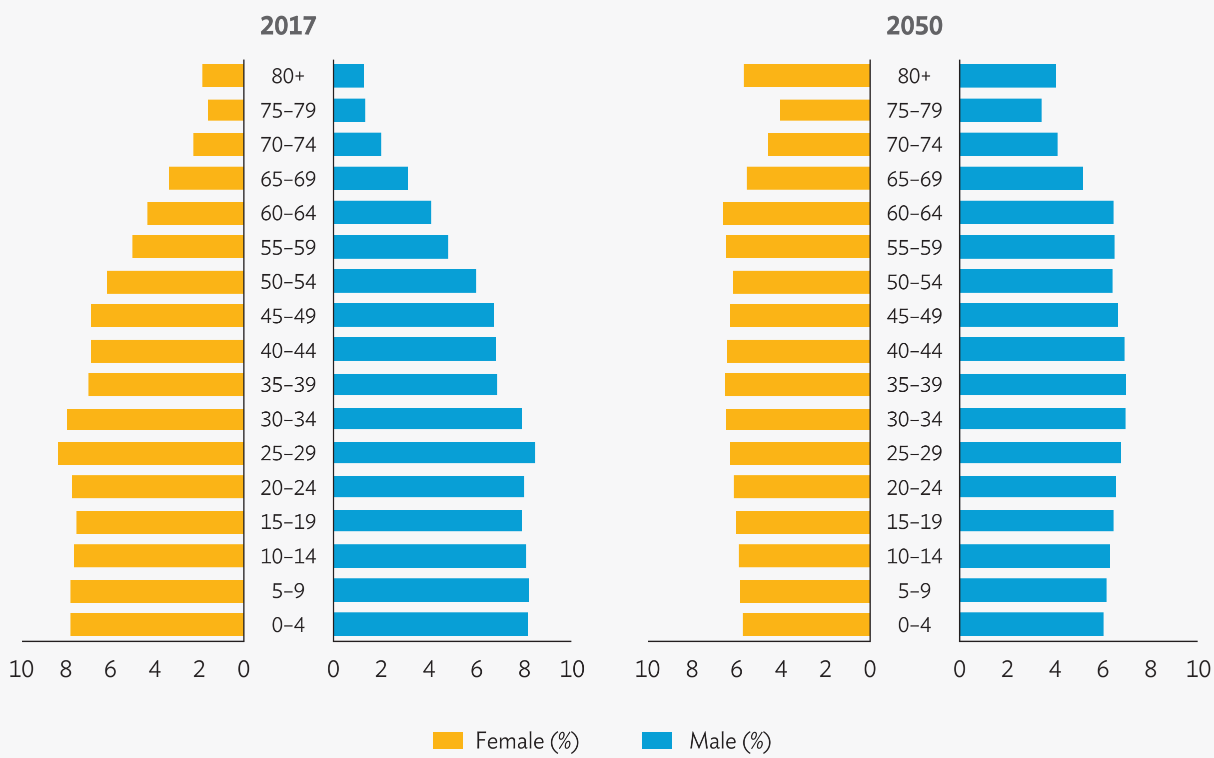
DEMOGRAPHIC TRANSITION IN ASIA

1.1 | Asia's Demographic Transition: Progress and Outlook

It is a stylized fact that economic development is accompanied by lower mortality and birth rates due to improvements in public health and medical science while increasing the direct and indirect opportunity costs of having children.

Asia and the Pacific has witnessed significant demographic transition (Figure 1). The region's total population grew from 1.3 billion in 1950 to 4.2 billion in 2017 and is projected to reach 4.8 billion in 2050. The United Nations estimated that Asia's population will grow until 2053 (4.8 billion), after which it will steadily decline, falling back by 2100 to 4.3 billion people, the same population as expected in 2020.[1]

Figure 1: Population Pyramid in Asia, 2017 and 2050

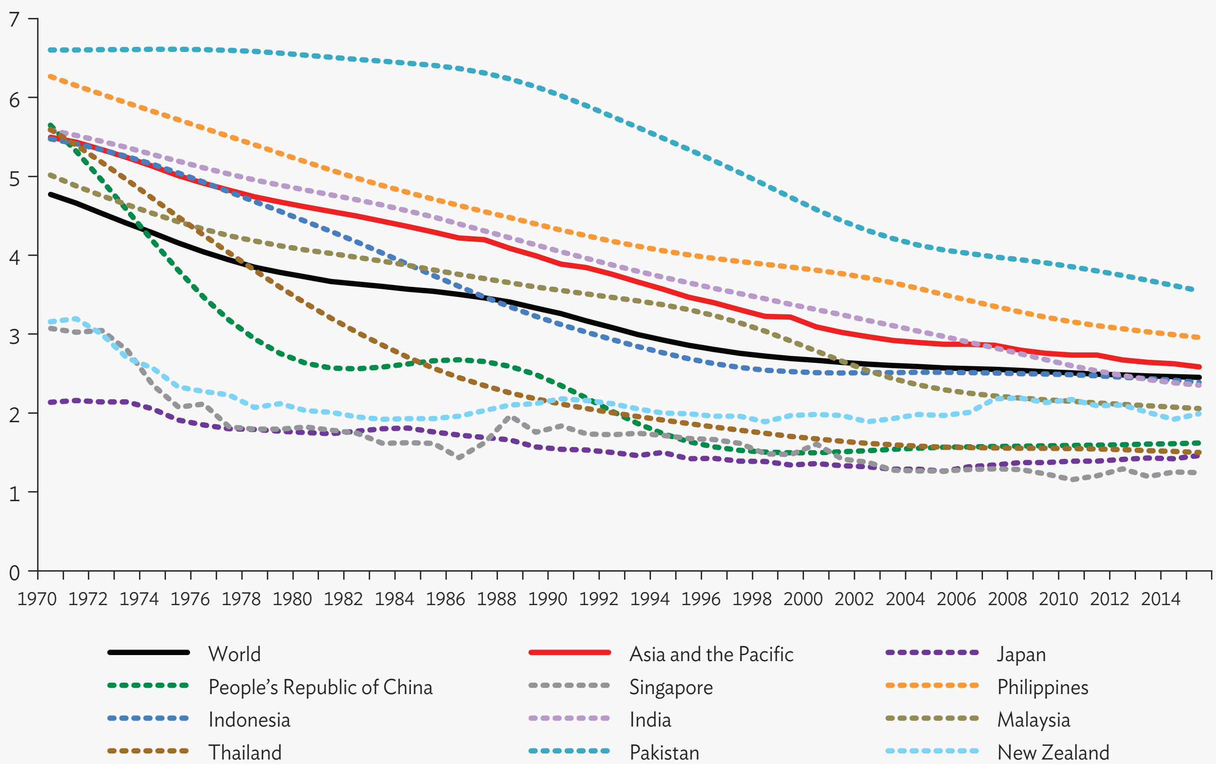


Source: ADB calculations using data from the United Nations, Department of Economic and Social Affairs, Population Division.

[1] Asia (used interchangeably with "Asia and the Pacific") refers to 48 ADB member countries.

Low mortality and fertility rates are the two biggest contributors to longer life expectancy and increases in the share of seniors in the populations of countries across the region. Lower mortality rates are realized primarily due to the drastic reduction in the infant mortality rate—from 88 to 23 per 1,000 births between 1970 to 2015 (World Bank, World Development Indicators). In response, fertility rates in Asia and the Pacific have declined from 5.5 births per woman in 1970 to 2.6 in 2015, with significant variation across countries (Figure 2). On a global scale, the average fertility rate dropped from 4.8 to 2.5 in the same period.

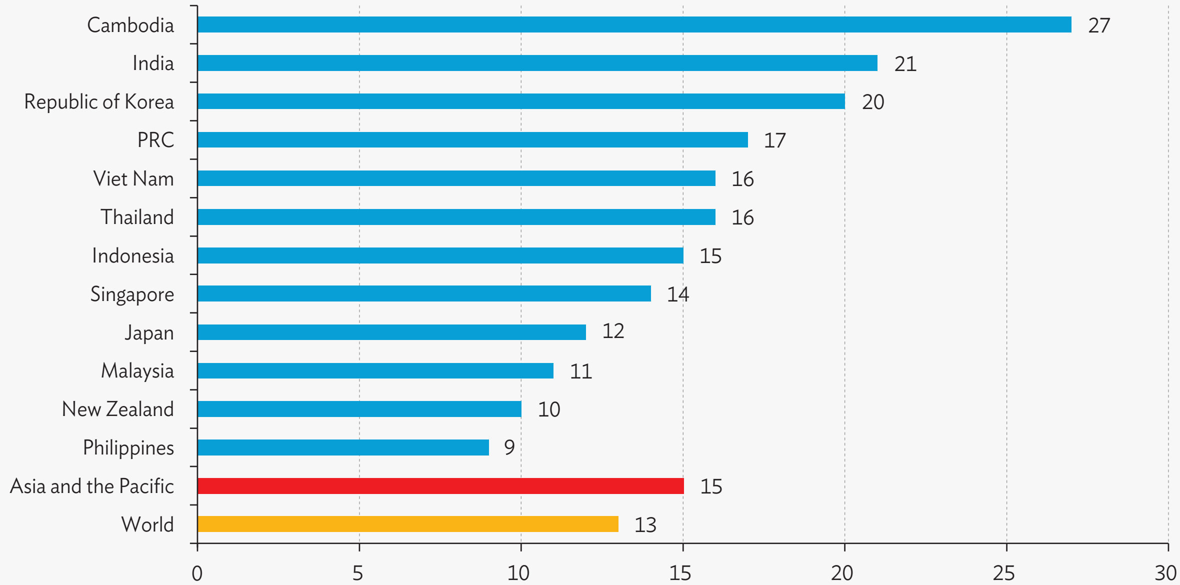
Figure 2: Fertility Rates in Asia and the Pacific, 1970–2015



Source: ADB calculations using data from the World Bank, World Development Indicators (accessed March 2018).

Low mortality and fertility rates along with further improvement in medical service and nutrition expanded the average life span from 57 years in 1970 to 73 years in 2015 in Asia. For Cambodia, India, and the Republic of Korea, life expectancy lengthened by at least 20 years (Figure 3). For the countries in advanced stage of aging—i.e., Japan, the Republic of Korea, New Zealand, and Singapore—life expectancy lengthened by at least 10 years in the same period.

Figure 3: Increase in Life Expectancy between 1970 and 2015



PRC = People's Republic of China.

Source: World Bank, World Development Indicators (accessed March 2018).

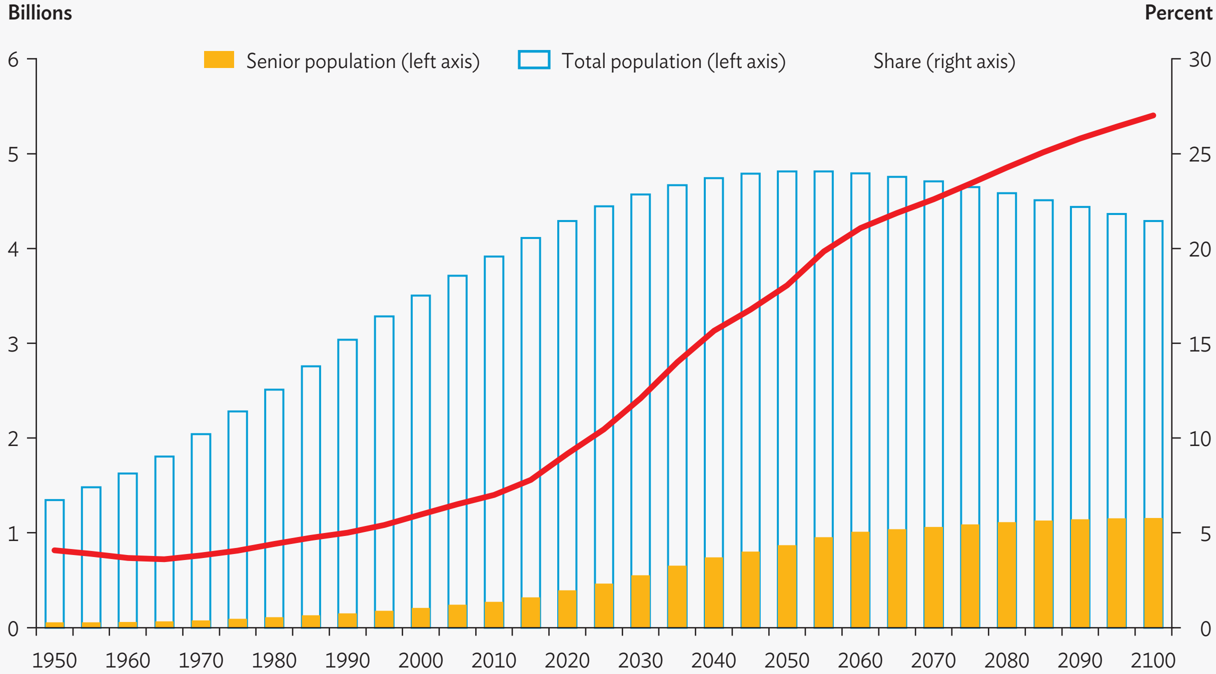
1.2 | Compressed and Accelerating Speed of Aging in Asia

Asia and the Pacific is graying at an accelerating speed (Figure 4). From 2020 to 2050, the region's share of seniors (age 65 or above) to the total population is to double from 9.2% to 18%, while the pace of change was more moderate in the past (4.4% to 7.0% between 1980 to 2010). Increased availability of family planning that resulted in a sharp decline in fertility rates is one major contributor to the faster speed of aging in the populations of some countries.

Rapid graying process results in compressed period of aging in which a country climbs from being "aging" economy (share of seniors in the total population reaching 7%), "aged" (14%) to "super- aged" (21% or above) society (Figure 5).[2] It took many decades for Western nations to transition from aging to aged society (the United States 70 years, Australia 75 years, the United Kingdom 45 years), but it took Japan, the only country in Asia to have reached a "super aged" population as of now, 37 years to reach that point. For other countries, graying is expected to progress in an even shorter time. It is projected that it will take 35 years for the PRC to witness its share of seniors to increase from 7% to 21 %, and 27 years for the Republic of Korea. Thailand and Viet Nam will have less than 32 and 33 years left, respectively, to prepare for one in every five citizens being senior. The speed with which countries are aging relative to their pace of economic development concerns economists because a nation that ages before reaching high-income status can face a slew of challenges that may compromise economic growth.

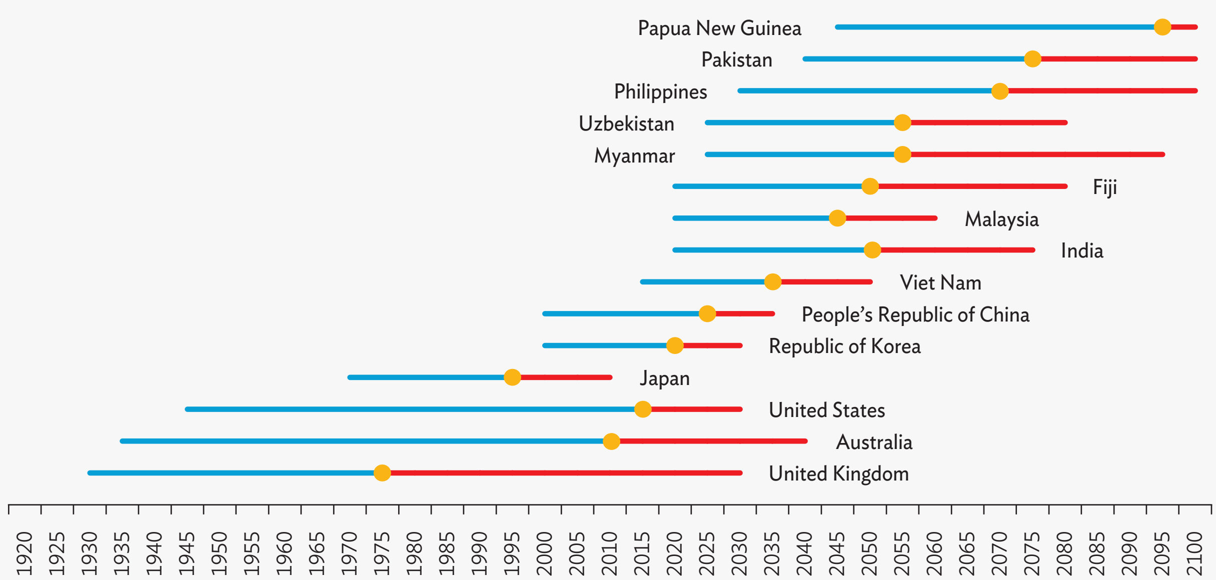
[2] For the definition of aging, aged, and super aged societies see, http://www.unescap.org/ageing-asia/countries.

Figure 4: Senior Population in Asia and the Pacific, 1950–2100



Source: ADB calculations using data from the United Nations, Department of Economic and Social Affairs, Population Division.

Figure 5: Speed of Aging



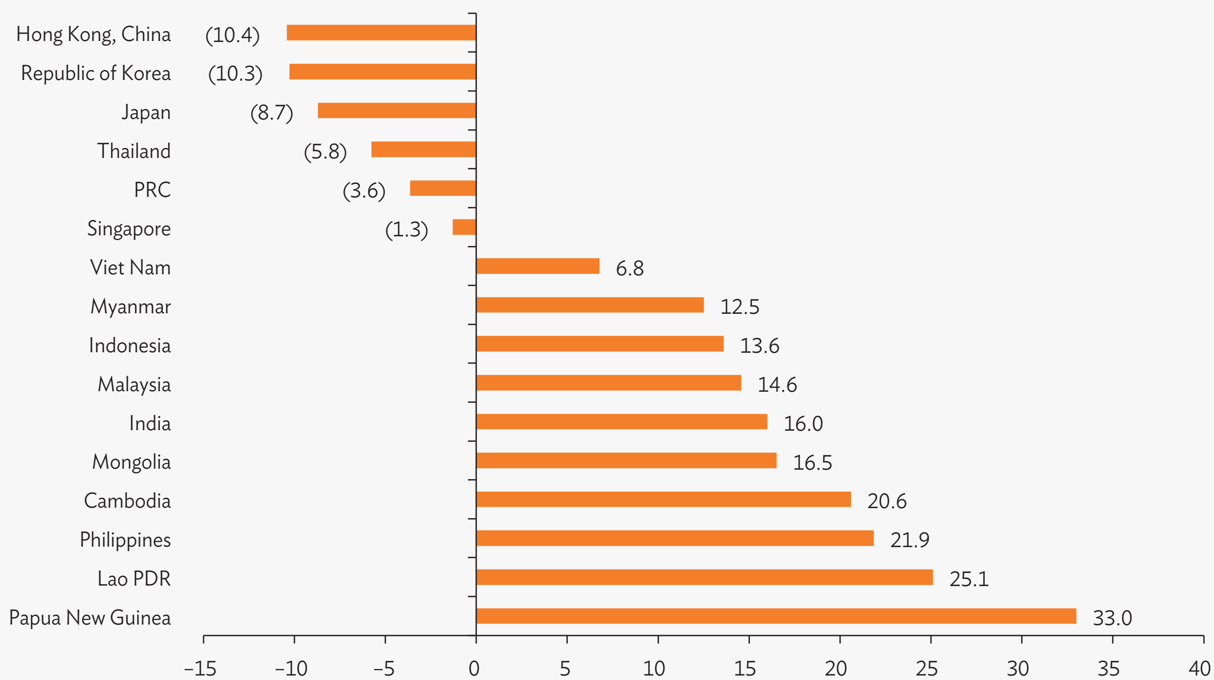
Note: The blue line refers to the projected number of years for the share of the population of age 65 and over to rise from 7% to 14%. The red line refers to the projected number of years for the share of the population of age 65 and over to increase from 14% to 21%.

Source: ADB calculations using data from the United Nations, Department of Social and Economic Affairs, Population Division.

1.3 | Demographic Shift and Labor Supply

Some economies in Asia will experience drastic reductions in working-age populations (ages 15–64). In Hong Kong, China and the Republic of Korea, the productive population will shrink by 10% (Figure 6) between 2017 and 2030. Japan, which has already reached an advanced stage of aging, will also witness further shrinkage of its working-age population by 8.7% in the same period. On the other hand, the workforce pool will continue to expand by at least 20% in Cambodia and the Philippines and over 30% in Papua New Guinea by 2030. Asia's working-age population is expected to increase from 2.8 billion to 3.1 billion between 2017 to 2030, but its share of total population will no longer grow and plateau during this period at around 67% and decline to 64% by 2050.

Figure 6: Percentage Change in Population of Ages 15–64 between 2017 and 2030

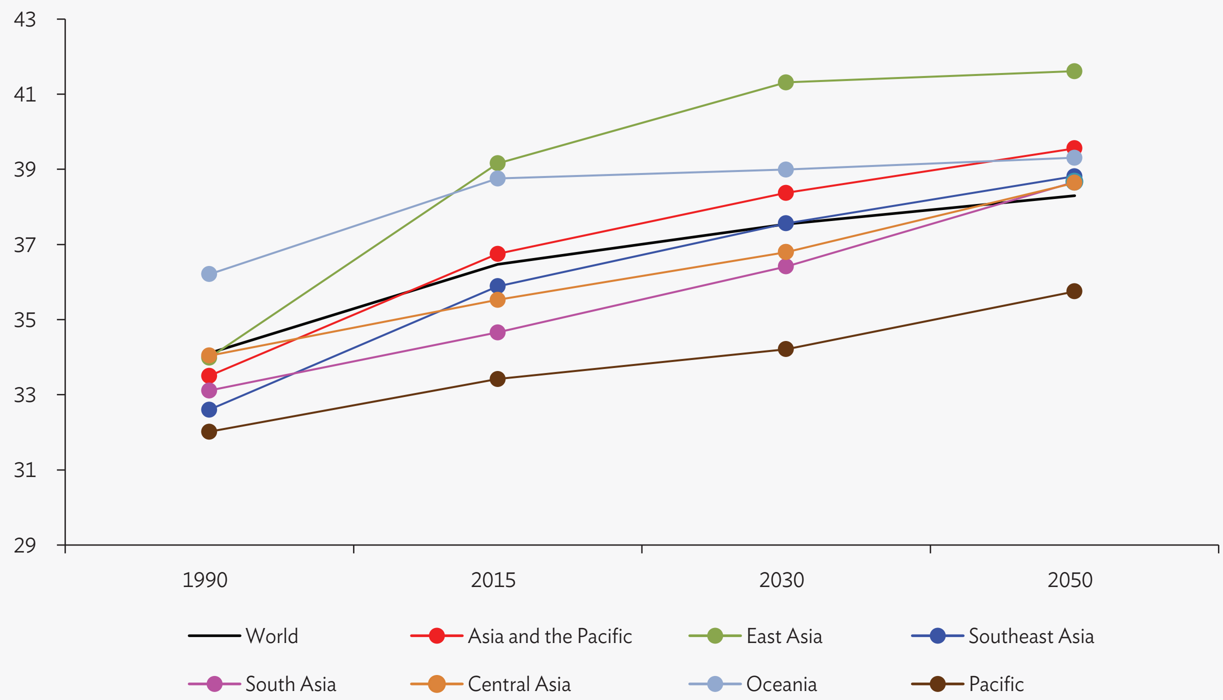


Lao PDR = Lao People's Democratic Republic, PRC = People's Republic of China.

Source: ADB calculations using data from the United Nations, Department of Economic and Social Affairs, Population Division.

Aging also progresses within a workforce. Increases in the mean age of the working-age population are evident across all subregions in Asia. From 2015 to 2050, the average age is expected to increase from 37 to 40 in the region (Figure 7). The mean age was highest in East Asia (39) and lowest for the Pacific (33) in 2015. By 2050, these mean ages will increase to 42 and 36, respectively.

Figure 7: Mean Age of the Working-Age Population in Asia and the Pacific



Source: ADB calculations using data from the United Nations, Department of Economic and Social Affairs, Population Division.

The accelerating speed of aging is evident in many countries in the region, which has resulted in smaller and more aged workforces. Other countries are expected to continue experiencing demographic dividends for decades to come, but none are exempt from the force of demographic transition. Concern over the economic and social consequences of aging is growing as the era for reaping returns from the demographic dividend in the younger share of a population reaches its end. The next section explores the nexus between aging, economic development, and the economic implications of demographic transition. It collects evidence from aged countries with an aim of drawing policy implications for both aging and soon-to-be aging countries.

AGING WORKFORCE, PRODUCTIVITY, AND THE ROLE OF TECHNOLOGY

2.1 | Aging, Productivity, and Growth

Demographic transition carries profound implications over the course of economic and social development of a country or a region. A bulge in the young workforce is closely associated with accelerating growth—a phenomenon known as the "demographic dividend." As much as 33% of the growth in East Asia from 1965 to 1990 can be attributed to favorable demographics (Bloom, Canning, and Malaney 2000). Many parts of Asia which sustained low fertility rates are now facing a demographic transition, a shrinking working-age population and an aging workforce. Literature points to a possibility of demographic headwind that may fetter growth (Chomik, McDonald, and Piggott 2016; Flochel et al. 2015; Bloom, Canning, and Finlay 2010).

Aging and Aggregated Growth: The Macroeconomic View

Empirical evidence suggests that aging in advanced economies led to a decline in per capita product. In the United States, a 10% increase in the population share of those aged 60 and above is estimated to have led to a 5.5% decline in gross domestic product (GDP) per capita growth rate, based on data from 1998 to 2010 (Maestas, Mullen, and Powell 2016). A third of this decline is due to the smaller size of the workforce, while the rest is explained by labor productivity growing more slowly. Several other studies show that a higher share of senior people in the workforce leads to lower productivity (Tang and MacLeod 2006) and hence, lower growth (Gordon 2016). Wasiluk (2014) projected a 0.13-percentage-point decrease in the annual productivity growth rate for Germany between 2010–2015, due to aging of the workforce.

In Asia, demographic shifts are expected to continue influencing the speed of economic development, but its direction depends on the country's labor force endowment. Estimates from Park and Shin (2011) show that the impact of demographic change (defined as the effect of changes in young and elderly dependency rates over the changes in savings, capital accumulation, labor force participation, and total factor productivity) on per capita GDP growth rates varies for developing Asia (Table 1). Aging and advanced economies such as Hong Kong, China; the Republic of Korea; and Singapore have already been paying a demographic tax, with the negative impact of the old-age dependency ratio outweighing the positive contribution of youths to growth. For developing countries such as the PRC, Thailand, and Viet Nam, the demographic contribution to growth is positive in the medium term, but will become negative from 2021 to 2030. Ha and Lee (2018) argue that several economies in Asia are at risk of a demography-driven middle-income trap because these countries will find it increasingly difficult to finance growth while having to provide social services and income support for a large and growing number of seniors.

Table 1: Projected Impact on Growth from Changes in Youth and Old-age Dependency, 2011–2020 and 2021–2030

		2011–2020 (%)		2021–2030 (%)	
Economy	"Variable (Dependency Ratio)"	Total	Net effect	Total	Net effect
People's Republic of China			0.156		−0.785
	Youth	0.605		0.148	
	Old-age	−0.449		−0.933	
Hong Kong, China			−0.094		−2.175
	Youth	0.592		−0.260	
	Old-age	−0.686		−1.915	
India			0.959		0.509
	Youth	1.113		0.853	
	Old-age	−0.154		−0.344	
Indonesia			0.551		0.188
	Youth	0.819		0.630	
	Old-age	−0.268		−0.442	
Republic of Korea			−0.094		−1.448
	Youth	0.780		0.074	
	Old-age	−0.874		−1.522	
Philippines			0.845		0.435
	Youth	1.097		0.779	
	Old-age	−0.252		−0.344	
Singapore			−0.099		−2.517
	Youth	1.061		−0.111	
	Old-age	−1.16		−2.406	
Thailand			0.079		−0.859
	Youth	0.475		0.074	
	Old-age	−0.396		−0.933	
Viet Nam			1.464		−0.279
	Youth	1.494		0.408	
	Old-age	−0.030		−0.687	

Source: D. Park and K. Shin. 2011. Impact of Population Aging on Asia's Future Growth. *ADB Economics Working Paper Series* 281, Manila: ADB.

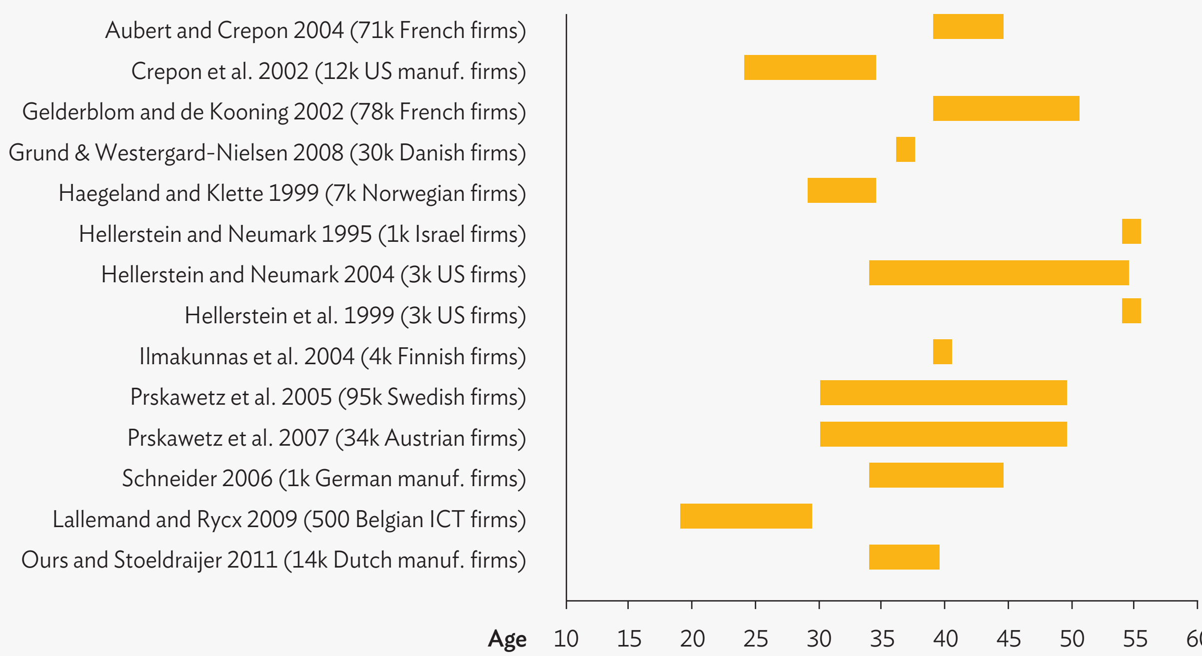
Productivity of an Aging Workforce at Worker and Firm Level

The outcome of studies into the productivity of senior workers or of an aging workforce is inconclusive as to whether and to what extent aging can affect growth. Drivers of productivity include three elements: (i) quality of labor or human capital (health, education, training), (ii) physical capital (infrastructure, machinery and the like) and (iii) technology and innovation (such as new production methods, and management techniques). As for human capital, the intuition suggests that senior workers and aging workforces are associated with lower productivity (International Monetary Fund 2016).

Aging accompanies a deterioration of physical and cognitive capacities that can affect productivity, especially where physical skills are required. However, a study by Borsch-Supan and Weiss (2016), using data from a truck assembly plant in Germany, found that average productivity among individuals increases up to the age of 60. The increase was attributed to other characteristics such as older workers' experience and noncognitive abilities such as ability to work in teams. Similarly, a study by Burtless (2013) in the United States found little evidence that aging led to lower productivity.

Firm-level studies across the countries suggest that the ages in which productivity peak tend to be around ages 30–45, but the range vary across countries and industries (Figure 8, Gordo and Skirbekk 2013 cited by Chomik and Piggott 2018), such as the relatively young range for information and communication technology firms in Belgium, at ages 19–29, compared to Dutch and German manufacturing firms, where peak age starts at 35. Some firms also exhibit relatively long period of peak ages while others have very short time span. Some variation suggests that there are some sectors where workers may exhibit higher productivity even at later stages in their careers.

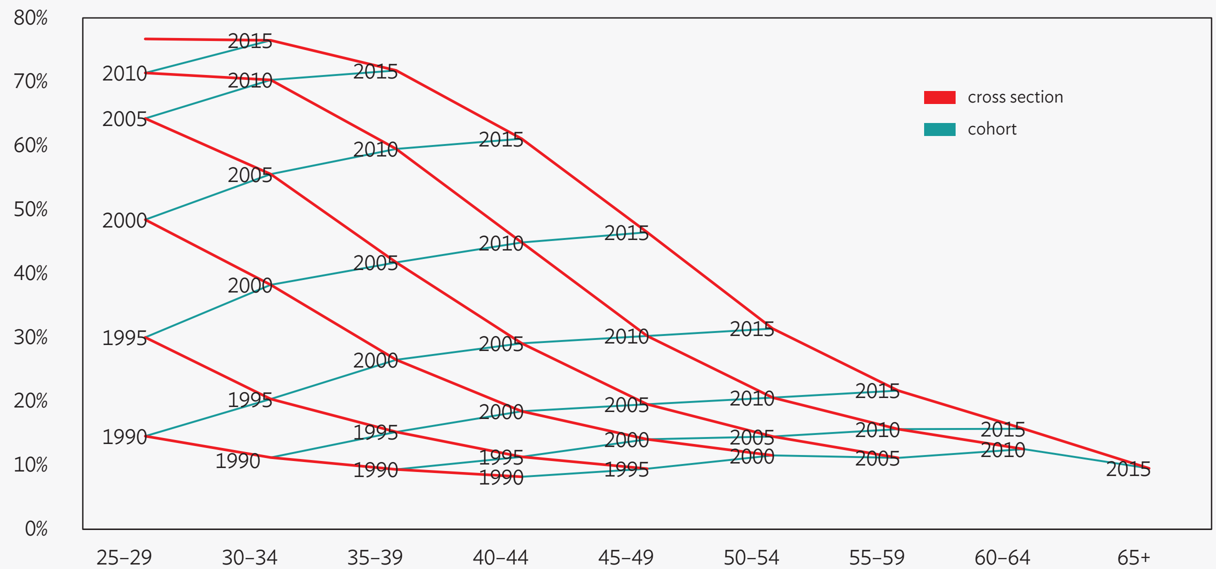
Figure 8: Peak in Productivity by Age in Firm-level Studies, by Study from 1999 to 2011



Source: Adapted from R. Chomik and J. Piggott. 2018. *Population Ageing and Technology: Two Megatrends Shaping the Labour Market in Asia.* Background paper prepared for an ADB-led workshop on technology and aging to be held in Seoul, Republic of Korea on 17–18 May 2018.

It is likely that the productivity of seniors today compared to cohorts (same age group) in the past has increased because seniors today are more educated. In Singapore, for example, tertiary educational attainment by age of a cross-sectional view suggests a simple declining pattern. However, comparing across the same age group (cohort) from different years, the educational attainment of older workers has been rising (Figure 9).

Figure 9: Tertiary Educational Attainment by Age Group in Singapore, 1990–2015



Sources: Statistics Singapore (2018), www.singstat.gov.sg/; Adapted from R. Chomik and J. Piggott. 2018. *Population Ageing and Technology: Two Megatrends Shaping the Labour Market in Asia.* Background paper prepared for an ADB-led workshop on technology and aging to be held in Seoul, Republic of Korea on 17–18 May 2018.

Further research is needed to better understand the complex relationships and interactions between aging, productivity, and technology. Research that explores the following questions may be helpful in bringing further insights: (i) What aspects of aging (health, physical and cognitive capacity, education level, noncognitive abilities, and so on) are associated with changes in productivity for different age groups across different sectors/occupations? (ii) How does the productivity of older workers change over time as more workers chose to extend their working lives beyond normal retirement age?; and (iii) How are technological changes in production associated with the productivity of senior workers and an aging workforce? Novel data that traces a representative population, including seniors, in and out of the workforce, with some indicators of productivity such as wages, skill sets, physical and cognitive skills, noncognitive abilities, and firms' revenues will be required if analysis is to prove credible.

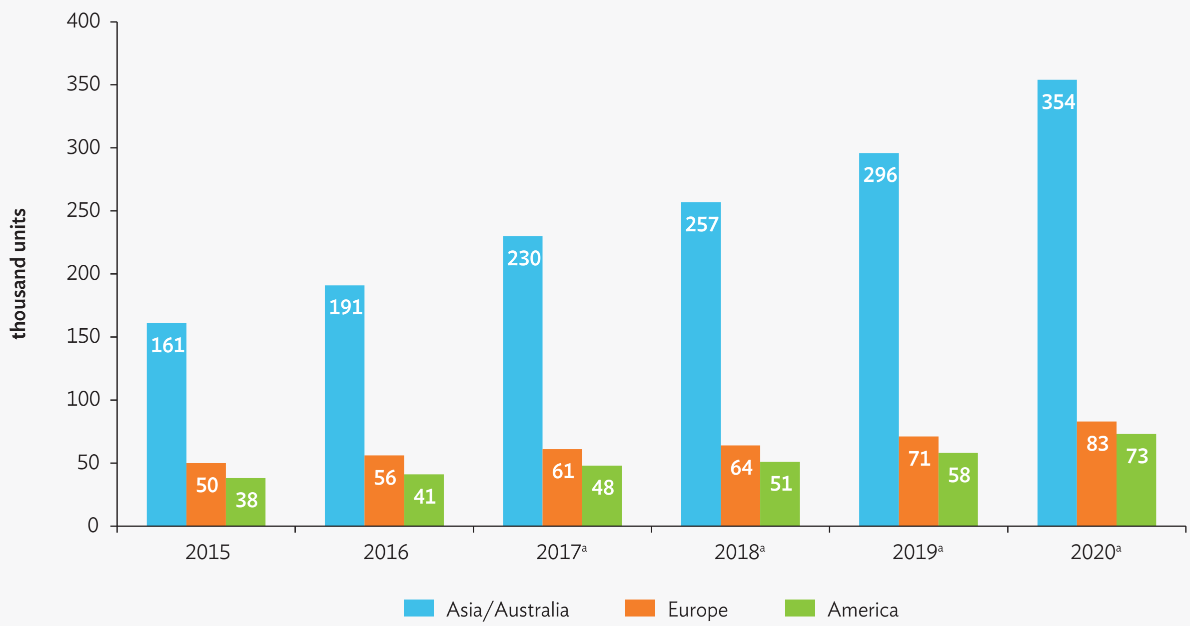
2.2 | Technology and Innovation as Drivers of Growth

The extent to which demographic headwinds affected the overall economic performance of the advanced economies that have already passed through progressive population aging gives some indication about how other aging populations may experience its impact in the future. Interestingly, economic growth of these advanced economies is more modest (than in some fast-growing middle-income economies), but is well-sustained. The association between change in GDP per capita and the change in the ratio of old to young workers over the past few decades is positive across the countries (Acemoglu and Restrepo 2017b). This implies that aged countries must have alternative sources of growth that offset the demographic burden.

Technological change is a key contributor to sustaining economic growth among advanced countries. Innovations in telecommunication and mobile technology, industrial robots, artificial intelligence (AI), biotechnology, three dimensional (3D) printers, and connections of devices online (the Internet of Things) have drastically changed the production processes of many industrial sectors.

The adoption of new production technologies is evident from the growing number of industrial robots globally, where Asia is the key supplier (Figure 10). The annual supply of industrial robots in Asia increased from 161,000 units in 2015 to 191,000 in 2016. The International Federation of Robotics (IFR) estimates this number will reach 354,000 by 2020, a 120% increase in five years.

Figure 10: Estimated Annual Global Supply of Industrial Robots, 2015–2016, and Forecast for 2017–2020

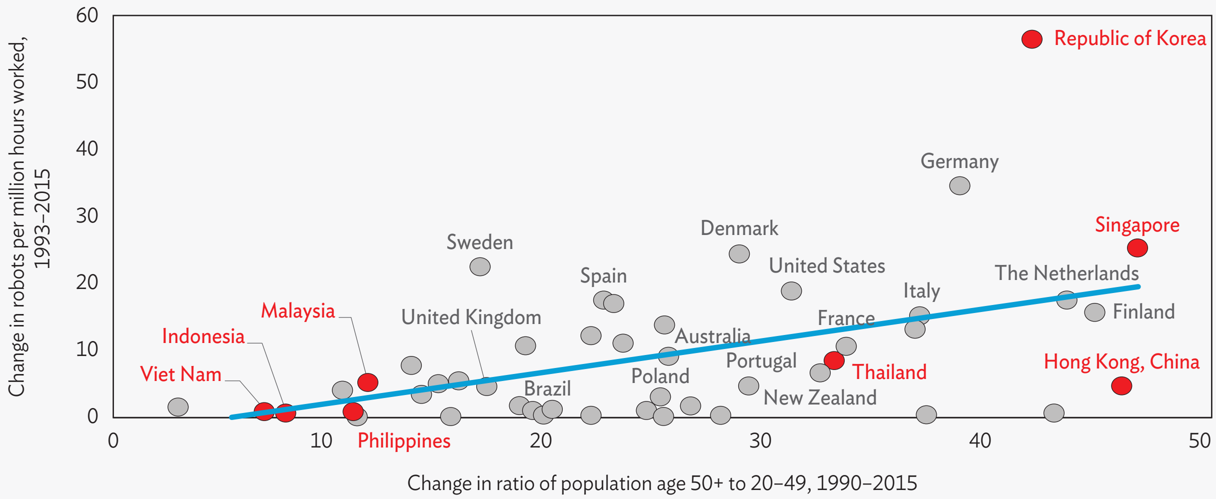


[a] Forecast for 2017 to 2020.

Source: IFR World Robotics 2017, https://ifr.org/.

The relative shortage of young and middle-aged labor may contribute to encouraging the adoption of robots and automation into the production process (Figure 11, Acemoglu and Restrepo 2017a–b, 2018). Countries with higher shares of senior workers such as the Republic of Korea and Germany show greater automation (Acemoglu and Restrepo 2017b). Acemoglu and Restrepo (2018), using cross-country data from 1993 to 2014, estimate that a 10-percentage-point increase in the share of aged workers (ages 56 and over) prompts the adoption of as much as 0.9 installations of robots per 1,000 workers. Similarly, higher government spending on research and development in Europe was shown to reduce the negative effect of aging on growth in total factor productivity (Aiyar, Ebeke, and Shao 2016).

Figure 11: Workforce Aging and the Use of Robots, 1990 to 2015



Source: Acemoglu, Daron, and Pascual Restrepo. 2017b. Secular Stagnation? The Effect of Aging on Economic Growth in the Age of Automation. *NBER Working Paper Series* 23077. doi: 10.3386/w23077. Adapted from R. Chomik and J. Piggott. 2018. *Population Ageing and Technology: Two Megatrends Shaping the Labour Market in Asia.* Background paper prepared for an ADB-led workshop on technology and aging to be held in Seoul, Republic of Korea on 17–18 May 2018.

2.3 | The Role of Technology in an Aging Society and the Workforce

Technology, broadly defined as the application of scientific knowledge for production, provides solutions to some of the key labor market challenges that a country with progressive aging must face (Table 2). First, advancement in medical science and biotechnology improves general physical health and extends working lives by providing effective and affordable medical treatment and interventions to prevent disease (Figure 3). Healthier workers are also more productive (Arora 2001, Weil 2013). Second, technology transforms work and workplaces to be less manual and less physically demanding while extending flexibility, which encourages older workers to reenter and/or remain in the workforce (ADB 2018). Third, technology can contribute to creating more supportive labor markets and market infrastructure through innovative education and skills training, better human resource management for age-diversity, and improved job-matching. These three roles not only increase workforce participation, but also productivity.

Table 2: Types of Technological Solutions to Aging Labor Markets

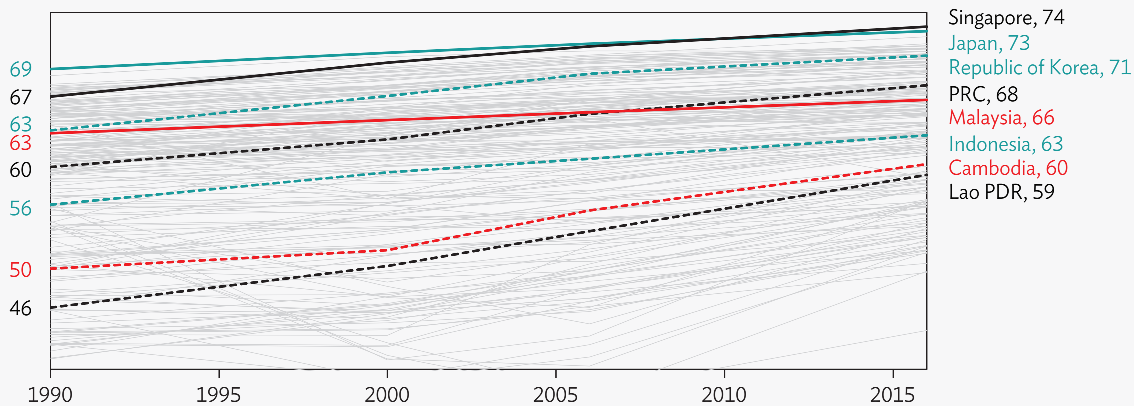
Type of Technology	Examples
Technology for health and longevity	Biotechnology, automated diagnosis, surgery and therapies. The internet of things (medical equipment and wearable devices), and health-related big data analysis
Technology for transforming work and workplace	Industrial robots, automation, AI, machine learning, and remote/telework platforms
Technology for workers and supportive labor market infrastructure	Remote and virtual education and training, human resource and age diversity management, cloud-based job matching service; ergonomic and human function aiding devices at the workplace (adaptive technologies)

Source: Authors.

Improving Health and Extending Healthy Lifespans

Individuals across all age cohorts in Asia have significantly improved their healthy life expectancies at birth over the past decade.[3] From 1990 to 2016, this rose even for developed countries, from age 69 to age 73 for Japan and from age 67 to 74 for Singapore (Figure 12). The improvement in healthy life expectancy has been more pronounced in developing countries, where it rose from age 50 to 60 for Cambodia and from age 46 to 59 for the Lao People's Democratic Republic over the same period.

Figure 12: Healthy Life Expectancy at Birth for Both Sexes, 1990 to 2016



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

Source: Global Burden of Disease Study 2016 (GBD 2016) Disability-Adjusted Life Years and Healthy Life Expectancy 1990–2016. 2017. Seattle, United States: Institute for Health Metrics and Evaluation (IHME). Adapted from R. Chomik and J. Piggott. 2018. *Population Ageing and Technology: Two Megatrends Shaping the Labour Market in Asia.* Background paper prepared for an ADB-led workshop on technology and aging to be held in Seoul, Republic of Korea on 17–18 May 2018.

Extended Health Capacity to Work

Better health has made it significantly easier for seniors to continue working beyond current retirement age. A comparative study that translates improved health status of seniors into their capacity to work shows that additional capacity, measured by extended years of working life, among men of ages 55–69, can be as much as 8 years and 5.5 years on average, when comparing that cohort between 1977 and 2010 (Table 3). With such improvements, Matsukara et al. (2017) estimated that about 11.1 million workers worth of untapped work capacity exists among people in Japan aged 60 to 79.[4]

3 Healthy life expectancy at birth is defined as the average number of years of full health that a newborn can expect to live, accounting for current age-specific mortality, morbidity, and disability risks (United Nations, 2007). http://www.un.org/esa/sustdev/natlinfo/indicators/methodology_sheets/health/health_life_expectancy.pdf (accessed 16 April 2018).

4 The study assumed that those of age 60–79 continue to work as much as those of age 50–59.

It is evident that a greater number of seniors above the normal requirement age of 65 are engaged in employment among the OECD countries (Figure 13). The average labor force participation of the seniors between the ages 65–69 (in OECD countries) increased from 20% in 2006 to 26% in 2016, and the rate for 70–74 age group also increased from 12% to 15% over those years. The share of employed seniors in age 65–69 increased from 28% to 43% in New Zealand, from 18% to 26% in Australia, and from 35% to 43% in Japan during the same period. Besides the improving health status, policy incentives play an important role in raising the rate. Reducing disincentives to work beyond retirement (such as generous pension schemes) while adding more benefits for those who continue to work after reaching legal retirement age has been shown to encourage more seniors to work (Oshio et al. 2011, Oshio et al. 2016).

Table 3: Years of Additional Work Capacity for Men at Ages 55 to 69

Country	2010 vs 1977	2010 vs 1995
Belgium	5.0	1.0
Canada	4.9	1.3
Denmark	4.7	1.6
France	8.0	2.2
Germany	5.9	2.6
Italy	7.7	2.7
Japan	3.7	2.2
Netherlands	3.4	–0.1
Spain	7.0	2.2
Sweden	3.2	0.8
United Kingdom	8.4	1.8
United States	4.2	1.8
Average	**5.5**	**1.7**

Note: Years used differ: Belgium (1983 not 1977); Germany (2005–2009 not 2010, 1989–1995 not 1977); the Netherlands (1981 not 1977); Sweden (2009 not 2010, 1985 not 1977).

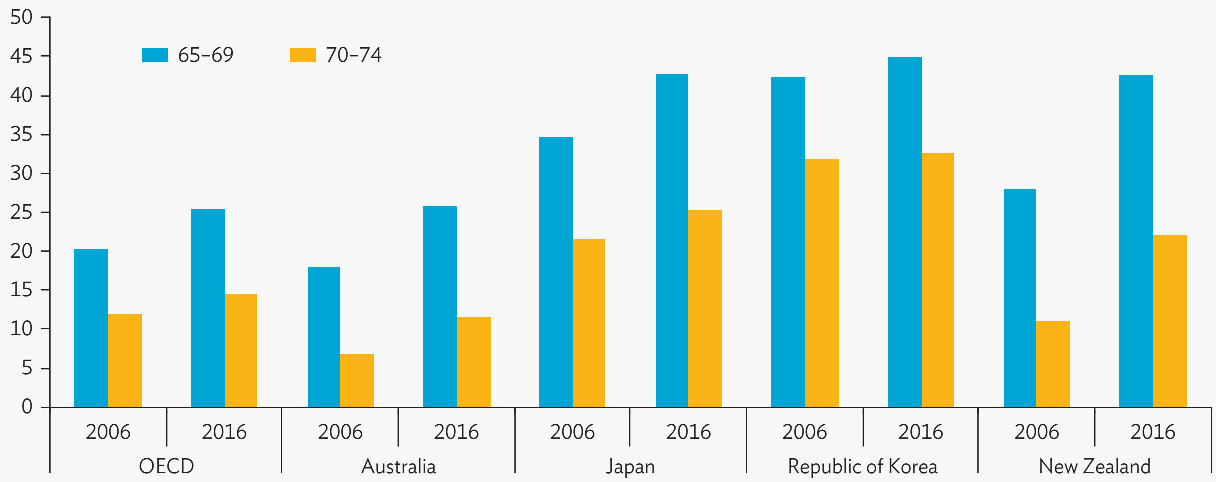
Source: C. Coile, K. Milligan, and D. A. Wise. 2016. Social Security and Retirement Programs Around the World: The Capacity to Work at Older Ages – Introduction and Summary. *NBER Working Paper Series* No. 21939, Cambridge, Massachusetts: National Bureau of Economic Research.

Biotechnology and Automation of Medical Service and Care

In years to come, advancements in biotechnology are expected to improve medical and preventive care. Medical services are increasingly automated and made affordable for the diagnosis of diseases, robotized surgeries, robot-assisted therapies, intelligent prosthetics, and the provision of affordable and effective care. Big data analysis will help monitor behavior that affects health (such as daily activity, diet) and predict the determinants of good health and effective and customized prevention (Collins and Varmus 2015). Wearable technology and other devices connected online can monitor vital indicators of health such as the number of steps a person takes, their heart-rate, and blood-glucose. These developments will contribute to maintaining health, the prerequisite for being able to work, and the early detection of disease, which leads to better survival rates (Butter et al. 2008).

Improvements in health boost both labor market participation and workers' productivity (Bloom and Canning 2005). A longer working life increases lifetime return to education, and therefore incentivizes further investment in human capital (Weil 2013). People whose working lives have been extended can perform tasks better using the professional experience they have accumulated throughout their careers. A cross-country analysis from 1960 to 1995 show that a 1-percentage-point improvement in adult survival rate translates to a 2.8% increase in labor productivity (Bloom and Canning 2005).

Figure 13: Labor Force Participation of Senior Workers in OECD Countries, 2006 and 2016



OECD = Organisation for Economic Co-operation and Development.
Source: OECD Older Worker Scoreboard 2016.

Transforming Work and the Workplace through Technology

Automation has already made a substantial impact on the pattern of changes in employment, including allowing more seniors to participate and remain in the labor force.[5] In the United States, for example, the 18% decline in routine manual tasks and 26% decline in routine cognitive tasks between the 1970s to 2009 has been attributed to automation and computerization (Figure 14).[6] On the other hand, the non-routine interactive and analytic tasks that are difficult to computerize, have increased by 34% and 25% over the same period. In Japan, the change has been less drastic, but the trend follows a similar pattern to the US example. Routine tasks declined by 6% for manual tasks and 1% for cognitive tasks, while non-routine tasks increased by 0.7% to 3%, from 1960 to 2005. For the PRC, whose working-age population contraction began sometime around 2011, a clear drop of routine manual tasks was seen in the same period.

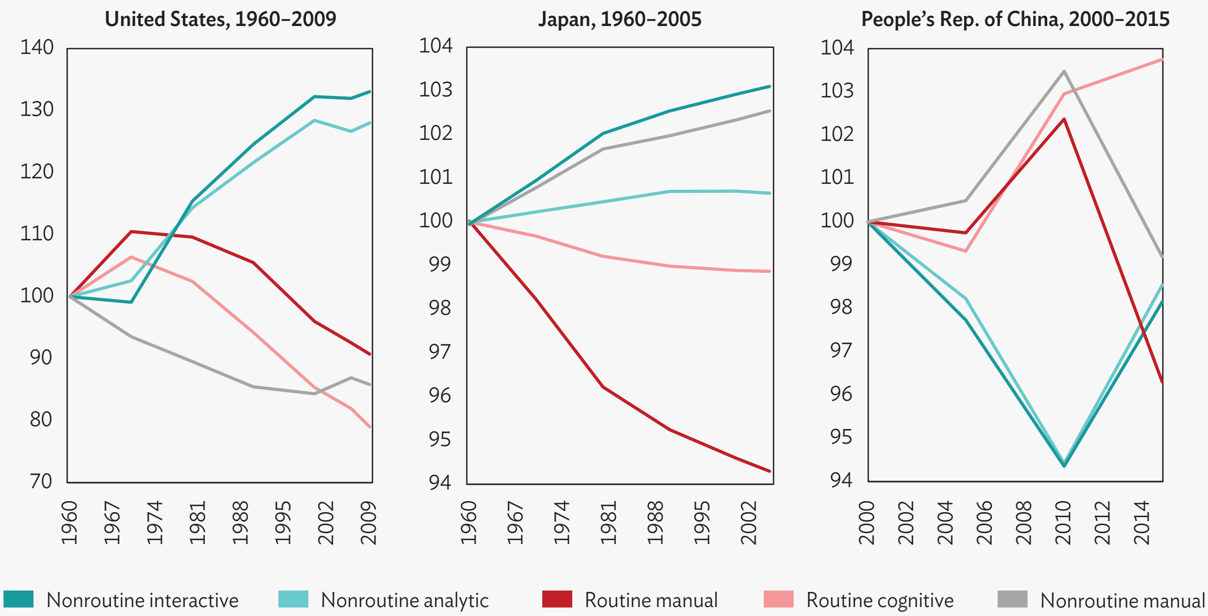
Artificial Intelligence and Machine Learning

The sectors and types of jobs where technology provides labor-saving solutions are expanding beyond simple robotics that replace low-skilled and physical work (ADB 2018). Advancements in artificial intelligence that adopts machine learning and cloud computing for deep learning allow robots and machines to conduct non-routine and complex tasks that traditionally were completed by medium- and high-skilled workers, such as car navigation or deciphering handwriting in medical diagnosis (Frey and Osborne 2013).

5 Economies have used different approaches to tackle labor shortages (Ducanes and Abella 2008). The Japanese government encouraged labor-saving technology adoption for firms as long ago as 1991, along with other incentives to increase workforce participation for women, disabled people, and new graduates. The Republic of Korea made large investments in research and development that led labor productivity to grow on average up to 4.6% a year from 1970 to 2005. The government also encouraged automation and relocation, and the admission of skilled foreign workers. Singapore focused on attracting foreign workers for high-skilled jobs; and Hong Kong, China offshored manufacturing to the mainland to address a shortage in low-skilled workers.

6 Offshoring of production to overseas locations also contributes to the reduction of manual tasks.

Figure 14: Changes in Tasks Performed Across the Economy



Note: Employment shares of tasks normalized to 100 in 1960; charts have different scales over different periods.

Sources: Adapted from F. Levy and R. Murnane. 2013. "Dancing with Robots: Human Skills for Computerized Work." Third Way NEXT. https://thirdway.imgix.net/downloads/dancing-with-robots-human-skills-for-computerized-work/Dancing-With-Robots.pdf (accessed April 2018); T. Ikenaga. 2013. "Increase in Nonroutine Tasks in the Japanese Labor Market—Background and Policy Implications." *ESRI International Conference*, Tokyo. http://www.esri.go.jp/jp/workshop/130725/data/s02_ikenaga_report.pdf (accessed April 2018), and; A. Park. 2017. "Changing Demand for Tasks and Skills in China." *HKUST Institute for Emerging Market Studies*. http://ibs.org.pl/app/uploads/2017/07/Albert_Park_Changing-Demand-for-Tasks-and-Skills.pdf (accessed April 2018). Adapted from R. Chomik and J. Piggott. 2018. *Population Ageing and Technology: Two Megatrends Shaping the Labour Market in Asia.* Background paper prepared for an ADB-led workshop on technology and aging to be held in Seoul, Republic of Korea on 17–18 May 2018.

Workplace Flexibility

New technology is also driving changes in traditional workplaces. Technology has enabled people to work from anywhere, while solutions such as collaboration tools and cloud platforms present vast potential and opportunity to enhance workplace flexibility. Flexible and remote working can generate significant productivity gains, with people spending less time travelling for work. Through the rise of wearable technology, firms can now monitor the productivity and wellbeing of their employees and communicate more effectively with them.

As technology, such as cloud-based services that enables remote work continues to become more available and affordable, workplace flexibility is expected to increase. Cloud and remote work platforms can encourage seniors who are hesitant to commute to work, to take up task-based jobs. Studies show many seniors may not wish to work regularly. For example, in one survey, over 70% of Japanese workers over 60 preferred non-regular and task-based employment (Ministry of Health, Labor and Welfare 2017). The adoption of flexible workplace is therefore important in encouraging greater labor participation of seniors and retaining talent over the retirement age.

Supporting Human Resource Development and the Functions of Labor Markets

New strands of technology are offering innovative, customized, and interactive learning and training that helps seniors take up new jobs and build new skills. Labor demand and supply, including those for senior workers, can be better matched by applying technology and using cloud/remote services. Effective human resource management and office environment can also boost the productivity of an aging workforce in teams.

Tapping Technology for Learning and Training

Advances in technology have created opportunities to transform the learning environment. Many technologies in education focus on web-based services, which are classified as first-order innovations in Table 4. Web-based learning offers a plethora of leaning resources such as teaching materials, online learning platforms, and other tools affordable even in developing countries. Online learning has the advantage over formal classroom settings in providing customized courses accounting for different levels and speeds of learning.

Table 4: Common and Emerging Innovations in Technology-rich Innovative Learning Environments

First-Order Innovations	Second-Order Innovations
blog, wikis	augmented reality (AR)
social networking sites	simulations
virtual learning environments (VLE)	digital games
laptops, netbooks, and tablet PCs	console games
interactive whiteboards	remote-response systems
Web apps	mobile/handheld computing
digital cameras, scanners, projectors	programming applications
e-Learning	Handheld projectors
digital portfolios	electronic books

Source: J. Groff. 2013. "Technology-Rich Innovative Learning Environments." OECD Learning Environments project.

Technology-based learning is entering the second-order innovations (Groff 2013). In Scotland, students were found to be more engaged and worked better together in schools that used gaming consoles in class. Similarly, augmented or virtual reality is also being used in training and research, through a wide array of fields, from military to aerospace engineering (Abulrub, Attridge, and Williams 2011). Trucano (2017) points to several other innovative education projects such as adaptive learning solutions like Mindspark,[7] a subscription-based computer-based learning program which helped improve math skills in India. Impact evaluations of new technologies are helpful in guiding policy makers, educators, and parents as they select services.

[7] https://mindspark.in/.

Improved Job Matching for Senior Workers

Another area where new technology can encourage participation of seniors and others in the latent workforce is that of job matching. Seniors seeking non-regular and task-based employment would benefit from effective job placement services. There is scope for improvement. The survey confirming the preference for flexible jobs among elderly workers shows that the percentage of those who would like to work but had not found employment is somewhat high (i.e., 15% among ages 60–64, 22% among ages 65–69, and 27% among ages 70–74) (Ministry of Health, Labor and Welfare, 2017). Technology can help provide real-time labor market information and share more timely details about occupational demand.

Labor market matching technologies can make job-clearing more efficient, benefiting both employer and employee. Examples include job boards, algorithmic matching technologies, online skills assessments, skills-building and career-development portals, and online social networks (JPMorgan Chase & Co. 2016). Cloud and remote work platforms may encourage more seniors who are hesitant to commute to work, to take up task-based jobs. One example is "Senior Cloud," a public–private initiative in Japan that is a cloud-sourcing website targeting the elderly.[8] The initiative tests and develops a system that assesses and classifies skills that firms want to outsource, and matches them with senior workers who have registered their skills and preferred work times. Many of these new technologies are still nascent, therefore their impact and wider applicability must be carefully examined.

Age-friendly Workspace and Adaptive Technologies for Seniors

Technology can improve workspaces and the office environment. Ergonomics, an applied science that looks at how people perform in their working environment, can help improve office space to support senior workers and contribute to minimizing injury while raising productivity. To create senior-friendly workspaces, employers may want to look at indoor air quality (simple thermal comfort control interfaces), acoustic quality (appropriate for older workers to reduce noise effects), adequate illumination (in-depth analysis on glare that can trouble older works, and their distance from windows), in addition to other traditional ergonomic requirements such as office furniture and equipment (Afacan 2015). Evidence shows that improvements in lighting or adding ergonomically designed desks to accommodate the needs of seniors is effective in increasing production efficiency (Anders 2015).

A range of new technologies can make job-related tasks even more age-friendly. Adaptive technologies have been developed with an aim of helping seniors perform tasks more productively (Table 5). A wider variety of technologies aiding not only physical strength, but also visual, hearing, dexterous, and cognitive capabilities can be expected in future. At present, however, some of these are somewhat new and so there is little evidence showing their impact on the productivity of senior workers.

[8] More information on the Senior Cloud initiative can be found here: http://sc.cyber.t.u-tokyo.ac.jp/en/index.html.

Table 5: Examples of Adaptive Technologies by Disability Type

Impairment	Adaptive Technologies
Visual	Screen enlargement software Braille input and output systems Speech synthesis Optical character recognition Video magnifiers
Hearing	Hearing-aid technologies Personal amplification devices Amplified telephone receivers Text telephones
Hand and mobility	Voice recognition software On-screen keyboard programs Touch screens Eye-gaze programs
Cognitive	Online reminder systems Personal organizers and notebooks

Source: S. Czaja and P. Moen. 2004. *Technology for Adaptive Aging*. Washington, DC: The National Academies Press.

Managing Age Diversity

Evidence shows that human resource management has a role in boosting productivity. Firms that make adjustments in complementary inputs, such as improving the workplace and inter-generational human resource management, have profited. Cultivating diversity in teams, while toning down management hierarchies based on seniority, may also contribute to boosting productivity. In a study of 374 German firms, Meyer (2007) found that workplace reorganizations such as improved teamwork and flattening out the hierarchal system, can lead to greater adoption of productivity-boosting technologies among groups with a high share of older workers. Göbel and Zwick (2013) also found that having age-mixed teams resulted in higher relative productivity of both old and young employees in German firms.

UNLOCKING TECHNOLOGY POTENTIAL TO BOOST PRODUCTIVITY

3.1 | Lifelong Learning and Career Planning

With technology rapidly changing the jobs landscape, it is essential that workers of all ages, including the seniors, have opportunities to continually update skills and reskill throughout their careers. Lack of opportunities to refresh skills and knowledge will have grave consequences. A study in the United States showed that the elderly, though willing to work, had a hard time going back to work. The main reasons they cited were age discrimination and lack of technology skills (Lee, Czaja, and Sharit 2009).

The need for lifelong learning is even greater in anticipation of "The 100-Year Life," where longevity enables one to work beyond conventional retirement age. Near-retirement would be too late to upgrade one's skills because it is extremely difficult to fill decades-long gaps (Scott and Gratton 2016). The career path of someone seeking to extend their working life may consist of multiple stages, rather than the old dichotomy of pre- and post-retirement, and includes a conscious review and upgrading of skillsets. The investment of time and resources involved may require taking a break from full-time paid work yet may be essential to accessing gainful employment in the long-term.

On the other hand, the lack of uptake of training and learning opportunities by seniors, despite government programs on lifelong learning, is evident in the Republic of Korea and Japan where such data is available. OECD data show low on-the-job training rates for middle-aged to older workers in the Republic of Korea and Japan. In Singapore, only 19% of age 50–64 workers participate in training, while less than 10% do so in the Republic of Korea. This contrasts with 40% of the cohort in the United States and Nordic countries (World Bank 2016). Seniors need access to technology training programs that are tailored to their learning needs and preference (see "Gray Divide" section below). It is also important for employers to provide equal training opportunities to employees of all ages.

3.2 | Learn, Unlearn, and Relearn

Technological change has transformed the size and the nature of available jobs as well as their quality (Autor and Salomons 2018), resulting in a smaller share of low-skilled employment (Graetz and Michaels 2018). In the United States, about 47% of jobs were projected to be automated in the next few decades (Frey and Osborne 2016). Education and skills training must adapt to rapidly changing environments and train workers for "future jobs." This means that training should focus not only on acquired skills for specific vocational tasks, but more on equipping workers to acquire skills as the labor market changes its demands (Box 1).

Box 1: What Types of Jobs Are Created through Automation?

Several studies have estimated a sizable share of jobs that will be displaced because of artificial intelligence (AI), however, few have looked into the jobs that AI will inevitably create. Following a global study by Accenture of more than 1,000 companies that use AI, three main categories of jobs were identified by Wilson, Daugherty, and Morini-Bianzino (2017). These categories are: trainers, explainers, and sustainers. Since they are new and unique for humans, training will be needed for these jobs.

Trainers will teach AI systems algorithms that mimic human behavior or that tell them how to perform. An example is an "empathy trainer," which will be particularly useful for customer service chatbots that need training to detect human complexities such as sarcasm or the need to show compassion. The second category, explainers, will translate the inner workings of AI algorithms to nontechnical professionals and business leaders. An example would be an algorithm forensics analyst, who will perform detailed autopsies whenever a system makes mistakes or an unintended event occurs. The last category is the sustainers, who are responsible for ensuring that AI systems work as designed and that they uphold human values and morals.

Source: Wilson, H., P. Daugherty, and N. Morini-Bianzino. 2017. The Jobs That Artificial Intelligence Will Create. *MIT Sloan Management Review*, Summer 2017, Vol. 58, No. 4: 14–16.

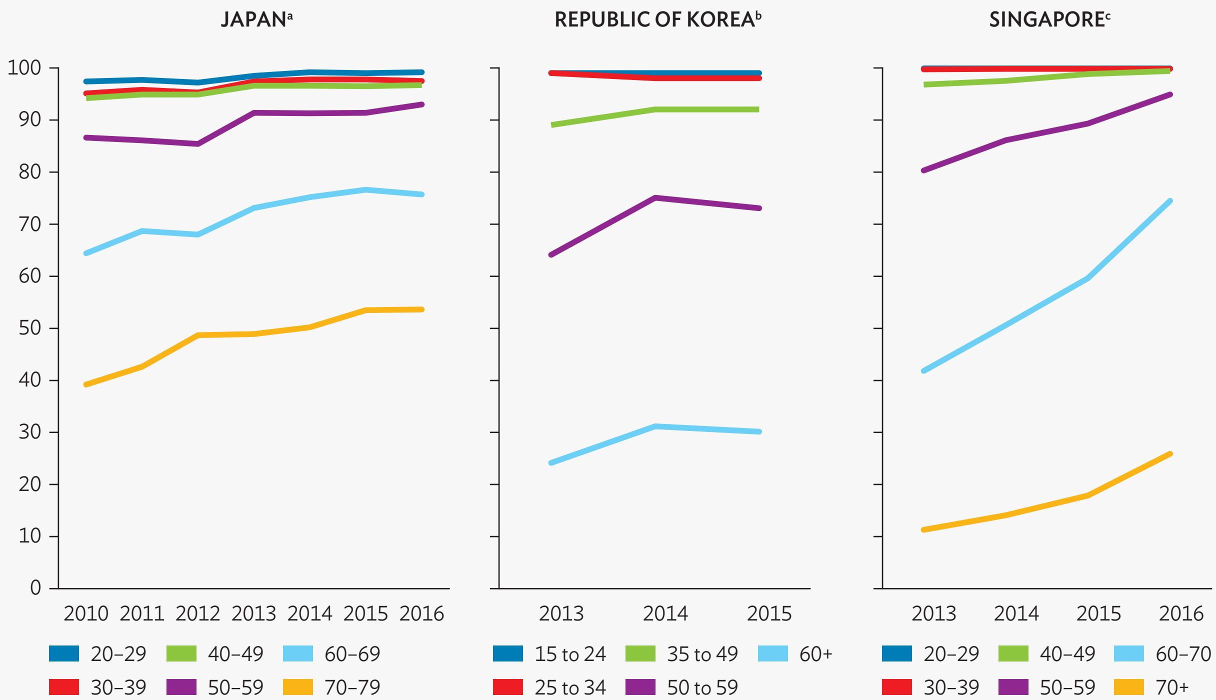
Learning, unlearning, and relearning play crucial roles in lifelong learning, especially given 21st century needs. Since most technological advancement is innovation and not just improvement, there is a need to unlearn old technological skills to make space for new ones (Prahalad 1998). Unlearning, as Dede (2010) emphasized, is the main challenge of acquiring 21st-century skills, even more than the need to learn new materials. The key challenge to unlearning is that it not only covers skills, but also concerns one's beliefs, values, and assumptions, which would need more time to change. Some of the methods used to build such skills include working on problem solving and improving how to think, as well as communication and emotional skills. Accordingly, the role of formal education that nurtures conceptual and critical thinking is expected to increase. It is worth noting that these noncognitive abilities are malleable among adults (Heckman 2007).

3.3 | Bridging the "Gray Divide"

Computers, the Internet, and smartphones are becoming more widespread, even among seniors. However, the coverage and depth of use of these technologies remains significantly lower among seniors compared to other age groups. In Japan, the rate of internet access among ages 60–69 was 23.5% lower than for ages 20–29 in 2016 (Figure 15). Similar trends are evident in the Republic of Korea and Singapore. Gray divide, or the gap between technology and the ability of seniors to use it, has reduced over time, but remain apparent. The government and the private sector can do more to narrow the gap.

Friemel (2014) found that the seniors' main reasons for not being online are lack of motivation to use the Internet, indifference, and lack of knowledge. The study finds that the preferred setting for learning about internet use among seniors is at home, with support from family and friends, rather than a classroom. Technology tends to be designed with young users in mind, which adds to the reasons why seniors have a hard time adopting it. Promoting age-related technology must account for their preferences and association patterns. The need for bridging the gray divide is even greater, now that development and improvement of services are based on data (big data) collected when existing services are being used.

Figure 15: Internet Use in Japan, the Republic of Korea, and Singapore by Age Group (%)



Sources:

[a] Ministry of Internal Affairs and Communications, Japan (accessed March 2018).

[b] Statista. 2018. www.statista.com (accessed April 2018).

[c] Infocomm Media Development Authority. 2017. "Annual Survey on Infocomm Usage in Households and by Individuals." www.imda.gov.sg. (accessed April 2018).

3.4 | Harvesting the Longevity Dividend through Regional Cooperation

Lastly, the Asia and Pacific region consists of economies with varying demographic profiles and an increasing number of skilled workforces. Countries such as Bangladesh, India, Indonesia, Pakistan, and the Philippines, which have growing and relatively younger workforces, will continue to reap the benefits of the demographic dividend until 2030 or beyond. For the 27 countries classified as "young" in the share of seniors to the population (see Box 2), the total working-age population is expected to grow by 22% between 2015 and 2030. Workers in young population countries are still largely employed in agriculture, but they are increasingly transitioning into other sectors, such as services and manufacturing.

Young and populous countries can complement the demographic transition in aging countries. For these countries to harvest the population dividend, their young workers should be given gainful employment to learn and experience from the jobs. Enhanced cross-border mobility can help tackle labor shortages and the notable skills mismatch across developing Asia.

Box 2: Classifying Economies into the Different Stages of the Demographic Transition

Economies in Asia and the Pacific are at different stages of the demographic transition. Based on the share of seniors in the population, economies can be grouped into three categories (Box 2 Figure 1).[a,b] The first group ("*aged*") where seniors comprise at least 14% of the population (in 2020) includes high-income economies and an upper middle-income economy (Georgia). The second group ("*aging*"), which has an aging rate 7% to below 14% in 2020, comprises middle-income countries including the People's Republic of China, many of which face or soon face the end of growth in working-age population. The third group of economies consists of a more income-diverse mix of economies with aging rates lower than 7%. These "*young-*" or "*young-population*" countries have ample room to earn demographic dividends from their population structure and can maneuver labor resources to fuel economic trajectory.

Box 2 Figure 1: Economies by the Stages of Aging in Asia and the Pacific

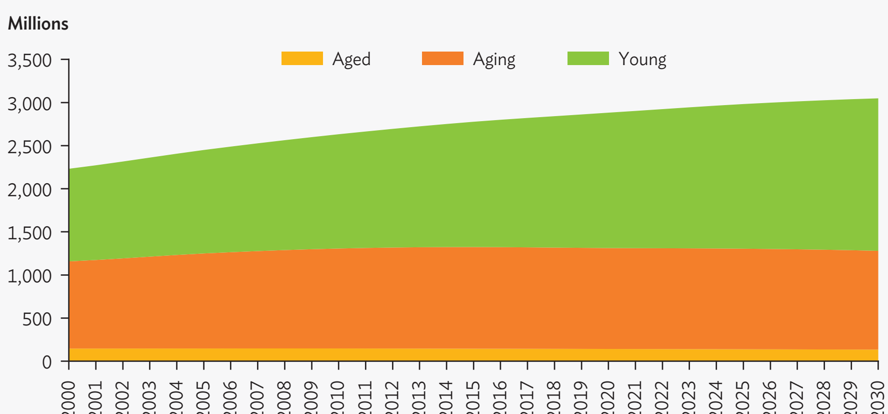
Aged (225 million, 5%)	• Japan (28.2%) • Hong Kong, China (18.1%) • Australia (16.3%) • New Zealand (16.3%) • Republic of Korea (15.7%) • Georgia (15.3%) • Singapore (15%)
Aging (1,648 million, 40%)	• Thailand (12.9%) • Armenia (12.1%) • People's Republic of China (12.2%) • Sri Lanka (11.2%) • Viet Nam (8.1%) • Kazakhstan (7.6%) • Malaysia (7.0%)
Young (2,290 million, 55%)	• Fiji (6.9%) • Azerbaijan (6.8%) • India (6.6%) • Nepal (6.2%) • Myanmar (6.4%) • Samoa (6.1%) • Tonga (5.9%) • Indonesia (5.8%) • Brunei Darussalam (5.6%) • Micronesia, Federated States of (5.5%) • Pakistan (4.5%) • Bangladesh (5.2%) • Bhutan (5.3%) • Philippines (5.2%) • Kyrgyz Republic (5.0%) • Uzbekistan (5.0%) • Cambodia (4.9%) • Turkmenistan (4.8%) • Maldives (4.4%) • Lao People's Democratic Republic (4.3%) • Mongolia (4.4%) • Kiribati (4.2%) • Papua New Guinea (4.1%) • Timor-Leste (3.6%) • Solomon Islands (3.6%) • Tajikistan (3.8%) • Afghanistan (2.7%)

Notes: Figures in parentheses for every aging group refer to the total population stock and the share to the total population in Asia and the Pacific. Figures in parentheses after every economy refer to the senior share of the population in 2020. Japan has been a "super-aged" economy (that is, senior share of its population is at least 21%) since 2008.

Source: ADB calculations using data from the United Nations, Department of Economic and Social Affairs, Population Division; and the World Bank, World Development Indicators (accessed March 2017).

Box 2 Figure 2 presents actual and projected working-age population in Asia and the Pacific by the demographic grouping. The working-age populations of the aged group of economies started to decline in 2010, while that of the aging group followed suit in 2016. From 2015 to 2030, the working-age population in the aged group will contract by 7.4% to 135 million from 146 million while in the aging group it will drop by 3% (33 million). Meanwhile, the working-age population will rise by 22% for the young group of countries.

Box 2 Figure 2: Working-Age Population in Asia and the Pacific, by Aging Group



Source: ADB calculations using data from United Nations, Department of Economic and Social Affairs, Population Division.

[a] An economy is considered "aging" once the share of its senior population hits 7%. Over time, its senior share of total population will breach the 14% mark, at which point it is considered "aged", and "superaged" once the share reaches 21%. For the definition of aging, aged, and super aged societies see, http://www.unescap.org/ageing-asia/countries.

[b] The following ADB developing member countries are not included: Taipei,China, the Cook Islands, the Marshall Islands, Nauru, Palau, and Tuvalu for lack of data.

Source: ADB calculations using data from ILOStat (accessed March 2018) and United Nations, Department of Economic and Social Affairs, Population Division.

While technological innovation may be slow, the decline of technological adoption costs is rapid, so many countries in the "young" group will likely start adopting automation and other production methods in the coming years. To gain from potential complementarity, countries need to invest in connectivity, as well as in developing human capital. As more technologies permeate the workplace, formal and higher education, lifelong learning, and education in information and communication technology are important not only for aging countries but also for countries undergoing population growth. A large collective gain is there to be made beyond the national demographic dividend—be it based on a young population or longevity—by leveraging this diversity.

Countries can also strengthen their existing collaborations to facilitate cross-border labor mobility. This can be facilitated by a range of policy measures that will be mutually beneficial among countries with different demographic endowments. Such measures include harmonizing and simplifying procedures for both skill and qualification recognition and immigration of workers, reducing the costs of migration, and fostering transparency in the overseas employment industries/market. One possible form of facilitation can be a skill mobility program that combines education and on-the-job training implemented through the collaboration of higher education institutions and professional training bodies across the region. Such programs can aim for a circular movement of workers to help address concerns about brain drain (Batalova et al. 2017).

With technological advances, jobs will likely require higher education and greater cognitive skills. Some of the key sectors that have benefited and can gain further from improved regional labor mobility include information technology (IT professionals and engineers), financial services (investment bankers, lawyers and accountants), medical service (doctors, nurses, care workers), construction (architects and skilled engineers), and higher education and research (professors and researchers).

CONCLUSION AND POLICY IMPLICATIONS

Asia needs to harness technology to overcome the negative consequences from a contracting and aging workforce, while maximizing the benefits of longevity for inclusive and sustained economic growth. Experience from countries in the advanced stage of demographic transition shows that it is feasible with greater policy attention and more proactive and innovative measures. Countries in Asia and the Pacific at the forefront of aging are encouraged to continue promoting innovation, adoption, and the diffusion of age-related technology and lifelong learning, and to provide working environments conducive to senior workers. Similarly, it is critical for countries with young and growing populations to invest in human capital even if aging and technological change are expected to arrive at a slower pace.

4.1 | Innovation to Weather Demographic Headwinds

Technology and innovation play key roles in helping tackle the challenges posed by a declining and aging working population. These are: (i) improving health and extending longevity, (ii) transforming work and the workplace, and (iii) creating a supportive environment for workers and improving the functioning of labor markets. All contribute to boosting labor force participation and productivity. Rapid technological advancement can further contribute to ensuring that jobs are age-friendly and to improving human capital of the workforce through enhanced health, education, and skills.

Aging and soon-to-be aged countries are encouraged to allocate sufficient funds to research and development to promote innovation and the adoption of suitable technologies and to invest in human capital and resources development, particularly in Science, Technology, Engineering and Mathematics (International Monetary Fund 2016). This point is particularly salient for soon-to-be aged countries which anticipate having to spend more on pensions and healthcare. Countries are also encouraged to foster innovation by protecting patents and licenses and by creating a business environment and economic infrastructure attractive to the private sector.

Seniors can be a rich source of productive workers, especially among countries progressing to aging and aged societies. There is a scope for encouraging work participation of seniors, given that healthy life spans are increasing, and working environments and labor markets are accommodating their needs and work preferences. Intensive use of machinery and automation has made many jobs and tasks less physically demanding and more accessible to older workers, helping them stay in jobs beyond normal retirement age. Senior workers also prefer flexible and part-time arrangements, tasks that exploit their experience and knowledge, and work that provides a meaningful social space and a sense of contribution and fulfillment.

The right incentives can readily draw seniors into returning to the labor force. Existing policies must be reviewed to remove disincentives to work and add more benefits for those who choose to work after reaching legal retirement age. Working conditions and environments should be reviewed to accommodate the preferred working style of senior workers. Investing in relevant technologies such as cloud sourcing that help match jobs and tasks with skills has great potential to cultivate the latent senior workforce. More effort should also be made to create an enabling policy environment for elderly labor force participation, such as removing age-related aversion in hiring (OECD 2015).

4.2 | Raising Productivity of Aging Workforce via Technology

The key channel through which countries can harvest the longevity dividend is raising the productivity of seniors in their workforces. Elderly people are better educated than in the past, so they can carry out high value-adding tasks and work with complementary technologies. Their productivity can also be enhanced by continuing investment in skills development and by developing technologies such as human resource management tools that aid physical and cognitive capacities and help seniors and aging workforces perform better as a whole.

However, skills development opportunities for seniors remain limited, and many are reluctant to take them up due to age-related concerns. Thus, training programs that consider the special learning needs of elderly should be made widely available. The importance of lifelong learning cannot be overemphasized in anticipation of greater longevity and extended working years. Given that the types of skills needed for future jobs are unpredictable, job training should not merely focus on skills relevant for today's jobs. Old curricula need a thorough review to incorporate an element to build the capacity of workers to "learn to learn" new skills. Tapping technological solutions for education, from customized online courses to more engaging and participatory platforms such as game and simulations, can produce solid learning outcomes at affordable cost, but their impact must be carefully evaluated.

The 'gray divide,' the gap between technology and the ability of seniors to use it, is gradually being filled as new generations of seniors become more technology-savvy. However, more work is needed to better connect elderly workers to available and emerging technologies. Examples include better information outreach and improved user-friendliness of services and devices. Age-friendly technological advancement can also be promoted through public and venture capital investments that fund initiatives to change the way seniors work in future.

4.3 | Regional Cooperation to Gain from Diversity in Labor Force Endowment

Lastly, the Asia and Pacific region consists of countries with varying demographic profiles, among them young and populous countries that can complement the demographic transition in aging countries. To gain from potential complementarity, countries in the region need to collaborate and invest in connectivity, as well as in developing human capital.

Countries can strengthen their collaborations to facilitate cross-border labor mobility through the development of multilateral skill and qualification recognition programs and regionwide mobility (brain circulation) schemes for skilled professionals. They can also work together to reduce barriers to mobility such as high migration costs.

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Tapping Technology to Maximize the Longevity Dividend in Asia

Asia is graying rapidly: its share of senior population aged 65 and over will double from 9.2% in 2020, to 18% in 2050. Some countries will experience a drastic reduction of its working-age population (ages 15-64), as well as aging of the current workforce. This report explores the role and potential of technology in addressing economic and labor market opportunities and challenges posed by aging. It shows how technology can harness gains from the longevity dividend and draws together national and regional policy recommendations for countries in Asia and the Pacific.

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ASIAN DEVELOPMENT BANK
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines
www.adb.org