McKinsey Global Institute

Reskilling China

Transforming the world's largest workforce into lifelong learners

January 2021

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Preface

China has the largest workforce in the world, and the economy in which citizens live and work is in the throes of dynamic change. China is modernizing and digitizing, and is now turning its attention to how to ensure that workers have the skills they need for the next phase of the country's economic journey. After three decades of educational reform, the new focus is on reskilling and embedding an ethos of lifelong learning in China's workplaces and society.

This report focuses on ways to reform China's talent-development systems. It builds on MGI's extensive research on China's economy and global analysis on the future of work. Educational reform is a broad topic that includes philosophy, culture, history, and society, and requires in-depth expertise from academics, policy makers, educational institutions, parents, and students. In this research, however, we take an economic lens, focusing in particular on the development of skills.

The research was led by Jonathan Woetzel, McKinsey senior partner and a director of MGI in Shanghai; Jeongmin Seong, MGI partner in Shanghai; Nick Leung, McKinsey senior partner and chairman of McKinsey Greater China in Hong Kong; Joe Ngai, McKinsey senior partner and managing partner of McKinsey Greater China in Hong Kong; Li-Kai Chen, McKinsey senior partner in Kuala Lumpur; and Vera Tang, a McKinsey partner in Shenzhen. The work was also guided by James Manyika, McKinsey senior partner and co-chair and director of MGI in San Francisco; Jaana Remes, MGI partner in San Francisco; and Susan Lund, MGI partner in Washington, DC. Shivin Agarwal and Bo Wang led the research team, which comprised Gang Chen, Ke Dong, Ashley Li, Yifei Liu, Julia Ni, Erik Rong, Yining Xu, Athena Yan, and Chang Zhao. We thank Gurneet Singh Dandona and Alok Singh for their input on future of work analytics.

We thank our academic advisers, who challenged our thinking and provided valuable guidance. They are Rakesh Mohan, a senior fellow at the Jackson Institute for Global Affairs at Yale University and distinguished fellow at Brookings India; Gordon Orr, director emeritus and senior adviser to McKinsey; Christopher A. Pissarides, winner of the 2010 Nobel Memorial Prize in Economic Sciences and Regius Professor of Economics, London School of Economics; and Andrew Sheng, distinguished fellow of the Asia Global Institute.

We are grateful to many McKinsey and MGI colleagues around the world who offered valuable insights, including Tera Allas, Marco Dondi, Emma Dorn, Andre Dua, Kweilin Ellingrud, Karel Eloot, Elizabeth Foote, Xiang Ji, Jonathan Law, Denise Lee, Guangyu Li, Cheryl Lim, Meng Meng, Oliver Ren, Naba Salman, Saurabh Sanghvi, Dirk Schmautzer, Vincent Tsao, Tianwen Yu, and Haimeng Zhang. We also thank experts from academia, social institutions, and corporations who shared their observations on the topic of education and training.

This report was edited by MGI senior editor Janet Bush, with MGI senior editor Stephanie Strom. For their support, we thank members of MGI's operations team: editorial production manager Julie Philpot; graphic designers Marisa Carder and Patrick White; Dennis Alexander, Nienke Beuwer, Cathy Gui, and Rebeca Robboy in MGI's external relations team; digital editor Lauren Meling; research specialist Tim Beacom; and manager of personnel and administration Deadra Henderson. We also thank graphic designer Laura Brown and Richard Johnson, McKinsey senior editor, data visualization. We thank Glenn Leibowitz, McKinsey's group head of reputation and communications in Greater China; Ellie Miao, managing producer and editor in Shanghai; Xiaoyun Li, external communications specialist; and Lin Lin, deputy editor in chief. We are grateful to Arjun Chandrasekhar, Ziad Haider, and Meng Liu of McKinsey's risk team.

While we are grateful for all the input we have received, the report and views expressed here are ours alone. We welcome your comments on this research at MGI@mckinsey.com.

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January 2021


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In brief

Reskilling China

Three decades of Chinese educational reform have created a workforce oriented toward an industrial economy. Now the challenge is to transform China's talent-development model to develop the skills needed in an innovative, digitized, postindustrial economy. Key findings include the following:

A talent revolution in China can enable continuous improvement in living standards for all. Over the past three decades, China has achieved significant progress in incomes, labor productivity, and GDP growth. To continue to improve living standards, sustaining wage growth and productivity gains will be critical. For China to achieve 70 percent of the average per capita GDP of high-income economies by 2050, a long-term goal as interpreted by Chinese think tanks, necessary per capita GDP growth of 4.7 percent and wage growth of 4.9 percent is implied. This requires a skills revolution in China's workforce.

Up to one-third of global occupational and skills transitions may occur in China. By 2030, up to 220 million Chinese workers, or 30 percent of the workforce, may need to transition between occupations due to automation. That's about 36 percent of all global transitions simulated by MGI's future of work model. In a midpoint automaton scenario, about 516 billion hours of work—an average of 87 days per worker—need to be redeployed by 2030 as the mix of skills in demand changes. China needs to support the adaptation of migrant workers, who have limited resources and access to training and, often, low skills, given that 22 to 40 percent of their work is susceptible to automation.

These transitions will require transforming China's education and skills development system. Three elements stand out. First, learning will need to be extended beyond schools to cover China's working adults (everyone); this implies tripling the scope of skills development. Second, content needs to evolve from basic to a broad range of skills (everything). The high cognitive, social and emotional, and technical skills that will be in demand could account for an additional 236 billion hours by 2030, or an average of about 40 days per worker. Third, education and skills development should be available to all throughout their lives (everywhere) to support all workers who need to undertake some reskilling every year.

Based on an extensive survey of best practices in China and around the world, pilot projects based on four levers could kick-start the transformation:

— **Adoption of digital technologies.** China's economy is already significantly digitized, with increasing investment in educational technologies. More than two million people could deliver microcurricula through digital platforms while various tools such as artificial intelligence and virtual reality can improve the efficiency of delivery. More than 900 million internet users can benefit from digital technology and enjoy enhanced quality through hybrid online-offline learning.

— **Collaborative ecosystem.** Expanded use of public-private partnerships can help plug the gap between skills developed and what the market needs. Educators and employers can partner to design joint programs and drive innovative research. A coalition of school–industry partnerships, potentially with commitment from 300,000 companies, could be developed. Industry-specific partnerships can help address talent shortages of 30 million people in ten key manufacturing sectors identified by the government.

— **Enhanced vocational tracks.** China can make the vocational track attractive to students by expanding flexible pathways such as a "3+4" secondary-undergraduate model that enables them to go directly to application-oriented universities. Vocational pathways also need to be flexible to support midcareer transitions. China can develop vocational educators with industry experience—more than 80 percent of the total—to improve the quality of teaching staff.

— **Mindsets and incentives.** Individuals can shape their lifelong learning journey by using information platforms and acquiring required skills through microcredential programs. Employers can enhance competitiveness by strengthening their provision of training. The government can provide incentives to further investment in human capital.

Implementing the transformation requires an integrated delivery unit approach. A national leading group with ministry representatives and subject-matter experts can steer the overall direction together with local delivery units of governments, employers, educators, and social institutions to drive implementation. Deeper participation by private-sector players as educators in their own organizations and investors in training and skills is needed. Executives can consider a checklist of priorities such as identifying skill gaps, devoting more resources to training workers, and expanding partnerships with other stakeholders.

Reskilling China for a postindustrial economy

China faces skills and jobs shifts on an unprecedented scale

Three transitions to 2030

Occupations

Workforce shifting occupation, %

~36

Chinese workers — Global

Up to 220 million workers may shift occupational categories (early automation scenario)

Skills

Hours of work, 2018–30

516B Displaced by automation

~87 days per average worker could be automated, and need to be redeployed

Equity

Migrant worker activities, %

22–40

Automation risk

22-40% of work activities of 331 million migrant workers at risk of automation

Transforming China into a nation of lifelong learners

Everyone

3x

expansion of skills development system to cover all students and workers

Everything

236B

hours by 2030 (40 days per worker) subject to rising demand for higher cognitive, social and emotional, and tech skills, requiring new content and delivery

Everywhere

24/7

access to skills development to overcome time, place, and money constraints

Pilots based on four levers could start the skills transformation

Potential goals by 2030

Digital technologies

Engaging, multi-channel hybrid model

>900m reached through tech-enabled learning platforms and more than 2m people deliver microcurricula

Collaborative ecosystem

Partnerships among educators, employers, and government

300,000 school-industry partnerships

Enhanced vocational track

Competitive and flexible pathways for students and adults, higher quality teachers

>80% of teachers have industry experience

Shift in mindset and incentives

Culture of lifelong learning for individuals and employers

All eligible for skills development subsidy

Implementing a new system needs a national leading group, local delivery units, and deeper engagement from employers, including those in the private sector

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Executive summary

China has changed beyond recognition since its opening in the late 1970s and is now undergoing another significant evolution from an export-, manufacturing-, and investment-led economy to one driven by domestic consumption, services, and innovation—arguably a postindustrial economy. After decades of reform, China today has an education system that is oriented toward an industrial economy. Gaps in access, quality, and relevance in education still need to be plugged, but there is now potentially an even larger challenge to meet: developing the skills needed for a modern, digital, and innovative economy, instilling a new national ethos of lifelong learning, and ensuring that the system is equitable. Nothing less than a transformation of China's education and talent-development systems appears necessary. China has undertaken transformative reform before; it now needs to do so again.

Around the world, work is changing as digitization and automation spread, and many millions of people will need to become more skilled, refresh their skills, and continually reinvent themselves—and some to change occupations. Because of the country's sheer scale, as many as one-third of the global occupational transitions needed for the future of work may be in China. If it gets this right, best practices and models could offer a helpful reference point for other economies, particularly emerging ones.

In this report, the McKinsey Global Institute (MGI) assesses the country's education system today and, based on an extensive survey of best practices in China and around the world, describes pilot projects using four levers that could kick-start a transformation of China's talent-development system designed to have sufficient breadth and ambition to enable continuous rising in living standards in the period to 2030. We do not attempt to tackle the full breadth of the issues relating to educational reform, which, we acknowledge, includes much broader dimensions such as philosophy, culture, history, and society, and which requires the in-depth expertise of academics, policy makers, educational institutions, parents, and students. Rather, we focus on the economic dimension of talent development and, in particular, on the development of skills. We hope that this analysis can provide helpful input and facilitate discussion among key stakeholders.

China needs a skills revolution to enable continuous rises in living standards for all in a postindustrial economy

A skills revolution is vital if the quality of life of the average Chinese person is to continue improving even as the nature of the economy changes. Over the past 30 years, incomes and labor productivity have grown tenfold, and GDP has increased by 13 times. However, some key drivers are waning. The mass migration from agriculture to urban employment helped fuel rapid growth, but the pace of urbanization is slowing down. China is aging, and the working-age population is shrinking. Debt levels and costs are rising.

To sustain continuing increases in per capita GDP and wages will require rising productivity enabled by improved skills and innovation.[1] Chinese think tanks have simulated scenarios in which the country achieves the aspirations of 70 percent of the per capita GDP of high-income economies by 2050, compared with 27 percent today.[2] The scenarios suggest that China needs to achieve annual growth in per capita GDP of 4.7 percent and wage growth of 4.9 percent by 2050 (Exhibit E1).

Exhibit E1

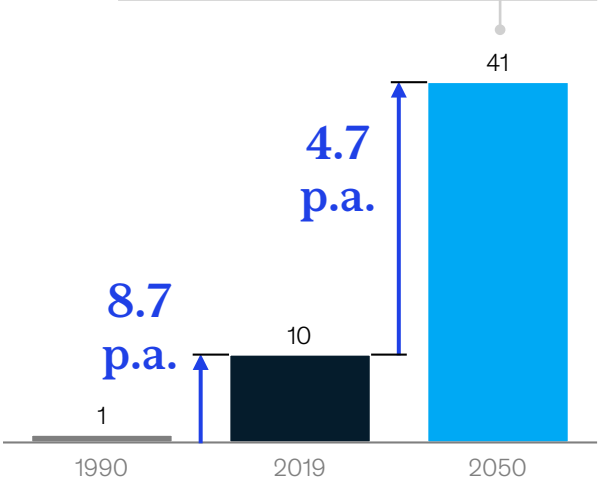
Sustaining per capita GDP and wage growth is important for continuous improvement of living standards.

Simulation

$ thousand, 2015 real terms

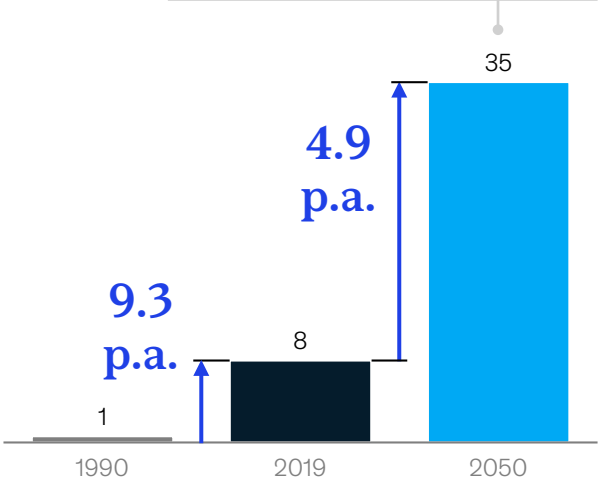
China per capita GDP

Scenario: Chinese think tanks' interpretation of long-term goal to achieve 70% of average per capita GDP of high-income economies[1]



Average annual wage per employee

Scenario: Implied wage growth for China to 70% of average per capita GDP of high-income economies[2]



1. Some Chinese think tanks defined a long-term scenario in which China achieves 70% of the average of high-income economies' per capita GDP by 2050. The World Bank defines a high-income country as one with gross per capita national income of $12,536 or more in 2019.
2. Assuming labor share of income remains constant.

Source: World Bank; McKinsey Global Institute analysis

[1] *The China effect on global innovation*, McKinsey Global Institute, October 2015.
[2] A high-income country is defined by the World Bank as having gross per capita national income of $12,536 or more in 2019; China did not belong to this category in that year. Several Chinese think tanks interpret China's goal of becoming a fully modernized economy by 2050 to achieve between 50 percent and 80 percent of high-income economies by 2050.

China's economy is undergoing rapid changes in pursuit of these goals. The economy is transitioning away from being led by investment and manufacturing to being driven by consumption, services, and innovation.[3] This changes the mix of skills and talent needed. At the same time, a global spread of digitization and automation is reducing demand for manufacturing jobs characterized by repetitive physical activity, as well as service jobs requiring basic cognitive skills such as data entry and validation. Demand is rising for social and emotional skills as well as technological skills. If anything, digitization and automation have accelerated in response to the COVID-19 pandemic, and therefore the need to be mobile and reskill may have become even more urgent.[4]

China could make three transitions that in combination amount to a transformation of its labor market on an unprecedented scale (Exhibit E2).

30%

of Chinese workers may need to transition between occupations by 2030

— **Occupations.** By 2030, up to 220 million Chinese workers, or 30 percent of the workforce, may need to transition between occupations. That's about one-third of all global transitions forecast by MGI's future of work model. We segmented China's workforce into six occupational categories to analyze in some detail shifts in labor-market demand and changes in the occupational mix that those shifts necessitate. The six occupational categories are frontier innovators, skilled professionals, administrative white-collar workers, frontline services labor, manufacturing workers, and construction and agriculture workers. Our simulation found that demand for frontier innovators could rise by 46 percent, for skilled professionals by 28 percent, and for frontline services labor by 23 percent, while demand declines for manufacturing workers by 27 percent and for construction and agriculture workers by 28 percent.

— **Skills.** In a midpoint automation scenario, about 516 billion hours of work, or an average of 87 days per worker, may be displaced and need to be redeployed by 2030.[5] Overall, demand for physical and manual skills and basic cognitive skills could fall by 18 percent and 11 percent, respectively. However, demand for social and emotional skills and technological skills could rise by 18 percent and 51 percent, respectively.

— **Equity.** Labor-market and skills transitions are likely to be particularly challenging for China's rural-urban migrants. By 2019, the number of those workers stood at 291 million. The country is continuing to urbanize, and if the historical rate were to hold, the number of rural-urban migrant workers could reach 331 million by 2030. Because of the hukou household registration system, many migrants lack access to services including healthcare and education, and cannot access quality training programs; moreover, many of these workers are low skill and low paid and do not have sufficient financial resources for those programs.[6] Automation may compound the challenges migrant workers face. About 22 to 40 percent of the work of China's migrant workers is susceptible to automation—about 151 billion to 277 billion hours, or 57 to 105 days per person. Particular attention needs to be given to helping migrant workers make necessary transitions.

An effective transformation in China to manage these transitions could generate valuable know-how that could be a helpful reference point for other parts of the world.

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3 *China's choice: Capturing the productivity opportunity*, McKinsey Global Institute, June 2016.

4 Sapana Agrawal, Aaron De Smet, Sébastien Lacroix, and Angelika Reich, *To emerge stronger from the COVID-19 crisis, companies should start reskilling their workforces now*, McKinsey & Company, May 7, 2020; Oliver Tonby, Jonathan Woetzel, Noshir Kaka, Wonsik Choi, Jeongmin Seong, Brant Carson, and Lily Ma, *How technology is safeguarding health and livelihoods in Asia*, McKinsey & Company, May 12, 2020; and Aamer Baig, Bryce Hall, Paul Jenkins, Eric Lamarre, and Brian McCarthy, *The COVID-19 recovery will be digital: A plan for the first 90 days*, McKinsey & Company, May 14, 2020.

5 Our midpoint scenario already includes the impact of COVID-19.

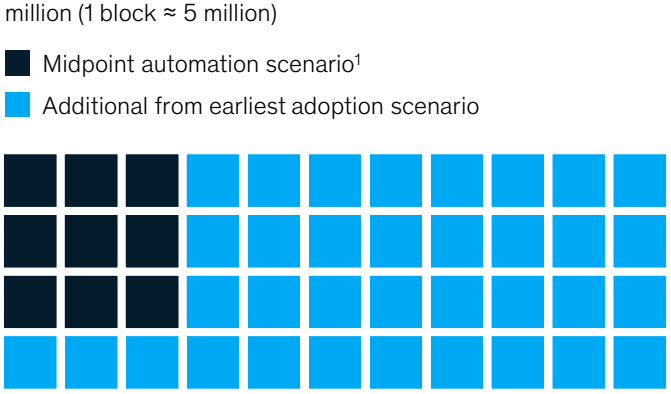
6 L. Rachel Ngai, Christopher A. Pissarides, and Jin Wang, "China's mobility barriers and employment allocations," *Journal of the European Economic Association*, 2019, Volume 17, Number 5; Zhenxiang Chen and Kayuet Liu, "Assimilation of China's rural-to-urban migrants: A multidimensional process," *Chinese Journal of Sociology*, April 2018; Russell King and Ronald Skeldon, "'Mind the gap!' Integrating approaches to internal and international migration," *Journal of Ethnic and Migration Studies*, 2010, Volume 36, Number 10; and Wenfei Winnie Fang and C. Cindy Fan, "Migrant workers' integration in urban China: Experiences in employment, social adaptation, and self-identity," *Eurasian Geography and Economics*, 2012, Volume 53, Number 6.

Exhibit E2

China needs to achieve three labor force transitions in the next decade.

Occupational transition

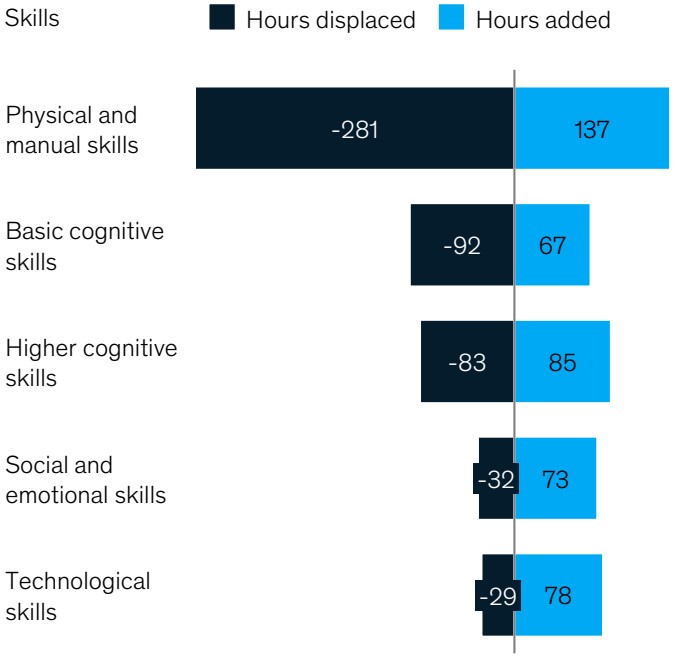
Number of workers in China needing to move out of current occupational categories to find work, 2018–30, million (1 block ≈ 5 million)



Up to **220M workers** (~36% of global workforce) may need to switch occupations

Skills transition

Change in hours worked by 2030, midpoint automation scenario, billion



~516B hours displaced due to automation (average ~87 days per worker) and need to be redeployed across different skills

Equity transition[2]

Number of migrant workers, million

~330M migrant workers at risk of 22–40% of work activities automated

1. Includes changes expected due to COVID-19.
2. 2030 estimate based on historical compound annual growth rate of migrant worker population, 2014–19. Calculation takes effect of hukou reform into account.

Source: ILO; National Bureau of Statistics of China; O*NET; Oxford Economics; McKinsey Global Institute analysis

China's education and skills development system needs to be transformed

Over the past 30 years, China has achieved transformative change in its education system. The system served the industrial economy well, but the economy is changing. The country once again needs to reinvent education and skills development in the broadest sense, to enable people to develop the capabilities they need to thrive in life and at work—to equip its people for a postindustrial society.

To achieve this transformation, three elements stand out, which we can summarize as the "three Es": everyone, everything, and everywhere. First, education, training, and learning should be available not only to school-age people but to working adults. Second, the content of education and skills development needs to change to reflect an economy that is moving far away from the industrial model of the past 30 years. Third, education and training should be ubiquitous, available to all throughout their lives, anywhere and anytime (Exhibit E3).

Exhibit E3

China's skills development system needs to be transformed in order to sustain economic growth and improve living standards.

	Current state	Potential direction
Everyone	Primary focus on **formal education system** accommodating ~243 million students[1]	**3x expansion of scope** to support entire population including 775 million workers
Everything	**Strong academic performance** (PISA reading, math scores) yet **gaps in some metrics** including growth mindset and critical thinking	**Broad capability building** to equip 236 billion hours of work requiring higher cognitive, social and emotional, and technical skills by 2030 through a new content and delivery model[2]
Everywhere	**Rural-urban gaps** (30 pp lower enrollment in higher education) and **limited migrant worker support**	**Ubiquitous access** to training to support reskilling of almost all workers every year on 24/7 basis

1. All students enrolled in K–12 and higher education in 2019, according to official statistics.
2. On average, 40 days per person by 2030 due to the impact of automation.

Source: Chinese General Social Survey; Ministry of Education; National Bureau of Statistics; McKinsey Global Institute analys is

Everyone: Education and skills development needs to expand beyond students to China's workforce

Over the past 30 years, China has continuously reformed education. Public investment in education soared 50-fold between 1992 and 2018, from 2.7 percent of GDP to 4.1 percent. In 1978, only 66 percent of children were covered by compulsory education; today that share is 100 percent. Gross enrollment in secondary education more than doubled from 41 to 95 percent over the same period. The number of college admissions increased from 3.7 million in 2000 to 9.1 million in 2019. 91 percent of teachers in secondary education now hold a bachelor's degree and above, compared with only 24 percent in 2000.

China now needs to focus on reskilling the current workforce to match the needs of a changing economy. By 2030, we find that 75 percent or 543 million workers is likely to be people who are already in the labor force today. This implies that workforce reskilling and vocational training systems can be the major drivers of impact by 2030. The number of students currently enrolled in K–12 and higher education is about 243 million; total employment today is about 775 million. As China expands workforce training and lifelong learning, the scope of education and skills development system needs to triple by 2030. According to official statistics, the number of students (including adults) undertaking non-diploma programs declined from 44 million to 37 million between 2015 and 2019.[7] Not all training needs to be offered in formal school programs. In the future, the skills development system can encourage the development of new platforms and flexible training venues outside the school system to meet a variety of learning goals. Private institutions and employers can play a role in filling gaps and expanding the access to all.

3x

expansion of education and skills development system needed by 2030

Workforce training is facing challenges today from low investment, limited relevance to the world of work, and a lack of a sense of urgency about the importance of skills among Chinese people, leading to low participation in programs. China could act to develop competitive vocational schools to offer high-quality training, expand the number and capabilities of industry experts, and overcome social bias. Singapore did this from the 1980s onward through public-relations campaigns and substantial investment in technical schools. Low investment in training appears to reflect the fact that many Chinese companies tend to experience high turnover of workers. One study found that average time spent in the first job for the generation born in the 1990s in China was only 19 months, but for the generation born in the 1970s and 1980 it was 51 and 43 months, respectively.[8] The incentive to devote substantial resources to training is weak. Many Chinese workers do not appear to regard participation in training programs as important. In one survey, 79 percent of respondents said training was necessary, but the survey also found that many of them do not consider vocational skills training to be urgent.[9] This may reflect time and financial constraints on workers.

In parallel, the long-term task of tackling remaining structural issues in China's education system should get under way. About 288 million students may enter the workforce after 2030, and about 400 million new Chinese are expected to be born between 2020 and 2050. The work of changing the education system for these future students arguably needs to begin now to ensure that reforms in education and talent development continually support a rising standard of living.

[7] This includes graduates from technical-vocational programs (three million in 2019), technical training for peasants (24 million), and other training (11 million).
[8] *First job insights*, LinkedIn, August 2018, linkedin.com.
[9] *White paper on China's education and training industry*, iResearch, 2017, report.iresearch.cn.

Everything: The content of education and skills development needs to offer broad capabilities that equip people for a fast-evolving economy

The content of both education and any expanded worker training needs to better match what society needs. In an industrial society, basic literacy and the ability to follow predefined instructions were often sufficient. Now, in China's changing economy, boundaries between sectors are blurred and the nature of work is continuously being reinvented. More than ever, therefore, people need to deal with ambiguous and complex situations where there are no clear instructions to follow. Knowledge and skills can become outdated quickly, and skills development content needs to equip students and workers with broader and flexible capabilities—continuously refreshed—if they are to meet changing demand. Demand for higher cognitive (such as critical thinking and decision making), social and emotional (such as interpersonal skills and leadership), and technical skills (such as advanced data analysis) will increase. Our simulation of a midpoint automation scenario suggests that 236 billion hours of work related to these three skill sets—about 40 days per person on average—needs to be added by 2030. This requires investment in developing different content beyond traditional textbooks, such as case studies and hands-on projects as well as new delivery approaches such as participatory learning and experiential training.

~40

days per average worker needs to be added to higher cognitive, social and emotional, and tech-skilled work by 2030

In academia, PISA statistics suggest that although China scores above the Organisation for Economic Co-operation and Development (OECD) average on reading and mathematics, it scores below the OECD average on growth mindset and students' well-being.[10] China was in the bottom 20 countries in the world on PISA scores for students' "ability to think like a scientist," an attribute relevant to creativity and entrepreneurship.[11] In universities, there appears to be an unmet appetite among students for more exposure to practical skills. In one 2018 survey of graduates, 62 percent of respondents said they had insufficient practical lessons including, for instance, field studies and internship opportunities.[12] The same survey found that 63 percent of students who responded said that they didn't have enough information when choosing a major.

In the case of vocational training, content is often outdated, and some instructors lack expertise. Vocational curricula have not been updated to keep pace with the changing economy. In a TÜV Rheinland survey of vocational schools and firms, respondents from about 36 percent of schools said that instructors lack practical industry experience, 50 percent said that instructors' fields of expertise were not fully consistent with their teaching, and 30 percent of 115 corporate representatives surveyed said that vocational school instructors lack hands-on industry experience.[13] A survey by Zhaopin in 2019 found that among white-collar workers not satisfied with their training, nearly 40 percent of respondents said that training outcomes were below their expectations.[14]

[10] We note that the score for Chinese students is based on relatively prosperous cities of Beijing, Jiangsu, Shanghai, and Zhejiang. The Organisation for Economic Co-operation and Development (OECD) defines growth mindset as the belief that someone's ability and intelligence can develop over time. For an overview of OECD findings on PISA scores for Asia, see Li-Kai Chen, Emma Dorn, Marc Krawitz, Cheryl SH Lim, and Mona Mourshed, *Drivers of student performance: Asia insights*, January 2018, McKinsey.com.

[11] Li-Kai Chen, Emma Dorn, Marc Krawitz, Cheryl SH Lim, and Mona Mourshed, *Drivers of student performance: Insights from Asia*, 2017, McKinsey.com.

[12] Boqing Wang and Yonghong Chen, *Chinese 4-year college graduates' employment annual report (2019)*, Social Science Literature Press, June 2019, pishu.com.

[13] *Welcoming Industry 4.0 white paper on the development of Chinese vocational education*, TüV Rheinland, September 2018

[14] *Demand and satisfaction of vocational training by Chinese workers*, Zhaopin, September 2019, marketwatch.hroot.com.

Everywhere: Provision of education and skills development needs to be ubiquitous
Geography, time, and money currently constrain the ability to learn. Yet to reskill China effectively, access to education and skills development needs to be ubiquitous. In the new system, more than 80 percent of the workforce could take reskilling programs of various kinds. The system can also make competitive vocational tracks more widely available and can reduce gaps between those who live in cities and those who live in rural areas. China could take an ambitious view, seeking to craft a system that is available 24/7 through expanded use of digital technologies and that could even be mandatory for workers—in other words, "opt out" rather than "opt in." Employers could enable this by vastly increasing the training of their own workers, partly supported by policy incentives.

Public expenditure on education in tier-one cities is

3.3x

higher than in tier-three and tier-four cities

In today's system, where people live still to an extent determines whether they can access educational and training resources. On the whole, these resources are more available and of higher quality in urban than in rural areas. According to official statistics, only three million migrant workers—about two percent of the total 291 million—took part in a vocational or technical program in 2019. Many migrant workers do not have sufficient time to study or financial resources to pay for courses. The compulsory education budget per student each year in rural areas is about 60 percent of that of central urban areas; in those areas, more than 90 percent of teachers have university degrees and above, compared with 72 percent in rural areas according to China Education Panel Survey data. And although gaps between cities are narrowing, public expenditure on education in tier-one cities is 3.3 times higher than in tier-three and tier-four cities.

In China, as in many other countries, vocational training is less highly prized than academic education, and it is perceived as not offering a good return on investment of time and money. The number of secondary vocational schools, students, and teachers is falling rather than rising. Pathways from vocational courses to employment are uncertain, and student satisfaction tends to be low. Within three years of job placement, half of vocational graduates change career paths, compared with 30 percent of traditional academic graduates.[15]

Digital technologies, public-private partnerships, vocational education, and a shift in mindsets and incentives could be levers

A survey of best practices in China and around the world highlights four levers that could be used as the core of various pilot projects. China could use them to kick-start a broader transformation of the environment for learning and teaching—powered by digital technologies; characterized by close collaboration between the public and private sectors and among educators and companies; flexible and competitive vocational tracks; and available throughout people's lifetimes.

On all four levers, China has strengths that suggest it can achieve large impact and significantly beneficial outcomes that are needed to meet an aspiration to develop the skills needed to support continuous rises in living standards in the period to 2030 (Exhibit E4). Managing a transformation on the scale needed is a huge challenge that involves all of Chinese society, and it arguably makes sense to avoid major disruption and unintended consequences by establishing best practices in relatively small-scale pilots before scaling up to the national level. In many cases, China already has examples of best practices in different locations.

[15] *Chinese 3-year vocational college graduates' employment annual report*, MyCOS, June 2017, pishu.com.

Exhibit E4

Four levers could lead to significant impact on education and skills development by 2030.

Digital technologies	**900M+** individuals reached through tech-enabled learning platforms	**2M+** individuals deliver microcurricula through digital platforms
Collaborative ecosystem	**300K+** school-enterprise partnerships, covering **11K** vocational schools and **27M** students	
Enhanced vocational tracks	**All** application-oriented universities open to flexible paths (eg, "3+4" program) for vocational students	**>80%** of vocational educators with industry experience
Mindset and incentives	**220M** people benefiting from information platforms to navigate occupation transition[1]	**All** eligible for subsidized training programs[2]

1. Early adoption automation scenario.
2. Singapore's Skills Future program typically offers SGD$500–SGD1,000 over a 5-year period to all aged between 25 and 60.

Source: McKinsey Global Institute analysis

Digital technologies: Traditional textbook-based learning can be transformed into a more engaging, multichannel hybrid model

Today, education and training are largely delivered using traditional methods. According to one survey on corporate training, only 20 percent of respondents were taught online and 10 percent on microlearning platforms.[16] The adoption of digital technologies can transform traditional textbook-based teaching and learning methods into more engaging, multichannel, and hybrid models.[17]

Digital technologies can empower content creators to deliver microcurricula and make content delivery more engaging and personalized by using tools such as artificial intelligence (AI) technologies and gamification. Lizhiweike, an online education platform in China, offers a solution that helps people create video clips and open classes for anyone who has a smartphone. Boost, a provider of leadership training, offers a mobile app enabling users to interact with 3-D characters in real-life role-playing to learn and practice leadership skills while providing personalized feedback. A hybrid model that combines online and offline and a redefinition of the role of teachers can broaden access to rural students. In rural areas, hardware is gradually improving. Today, 99 percent of rural villages have installed networking broadband. QingXiYuanShan is dedicated to improving rural students' English-language capabilities, with content as good as that of urban schools, streamed from the certified teacher's office; local teachers then are responsible for after-class coaching. Digital platforms can also help rural students establish pathways to urban jobs by offering training and an opportunity to explore potential careers. It is important that digital is fully

[16] "China training industry report 2016–2017," *Training Magazine* and OnDemand Consulting, June 2020, trainingmag.com.cn.

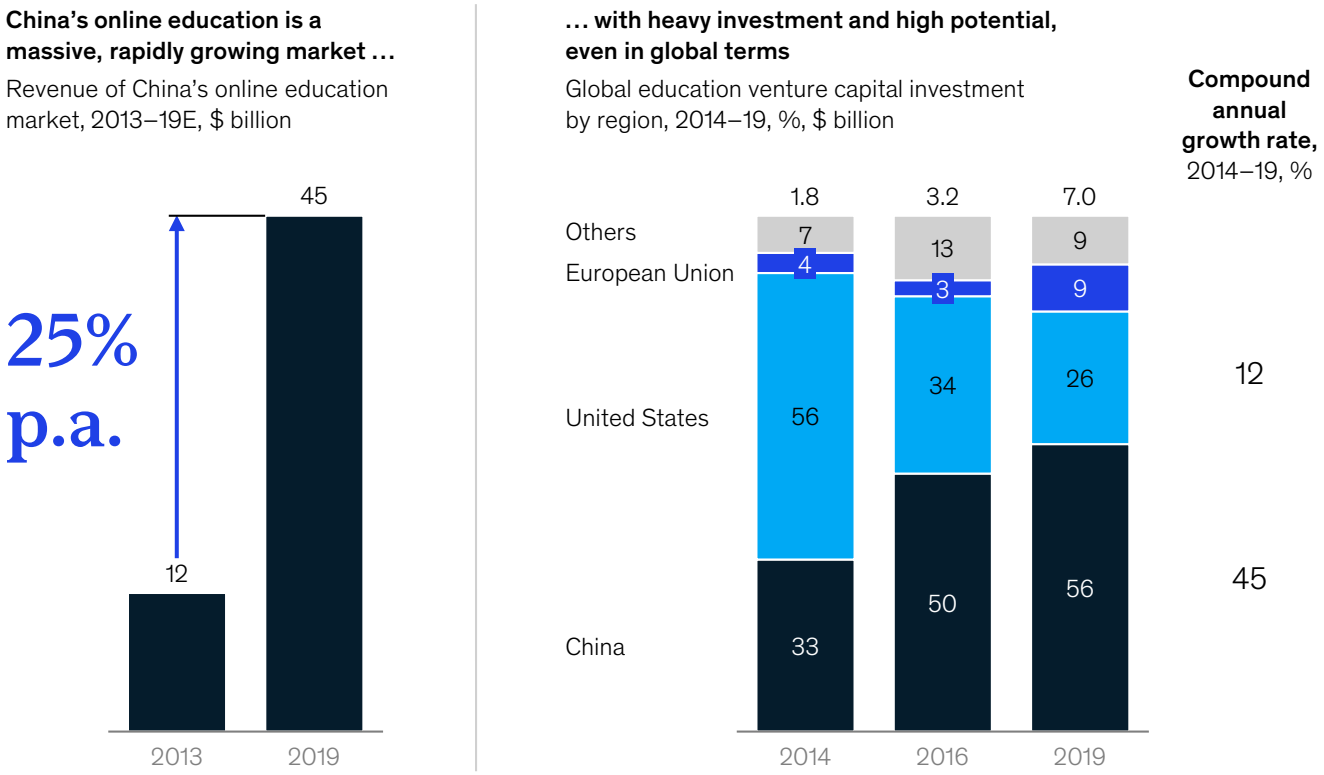
[17] Jake Bryant, Christine Heitz, Saurabh Sanghvi, and Dilip Wagle, *How artificial intelligence will impact K–12 teachers*, January 2020, McKinsey.com; Jake Bryant, Felipe Child, Emma Dorn, and Stephen Hall, *New global data reveal education technology's impact on learning*, June 2020, McKinsey.com; and Jake Bryant, Emma Dorn, Stephen Hall, and Frederic Panier, *Reimagining a more equitable and resilient K–12 education system*, September 2020, McKinsey.com.

understood by teachers and students—providing every child with a laptop or education app will not be sufficient. Without effective implementation, technology alone may not help to improve outcomes.[18]

China is in a good position to expand the use of digital in education and training. It has a large, young market that enables rapid, large-scale commercialization of digital business models. For example, penetration of e-commerce and mobile payments is two to three times higher than in many other countries. In China, more than 95 percent of users access the internet via mobile.[19] Adoption of innovations such as online to offline, social commerce, and livestreaming has been rapid, and the COVID-19 pandemic accelerated their use even further. For instance, the number of monthly active users of Zuoyebang, an online education startup that provides tutoring, increased from 106 million in January 2020 to 157 million in March 2020 according to QuestMobile. China is building a solid position in educational technology investment (Exhibit E5). In 2019, it accounted for 56 percent of global venture capital investment in education. From 2014 to 2019, venture capital going into China's education technology sector grew at a compound annual rate of 45 percent to total $3.9 billion.

Exhibit E5

Educational technology is already a huge, rapidly growing market in China, with high potential.



Source: HolonIQ; iResearch Global Group; McKinsey Global Institute analysis

[18] Li-Kai Chen, Emma Dorn, Marc Krawitz, Cheryl SH Lim, and Mona Mourshed, *Drivers of student performance: Asia insights*, January 2018, McKinsey.com.
[19] *Digital China: Powering the economy to global competitiveness*, McKinsey Global Institute, December 2017.

The potential is large. More than 900 million people—that is, virtually everyone with internet access—could obtain high-quality digital content to meet the needs of their skills transitions. More than two million people could deliver microcurricula through digital platforms that are not usually covered by traditional textbook-oriented curricula. That's double today's number assuming the number of users on education and training platforms follow the typical growth pattern of other technology platforms, and the ratio to content providers remains constant. A large share of education and training hours can be enhanced by advanced technologies in a hybrid online-offline model.

Collaborative ecosystem: Expanded public-private skills development partnership can help address the gap between workforce skills and what employers need

Today, there is a gap between the capabilities and skills China's education and skills development systems enable people to develop and what employers need. Expanded collaboration between education and training providers and employers could help bridge this gap. Stronger collaboration can create benefits for all stakeholders. For instance, employers can access qualified talent, educators can achieve improved outcomes in job placement, and government can benefit from a more productive labor force.

Collaboration between academia and industry can lead to opportunities in designing joint programs, driving innovative research, and improving job placement for students. There are emerging examples in China. DJI, a commercial drones maker, launched a joint innovation laboratory with the Hong Kong University of Science and Technology to drive further advances in unmanned aerial vehicle technology. Tencent and Beijing University of Posts and Telecommunications codeveloped a course on social media. Alibaba Group and Hangzhou Normal University co-founded the Alibaba Business School, which offers four bachelor's degrees.

Enterprises can play a more significant role in vocational education, committing themselves to playing a part in the design of curricula, training, and recruiting, while government can facilitate collaboration among different stakeholders. A subsidiary of China Metallurgical Group, the China MCC5 technical school has good access to experienced professionals—70 percent of the school's 2,300 educators have both academic knowledge and mid- to senior-level industry credentials. Over the past five years, 98 percent of students have gone on to jobs. The DAWT training center, which employs the dual vocational training system used in Germany, was developed with co-owners Taicang secondary vocational school, the Taicang government, and leading auto engineering companies Kern-Liebers and Mubea. The co-owners share training costs, and 95 percent of students get jobs in their chosen profession. It is also important to expand the pool of high-quality teachers by facilitating more exchange with companies through rotational programs.

China is well positioned to develop more collaboration through public-private partnerships with its dynamic corporate ecosystem. The country has about 120 Chinese companies in the Fortune 500, and some 4,000 listed companies on the Shanghai and Shenzhen stock exchanges. Leading vocational schools have developed partnerships with about 200 corporate partners and demonstrate successful development of skill set and placement programs. China needs to scale up similar partnerships across the nation.

We see potential for a coalition of vocational school-industry partnerships, potentially with commitment from 300,000 companies (that is, 40 percent of companies the China Statistics Bureau classifies as above scale). This coalition, which could work on improving the design of curricula, the quality of training, and job placement, could cover about 11,000 secondary and higher vocational schools with 27 million students. If industry-specific public-private partnerships can strengthen the provision of training, China may be able to address a combined shortage of more than 30 million skilled workers in key manufacturing sectors identified by governments by 2025. Pilot programs can potentially be initiated in 30 cities where manufacturing accounts for a large share of GDP and local governments have strategies to drive structural upgrade.

300,000

companies could take part in vocational school-industry partnerships

Vocational tracks: Competitive and flexible educational pathways and making educators with industry experience the norm could more effectively develop and reskill talent

The pathway to training could have multiple entry points, giving workers flexibility in returning to school, receiving retraining, and pursuing higher-skill jobs. Chinese workers considering enrolling in training programs have many constraints on their time and mobility, and flexibility is vital. As an example of an approach in the United States that China might consider, the entire curriculum of the University of Phoenix is designed for adult learners. Courses tend to be five to six weeks in duration and largely conducted online.

China could also make the vocational track more attractive to students, for instance by offering a "3+4" secondary-undergraduate model that enables them to go directly to higher vocational or application-oriented universities without taking the national gaokao college entrance exam. This model is already being pioneered in China by Shandong and Zhejiang provinces, where secondary vocational schools are partnering with local universities to create 3+4 programs. To provide more options to vocational students, this approach could be expanded to all application-oriented universities in China, including ones that the government is expecting to convert from traditional universities.[20]

Vocational training programs could offer improved teaching if they were to collaborate more with companies to gain up-to-date knowledge and invite company representatives to teach at vocational colleges. Finland's Telkkä program, for instance, provides on-the-job training and coaching programs in a company environment.[21] Company instructors develop their skills by tapping into the knowledge of faculty members, and teachers benefit from the instructors' practical knowledge of recent technologies and working practices. Skilled workers can also be deployed to teach at vocational schools, as in the Teach Too program in the United Kingdom.[22] In 2020, vocational schools in Zhangjiagang organized an internship program for more than 300 professional teachers, covering fields such as accounting, electrical engineering, logistics, finance, and computer engineering.

>80%

of specialized vocational teachers could be required to have industry experience by 2030

China could also develop more dual vocational educators with industry experience. By 2030, more than 80 percent of teachers of specialized courses at vocational schools could be required to have industry experience in related areas, up from today's actual proportion of 32 percent for secondary and 40 percent for higher vocational schools. Industry experience is a prerequisite in German vocational schools.

Mindset shifts and incentive schemes: Individuals and employers need to be prepared for a lifelong learning journey

The importance of skills needs to be elevated, and a culture of lifelong learning should be developed and nurtured to help motivate a broad-based increase in skills. This will require a major mindset shift among individuals and companies. The 18th National Congress emphasized the importance of the "learning society" to promote an inclusive, prosperous society. This is a significant shift, but China's companies and people have successfully adapted to radical change in the past.[23] A number of initiatives could be considered to enable the change. For instance, information platforms could help people to develop necessary capabilities and manage skills and occupational transitions throughout their lives (see Exhibit E6 for an illustration of the choices that a tour guide, for instance, may have, which could lead to a tripling of salary, according to our simulation). The impact and reach of information platforms would be significant, benefiting 220 million people who would need to make an occupational transition by 2030 in our early automation adoption scenario.

[20] There are currently about 1,200 universities in China and the government plans to transform existing higher vocational schools or ordinary universities into about 600 "application-oriented" universities. The purpose is to equip students with both theoretical knowledge and practical experience.

[21] Pia Cort, Auli Härkönen, and Kristiina Volmari, *PROFF – Professionalisation of VET teachers for the future*, Panorama series number 104, European Centre for the Development of Vocational Training (Cedefop), 2004.

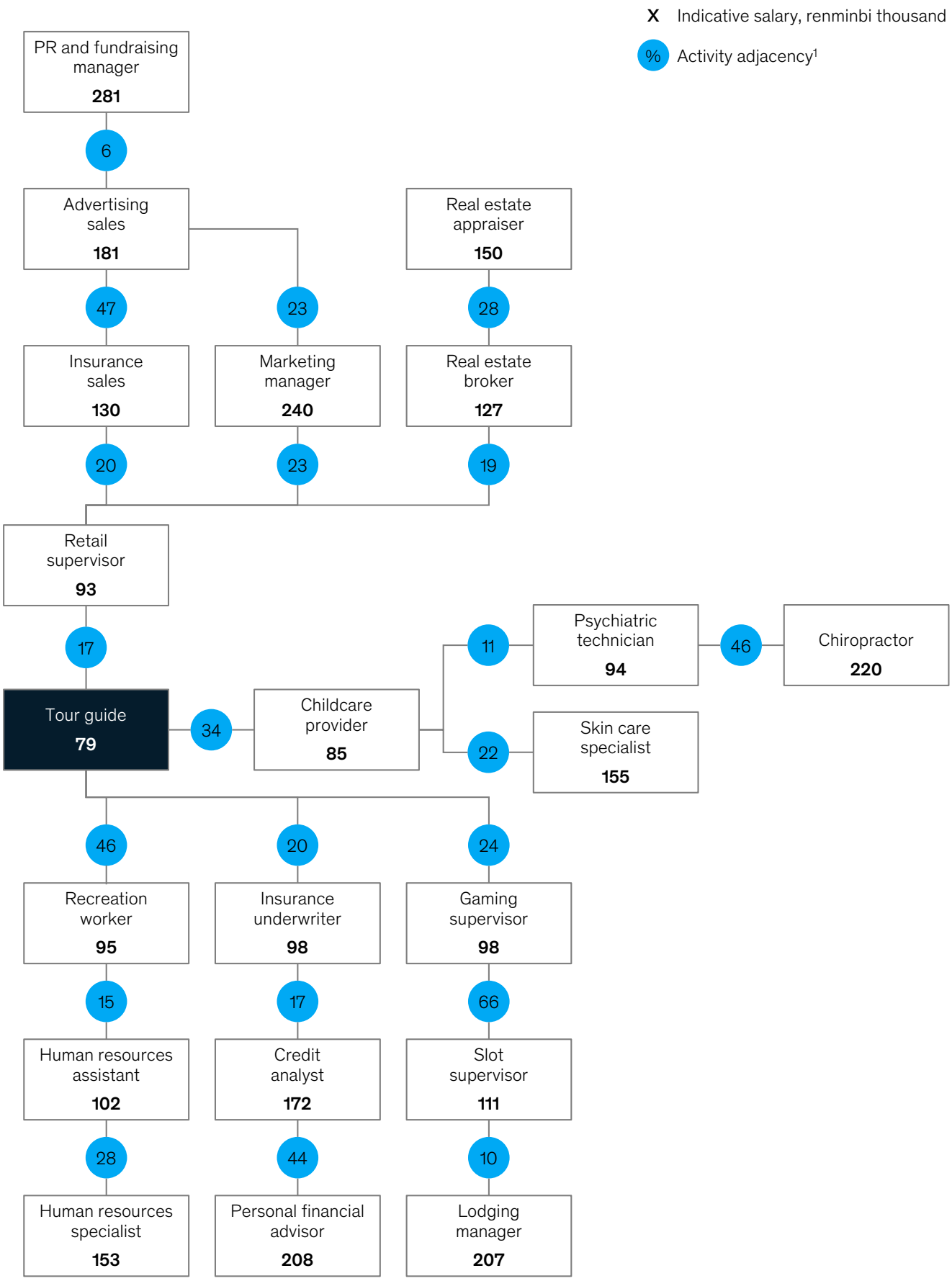
[22] *Teach Too: Carshalton college with Mirabot*, YouTube, March 2, 2016, youtube.com.

[23] Consider, for instance, the fact that in three decades China shifted from being a largely agrarian economy to an industrial one. From employing 75 percent of workers in 1977, today agriculture employs only 25 percent. Since 1978, more than 600 million people are estimated to have moved from rural to urban areas. Another example of change is China's rapid embrace of the private sector. In 1995, the private sector accounted for only 18 percent of urban employment; today, the share is 87 percent.

Exhibit E6

Information platforms can guide pathways for job seekers.

Illustrative



1. Minimum time worker in each occupation spends doing activities performed by its adjacent occupation.

Source: O*Net; McKinsey Global Institute analysis

A microcredential system beyond the awarding of degrees would ideally be in place to promote a continuous learning culture. Governments can also play a role in offering incentives to facilitate the transition. MySkillsFuture, a government-sponsored program in Singapore, offers courses, career information, and employment services, and allows content providers to post certified courses online. An important element of the program is that the government offers citizens a training account with funds that individuals can choose how to spend, giving them ownership of their learning journey.[24]

Employers can embrace the lifelong learning system, too. By investing sufficiently in learning opportunities for their employees, companies may become more competitive in the job market and be more attractive to individuals with the skills they may need, creating a virtuous cycle of productivity growth in the medium term. Reflecting this reality, the number of "corporate universities" is on the rise as companies judge that this route enables them to design courses that suit their skills needs; for students, this is an attractive option because they are more or less assured of a job.

A major issue to overcome is inertia among companies when it comes to training their workforces. In theory, an overarching incentive for companies is that investing sufficiently in learning opportunities for their employees should mean that they have the skills they need to be competitive and productive. However, market failures do exist in the provision of workforce training. One study, for instance, highlighted a "poaching externality" that reduces the incentive among employers to train their employees, because they bear the cost but another firm may reap the benefits.[25] Another study argues that when firms do not appropriate all the gains from the on-the-job training they provide, training subsidies or training levels may be required.[26] In China, government may need to step in as governments around the world do. A number of tools could be used to provide effective incentives. One is government subsidies. Many countries have been experimenting with systems such as co-funding through grants or vouchers, and financial incentives through the tax system. China has been moving in this direction, for instance increasing the tax-free employee training expense cap, and related subsidies.[27]

Moving China forward could require a systemic approach with the private sector playing an integral role

To transform the Chinese education and training system in the ways that we describe in this report, such as incorporating digital solutions and offering lifelong learning to the entire workforce, would require substantial investment. The returns are potentially very large, but China needs to incorporate an investment requirement into its planning and consider carefully what investment mix may be most effective, how much the public and private sectors and even individuals could contribute to the effort, and how to design a system of workable incentives to achieve a new era of workforce training and lifelong learning.

The transformation will require comprehensive strategic thinking with input from all relevant stakeholders—notably, with the private sector playing a greatly expanded and more integral role. The challenge is how to coordinate the many players in a fragmented system characterized by a lack of collaboration especially between the public and private sectors, but also between educational providers and companies.

[24] The program typically offers 500 Singapore dollars to 1,000 Singapore dollars over a five-year period to all aged between 25 and 60.

[25] Giorgio Brunello and Maria De Paola, *Market failures and the under-provision of training*, prepared for EC-OECD Seminar on Human Capital and Labour Market Performance in Brussels, Belgium, December 8, 2004.

[26] Alison L. Booth and Dennis J. Snower, eds., *Acquiring skills: Market failures, their symptoms and policy responses*, Cambridge University Press, 1996.

[27] *Notice on the tax refund for enterprise employee training budget*, State Taxation Administration, May 2018, chinatax.gov.cn.

At the national level, in other spheres, China has made use of a "leading group" and other cross-functional organizational approaches to tackle complex and cross-departmental agendas. Examples of such approaches include the framework of five-year plans for economic reform, innovation, and urbanization, for instance. Following this approach would mean setting up a national leading group focused on the future of work with a broad membership of officials from multiple ministries. This group would in turn seek input from representatives of educational and vocational institutions, employers, and a range of subject-matter experts.

Crucially, any national plan needs effective implementation at the local level, where conditions and characteristics vary widely, from the structure of industry and its likely evolution to the number of employers and education providers to fiscal health. For important items on the national agenda—including, for instance, New Style Urbanization and poverty eradication—local governments have similarly used a small leading group model or delivery units. For education and skills development, China could consider setting up local delivery units that can be dedicated to the detailed implementation of the national strategy, tailored to local contexts, defining specific milestones, continuously monitoring progress, and holding performance dialogues. The group can encompass stakeholders including private-, social-, and education-sector institutions. It can also ensure broad and inclusive access, especially for underprivileged workers.

Educators can likewise contribute to the transformation. They can be more open to collaboration with employers in order to better understand changing patterns in demand for skills, working with companies to improve the design of curricula and strengthening pathways from education and training to employment. Teachers need to be reskilled if they are to be effective in their use of digital technologies and adopting a hybrid online-offline model. China can further embrace incentives for educators to encourage them to experiment with new approaches to developing educational content and new delivery models. The final priority is to expand training capacity to support the development of lifelong learning, especially for workers who will continually need to refresh their skills.

Employers, particularly those in the private sector, can also play a crucial role as educators and trainers as well as investors. Much of the reskilling can be carried out through corporate mechanisms, including, for instance, corporate universities for both internal and external audiences. Training programs by cohort and collaboration with external educators can also be considered. Companies can put in place incentives for workers to train by, for instance, making pay raises and promotion contingent on completing courses. These investments could pay off if managed well. One study found that companies that have a corporate university delivered 9 percent higher shareholder returns than an equity index of 3,000 firms over a ten-year period.[28] Investment opportunities are emerging, too. Chinese tech players have been offering programs to produce next-generation entrepreneurs and teach the skills that the market demands. China's education and training market has been growing rapidly—at 16 percent a year since 2014—to reach a value of three trillion renminbi (about $435 billion) in 2019.[29] However, the share of vocation-related training is estimated to be only 14 percent.[30] As China shifts its focus toward workforce development, significant growth may come from the services related to lifelong learning that could provide long-term investment opportunities.

16%

annual growth in China's education and training market since 2014

[28] Peter McAteer and Mike Pino, *The business case for creating a corporate university*, Corporate University Xchange, September 2011.
[29] We used an exchange rate of 6.9 renminbi per $1 (the 2019 average).
[30] iResearch.

To kick off the journey, business executives can consider a checklist of priorities to keep in mind, from identifying skill gaps and devoting more management time to the broad issue of training workers, to developing partnerships with educators and ensuring that training is an integral part of companies' government relations effort (Exhibit E7).

Exhibit E7

To kick off the skills development journey, business executives can consider a checklist of priorities.

Key actions	Potential approach
Prioritize worker skills. Identify skills gaps and devote management time and budget to closing them	• Skills and competency mapping • Competitive benchmarking
Expand skills training. Provide training needed to cover all workers, preferably with tailored content	• Digital platform • Cohort-based programs
Ensure incentives to train are in place. Introduce training "opt out" system and link with performance evaluation system	• Corporate credit banks • Revised evaluation metrics to reflect learning
Adjust training content. Offer a mix of "forum, field, and feedback" to improve the effectiveness of learning	• Digital technologies (eg, gamification) • Field trips and on-the-job training
Track impact. Ensure that effective evaluation systems are in place to track effectiveness of training and value for money	• Pre- and post-training assessment • Peer observations, self-reflection
Develop partnerships. Explore partnerships with educators to offer competitive, up-to-date programs and content	• Corporate universities • Public-private partnerships
Integrate training into government affairs efforts. Ensure that training provision is integral to government relations	• Policy monitoring • Public program application

Source: McKinsey Global Institute analysis

China has transformed education over the past three decades, creating a workforce oriented toward an industrialized economy. But the country is now arguably entering a postindustrial phase, and education and skills development systems need to adapt. Our future of work simulation suggests that occupational and skill shifts will need to be achieved on an unprecedented scale. Indeed, those transitions could be up to one-third of all such shifts globally. If China gets this right, its experience could be shared in other parts of the world, especially in emerging economies in Asia and beyond.

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1. China faces skills and jobs shifts on an unprecedented scale

China continues to change rapidly. It is shifting toward a consumption-led economy. Services are rising as a share of GDP, the nation is moving up the value chain into higher-value-added industries, and innovation is front and center in national economic planning.[31] Some of the main drivers of rapid growth and rising prosperity are weakening, and, more than ever, further increases in living standards rely on innovation-enabled productivity gains. That will require a skills revolution.

Moreover, sweeping digitization and automation are changing the nature of the labor market and the skills and capabilities that will be in demand. By 2030, up to 220 million Chinese workers, or 30 percent of the workforce, may need to transition between occupations. That's about one-third of all global transitions simulated by MGI's future of work model. Because of the sheer size of China's population and workforce, the lessons it learns on this journey and the solutions it crafts are likely to have broader relevance to other economies as they face similar challenges.

In this chapter, we use MGI's future of work model to simulate the scope and size of labor-market transitions and skill shifts that will be needed to match the demands of China's evolving economy. We look at the educational and skills challenge in the medium term and long term; in truth, reform is a continuous process.

Because of the sheer size of China's population and workforce, the lessons it learns on this journey and the solutions it crafts are likely to have broader relevance to other economies as they face similar challenges.

[31] The government has set a goal of becoming a "fully developed and advanced nation" by 2050. See Zhang Jun, "China's vision for the future is bright," China Daily, November 11, 2017; Xi Jinping, *Decisive victory to build a well-off society in an all-round way and win the great victory of socialism with Chinese characteristics in the new era,* report at the 19th National Congress of the Communist Party of China, Xinhua News Agency, October 27, 2017; and Xi Jinping, *Secure a decisive victory in building a moderately prosperous society in all respects and strive for the great success of socialism with Chinese characteristics for a new era*, speech at the 19th National Congress of the Communist Party of China, Beijing, October 18, 2017.

What does China need to achieve continuous improvement in living standards?

Over the past 30 years, China has achieved large gains in incomes (tenfold), labor productivity (tenfold), and GDP (13-fold), but some of the key drivers are now waning, placing even more importance on innovation-enabled productivity growth and skills to drive increases in wages and living standards.[32]

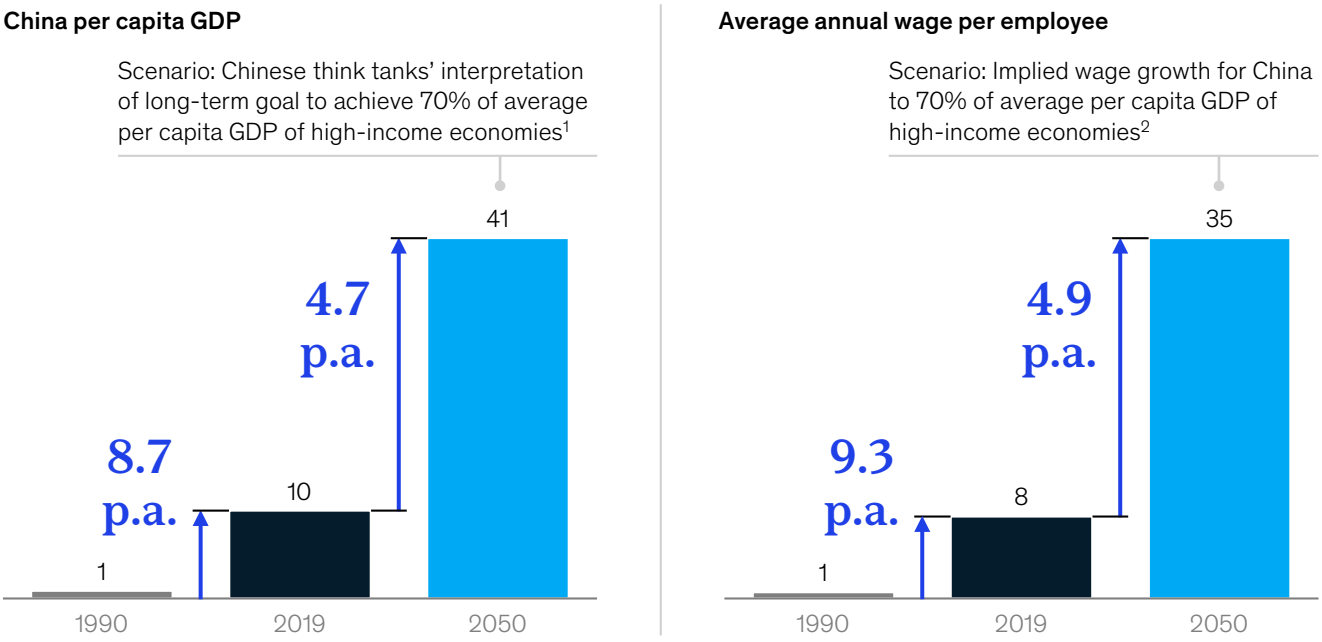
Chinese think tanks have simulated scenarios in which China achieves the government's aspirations of 70 percent of the per capita GDP of high-income economies by 2050, compared with 27 percent today.[33] The scenarios imply that China needs to achieve annual growth in per capita GDP of 4.7 percent and wage growth of 4.9 percent by 2050. China today stands below the threshold for high-income countries according to the World Bank classification (Exhibit 1).

Exhibit 1

Sustaining per capita GDP and wage growth is important for continuous improvement of living standards.

Simulation

$ thousand, 2015 real terms



1. Some Chinese think tanks defined a long-term scenario in which China achieves 70% of the average of high-income economies' per capita GDP by 2050. The World Bank defines a high-income country as one with gross per capita national income of $12,536 or more in 2019.
2. Assuming labor share of income remains constant.

Source: World Bank; McKinsey Global Institute analysis

[32] *The China effect on global innovation*, McKinsey Global Institute, October 2015.
[33] A high-income country is defined by the World Bank as having gross per capita national income of $12,536 or more in 2019; China did not belong to this category in that year. Several Chinese think tanks interpret China's goal of becoming a fully modernized economy by 2050 to achieve between 50 percent and 80 percent of high-income economies by 2050.

As China's working-age population has been declining since 2013 and its debt-to-GDP ratio today stands at about 260 percent, or 65 percent higher than the average of emerging economies according to BIS data, productivity fueled by innovation is becoming increasingly important for sustainable growth. MGI research in 2016 found that by shifting to a productivity-led growth model, by 2030 China could increase household income by $5.1 trillion (33 trillion renminbi) compared with an investment-led path.[34]

The benefit to growth of the mass migration of workers from agriculture to urban employment, which supplied low-cost labor to fuel the industrialization of the economy, is gradually slowing down. This implies the need for a workforce that has, in aggregate, a higher level of skills, but also a different mix of skills. To achieve a required rate of growth in wages, improving workers' skills is critical. A considerable body of literature suggests that improved skills lead to higher wages (see Box 1, "The relationship between improved skills and growth in wages").

Box 1

The relationship between improved skills and growth in wages

Wage differentials are commonly attributed to the level of education achieved. A widely used model is the Mincer earnings function, which explains wage income as a function of schooling and work experience. The World Bank compiled a database of 1,120 estimates in 139 countries and showed that the average rate of return on an incremental year of schooling, as measured by lifetime earnings of an individual, is about 9 percent.[1] After holding stable since the 1950s, this figure has increased a little, to 10 percent, since 2000.

The increase can be explained using Goldin and Katz's argument of a race between education and technology.[2] This influential work in labor economics argues that technological progress is skills-biased with consequences for income inequality, and that education plays a pivotal role in mediating the consequences. The higher a worker's skills, the higher the wages. The estimated return on one standard deviation of skills improvement is a 15 to 20 percent increase in wages; this correlation is strong across countries. Wages of high-skill workers can be double those of low-skill workers (in the United Kingdom and the United States, for instance).[3]

Moreover, wage inequality has been shown to be lower in countries that are effective in meeting demand for skills. For instance, one-third of the difference among countries of the wage ratio of the 90th percentile to the 50th percentile can be explained by the net supply of high-skill workers. This suggests that the net supply of skills in the workforce can have positive effects on social equity.[4]

There is also evidence that the labor market increasingly rewards social skills. Between 1980 and 2012, employment and wage growth were particularly strong in the United States for jobs requiring high levels of both math and social skills. One study found that an increase in social skills of one standard deviation yields a wage gain of about 10 percent.[5] The high value of social skills has been attributed to the difficulty of automating social and emotional tasks as well as the contribution of high social skills to greater efficiency when working in a team environment.[6]

1 George Psacharopoulos and Harry Antony Patrinos, *Returns to investment in education: A decennial review of the global literature*, World Bank policy research working paper number 8402, 2018, worldbank.org.
2 Claudia Goldin and Lawrence F. Katz, *The race between education and technology*, Belknap Press, 2008.
3 Key studies include Eric A. Hanushek et al., *Return to skills from around the world: Evidence from PIAAC*, National Bureau of Economic Research working paper number 19762, December 2013; Franziska Hampf, Simon Wiederhold, and Ludger Woessmann, *Skills, earnings and employment: Exploring causality in the estimation of returns to skills, Large-scale Assessments in Education*, 2017, Volume 5; David J. Deming, *The growing importance of social skills in the labor market*, NBER working paper number 21473, August 2015; and Tommaso Agasisti, Geraint Johnes, and Marco Paccagnella, "Tasks, occupations, and wages in OECD countries," *International Labour Review*, May 2020.
4 Stijn Broecke, *Do skills matter for wage inequality?* IZA World of Labor, February 2016, wol.iza.org.
5 David J. Deming, *The growing importance of social skills in the labor market*, NBER working paper number 21473, August 2015.
6 Ibid.

34 *China's choice: Capturing the productivity opportunity*, McKinsey Global Institute, June 2016.

China needs to make three broad transitions in light of two major shifts in the economy and labor market

China's economy and labor market are changing dramatically because of two major trends. The first is the transition now under way from an economy led by investment and manufacturing to one led by consumption, services, and innovation. This radically changes the type of jobs that are available and therefore what kind of education and skills training students and workers need to position themselves for the labor market of today and the future. The country may face a shortage of workers who are highly educated and highly skilled, and the path to becoming a fully modernized economy will require the education and development of a larger cohort of frontier innovators and skilled professionals.

The second global phenomenon is the spread of digitization and automation that is displacing both manufacturing jobs with a high degree of repetitive physical activities and service jobs requiring basic cognitive skills such as data entry and validation. The quantitative analysis in this report draws on MGI's future of work model (see Box 2, "The MGI future of work model") as well as its analysis of the kind of jobs that may be lost or gained due to automation.[35] We have updated our assumptions about the adoption rate of automation to reflect changes caused by the COVID-19 pandemic.

MGI's previous research found that 395 million full-time-equivalent jobs in China could technically be automated; put another way, $3.6 trillion of wages being earned could be subject to automation. If anything, digitization and automation have accelerated in response to the COVID-19 pandemic, and therefore the need to be mobile and reskill may have become even more urgent.[36] As we discuss in this chapter, the type of skills in demand will change, and today's mix of skills as produced by the current education and talent development system may not be able to fully match the future demand.

~516B

hours could be displaced by automation by 2030

Here we focus on the reskilling imperative to 2030. We translate the two major shifts noted into three desirable—or necessary—labor-market transitions for China: (1) achieve a large-scale transition in the occupational mix for up to 220 million workers (30 percent of China's total workforce and 36 percent of needed global shifts) to meet the changing demand of the labor market; (2) make a substantial shift in skills by redeploying about 516 billion hours displaced by automation—that is, about 87 days per person on average; and (3) help migrant workers who are vulnerable to automation that could displace 22 to 40 percent of the work they do—that's about 151 billion to 277 billion hours or 57 to 105 days per person; reskilling efforts today often omit migrants (Exhibit 2).

[35] *A future that works: Automation, employment, and productivity*, McKinsey Global Institute, January 2017; and *Jobs lost, jobs gained: Workforce transitions in a time of automation*, McKinsey Global Institute, November 2017.

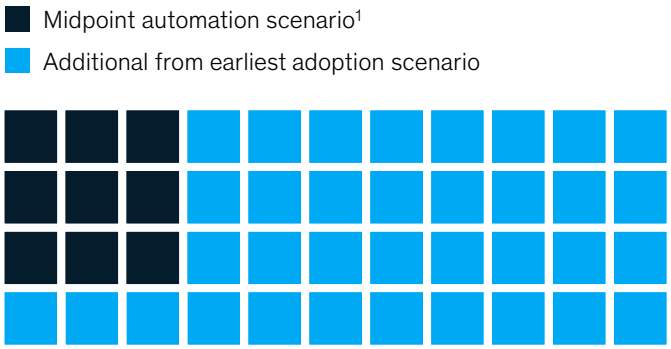
[36] Sapana Agrawal, Aaron De Smet, Sébastien Lacroix, and Angelika Reich, *To emerge stronger from the COVID-19 crisis, companies should start reskilling their workforces now*, May 2020, McKinsey.com; Oliver Tonby, Jonathan Woetzel, Noshir Kaka, Wonsik Choi, Jeongmin Seong, Brant Carson, and Lily Ma, *How technology is safeguarding health and livelihoods in Asia*, May 2020, McKinsey.com; and Aamer Baig, Bryce Hall, Paul Jenkins, Eric Lamarre, and Brian McCarthy, *The COVID-19 recovery will be digital: A plan for the first 90 days*, May 2020, McKinsey.com.

Exhibit 2

China needs to achieve three labor force transitions in the next decade.

Occupational transition

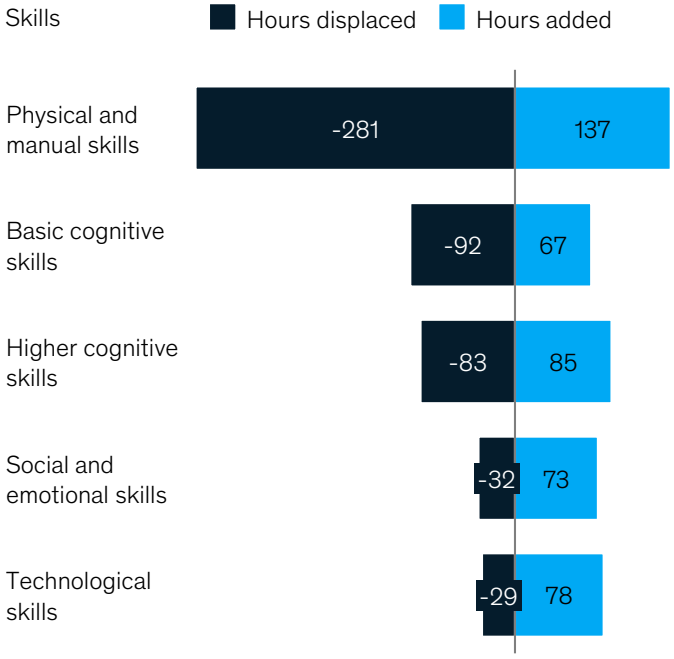
Number of workers in China needing to move out of current occupational categories to find work, 2018–30, million (1 block ≈ 5 million)



Up to **220M workers** (~36% of global workforce) may need to switch occupations

Skills transition

Change in hours worked by 2030, midpoint automation scenario, billion



~516B hours displaced due to automation (average ~87 days per worker) and need to be redeployed across different skills

Equity transition[2]

Number of migrant workers, million

~330M migrant workers at risk of 22–40% of work activities automated

1. Includes changes expected due to COVID-19.
2. 2030 estimate based on historical compound annual growth rate of migrant worker population, 2014–19. Calculation takes effect of hukou reform into account.

Source: ILO; National Bureau of Statistics of China; O*NET; Oxford Economics; McKinsey Global Institute analysis

Box 2

The MGI future of work model

MGI's future of work model examines both jobs that can be automated by 2030 and jobs that may be created in the same period. Previous MGI research estimated that about 15 percent and 30 percent of work activities globally could be automated by 2030 under a midpoint and early adoption scenario, respectively. The ratio is now higher partly due to technological advances and potential acceleration due to COVID-19. The analysis took account of the technical feasibility of automating work activities as well as factors including the cost of developing and deploying automation solutions for specific use cases, labor-market dynamics (including the quality and quantity of labor and associated wages), the benefits of automation beyond labor substitution, and regulatory and social acceptance.

The model also simulated the job creation potential of some potential sources of new labor demand. The research considered a trendline scenario based on current spending and investment trends, and a step-up scenario that assumed additional investment in some areas. Labor-demand catalysts in the trendline scenario were rising incomes, aging health care, technology spending, investment in real estate construction, investment in infrastructure, and energy transitions and efficiency. The step-up scenario also included incremental job creation from additional investment in real estate construction, infrastructure, and energy transitions and efficiency, as well as impact from the marketization of unpaid labor such as domestic work and childcare. In this report, we are using a step-up scenario in terms of creation of demand for labor and our estimate of net labor demand by 2030.

Transition 1: Manage a large-scale shift in the occupational mix

46%

increase in demand for frontier innovators possible vs. 27% decline for manufacturing workers

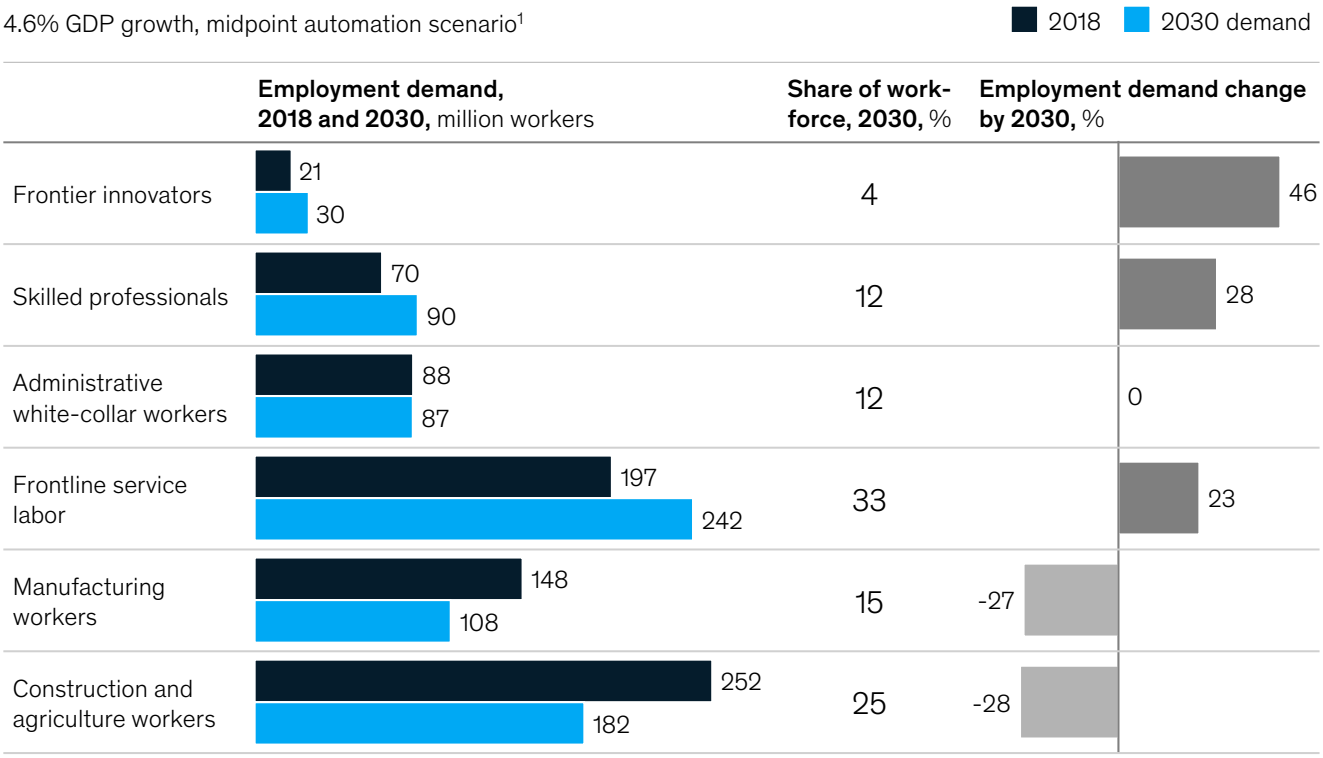
To analyze the impact of the potential magnitude of changes in the labor market, we segmented China's workforce into six occupational categories and analyzed shifts in labor-market demand and changes in the occupational mix that those shifts necessitate (we discuss needed skill shifts for each occupational category in the next section). The six occupational categories, detailed below, are frontier innovators, skilled professionals, administrative white-collar workers, frontline services labor, manufacturing workers, and construction and agriculture workers.

In response to automation and changing economic structure, China needs to manage large-scale changes in the type of skills that will be in demand. In some occupational categories, demand will fall; in others it will rise. This could create a mismatch between the skills available and those that are needed. We looked at potential shifts in demand by occupational category. Demand could increase by 46 percent for frontier innovators, 28 percent for skilled professionals, and 23 percent for employees in frontline service categories, and decline by 27 percent for manufacturing workers and 28 percent for construction and agricultural workers (Exhibit 3).

Exhibit 3

Different categories of workers will need to be taken into account in changing the workforce mix.

4.6% GDP growth, midpoint automation scenario[1]



1. Includes changes expected due to COVID-19.

Note: Figures may not sum to 100% because of rounding.

Source: ILO; National Bureau of Statistics of China; O*NET; Oxford Economics; McKinsey Global Institute analysis

— **Frontier innovators.** These are highly skilled workers at the forefront of technical or business innovation, including, for instance, computer engineers, scientists, academics, and executives. These workers sometimes have post-tertiary degrees. Our simulation suggests that demand is likely to rise by nine million by 2030, or a 46 percent increase from today. Although the absolute number of additional workers required is smaller than in other occupational categories, this group has disproportionate impact in driving innovation in the economy. It is important to constantly improve the quality as well as the quantity of the supply of talent in this category.

— **Skilled professionals.** These are white-collar workers in competitive industries such as finance, medicine, and design who need high levels of social and emotional skills and higher cognitive skills. These workers typically have received higher education and obtained a bachelor's degree or above. Demand for workers in this category may grow by 20 million, or a 28 percent increase from today.

— **Administrative white-collar workers.** These are other white-collar workers who perform more administrative or routine tasks; they include, for instance, administrative assistants and office support workers. These workers tend to have a range of educational backgrounds; some may have been to university, but others may have attended junior college or obtained a vocational degree. Demand may stay flat for this category, and oversupply is likely. The number of university and junior college graduates has increased rapidly from one million in 2000 to 7.6 million in 2019. If this historical trajectory were to hold, many university graduates may struggle to find white-collar jobs that match their expectations. They may lack the profile and skills needed to perform in the most competitive higher-wage occupations in the frontier innovators and skilled professionals categories. This implies oversupply unless these graduates can find work in other categories.

23%

increase in demand for service-sector jobs possible by 2030

— **Frontline services labor.** These are service-sector workers, typically in customer-facing roles such as restaurant hosts, personal-care workers, childcare workers, and sales personnel. Their educational attainment is typically at the high school level, vocational training, or less. As the weight of China's economy shifts toward services, incomes rise, and demographics shift, the new economy is creating service-sector jobs in areas such as hospitality, personal care (for instance, hairdressing), and childcare and elderly care. Demand for people in this category could increase by 45 million, or 23 percent over today.

— **Manufacturing workers.** These are blue-collar workers who provide semiskilled labor. They include factory workers, mechanics, and machine operators. They typically hold only a high school diploma or vocational degree or below. For China's huge number of manufacturing workers, the years ahead will be challenging. In the past, these workers were able to find work relatively easily as the industrialization of the economy generated many millions of labor-intensive manufacturing jobs that require few specialized skills. However, as the economy shifts to a consumption-driven growth model and manufacturing declines in importance, blue-collar opportunities that involve performing repetitive tasks are shrinking. Our simulation suggests that demand for these workers may decline by 40 million, or 27 percent of today's workforce. Manufacturing workers will need to adapt to automation and digital manufacturing to transition from the factory floor to more advanced roles or move into service sectors where demand is rising.

— **Construction and agriculture workers.** In addition to workers in the agriculture and construction industries, this group includes others engaged in manual labor such as building and grounds cleaners. Compulsory education may be a typical level attained for this category. As China continues to modernize agriculture and urbanize, demand for these workers could decline by 70 million, or about 28 percent from today.

Changes in the type of skills demanded by China's evolving labor market due to automation and the prospect of mismatches between the skills developed in today's educational and training systems and the talent that the labor market will need underlines the importance of increasing skills and continuous retraining. Skills not only will need to be increased and refreshed in every occupational category but will even shift within categories.

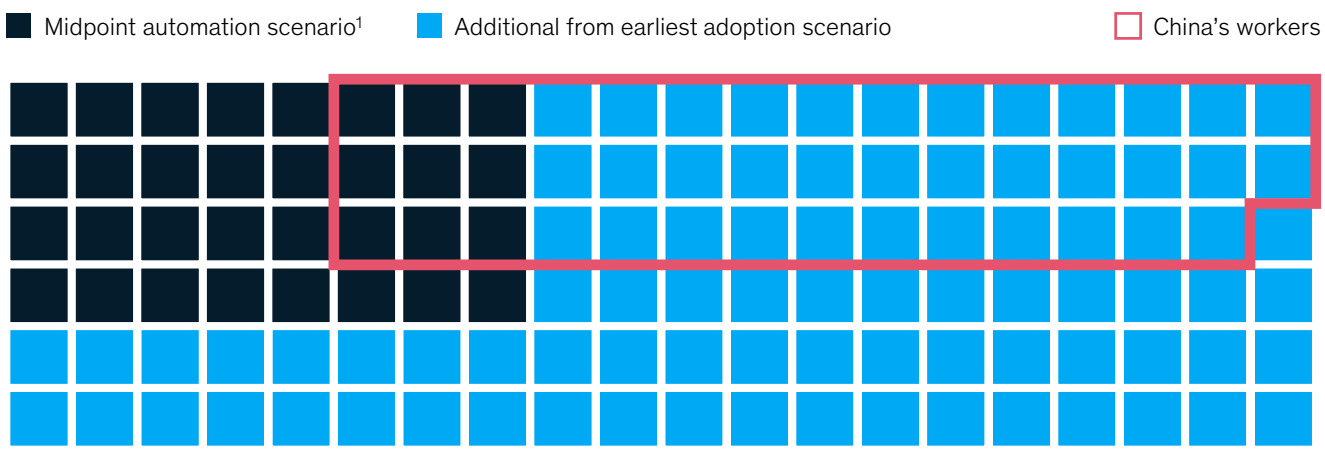
Our simulation suggests that between 45 million and 220 million workers—6 to 30 percent of the 2030 workforce—may need to switch occupational categories (Exhibit 4). The lower end of this range is based on a midpoint automation adoption scenario, and the top end on an early adoption scenario. At the upper end of this range, the number of Chinese workers who would need to shift occupations is about one-third of the 605 million global workers making necessary transitions that MGI has estimated in its early adoption scenario.

Exhibit 4

Up to 220 million Chinese workers may need to change occupations—about one-third of the global number who may need to make this transition.

Global number of workers needing to move out of current occupation categories, 2018–30, million (1 block ≈ 5 million)

Illustrative



China

45M–220M workers

(up to 30% of 2030 workforce): ~36% of global number of workers switching occupations

World

158M–605M workers

(up to 23% of 2030 workforce)

1. Includes changes expected due to COVID-19.

Source: ILO; National Bureau of Statistics of China; O*NET; Oxford Economics; McKinsey Global Institute analysis

China faces a challenge of necessary occupational transitions on a scale unique in the world. For comparison, a transition of this scale has not been seen since more than 600 million Chinese people are estimated to have moved out of rural areas since 1978. The two shifts differ, however. In the mass migration out of agriculture, new job opportunities required little training because the majority of them were low-skilled factory jobs with few qualifications. The challenge of the latest and next occupational shift is that a very large number of midcareer workers will need to be retrained or add new skill sets. We explore this in the next section.

Transition 2: Make a substantial shift in skills across occupations and sectors

Beyond analyzing necessary occupational shifts, we can look at the future of work at the level of types of skills, too.[37] The future of work model projects demand in 2030 for five broad skills categories and 25 specific skill sets (see Box 3, "Five categories of skills that will experience shifting demand").

Box 3

Five categories of skills that will experience shifting demand

MGI's future of work model developed a taxonomy for work-related skills that includes five major categories and 25 specific skill sets:

Physical and manual. This category includes general equipment operation and navigation, general equipment repair and mechanical skills, craft and technician skills, fine motor skills, gross motor skills and strength, and inspecting and monitoring skills. Demand for these skills will continue to decline, reflecting the fact that routine tasks are highly susceptible to automation. Despite expectations that demand for these skills will decline, this category will likely remain the single largest category of skills through 2030 in China, consistent with the global trend.

Basic cognitive. This category includes basic literacy, numeracy, and communication and basic data input and processing. Cognitive activities are likely to shift away from those that demand only basic cognitive skills to those that require higher cognitive skills as automation displaces the former.

Higher cognitive. This category includes advanced literacy and writing, quantitative and statistical skills, critical thinking and decision making, project management, complex information processing and interpretation, and creativity. Demand for creativity, critical thinking, decision making, and complex information processing will grow particularly strongly. However, some of the more basic aspects of advanced literacy and writing, quantitative and statistical skills, and project management will shift to machines.

Social and emotional. This category includes advanced communication and negotiation skills, interpersonal skills and empathy, leadership and managing others, entrepreneurship and initiative taking, adaptability and continuous learning, and other teaching and training skills. Social and emotional skills are highly resilient to automation trends across the board because machines are a long way from mastering interpersonal dynamics. China's future workforce will spend considerably more time deploying these skills than it does today.

Technical skills. This includes basic digital skills, advanced IT skills and programming, advanced data analysis and mathematical skills, technology design, engineering, maintenance, and scientific research and development. Demand for advanced technological skills will rise rapidly as innovation and analytics become increasingly important to China's economy. At the same time, there is a significant need for workers across occupational categories to develop basic digital skills in order to work in automation-rich environments.

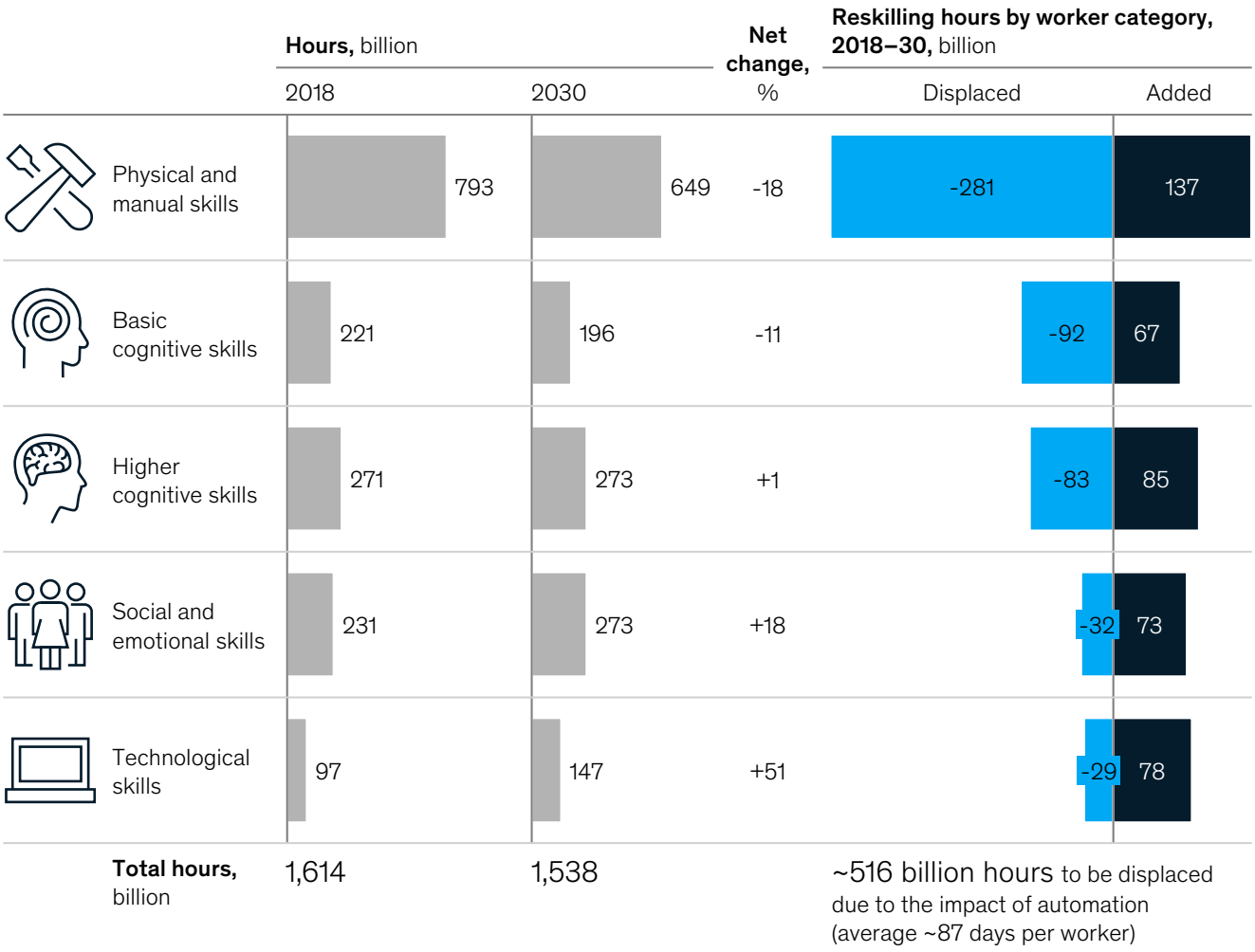
For China, our analysis suggests that by 2030 about 516 billion hours of work—an average of 87 days per worker—may need to shift to different skills as labor-market demand decreases for some types of skills but increases for others. In particular, 236 billion hours—an average of 40 days per worker—require increased technological, social and emotional, and higher cognitive skills, giving a sense of the huge dimensions of China's reskilling challenge (Exhibit 5). Overall, demand for physical and manual skills and basic cognitive and skills could fall by 18 percent and 11 percent, respectively. However, demand for social and emotional skills and technological skills could rise by 18 percent and 51 percent, respectively.

[37] *Skill shift: Automation and the future of the workforce*, McKinsey Global Institute, May 2018.

Exhibit 5

China's workers face potential redeployment of ~500 billion hours to activities needing different skills.

4.6% GDP growth, midpoint automation scenario[1]

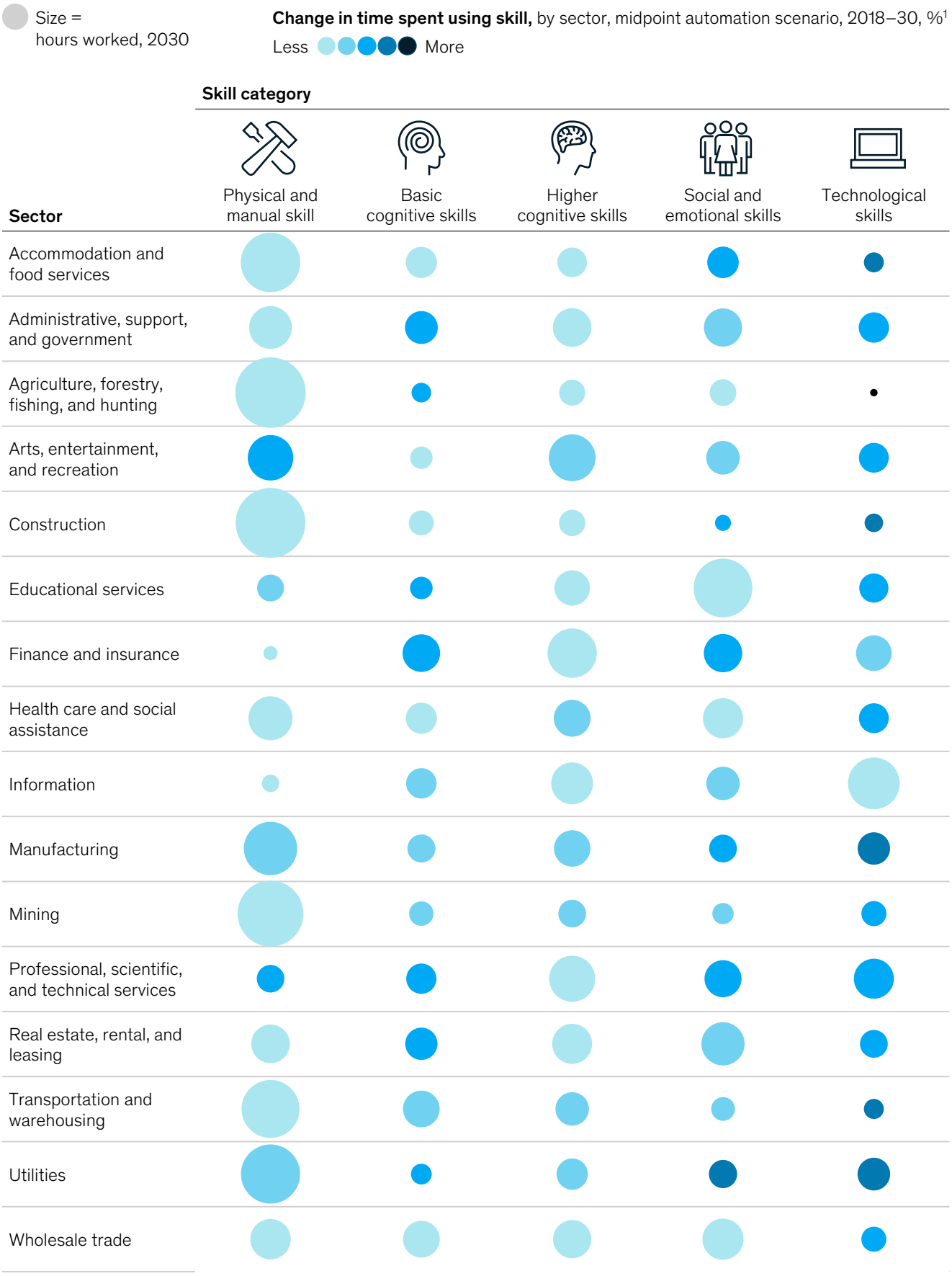


1. Includes changes expected due to COVID-19.
Note: Figures may not sum to 100% because of rounding.
Source: ILO; National Bureau of Statistics of China; O*NET; Oxford Economics; McKinsey Global Institute analysis

Skill shifts are likely to happen across sectors. Our analysis of five sectors suggests that there will be common patterns among them. Demand for physical and manual skills is likely to decline, while demand for social and emotional skills and technological skills is seen to be rising. But the degree of change in labor-market demand for skills will vary considerably depending on the characteristics of particular sectors. Here we highlight our observations on five sectors (Exhibit 6).

Exhibit 6

Skill shifts required by 2030 vary by sector.



1. Includes changes expected due to COVID-19.

Source: ILO; National Bureau of Statistics of China; O*NET; Oxford Economics; McKinsey Global Institute analysis

86.5%

mobile payment ratio in China, among the highest in the world

— **Finance and banking.** According to the MGI Industry Digitization Index, finance is one of the most digitized sectors.[38] As of June 2020, China has about 802 million mobile payment users, and its mobile payment ratio among internet users is about 86.5 percent, among the highest in the world.[39] Large incumbent players are undergoing digital transformations, too. China Construction Bank, for instance, piloted a robot-run bank branch enabled by technology including facial recognition, AI, and virtual reality.[40] Ping An Property and Casualty Insurance Company has experimented with an AI solution that enables drivers to make insurance claims through a mobile-based app by uploading photos that AI will assess for damage together with drivers' records.[41] COVID-19 has accelerated the adoption of digital solutions. In the early phase of the pandemic in the first half of 2020, one large Chinese bank used a call-center automation system to manage 350,000 calls a day—the equivalent of the workload handled by 1,200 human workers.[42] Administrative white-collar workers in the back office are particularly exposed to automation because a significant share of data collection, processing, and validation can be handled by technology solutions. Frontline service workers such as tellers and brokerage clerks who largely focus on repetitive paperwork are also vulnerable. Overall, demand for workers using only basic cognitive skills, such as information gathering and contract validation, will continue to fall. Meanwhile, demand for tasks that require social and emotional skills, such as consultative sales and relationship management, will increase. Moreover, demand will rise for people with strong technological skills who can develop and adopt technology solutions in customer engagement, branch operations, and automated back-end processing, for example.

— **Manufacturing.** China has been at the front and center of global manufacturing value chains, and manufacturing is an important source of labor demand, accounting for about 20 percent of total employment. Yet China's manufacturing sector has been dealing with challenges. Manufacturing labor costs have been rising rapidly and are now two to three times higher than those of lower-cost countries in Southeast Asia, for instance. In this context, China has to continue its transition from labor-intensive to higher-value-added operations. In some areas, companies struggle to find workers and suffer from high turnover. As a result, many businesses have been adopting automation solutions in order to stay cost-competitive. China's degree of automation, measured by robots per 10,000 workers, is much lower than in other economies at 140, compared with 217 in the United States, 327 in Japan, and 774 in South Korea.[43] This suggests that there is still considerable room for further automation, which will have a profound impact on China's labor market. Demand for people engaged in predictable manual occupations such as assembly workers, machine feeders, and packaging machine operators could decrease. Although workers engaged in physical activities remain the largest group in manufacturing, they still need to learn how to use digital tools and adopt tech-enabled solutions. They will need to train in basic digital literacy skills, such as reading digital dashboards on manufacturing equipment, as well as advanced IT skills such as applying predictive maintenance techniques to ensure that operations proceed without disruption. Manufacturing will also continue to demand highly skilled engineers, sales representatives who can manage relationships with customers, and professional managers who can steer the direction of capital expenditure investment to deal with increasingly volatile demand. There will be demand for social and emotional skills in activities such as negotiation, advanced communication, and leadership and management, as well as the higher cognitive skills needed to process complex information.

[38] *Digital China: Powering the economy to global competitiveness*, McKinsey Global Institute, December 2017.
[39] China Internet Network Information Center.
[40] Maggie Zhang, "China Construction Bank opens a branch managed by robots," *South China Morning Post*, April 11, 2018.
[41] *Ping An announces AI-driven car insurance claims processor*, Mobile ID World, January 25, 2019.
[42] Kai-Fu Lee, "Kai-Fu Lee on how covid spurs China's great robotic leap forward," *Economist*, June 25, 2020.
[43] *IFR press conference*, presentation, International Federation of Robots, September 18, 2019, ifr.org.

— **Healthcare.** Demand for healthcare services in China is likely to grow rapidly. Healthcare expenditure as a percentage of GDP today stands at about 6 percent, compared with 8 to 10 percent in advanced OECD economies and 17 percent in the United States. According to the Healthy China 2030 plan announced in 2016, China's broader healthcare market may reach 16 trillion renminbi (about $2.3 trillion) by 2030, from 4.6 trillion renminbi (about $667 billion) in 2016.[44] One driver of increased demand for healthcare is the rapidly aging population. Today, people over 65 years old account for 12 percent of the total population, a share that is expected to reach 17 percent by 2030 and 26 percent by 2050, according to UN data. Demand for nurses and home assistants will increase and therefore—unlike the trend in other sectors—demand for physical and manual skills will increase. However, technology will alter healthcare delivery. At the peak of COVID-19, telemedicine services surged, and the change is likely to stick. A hospital in Wuhan used AI to read lung CT scans, which helped overworked staff to detect visual signs associated with COVID-19 and prioritize patients for further examination.[45] AI engines can also perform some tasks, such as reading patterns from diagnostics and monitoring vital signs. Overall, demand for basic cognitive skills could decline, but social and emotional skills used to deal with patients and technological skills to take advantage of new tools will be increasingly important.

— **Construction.** The construction sector is one of the least digitized, not only in China but around the world. The industry is fragmented, and its productivity growth has long lagged behind that of other sectors. [46] Given that work activities are not standardized and differ from project to project, physical and manual activities should remain the dominant type of work in the period to 2030. However, construction is ripe for disruption, and that disruption may come sooner than anticipated because of COVID-19.[47] Specialization and industrialization can help companies to achieve economies of scale, and a significant share of construction activities may move from onsite to offsite by adopting prefabrication and modular approaches. As this shift occurs, demand should rise for the skills needed to handle technologies such as 3-D design, building information modeling, and process management. Workers on construction sites, in particular supervisors, need to improve their technological skills to use digital solutions such as AI to detect patterns, boost worker safety, monitor progress, and improve project planning.[48] AI solutions are already being used in China for workplace monitoring and workers' safety.[49]

24%

e-commerce share of total retail in China vs. 9% in Germany

— **Retail.** China has a globally competitive position in digital commerce. E-commerce as a share of total retail in 2019 was 24 percent, compared with 11 percent and 9 percent in the United States and Germany, respectively. Adoption of innovations such as online-to-offline, social commerce, and livestreaming has been rapid in China, and the COVID-19 pandemic accelerated their use even further in categories such as fresh food. Workers performing predictable physical tasks such as customer greeters, drivers, shelf stockers, packers, and cashiers will be highly susceptible to automation and, as a result, demand will decline. Self-checkouts are gaining popularity and robots are welcoming customers, answering questions, and restocking shelves. AI engines are interpreting sales and demand data to predict future demand more accurately. All of these innovations imply significantly reduced demand for physical and manual skills and basic cognitive skills. Conversely, the sector will need more technology experts to develop digital platforms to better engage customers, design tailored marketing programs, manage data and analytics, and improve supply-chain management.

[44] *National Health and Family Planning Commission year book*, State Council of the People's Republic of China, 2016; Center for Health Statistics and Information.
[45] Tim Simonite, "Chinese hospitals deploy AI to help diagnose Covid-19," *Wired*, February 26, 2020.
[46] *Reinventing construction: A route to higher productivity*, McKinsey Global Institute, February 2017.
[47] Maria João Ribeirinho, Jan Mischke, Gernot Strube, Erik Sjödin, Jose Luis Blanco, Rob Palter, Jonas Biörck, David Rockhill, and Timmy Andersson, *The next normal in construction: How disruption is reshaping the world's largest ecosystem*, June 2020, McKinsey.com.
[48] Kathleen Walsh, "AI transforming the construction industry," *Forbes*, June 6, 2020.
[49] Stephen Chen, "Chinese construction firms using AI to monitor workers' safety … but also to spot 'loiterers'," *South China Morning Post*, July 6, 2020.

Similar changes will occur by occupational category (Exhibit 7). Frontier innovators and skilled professionals already spend half of their time using social and emotional skills and technological skills. Demand for technical skills could rise further, by 8 to 28 percent. Administrative white-collar workers and frontline services labor will experience increased demand for social and emotional skills, while manufacturing workers and construction and agriculture workers will need to sharply increase their technological skills.

Scientists and researchers will spend less time on basic data input, processing, laboratory equipment operations, and even some complex analytics, because computers are increasingly capable of automating these tasks. Business managers will spend less time compiling information and reviewing and approving administrative tasks. However, they will need to develop a more advanced understanding of technology.

Basic cognitive skills account for about 30 percent of job activities of white-collar workers. Back-office functions performed by administrative white-collar workers that require largely basic cognitive skills, such as receiving customer requests, collecting data, and generating reports using standardized templates, are at high risk of automation and may experience an 18 percent decline in demand by 2030. However, demand for social and emotional skills may rise by 27 percent. Interpersonal skills needed to understand customer demand and address their needs will be critical, for example.

Frontline services are the largest source of rising demand in the Chinese economy. Increasingly sophisticated consumers will hold service-sector workers to a higher standard in the future. Successful service-sector workers will meet these expectations by improving their ability to communicate, interact, and manage conflict with customers while improving technological skills as they learn how to use digital tools to improve their productivity. Demand for these skills is expected to increase by 5 percent and 77 percent, respectively.

Among manufacturing workers, physical and manual skills account for about 70 percent of work activities. Time spent on physical and manual skills will decline by about 12 percent. Manufacturing employees will need to be increasingly comfortable working alongside machines, which will require significant training in basic digital skills, and the overall demand for technological skills may increase by 58 percent.

As with manufacturing workers, physical and manual skills account for the bulk of job activities for construction and agricultural workers, in this case about 75 percent. The demand for technological skills is expected to increase by 396 percent, starting from a very low base. Farmers will need to improve basic digital skills in order to use mechanical tools and employ digital devices to collect information on soil, yield, and market, for example.

58%

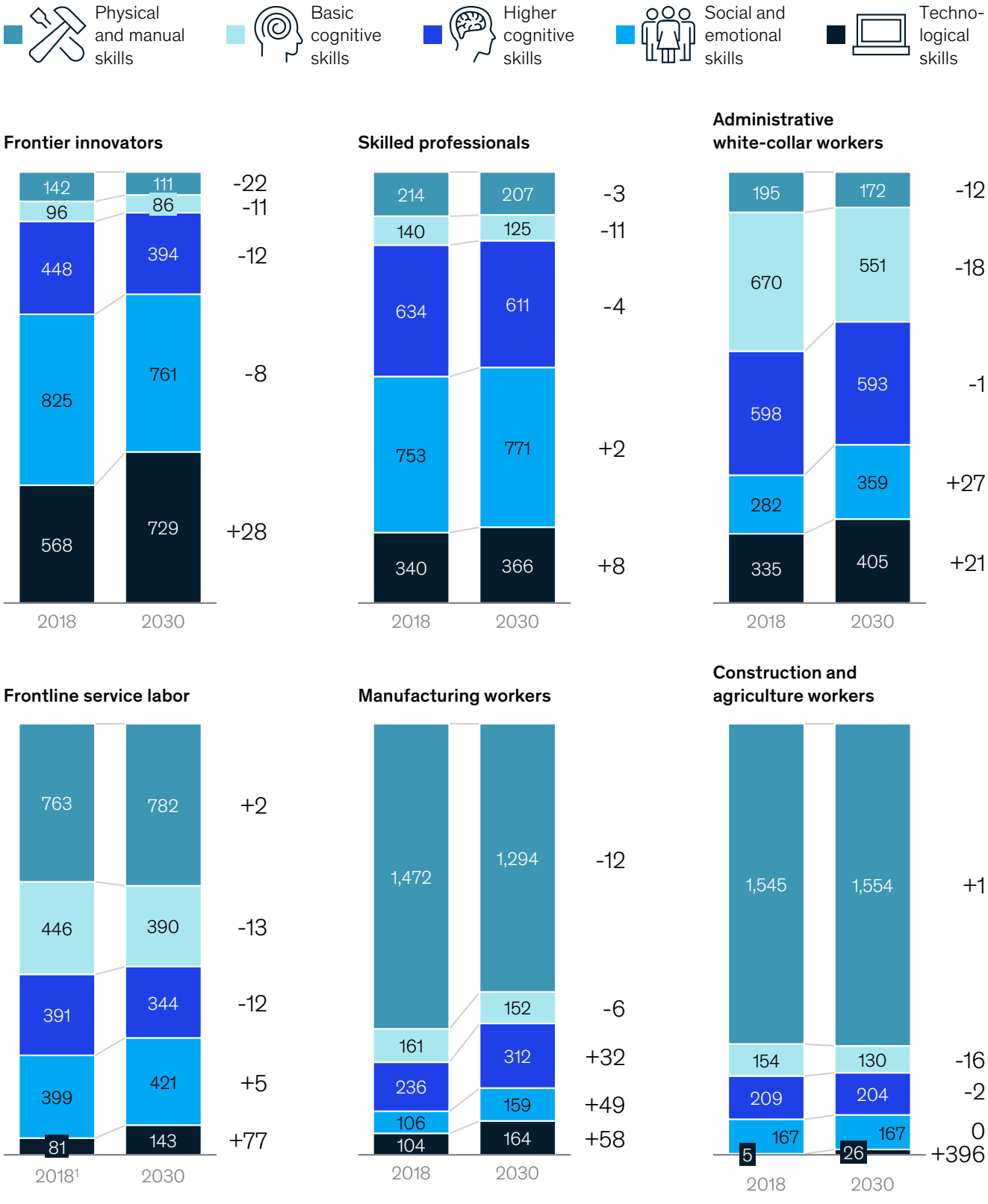
rise in demand for technological skills among manufacturing workers expected by 2030

Exhibit 7

Demand for social and emotional skills as well as technological skills will increase in different categories of workers.

4.6% GDP growth, midpoint automation scenario[1]

Change in skill hours by category of worker, full-time-equivalent (FTE) basis, 2018–30, hours, % change



1. Includes changes expected due to COVID-19.

Note: Figures may not sum to 100% because of rounding.

Source: ILO; National Bureau of Statistics of China; O*NET; Oxford Economics; McKinsey Global Institute analysis

Transition 3: Ensure equity by supporting migrant workers' participation in the skills revolution

Urbanization has been an important economic driver for China. The urbanization rate, measured by urban population as a percentage of total population, increased from 18 percent in 1978 to 61 percent in 2019 and is expected to reach 70 percent by 2030 and more than 80 percent by 2050. Urbanization has facilitated the mass movement of people from rural to urban areas.

The number of Chinese rural-urban migrant workers has steadily increased, from 225 million in 2008 to 291 million in 2019. As China continues to urbanize, the historical trajectory suggests that the total number of such workers could reach 331 million by 2030.

331M

Chinese rural-urban migrants expected by 2030

Labor-market and skills transitions are likely to be particularly challenging for migrants because many of them face two interrelated challenges. First, many of them are subject—for now—to hukou restrictions that prevent them from accessing services such as education and healthcare.[50] China is promising hukou residency reform to help many millions of rural residents enjoy the benefits of living in urban areas already available to non-hukou residents.[51] Second, these migrants tend to have lower-than-average educational levels and low skills and to earn relatively low wages, making it difficult to fund reskilling programs.[52]

Migrants arguably need access to education and vocational training more than other people, yet their access is more constrained. Migrant workers typically work long hours and retain little disposable income to invest for the long term. As a result, their ability to devote time and finances to their own education is extremely limited. Even if hukou restrictions were removed, rural-urban migrants are in a vulnerable position because of the combination of low skills and low incomes.

Their vulnerability is, arguably, growing. Migrants tend to be clustered in jobs that are more likely to be disrupted by automation. Our simulation suggests that 151 billion to 277 billion work hours currently performed by migrant workers, or an average of about 57 to 105 days per person, may be replaced by automation by 2030 in an earliest adoption scenario (Exhibit 8). These workers may need to leave factories and construction sites and find employment in the service sector—and learn an entirely different set of skills. They will need to develop the social and emotional skills required for the service sector, as the physical and manual skills they have largely relied on in construction and manufacturing may become obsolete.

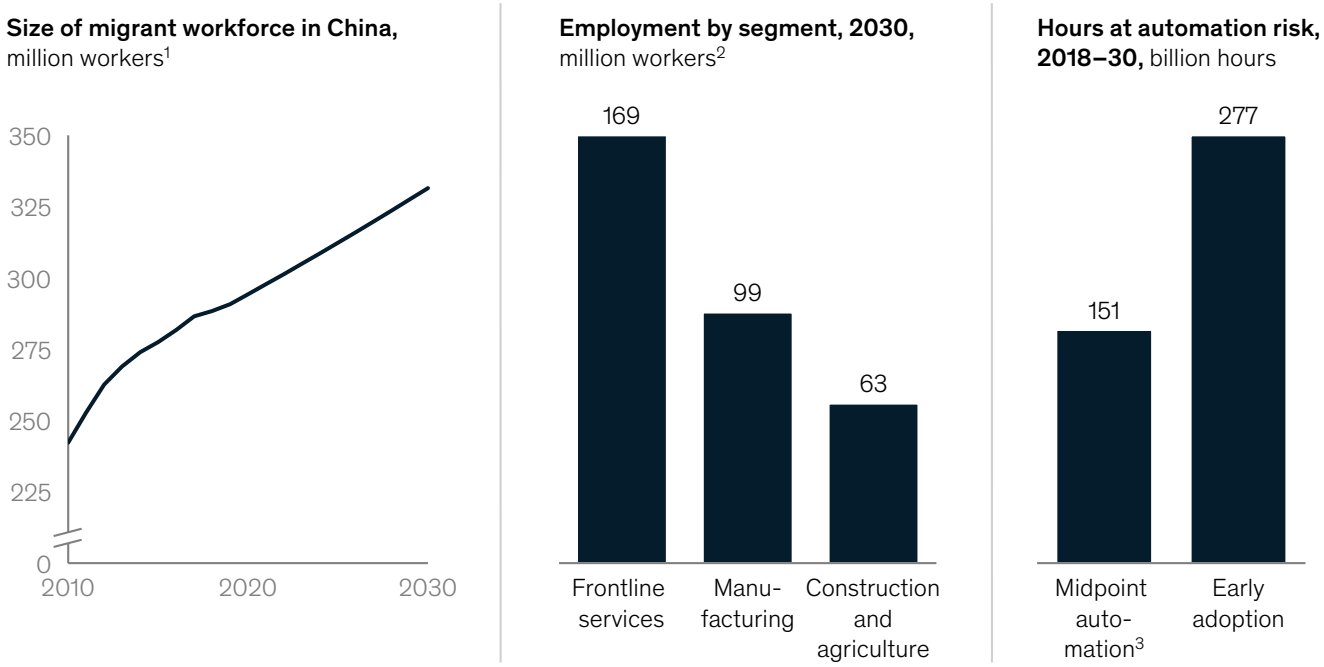
[50] L. Rachel Ngai, Christopher A. Pissarides, and Jin Wang, "China's mobility barriers and employment allocations," *Journal of the European Economic Association*, 2019, Volume 17, Number 5.

[51] Cao Siqi, "China to ease urban hukou restrictions for migrant workers," *Global Times*, April 10, 2020. Hukou reform pilots have been initiated in some of China's large cities. In Beijing in 2015, for instance, the National Development and Reform Commission said it was putting in place a pilot in an eastern district of the capital that would offer points to rural migrants meeting certain criteria on employment, housing, and duration of residency; once they have sufficient points, they can trade in their rural migrant status for urban migrant status. See *Beijing launches pilot program to reform*, The Caravel, February 10, 2015. In February 2015, the National Development and Reform Commission selected Jiangsu and Anhui provinces and 62 cities as "national comprehensive pilot areas," encouraging them to initiate a range of reforms, including to hukou. See Juan Chen, Deborah S. Davis, and Pierre F. Landry, *Beyond hukou reform: Enhancing human-centered urbanization in China*, Paulson Policy Memorandum, Paulson Institute, February 2017.

[52] Zhenxiang Chen and Kayuet Liu, "Assimilation of China's rural-to-urban migrants: A multidimensional process," *Chinese Journal of Sociology*, April 2018; Russell King and Ronald Skeldon, "'Mind the gap!' Integrating approaches to internal and international migration," *Journal of Ethnic and Migration Studies*, 2010, Volume 36, Number 10; and Wenfei Winnie Fang and C. Cindy Fan, "Migrant workers' integration in urban China: Experiences in employment, social adaptation, and self-identity," *Eurasian Geography and Economics*, 2012, Volume 53, Number 6.

Exhibit 8

The number of migrant workers is expected to continue rising while 22 to 40 percent of their work activities could be at risk of being automated.



1. 2030 estimate based on historical compound annual growth rate of migrant worker population, 2014–19. Calculation takes effect of hukou reform into account.
2. Based on historical growth in migrant worker population; segment breakdown based on mapping migrant workers by sector.
3. Includes changes expected due to COVID-19.

Source: ILO; National Bureau of Statistics of China; O*NET; Oxford Economics; McKinsey Global Institute analysis

Skills improvement can result in growing wages to differing degrees depending on the occupation

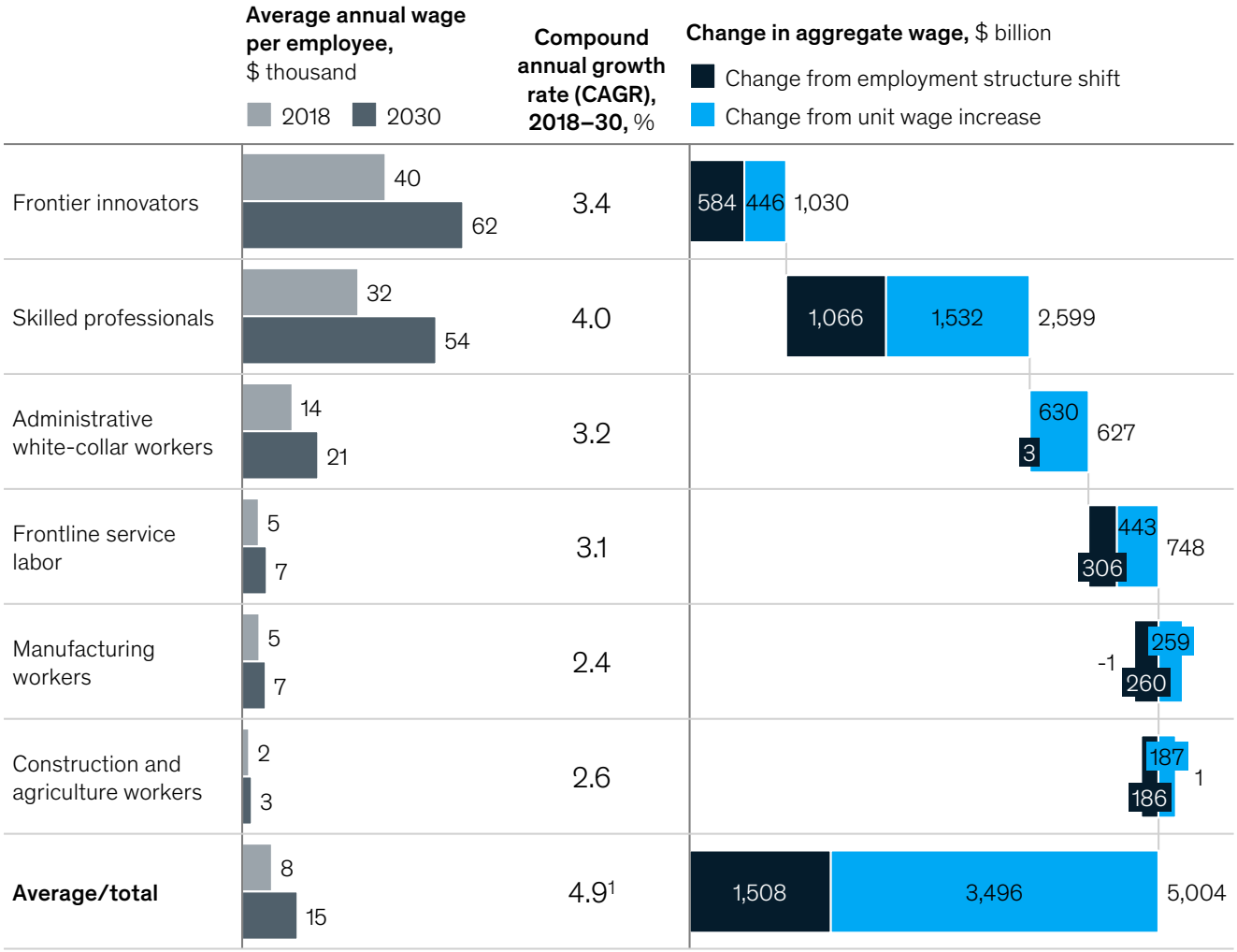
If China effectively manages transitions in the labor force and in skills, the changes could lead to higher wages. As noted, academic research has demonstrated a strong positive correlation between skills and wage growth. We disaggregate wage growth by occupational category. We consider two factors in our forward-looking simulation to meet the scenario of 4.9 percent annual wage growth at an aggregate level. The first is wage increases in individual jobs. Based on official data, we estimated that wage growth for frontier innovators was 6.4 percent per year from 2014 to 2019; 7.6 percent for skilled professionals; 6.1 percent for administrative white-collar workers; 5.8 percent for frontline service labor; 4.6 percent for manufacturing workers; and 4.8 percent for construction and agriculture workers.[53] We assumed this pattern of historical trajectory could continue, creating higher upward pressure on wages for high-demand jobs and less for low-demand jobs. This could translate into 2.4 to 4.0 percent wage growth depending on the segment we defined. The second factor is a shift of workers from lower-income to higher-income categories. If an agricultural worker can successfully transition to frontline service labor, for example, she may double her income. Our simulation suggests that there could be potential for a $5 trillion wage increase at the aggregate level by 2030, while about 70 percent of changes can be driven by wage increases in individual jobs and 30 percent by shifts among categories (Exhibit 9).

[53] The wage growth of each occupational category is mapped to occupations defined by China's National Bureau of Statistics (NBS). Wage growth of frontier innovators is average growth among middle and higher management personnel and professional skill workers as defined by the NBS. Wage growth among skilled professionals, administrative white-collar workers, frontline service labor, manufacturing workers, construction workers, and agricultural workers is mapped to wages of professional skill workers, staff and related personnel, business and service personnel, production and transportation equipment operators, and agricultural workers as defined by the NBS.

Exhibit 9

A successful transition could deliver a ~$5 trillion increase in annual aggregate wage income by 2030.

Simulation



1. CAGR reflects unit wage increase as well as demand increase or decrease from employment structure shift across the economy between 2018 and 2030; consequently, it may not be in line with the unit wage CAGR of each worker category.

Note: All values are based on 2015 price. Figures may not sum to 100% because of rounding.

Source: McKinsey Global Institute analysis

To support rising living standards in a dramatically changing economy, China will need to propel and manage shifts in its labor market, with reskilling a notable feature on an unprecedented scale. This will not be easy. In the next chapter, we look at three priorities that, if met, amount to a bold new vision for China's talent-development system.

Caption is optional. Detailed credit is mandatory.
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2. China needs the world's largest workforce to be lifelong learners

China's economy has been transformed since the country began to open up to the world and reform in 1978, embracing the market economy, enabling the private sector, modernizing industry, climbing the ladder of technological know-how, and inviting foreign investment and trade. The country's education system and skills development have evolved in parallel to meet shifting needs. China has made significant strides in improving access to education both secondary and tertiary and in raising quality. The system today is arguably oriented to the demands of an industrial economy.

China now faces a new challenge—transforming its education and talent systems to position its people for the latest evolution of the economy. China is changing and will require new skills and talent developed through reform. The task ahead amounts to a transformation of China's talent-development system that extends far beyond schools and universities into the world of work.

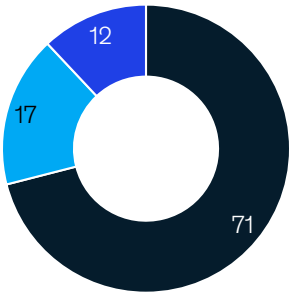
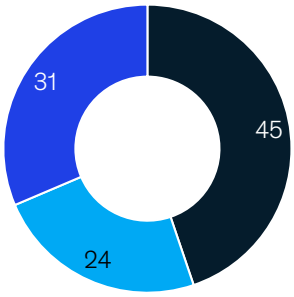
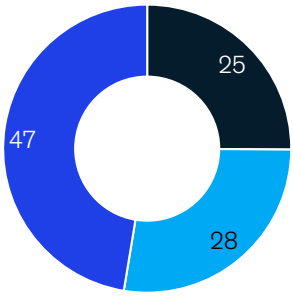
Even after 30 years of reform, the education system can evolve to better suit modern China. In education and training alike, quality and access issues still remain to be further addressed. On the all-important path from education to employment, there are challenges. Perhaps most important, China's vocational training and in-work training provision need to enter a new era and become higher priorities. The new wave of change has already begun. In recent years, the Chinese government has begun to focus on the broader imperative of improving development of skills by developing a "learning society."

Three waves of educational reform over 30 years have transformed schools

Since 1978, three broad waves of educational reform have formed an integral part of national economic planning. Today, China's education system is oriented toward a large-scale industrial workforce (Exhibit 10).

Exhibit 10

China's education system has experienced three waves of change since 1978, supporting the economy's structural transition.

	Economic development		
	Wave 1	**Wave 2**	**Wave 3**
	Supported modernization and globalization of Chinese economy	Deepened education reform and promoted quality education	Develop well-rounded citizens
	1978–98	1999–2009	2010–19
Per capita GDP, %[1]	156	1,754	10,276
Employment structure, %[1]			
Major education policy	Reintroduced Gaokao Implemented 9-year compulsory education Experimented with decentralization of education administration and financing	Raised quality and implemented suzhi education[2] Expanded national compulsory education programs in lower-income regions Expanded upper secondary and university enrolment	Reform Gaokao and pilot complementary evaluation schemes Narrow regional and rural-urban gaps in education resources Encourage development of private education institutions

1. Data in 1978, 2005, and 2019. Percentage of workers employed in primary, secondary, and tertiary industries.
2. Suzhi education is an educational pedagogy that aims to cultivate a whole person with specialized skills.

Note: Figures may not sum to 100% because of rounding.

Source: Ministry of Education; National Bureau of Statistics; World Bank; McKinsey Global Institute analysis

— **Wave 1: 1978–98.** In Wave 1, the government made education compulsory to support its journey toward being a modern, industrial society. The government took a fundamental step in 1985 when it proposed the staged introduction of nine years of compulsory education for children for the first time, a policy written into law the next year. Another key move was the reintroduction of gaokao, the national college entrance exam, in 1977. The merit-based test had been introduced in 1952 and suspended during the Cultural Revolution between 1966 and 1976. The revival of gaokao signaled China's commitment to evaluating students based on academic merit as part of its drive to equip the modernizing economy with the talent it needed. In the first year, 5.7 million people applied to take the test, despite the fact that only 273,000 university places were available. China placed significant emphasis on the reconstruction of its higher education system to support economic development and social reforms. In 1980, the government launched a system of bachelor's, master's, and doctoral degrees; the conferment ceremony for the first batch of 18 doctorate holders took place at the Great Hall of the People in Beijing in 1983.[54] During this period, China also started to decentralize its highly centralized education system. Following a plan for educational reform published in 1985, the central government began to hand over responsibility for the provision and management of education to provincial and municipal leaders.[55] The central government continued to monitor the educational system and provide basic guidelines for its development but gave local governments authority over financing and administration. Decentralization started with primary education in the early 1980s and broadened to tertiary education in the early 1990s.[56]

— **Wave 2: 1999–2009.** In this wave, reform shifted from guaranteeing access to raising quality. The suzhi system was put in place, with the aim of teaching students not only knowledge, ability, and skills but also how to become well-rounded citizens; the system aimed to diversify education from examination-oriented teaching to a broader experience that encouraged independent thinking and judgment.[57] During this wave, China devoted attention to ensuring that all children in lower-income regions attended school. By the end of 2000, 85 percent of children were receiving nine years of education—indeed, China was the first of the E9 countries to achieve this milestone.[58] The literacy rate in those aged 15 to 50 topped 95 percent.

95%

adult literacy rate in China by 2000

China continued to expand provision of, and access to, tertiary education, meeting demand for higher education and supporting the needs of rapid economic development. In the 1990s, the gross enrollment rate in tertiary education was only 5 percent, far below the typical 80 percent rate in advanced economies during that period.[59] Even in comparison with other developing countries, enrollment was low. For instance, the gross enrollment rate was about 37 percent in Thailand and 20 percent in the Philippines—both economies with per capita GDP similar to China's. In 1999, the Ministry of Education set a goal of raising the gross enrollment rate to 15 percent by 2010—the international benchmark for mass higher education.[60] In 1999, enrollment soared by 48 percent; in 2001, enrollment in the gaokao entrance exam rose above 50 percent for the first time.

[54] *Rooted in China's land and march towards a powerful country*, Ministry of Education, moe.gov.cn.
[55] Cheng Kai Ming, "China's recent education reform: The beginning of an overhaul," *Comparative Education*, 1986, Volume 22, Number 3.
[56] Yao-zong Hu and Zhi-min Liu, "From multiple-channels raising to the modern education finance system: The 40th anniversary of China's educational finance system reform," *Tsinghua Journal of Education*, February 2019, tje.ioe.tsinghua.edu.cn.
[57] Haishao Pang et al., "*Suzhi* education and general education in China," *ECNU Review of Education*, March 27, 2020.
[58] The E9 group was formed to achieve the goals of UNESCO's Education for All initiative. The nine countries are Bangladesh, Brazil, China, Egypt, India, Indonesia, Mexico, Nigeria, and Pakistan. See *Miracle in the history of human education*, Ministry of Education, September 10, 2012, old.moe.gov.cn.
[59] "Enrollment expansion in colleges and universities in 1999," *Xinhua*, news.sina.com.cn.
[60] *Enrollment of colleges and universities in 1999 is a major event in the history of Chinese education*, China.com.cn, 2008.

— **Wave 3: 2010–19.** In this wave, the government set a dual goal of continuing to improve quality and ensuring that the education system addressed the shift in the economy toward higher-productivity industries and services. Important adjustments to examinations and university enrollment were made. Gaokao remained the main test for college admission, but even before 2010, complementary evaluation methods were piloted. For instance, the Independent Freshman Admission Program allowed universities some autonomy in selecting some students and in setting their own entrance exams. By 2018, about 90 universities were allocating some 5 percent of places using independent admissions. In 2020, 35 prestigious institutions (including Peking and Tsinghua universities) piloted the Strengthening Foundation Plan, which enables students with outstanding performance in specific fields including math, medicine, physics, and history to apply.[61] Under this scheme, 85 percent of the final admissions decision is determined by the gaokao score, and 15 percent by an independent evaluation by the school. The evaluation conducted by Peking University included an extra written test, an interview, and independent assessment for special cases.[62] Although gaokao performance still plays a central role, other elements were introduced to judge a candidate more broadly. Another thrust of policy during this period was to narrow differences in educational provision between urban and rural areas, a persistent imbalance since 1978. Since 2013, the Ministry of Education has been evaluating the imbalance using indicators such as resource allocation, public support, educational quality, and social recognition. By the end of 2019, more than 95 percent of all countries and districts had passed this evaluation.[63]

>60%

rise in private schools 2010–19

Another element of this wave was increased government support for private educational institutions. In 2019, China had more than 192,000 private schools, representing about 36 percent of all schools. The 2019 figure represented an increase of more than 60 percent over the 119,000 private schools in 2010. A number of factors explain this increase, including the fact that opening up the system to private funding helped alleviate strain on the government's education budget while providing more diverse options such as international schools that facilitate learning English. In the 2010 reform plan for education in 2010 to 2020, the government took steps to remove bottlenecks in the sustainable development of private educational institutions, and it built on this effort in 2016 through a private education promotion law. This was followed by a series of frameworks and institutional guidelines on the establishment and governance of private schools.[64]

[61] *The university's "Strong Foundation Project" debuted at least 85% of the college entrance examination scores. Comprehensive evaluation of enrollment to promote nationwide*, Beijing, January 16, 2020, news.sina.com.tw.
[62] *Admissions guide for Peking Foundation Plan*, Peking University, May 7, 2020, gotopku.cn.
[63] *2019 national compulsory education balanced development supervision and evaluation work report released*, People's Network-Education Channel, May 19, 2020, edu.people.com.cn.
[64] Jianfeng Fang, "China's private education institutions—historical development, current status and challenges," *Educators*, August 2018, cnki.com.cn.

A significant increase in investment supported educational reform

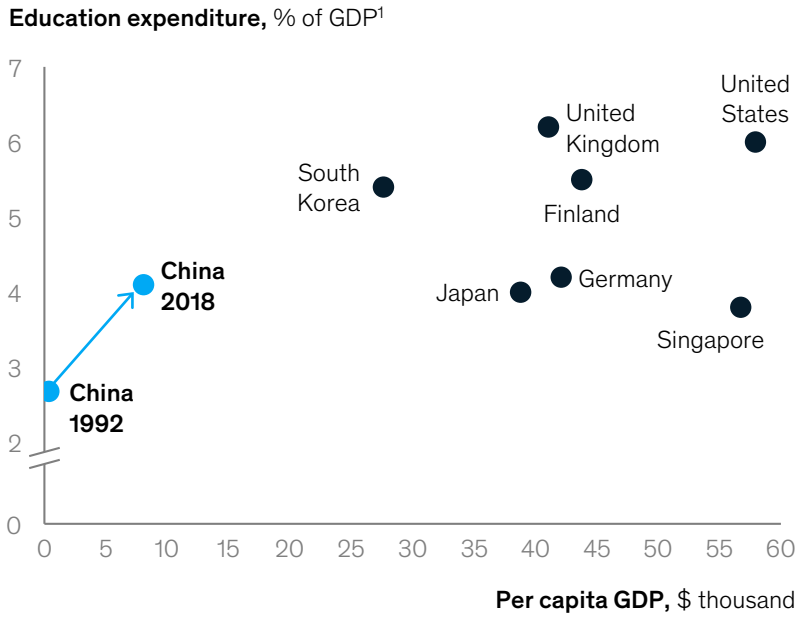
Public investment in education soared 50-fold between 1992 and 2018, from 73 billion renminbi to 3.5 trillion renminbi. In share of GDP, spending jumped from 2.7 percent to 4.2 percent (Exhibit 11). The target set in 1993 was 4 percent, and the share exceeded that target from 2012 to 2019. China has made it clear that the investment share should remain above 4 percent.[65] Despite the sharp rise in spending on education, China still lags behind advanced economies. The average in OECD countries is roughly 5.5 to 6.5 percent of GDP.

Exhibit 11

China has increased overall public expenditure on education.

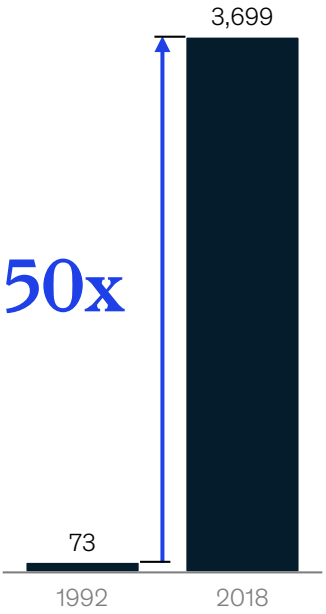
2016

China public expenditure on education as percentage of GDP has increased since 1992



Total public education expenditure has grown 50x since 1992

Renminbi billion



1. Includes only public expenditure; excludes R&D spending in educational institutions.

Source: China Education Statistics Yearbook; OECD; World Bank; McKinsey analysis; McKinsey Global Institute analysis

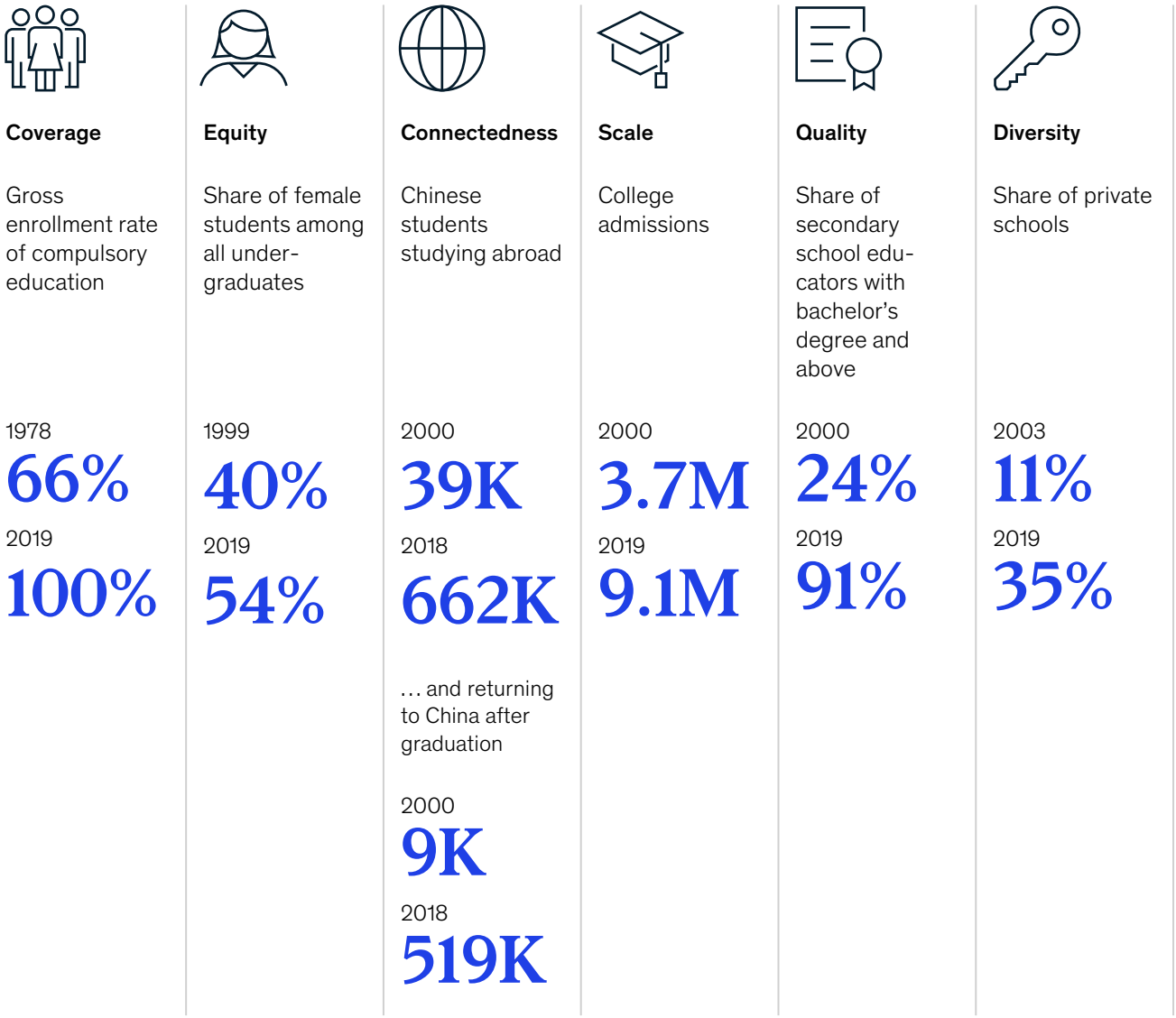
[65] *Data sees changes: Education funding security*, Ministry of Education, September 28, 2017, moe.gov.cn.

Educational reform has led to considerable achievements on four dimensions

China's attention to educational reform backed by a huge increase in investment has resulted in considerable achievements. We look at the following six dimensions (Exhibit 12):

Exhibit 12

Investment in, and reform of, education has resulted in considerable achievements.



Source: Ministry of Education; National Bureau of Statistics; McKinsey Global Institute analysis

9.1M

college admissions in 2019, from 3.7M in 2000

— **Coverage.** From 66 percent of children covered by compulsory education in 1978, the share is now 100 percent. The secondary education gross enrollment rate more than doubled, from 41 to 95 percent, over the same period.[66]

— **Scale.** Driven by the increasing provision of higher education, the scale of education also expanded significantly. For instance, the number of college admissions increased from 3.7 million in 2000 to 9.1 million in 2019, according to the Ministry of Education.

— **Quality.** Chinese students consistently demonstrate top-tier academic core performance (math, writing, and reading) measured by SAT scores, the percentage of international students at top undergraduate and graduate universities, and PISA scores.[67] National Compulsory Education Inspection Program results indicate that Chinese students are achieving strong and consistent academic performance across all disciplines.[68] Teachers' qualifications have been improving. Today, 91 percent of secondary school educators now hold a bachelor's degree, compared with only 24 percent in 2000.

— **Equity.** Over the years, China has taken steps to improve educational opportunities for broader groups. The share of female undergraduate students increased from 40 percent in 1999 to 54 percent in 2019, according to the Ministry of Education. Between 2012 and 2017, admissions quotas for students from rural areas increased tenfold. These efforts mean that the system is relatively equal today.

— **Connectedness.** China's education system is also becoming more connected to the rest of the world, with an increasing number of overseas students. In 2000, 39,000 students went abroad to study, but only 9,000 came back in that year. In 2018, 662,000 students studied abroad, and 519,000 students came back after finishing their studies, contributing their new knowledge and experience to their home economy and society, Ministry of Education data show.

— **Diversity.** China's educational landscape has become more diverse. By 2018, there were about 183,500 private educational institutions—35 percent of all institutions—up from 11 percent in 2003.[69]

[66] *Numbers: 40 years of China's education reform*, Li Seqi Think Tank, January 2019, idmresearch.com.
[67] *PISA 2018 results*, OECD, 2019, oecd.org. We note that the score for Chinese students is based on the relatively prosperous cities of Beijing, Jiangsu, Shanghai, and Zhejiang; it is less likely that these scores are as high in smaller cities and rural areas.
[68] *Report on 2018 national compulsory education inspection*, National Assessment Center for Education Quality, Ministry of Education, July 2018, moe.gov.cn.
[69] Li Mingjun, *Foreseeing 2019: The panorama of the private education industry in 2019 (with industrial layout and development trends)*, Foresight.com, 2019, qianzhan.com.

A system transformation should focus on three broad aims: worker skills, refreshed content, and ubiquitous provision

Three broad aims stand out as priorities in any reimagination of education and training, which are the focus of this chapter (Exhibit 13). We call these the three Es: everyone, everything, and everywhere.

Exhibit 13

China's skills development system needs to be transformed in order to sustain economic growth and improve living standards.

	Current state	Potential direction
Everyone	Primary focus on **formal education system** accommodating ~243 million students[1]	**3x expansion of scope** to support entire population including 775 million workers
Everything	**Strong academic performance** (PISA reading, math scores) yet **gaps in some metrics** including growth mindset and critical thinking	**Broad capability building** to equip 236 billion hours of work requiring higher cognitive, social and emotional, and technical skills by 2030 through a new content and delivery model[2]
Everywhere	**Rural-urban gaps** (30 pp lower enrollment in higher education) and **limited migrant worker support**	**Ubiquitous access** to training to support reskilling of almost all workers every year on 24/7 basis

1. All students enrolled in K–12 and higher education in 2019, according to official statistics.
2. On average, 40 days per person by 2030 due to the impact of automation.

Source: Chinese General Social Survey; Ministry of Education; National Bureau of Statistics; McKinsey Global Institute analys is

First, the talent-development engine should power not only schoolchildren and college students, but China's working adults. This implies a tripled expansion of scope, extending the focus from 243 million students in the K–12 and higher education systems to cover a workforce of 775 million people.

Second, the content of education and training needs to change to reflect an economy that is moving away from the industrial model of the past 30 years, evolving from teaching people basic skills to a broader range of knowledge. Our simulation finds that equipping China's workforce with the high cognitive (such as critical thinking and decision making), social and emotional (such as interpersonal skills and leadership), and technical skills (such as advanced data analysis) that will be in demand—and constantly refreshing those skills—could amount to an additional 236 billion hours by 2030, or an average of about 40 days per worker. It will require investment in the development of new content and delivery models.

Third, education and training should be ubiquitous, available to all throughout their lives, anywhere and anytime. In the postindustrial system, all workers may need some degree of reskilling every year.

Any transformed system needs to be equitable, ensuring that it fully includes poorer and less skilled workers, many of them rural-urban migrants. In 2019, the World Bank introduced the concept of "learning poverty," an expression that points to the fact that education deficits are largest among those with low incomes.[70] Learning poverty may even be exacerbated by the COVID-19 pandemic, which the World Bank fears has threatened hard-won gains in education (and health) over the past decade, especially in the poorest countries.[71]

This is a monumental task. As the popular Chinese saying goes, "It takes ten years to grow a tree, but one hundred years to cultivate people." Any country's education and talent-development systems, including China's, are deeply rooted in society and its myriad characteristics. To make fundamental changes to these systems requires that a range of stakeholders adopt a long-term view, because reform takes time. No country has a perfect system, and the task facing China is considerable.

Any transformed system needs to be equitable, ensuring that it fully includes poorer and less skilled workers, many of them rural-urban migrants.

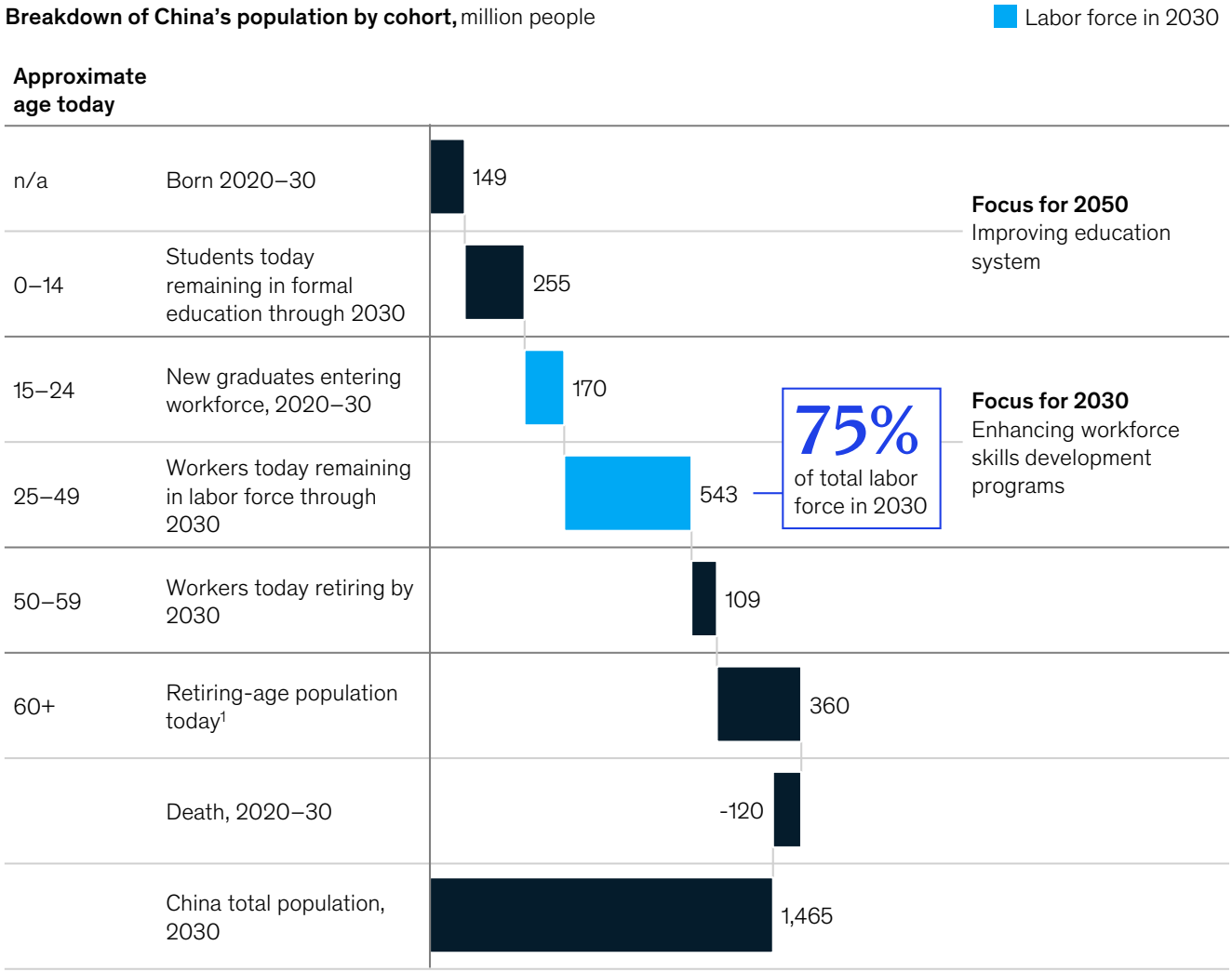
[70] *Learning poverty*, World Bank, October 2019, worldbank.org.
[71] *The Human Capital Index 2020 update: Human capital in the time of COVID-19*, World Bank, September 2020.

Everyone: Education and skills development needs to expand to all

Having continuously reformed education over the past 30 years, in the medium term—to about 2030—China should place its primary focus on ensuring that workers have access to high-quality, continuous education and training (Exhibit 14). The current vocational training system has a number of challenges, and in-work training by companies tends to suffer from underinvestment in an era in which lifelong learning is still a nascent concept. In each case, we look in particular at enrollment and pathways to employment.

Exhibit 14

Making the skills transition will require focusing on today's workers even as efforts continue to reimagine the formal educational system.



1. Includes female population aged 50-plus; the female retirement age in China is 50.
Note: Figures may not sum to 100% because of rounding.
Source: National Bureau of Statistics; United Nations *World Population Prospects* 2019; McKinsey Global Institute analysis

By 2030, we find that 543 million workers, or 75 percent of the workforce, will be people who are already in the labor force today. An additional 20 percent, or 170 million people, will be students who enter the workforce over the next ten years. This implies that the focus on workforce reskilling and vocational training system will be the major drivers of impact by 2030.

Number of people taking non-diploma programs fell from

44M to 37M

in 2015–19

Today, about 243 million students are enrolled in K–12 and higher education, while workers number about 775 million. As China extends the focus to workforce training and lifelong learning, by 2030 the system will need to accommodate three times as many people as the number of students enrolled in the education system today. Official statistics also show that the number of students (including adults) undertaking non-diploma programs declined from 44 million to 37 million between 2015 and 2019.[72] Not all training needs to be offered in formal school programs. In the future, the training system can encourage the development of new platforms and flexible training venues outside the school system to meet a variety of learning goals. Private institutions and employers can play a role in filling gaps and expanding access to all.

Government policy has begun to evolve in this direction. In 2013, China included the concept of lifelong learning in the nation's mission.[73] In the national medium- to long-term educational reform and development plan for 2010 to 2020, the government proposed the creation of a "comprehensive and open system for lifelong learning."[74] The 18th National Congress emphasized the importance of an inclusive, prosperous "learning society."[75]

In parallel to enhancing workforce training, over the long term, programs to tackle remaining structural issues in China's education system should get under way, too. About 288 million students will enter the workforce after 2030, and 397 million people are expected to be born between 2020 and 2050. China may need to enact a more fundamental transformation of the education and talent-development systems, including preschool and the K–12 system. The work needs to start now, given that it takes a huge amount of time and effort to build consensus and make gradual changes toward a long-term goal.

China's vocational training system faces a number of challenges

Vocational education in China is largely conducted on two levels: secondary vocational education and higher vocational education. For those students who choose to receive a high school education after graduation from junior high school, about 60 percent of students go to an academic high school and the remaining 40 percent attend a secondary vocational school.

Vocational training in China is regarded as a second-best pathway, as it is in many countries around the world. Beyond this broad observation, China's vocational training system faces multiple challenges. One of them is the shrinking numbers of vocational schools, enrolled students, and teachers in the sector. Student satisfaction is low, and a social bias against vocational training—and a perception that it does not offer a good return on investment of time and money—means that enrollment is low and dropout rates are high. Pathways to employment are uncertain.

[72] This includes graduates of technical-vocational programs (three million in 2019), technical training for peasants (24 million), and other training (11 million).
[73] "Building a society for lifelong learning is a major strategic decision for a well-off society," *China Education News*, January 11, 2013, theory.people.com.cn.
[74] "Outline of the National Medium and Long-Term Education Reform and Development Plan 2010–2020," *Xinhua News Agency*, July 29, 2010, gov.cn.
[75] "Building a society for lifelong learning is a major strategic decision for a well-off society," *China Education News*, January 11, 2013.

In 2019, the State Council announced funding of 100 billion renminbi to spend on raising the skills of the workforce, and a plan to provide vocational training to 50 million people in the next three years. The funding applies to all vocational training institutes, including vocational schools and private and public training institutions. The State Council also announced that this campaign will further expand to meet the growing demand for skilled roles, including positions in nursing, housekeeping, elderly care, and other service industries.[76]

31%

decline in number of secondary vocational schools 2008–18

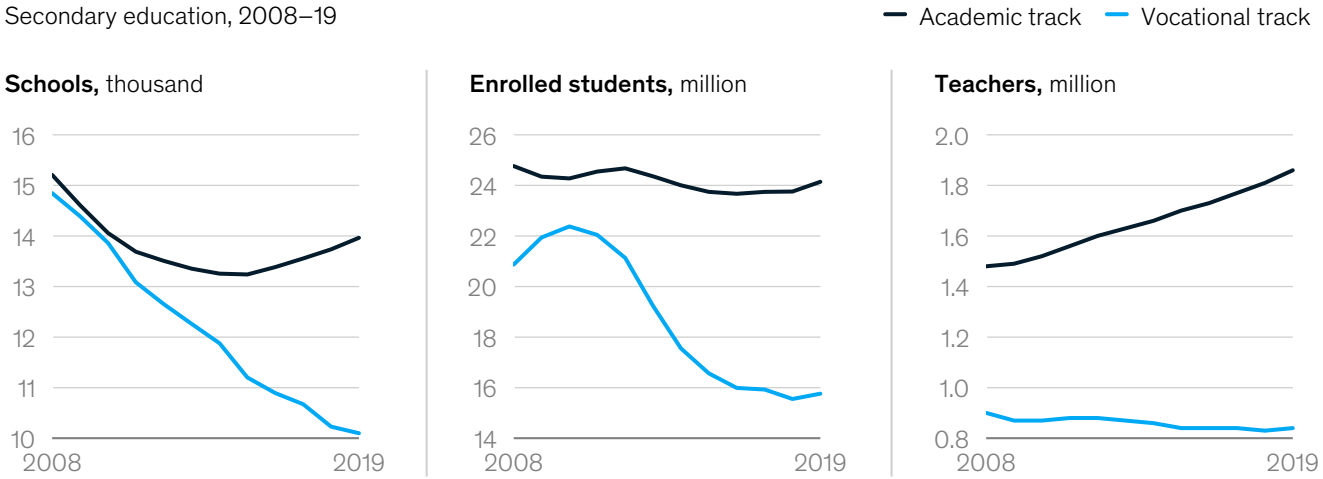
Vocational training is shrinking in China

The number of vocational schools, enrolled students, and teachers has been falling despite the fact that demand for higher-skilled vocational workers has been rising (Exhibit 15). The number of secondary vocational schools decreased from 14,847 in 2008 to 10,100 in 2019, a 32 percent decline, according to China's NBS. The number of academic high schools fell from 15,206 to 13,240 between 2008 and 2015, then slightly increased to 13,964 in 2019. The number of students enrolled in academic high schools has been stable at about 24 million over the past ten years, but the number of students enrolled in secondary vocational schools has fallen from 21 million to 16 million, a compound annual decline of 2.5 percent. The number of teachers at vocational schools also dropped, from 870,000 to 840,000, while the number of teachers at academic schools increased from 1.5 million to 1.9 million during the same period. The number of students enrolled in academic universities has been growing at a compound annual rate of 4.4 percent, while the comparable figure for higher vocational schools during the same period was only 2.1 percent. The main reason for these trends is the consolidation of vocational schools partly due to their inability to attract students, evidenced by the relative decrease in the number of students enrolled in vocational programs compared with academic programs.

Exhibit 15

The number of vocational programs, schools, enrolled students, and teachers in secondary education has been declining.

Secondary education, 2008–19



Source: National Statistics Bureau; McKinsey Global Institute analysis

[76] "China to upskill workforce to expand employment," *Xinhua*, May 1, 2019.

1.2T

renminbi annual spending on higher education vs. 221B on higher vocational training

Social bias and a perceived low return on investment are two causes for low enrollment and high dropout rates

The number of students enrolled in vocational training is either declining faster or growing slower than enrollment in academic institutions. There are two key reasons for this.

— **Social bias against vocational education.** Since 2000, undergraduate enrollment in China has expanded significantly and undergraduate degrees have proliferated.[77] At the same time, the government has devoted less attention and funding to vocational training. It spent 1.2 trillion renminbi in 2018 on higher education but only 221 billion of that total on higher vocational education according to the *China Educational Finance Statistical Yearbook*. In this context, students have long tended to see vocational education as a second-tier educational track. This leaves China with a potential oversupply of undergraduates and administrative white-collar workers, and a shortage of skills in key sectors. Social bias against vocational education exists in many countries around the world; in China, the bias is rooted partly in history and partly in the stratification of the traditional academic path and vocational schools. Emphasis on excelling in academia is a legacy from imperial times, when respect was accorded to those who could pass rigorous exams that enabled them to serve as public officials. This thinking appears to remain embedded in China's academic system today; scoring well on written examinations such as the zhongkao and gaokao is the most important criterion for being accepted into prestigious academic high schools and universities. A student who scores well is expected to pursue an academic path, while those who score lower are expected to go onto a vocational track.

— **Perceptions of low rates of return from vocational courses.** Another reason for low enrollment is a widespread view that vocational schools are not worth the time and money. Evidence that vocational learning is not regarded particularly highly by students is the high dropout rate of 29 to 32 percent in rural areas.[78] The low esteem partly reflects the lack of quality of current vocational offerings that we have noted, a sense that a vocational qualification does not lead to quality jobs, and a lack of a defined bridge between vocational schools and industry. Many students drop out because they believe they can earn more money by going directly into industry.[79]

[77] *Educational promotion action plan for the 21st century*, Ministry of Education, December 1998, old.moe.gov.cn.
[78] Yaojiang Shi et al., "Dropping out of rural China's secondary schools: A mixed methods analysis," *The China Quarterly*, 2015, Volume 224.
[79] Fang Lan, "The unknown future for millions of secondary vocational students," *Caixin Weekly*, January 2014, magazine.caixin.com.

Only

62%

of vocational graduates enter jobs relevant to their major, nearly 10% below share of academic graduates

Pathways to employment are uncertain, and satisfaction is low among students

In China, finding employment after graduation from vocational training is not always straightforward. This contrasts with Germany, for example, where the links between vocational institutions and companies are far more clear-cut. Graduates of German vocational programs find it relatively easy to be recruited by companies in their skill area, and they have comparable job satisfaction and career trajectory levels with their counterparts who pursued an academic path.[80] In China, total employment levels for both traditional academic and vocational graduates within the first six months are about 92 percent for all categories of degree.[81] However, other metrics point to challenges. Only 62 percent of graduates of vocational programs entered industries that were related to their major, nearly 10 percent lower than the figure for those on the academic path. Given that one primary purpose of supporting vocational schools in China was to develop skills for specific technical roles, it is concerning that so many graduates do not obtain jobs for which they were trained. One national survey found that the share of respondents on the vocational track saying that they were satisfied or very satisfied in their job has remained relatively low. Among vocational graduates expressing dissatisfaction, the three top reasons were a lack of career trajectory, high pressure caused by not having adequate skills, and low income. The average salary for vocational higher education graduates is 19 percent lower than that of university graduates, and the gap widens to 24 percent three years after graduation. Furthermore, within three years of job placement, 50 percent of vocational graduates change career paths (defined as moving to a company within a different field); the figure for traditional academic graduates is 30 percent.[82]

China has made some moves toward strengthening the teaching of practical knowledge and improving career counseling. Since 2003, middle and high schools in China have started to integrate practical knowledge into traditional academic modules, requiring students to participate in community work, science experiments, field studies, and career searches, for instance. Overall, there has been a shift toward students developing additional talents and skills beyond the classroom that are more applicable in the workforce and daily life.[83] Since 2017, the Chinese government has begun to emphasize the importance of personal career development, requiring high schools, universities, and even companies to provide career counseling and psychological support. Many businesses, including social media company XinShiXiang, now offer online career-development courses that attract thousands of individuals.[84] These expanding services enable people to acquire necessary job-related knowledge and make better career decisions.

Workforce reskilling has been a relatively low priority for employees and workers, and the concept of lifelong learning is nascent

Workforce reskilling suffers from low investment and a lack of a sense of urgency about the importance of skills, leading to low participation in the programs on offer today.

Investment in training workers is relatively low in China

Broadly, Chinese employers lack comprehensive training programs. According to a survey conducted by Training Magazine and OnDemand Consulting, only 14.2 percent of Chinese firms have comprehensive training programs, and 48.5 percent have a comprehensive training program only for key employees; 15.6 percent have no plan for a training system, while 21.1 percent plan to put one in place but have not yet done so.[85]

[80] *Welcoming Industry 4.0 white paper on the development of Chinese vocational education*, TÜV Rheinland, September 2018.
[81] *Chinese 3-year vocational college graduates' employment annual report*, MyCOS, June 2017.
[82] Ibid.
[83] David J. Deming, *The growing importance of social skills in the labor market*, NBER working paper number 21473, August 2015; and Lao Jang, *Quality education has become "education just need"? On the Golden Year of China's quality education in 2018*, STEAM Quality Education, November 2018, zhuanlan.zhihu.com.
[84] Lu Meihua, *The new blue ocean of career consulting? Development status and practice experience sharing in mainland China*, Taiwan Career Development & Consulting Association, September 2018, tcdca.org.
[85] "China training industry report 2016–2017," *Training Magazine* and OnDemand Consulting, June 2020.

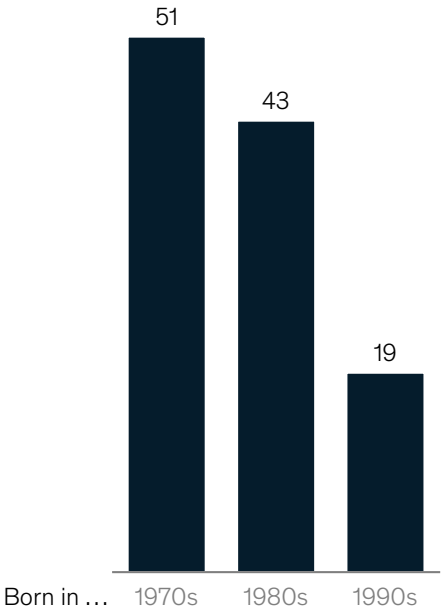
Chinese companies tend to think of training as a cost rather than as an investment in human capital. This appears to reflect the fact that turnover is high at many companies, and it may be easy to hire new workers to plug any skill gaps. In August 2018, one study found that the average time in the first job for the generation born in the 1990s in China was only 19 months, while members of the generation born in the 1970s and 1980s spent 51 and 43 months, respectively.[86] The incentive to devote substantial resources to training is weak, and as a result most training is devoted to managers rather than the broad group of employees with different tenures and functions. In 2016 to 2017, about one-third of spending on training went to managers (Exhibit 16).[87]

Exhibit 16

Turnover among young workers is increasing; employers tend to spend more resources training managers.

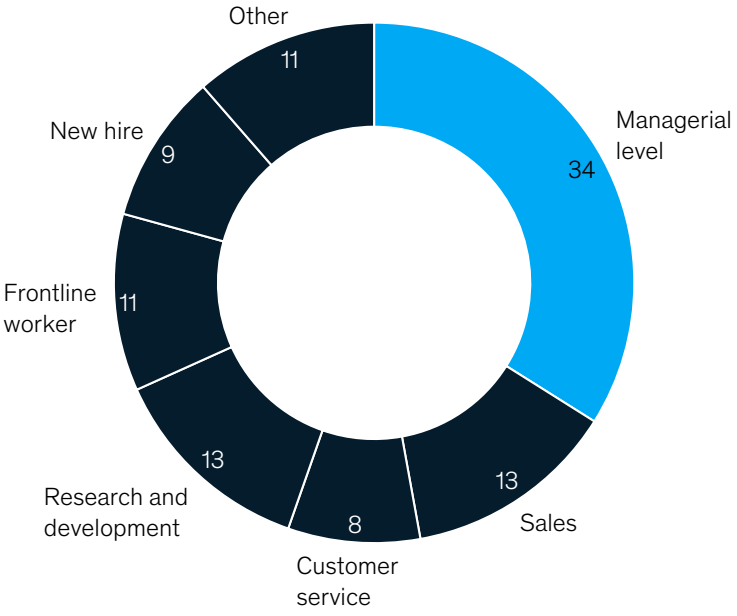
Turnover of employees is rising

Average length of first job by generation, months



Employers tend to spend more resources training managers

Overall training cost breakdown by type of participant, 2016–17, %



Note: Figures may not sum to 100% because of rounding.
Source: LinkedIn; *Training Magazine* and OnDemand Consulting; McKinsey Global Institute analysis

[86] Xin (Sophie) Li, *First job insights*, LinkedIn, August 2018, linkedin.com.
[87] "China training industry report 2016–2017," *Training Magazine* and OnDemand Consulting, June 2020.

Many Chinese workers do not yet recognize the urgency of gaining skills

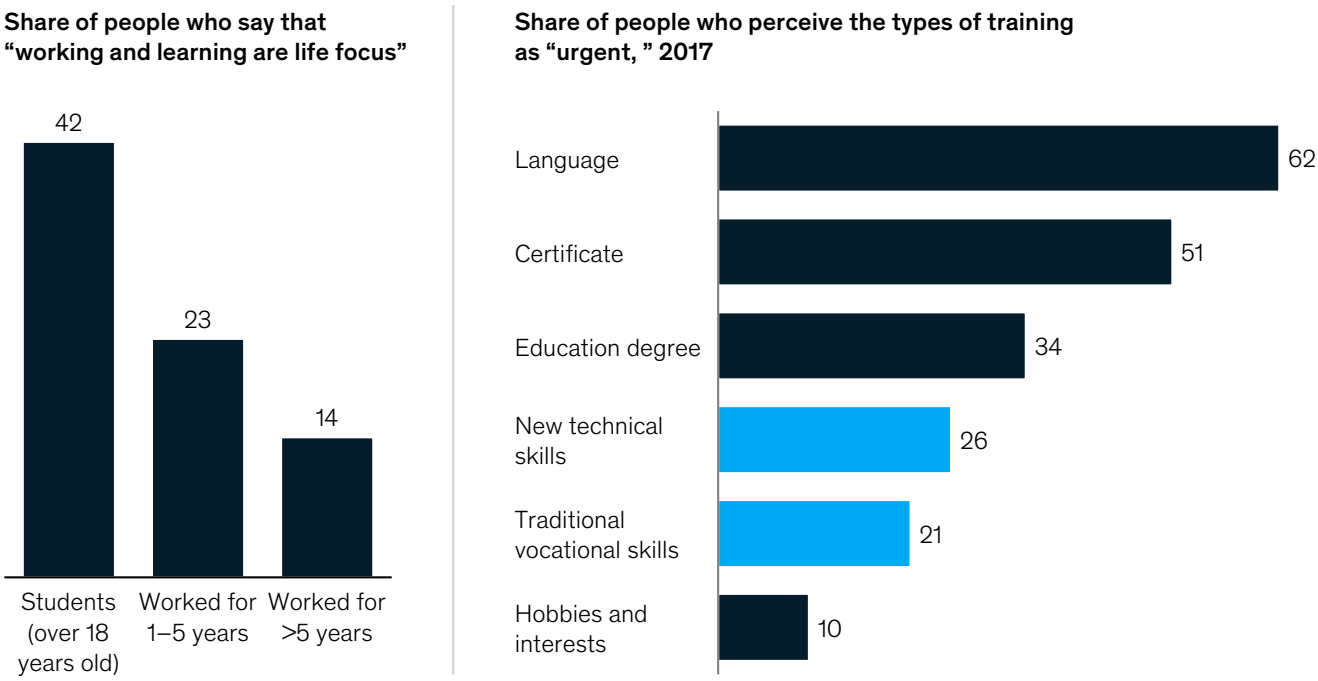
Although many Chinese workers accept that training is important, many do not appear to regard participation in training programs as urgent. One survey of Chinese workers found that 79 percent of respondents said training was necessary, but the survey also found that many of them would not consider vocational skills training urgent.[88] As noted in the previous section, a perception that training lacks relevance coupled with time and cost constraints may account for this reluctance. Workers tend to regard finding a job as their most urgent priority rather than increasing or refreshing their skills.

Once in a job, the urgency to train appears to drop even further. In a 2017 iResearch survey, 42 percent of students (over 18 years old) said that working and learning were focuses. However, the share of respondents taking this view fell to 23 percent among those who had worked for one to five years, and only 14 percent for those who had worked for more than five years. [89] The more settled an individual is in a job, the less of a priority skills development appears to become (Exhibit 17).

Exhibit 17

Chinese workers put less focus on skills development as tenure increases and perceive less urgency for learning new technical and traditional vocational skills.

% (n = 1,000)



1. New technical skills (eg, IT, accounting, data management, and marketing).
2. Traditional vocational skills (eg, cooking, automobile repair, excavator operation, massage).

Source: iResearch online survey; McKinsey Global Institute analysis

Looking at which subjects are regarded as important, the same survey found that 62 percent of respondents said learning a language was urgent. In the case of new technical (for instance, IT, accounting, and data management) or vocational skills (including cooking, automobile repair, and excavator operations), only 35 percent and 21 percent of respondents, respectively, said that training was urgent. Persuading more workers in China to regard training as a matter of urgency, and particularly technical and vocational training, clearly poses a challenge.

[88] *White paper on China's education and training industry*, iResearch, 2017.
[89] Ibid.

Everything: The content of education and skills development needs to change to equip Chinese people for a fast-evolving economy

Educational content needs to match what society needs. In an industrial society, basic literacy for reading basic instructions—say, in a factory—was an important priority, and China achieved that and more. Now, China's changing economy is shifting from manufacturing toward services, digitizing and automating, and being reinvented continuously, and boundaries between sectors are blurring. What is being taught and learned needs to change, too. Increasingly, workers need to have sufficiently broad-based skills to deal with complex and dynamically changing working requirements. Innovative, creative, emotionally intelligent people are in greater demand than people with basic skills. Skills and capabilities need continual refreshing to remain relevant and in demand. This requires investment in developing different content beyond traditional textbooks, such as case studies and hands-on projects as well as new delivery approaches such as participatory learning and experiential training.

In this section, we look at content issues in academic education (schools and universities) and vocational training. On the reskilling of the workforce due to automation alone, our simulation of a midpoint automation scenario suggests that 236 billion hours of work, or about 40 days per person on average, needs to be added to the skills that will be in demand.

The education system can further strengthen the development of broad capabilities

73%

of schools offer more weekly math classes than ministry recommends, but 90% offer fewer art classes than recommended

Chinese society tends to place a strong emphasis on academic performance. Gaokao remains the major evaluation tool for university admission, accounting for over 90 percent of all criteria used to determine who obtains a place. Because gaokao remains important, schools make academic performance their first priority and offer fewer nonacademic, vocational classes. In China, 73 percent of schools offer more weekly math classes than the Ministry of Education recommends, but 90 percent offer fewer weekly art classes and 61 percent fewer physical education classes than recommended.[90] With the emphasis on passing the gaokao test and on relatively narrow academic achievement, Chinese students study far more outside school than their counterparts in other countries. On average, in 2015, 15-year-old students studied for 27 additional hours per week outside school, compared with 20 hours in the United States, 14 hours in Japan, and 11 hours in Germany.[91]

Emphasis on academic performance has paid off. Results from China's National Compulsory Education Inspection Program indicate that students are achieving strong and consistent academic performance across all disciplines.[92] Chinese students consistently demonstrate very good academic core performance (math, writing, and reading) as measured by SAT scores, the percentage of international students at top undergraduate and graduate universities, and PISA scores.[93] In 2018, Chinese students scored above the OECD average on PISA reading, mathematics, and science tests.[94] We note that the score for Chinese students is based on the relatively prosperous cities of Beijing, Jiangsu, Shanghai, and Zhejiang; it is less likely that these scores are as high in smaller cities and rural areas.

On some aspects of performance, China has scope to make further progress, including, for instance, growth mindset and students' well-being. The OECD defines growth mindset as the belief that someone's ability and intelligence can develop over time.[95] Well-being refers to the "psychological, cognitive, social and physical functioning and capabilities that students need to live a happy and fulfilling life."[96] PISA finds that China scores below the OECD average on both metrics.[97] Other research reveals high levels of anxiety among Chinese students.

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90 *Report on 2018 national compulsory education inspection*, National Assessment Center for Education Quality, Ministry of Education, July 2018.
91 PISA 2015 database, oecd.org.
92 *Report on 2018 national compulsory education inspection*, National Assessment Center for Education Quality, Ministry of Education, July 2018.
93 *PISA 2018 results*, OECD, 2019, oecd.org.
94 Ibid.
95 See Li-Kai Chen, Emma Dorn, Marc Krawitz, Cheryl SH Lim, and Mona Mourshed, *Drivers of student performance: Asia insights*, January 2018, McKinsey.com.
96 PISA scores employ a "how's life" framework using 11 indicators of quality of life and material conditions. See "Students' well-being: What it is and how it can be measured," in *PISA 2015 results (volume III): Students' well-bring*, OECD, 2017.
97 Li-Kai Chen, Emma Dorn, Marc Krawitz, Cheryl SH Lim, and Mona Mourshed, *Drivers of student performance: Asia insights*, January 2018, McKinsey.com.

According to a joint survey published in 2019 by the China Youth & Children Research Center and the Institute of Psychology CAS, 5.1 percent of middle school students (aged 14 to 18) were suffering from severe anxiety, and 7.7 percent were at high risk of depression.[98] The situation seems to be even worse in rural areas. Another study suggests that more than half of rural students are at risk of at least one type of anxiety, and 48 percent of them displayed symptoms severe enough to interfere with their enjoyment of life while 27 percent experienced sleeping problems.[99]

There are now pilots in progress to explore broader approaches. As noted, about 36 top-tier universities now have independent admissions; gaokao still accounts for 85 percent of the admissions criteria, but there is an element of independent assessment.[100]

Another area is creativity, entrepreneurship, and critical thinking. China was in the bottom 20 countries in the world on PISA scores for students' "ability to think like a scientist," an attribute linked to creativity and entrepreneurship.[101] A 2017 Stanford survey determined that Chinese universities may have areas of improvement in fostering students' critical thinking.[102] The research found that Chinese freshmen in computer science and engineering programs demonstrated critical thinking skills similar to those of their US counterparts, or even more advanced. However, Chinese students showed limited improvement in critical thinking after two years of college, while their US and Russian counterparts made considerable improvements. The authors posited that the poor quality of teaching at many Chinese universities was an important factor. Chinese universities tend to reward professors for their research rather than their teaching abilities, and this means that top-notch academics may not be available to students as much as they could be. Many of the world's top universities ensure that top professors continue focusing on research by providing a cadre of staff dedicated to teaching.

The higher education system can be more flexible in creating exposure to practical skills and career options

Higher education in China tends to emphasize theoretical knowledge and offers insufficient exposure to practical skills. Students express an unmet appetite for instruction in practical skills. In a 2018 survey of graduates, 62 percent of respondents said they had insufficient practical lessons including, for instance, field studies and internship opportunities.[103]

62%

of respondents to one survey said they had insufficient practical lessons

Chinese students report that they experience little engagement in class. One study found that in 2012, 28 percent of Chinese students said that they had never received feedback from their teachers, compared with only 8 percent in US universities, and 55 percent of college students in China said that they had never discussed their potential careers with teachers, versus 25 percent in the United States.[104] There is clearly a strong desire for improved teaching among Chinese students. In a 2018 survey of university graduates, 62 percent of respondents said they had insufficient practical lessons, 45 percent said that the teaching they received did not inspire them to learn, and 38 percent said that lessons were not useful or were out of date.[105]

In China, university students have limited exposure to career planning and, especially in lower-tier universities, unclear career pathways. One survey found that nearly 63 percent of student respondents said that they lacked sufficient information when choosing a major to study

[98] Zheng Zhang, "Youth mental health raises the alarm: Nearly 30% are at risk of depression," *China Youth Daily*, April 2019, news.cyol.com.
[99] Hongyang Liu et al., "Adolescents: Comparisons across provinces and among subgroups," *International Journal of Environmental Research and Public Health*, September 2018.
[100] *Opinions of the Ministry of Education on the pilot reform of enrollment reform of basic subjects in some universities*, Ministry of Education, January 2020, moe.gov.cn.
[101] Li-Kai Chen, Emma Dorn, Marc Krawitz, Cheryl SH Lim, and Mona Mourshed, *Drivers of student performance: Insights from Asia*, 2017, McKinsey.com.
[102] "NY Times: Study finds Chinese students excel in critical thinking. Until college," Stanford Rural Education Action Program, July 30, 2016, reap.fsi.stanford.edu.
[103] Boqing Wang and Yonghong Chen, *Chinese 4-year college graduates' employment annual report (2019)*, Social Science Literature Press, June 2019.
[104] Hualin Jiang and Weiwei Zhang, "Student-faculty interaction: The effective approach to improving the quality of undergraduate education," *Tsinghua Journal of Education*, October 2012, Volume 33, Number 5.
[105] Boqing Wang and Yonghong Chen, *Chinese 4-year college graduates' employment annual report (2019)*, Social Science Literature Press, June 2019.

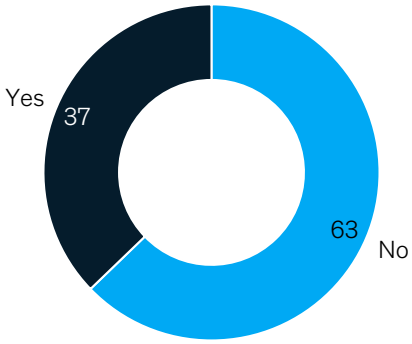
(Exhibit 18).[106] Where career advice is offered, it tends to be underused. In one survey, only 40 percent of students took advantage of career development advice and 20 percent used coaching in job-hunting strategies. This may also lead to a mismatch between employer and employee expectations. Turnover among new graduates in the first six months of their working lives is high at 30 percent. Nearly all of these individuals—98 percent—change jobs voluntarily, citing a lack of opportunities for personal development and unsatisfactory compensation as the main reasons.[107]

Exhibit 18

Most college students say they lack information when choosing a major and do not use the majority of career services provided.

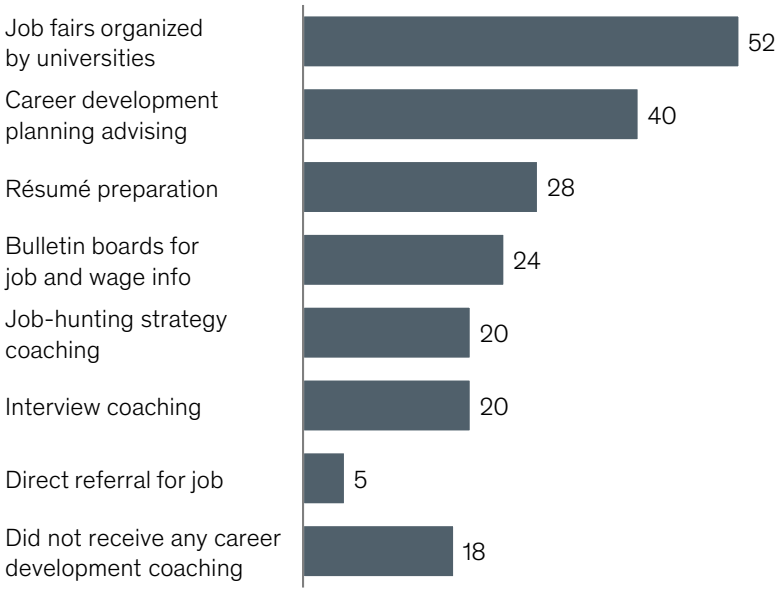
Approximately 2/3 of students indicate they had insufficient information when choosing a major

Did you have sufficient information to select an education program which supports you in getting a job you like?
% of respondents (n = 371)



Most students don't use the majority of services provided by college

Students who used career services during college, 2018,
% of respondents (n = 152,000)



Note: Figures may not sum to 100% because of rounding.
Source: Chinese 4-year college graduates' employment annual report 2018; SpeedUpEducation Report; McKinsey Global Institute analysis

Providing career guidance or job shadowing experiences, especially toward the end of high school, may be one way to help young students, whatever their talents and aptitudes, to develop ambitious and realistic expectations about their future.

[106] Ibid.
[107] *Economic transformation and structural change has resulted in a skills mismatch in China: J.P. Morgan – Tsinghua & Fudan University study*, J.P. Morgan press release, November 3, 2016.

Vocational training faces challenges related to lack of expertise and outdated content

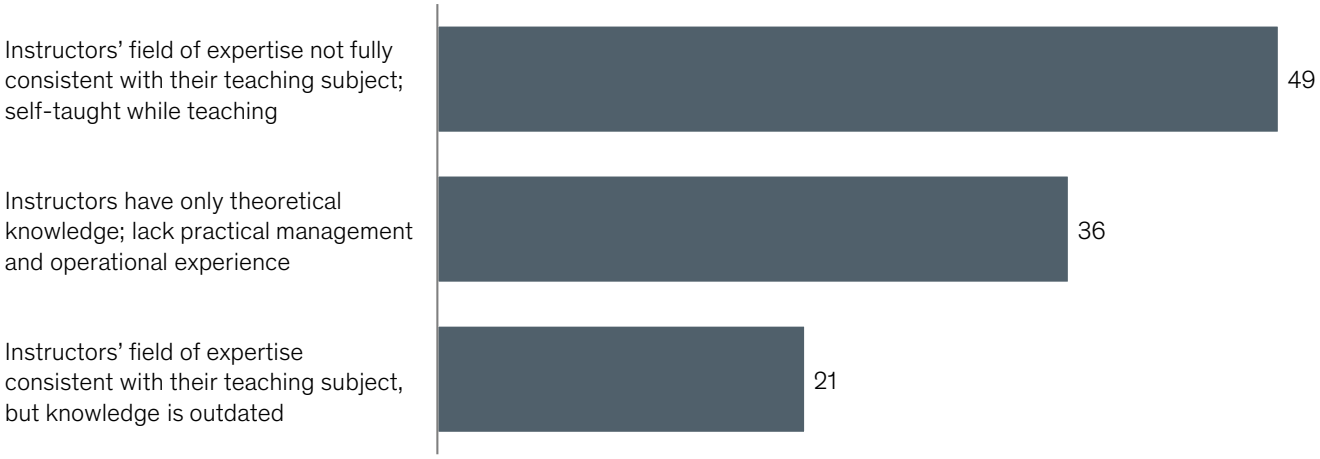
Vocational educators exhibit a lack of expertise, knowledge, and experience (Exhibit 19). In a TÜV Rheinland survey, about 36 percent of 40 vocational schools who responded said they believed that instructors lack practical industry experience, and 49 percent said they found their instructors' field of expertise not fully consistent with their teaching. Thirty percent of respondents from 115 corporate representatives said that vocational school instructors lack hands-on industry experience.[108]

Exhibit 19

Teachers at vocational schools tend to lack industry experience and expertise.

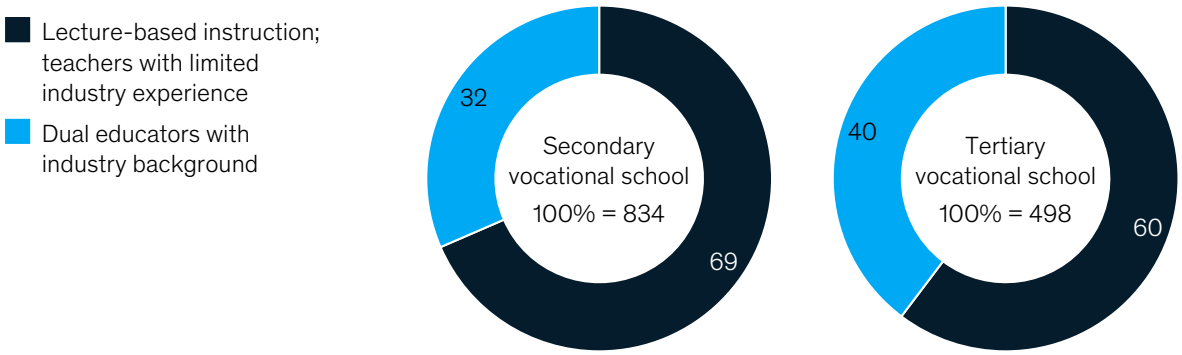
Instructors tend to lack expertise related to teaching subjects

Vocational schools' perception of instructor quality, % of respondents (n = 40)



Majority of instructors have limited industry experience

Background of vocational education instructors, 2018, % of total teachers, thousand teachers[1]



1. According to China's reform plan for dual educators, 50% of vocational educators need to have an industry background by 2022.

Note: Figures may not sum to 100% because of rounding.

Source: Ministry of Education; TÜV Rheinland survey; McKinsey Global Institute analysis

Moreover, instructors appear to lack industry experience and tend to rely on lecture-based learning. In 2018, in secondary vocational schools, nearly 70 percent of instructors were teaching lecture-based courses and had little or no industry experience. In tertiary vocational schools, the former number was about 60 percent. In contrast, all vocational educators in Germany need a minimum of five years' industry experience before becoming a full-time

[108] *Welcoming Industry 4.0 white paper on the development of Chinese vocational education*, TÜV Rheinland, September 2018.

teacher. China's national plan states that 50 percent of teachers at vocational schools need to be dual educators—with both academic and industry background—by 2022. As of 2018, an additional 210,000 dual teachers were still needed to meet the national target.

Vocational curricula have not been updated as industries have developed (Exhibit 20). More than 90 percent of students surveyed said they believed that curriculum-based programs did not reflect industry trends and needed to be updated.[109] More than 60 percent of vocational school educators cited limited capabilities as the main reason curricula were not being updated, although more than 50 percent of respondents also cited insufficient funding for the purchase of training equipment and devices, lack of collaboration with corporations, and lack of instructor and school capabilities. Students' main suggestion—from more than 66 percent of those responding—was for schools to collaborate with companies to codevelop curricula.

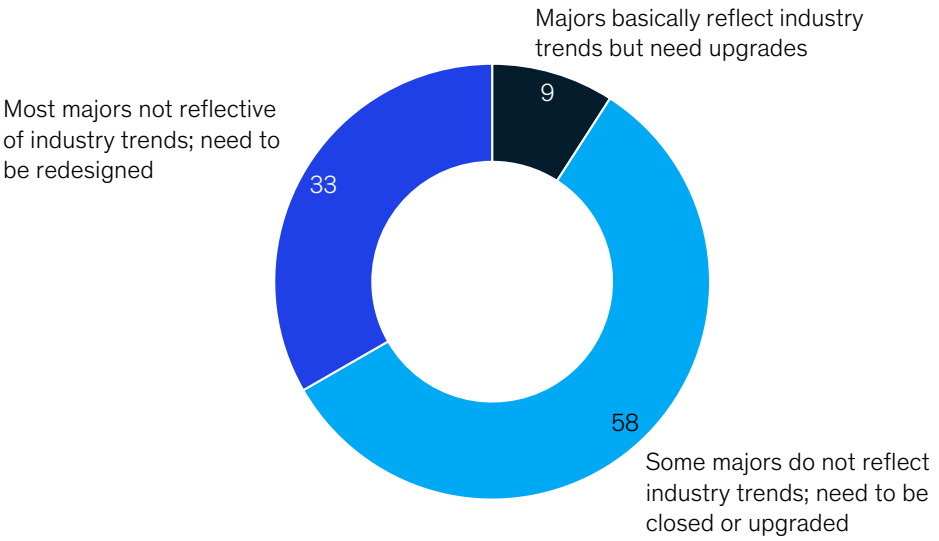
Exhibit 20

Vocational curricula have not been updated to match advances in industry, and schools lack capabilities to develop curricula.

% of respondents, 2018 (n = 40)

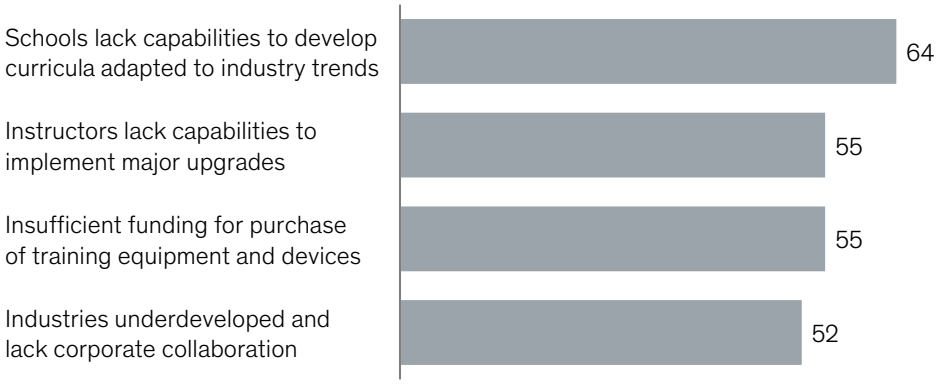
Curricula are in need of update

How vocational schools perceive their major setup



Lack of capabilities, limited funding, and lack of collaboration are main reasons behind outdated curricula

Reasons constraining industry updates



Note: Figures may not sum to 100% because of rounding.
Source: TÜV Rheinland survey; McKinsey Global Institute analysis

[109] Ibid.

The outcome of training can also be improved. A survey conducted by Zhaopin in 2019 indicated that among white-collar workers not satisfied with their training, nearly 40 percent of respondents said the effect of the training was below expectations.[110] The delivery of training also raises issues. Teaching and learning models still tend to focus on traditional methods—paper textbooks and lectures. Seventy-eight percent of in-house training in Chinese corporations is delivered by internal trainers who deliver lectures and use textbook-based teaching.[111]

Everywhere: Provision of education and training needs to be ubiquitous

To reskill China effectively, access to education and training needs to be ubiquitous. In a transformed system, almost the entire workforce could take part in reskilling programs, competitive vocational tracks would be more widely available, and the system would reduce gaps in provision between those who live in cities and those who live in the countryside. Taking an ambitious view, China could aspire to a system that, through a significant expansion of the use of digital technologies, is available 24 hours a day and seven days a week. The country could even make training mandatory—"opt out" rather than "opt in." To make this a reality, employers would need to expand employee training hugely; this may require support from policy incentives.

>90%

of teachers have university degrees in central urban areas vs. 72% in rural areas

In today's system, where you live still determines, to an extent, whether you can access educational and training resources. On the whole, these resources are more available and higher quality in urban than in rural areas. According to official statistics, only three million migrant workers, or about 2 percent of the total 291 million, went through a vocational and technical program in 2019. Many migrant workers do not have sufficient time to study or money to pay for courses. The compulsory school education budget per student each year in rural areas is about 60 percent of the figure in central urban areas, while more than 90 percent of teachers have university degrees and above, compared with 72 percent in rural areas.

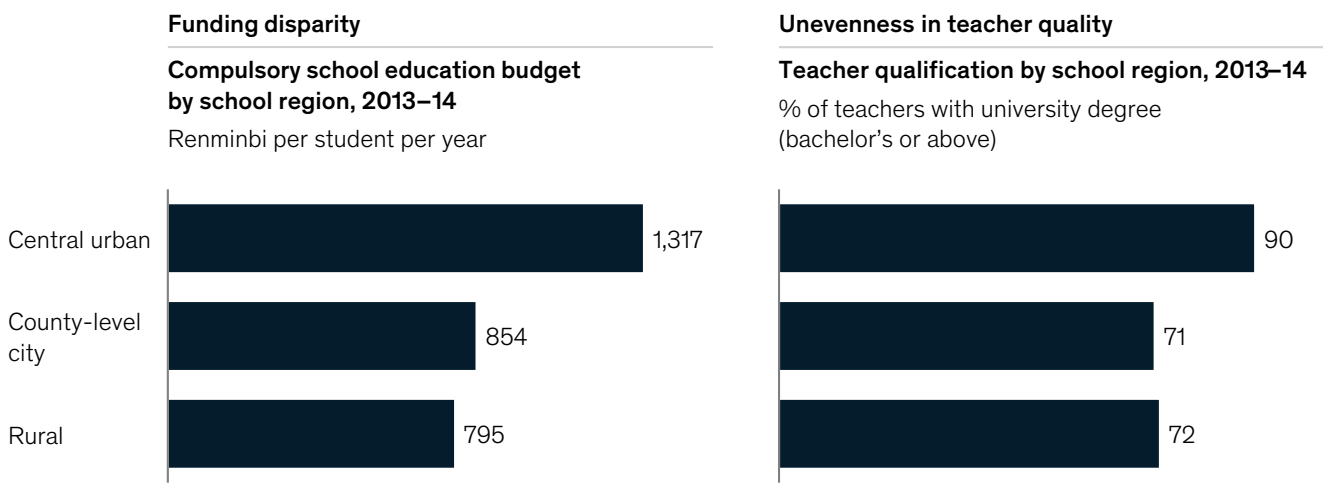
Gaps in provision of education and vocational training separate China's urban and rural areas as well as its cities

Large gaps in access to education and training persist in China, notably between rural and urban areas, in funding, teachers' qualifications, and student-teacher ratios (Exhibit 21). The current compulsory school education budget is 1,317 renminbi per student per year in central urban areas, but only 795 renminbi in rural areas.[112] In central urban areas, more than 90 percent of teachers have university degrees (bachelor's or above), compared with 72 percent in rural areas according to the China Education Panel Survey. The student-teacher ratio has been falling, but teacher shortages in rural areas worsened between 2013 and 2018.[113] It is notable that 27 percent of teachers in rural areas teach more than three subjects, and 30 percent teach more than three classes. The relatively low quality of education in rural areas affects attitudes toward education and makes shortcomings more difficult to tackle. Rural students tend to have higher dropout rates because in many cases they do not perceive it to be of value and would rather leave school and start earning.

[110] *Demand and satisfaction of vocational training by Chinese workers*, Zhaopin, September 2019.
[111] "China training industry report 2016–2017," *Training Magazine* and OnDemand Consulting, June 2020.
[112] China Education Panel Survey, National Survey Research Center at Renmin University of China, 2015, ceps.ruc.edu.cn.
[113] *Annual report on China's education 2017*, 21st Century Education Research Institute, 21cedu.org.

Exhibit 21

Compulsory education has urban-rural gaps in funding and the quality of teachers.

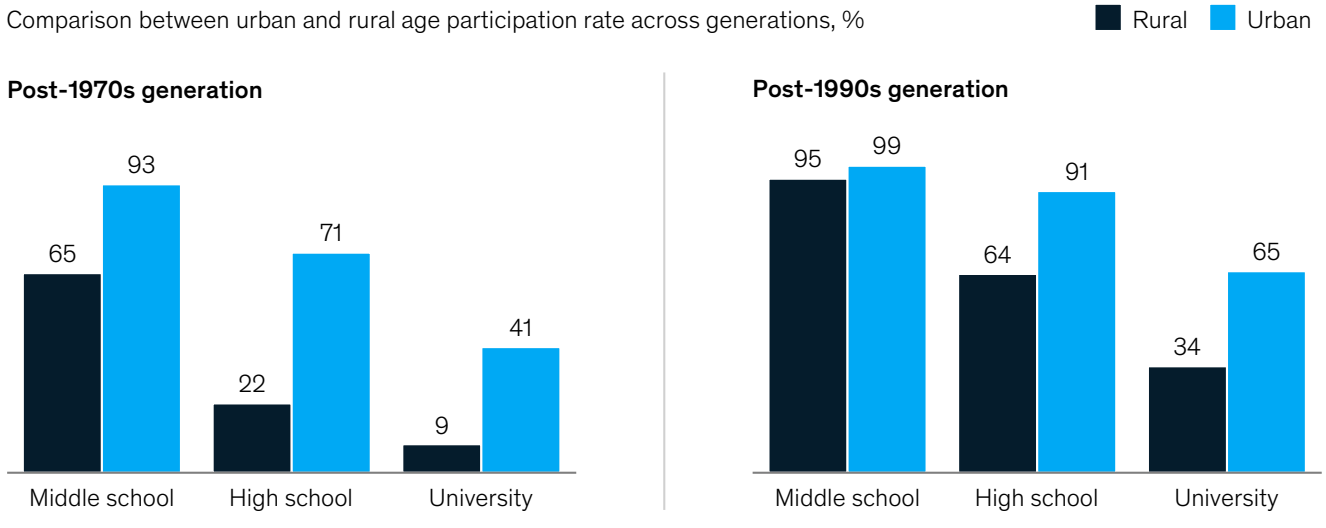


Source: China Education Panel Survey; McKinsey Global Institute analysis

As a result, gaps remain between urban and rural students in education and training from school to the world of work. For those born after 1970, the participation rate of young people in middle school and high school in rural areas is only 65 percent and 22 percent, respectively, compared to rates in urban areas of 93 percent and 71 percent. For those born after 1990, participation in middle school and high school in rural areas rose to 95 percent and 64 percent, respectively—in other words, more than 35 percent of students in rural areas never finished high school. Even today, participation in university among the post-90s rural area is still only 34 percent. In summary, although the enrollment gap between rural and urban areas is narrowing, there is still considerable room for rural enrollment to improve (Exhibit 22).[114] Another report highlights the fact that 30.5 percent of graduates of middle-tier universities who come from rural areas are unemployed upon graduation.[115]

Exhibit 22

Enrollment is significantly lower in rural than in urban areas.



Source: Chinese General Social Survey; McKinsey Global Institute analysis

[114] *Children in rural areas have already lost the college entrance examination at birth*, NetEase Data Blog, June 2018, data.163.com.
[115] Cai Wei Zhang, ed., *Population and labor green paper: China population and labor issues report number 16 (database experience card presented)*, November 2015, ssap.com.cn.

Public spending on education

3.3x

higher in tier-one cities than tier-three and tier-four cities

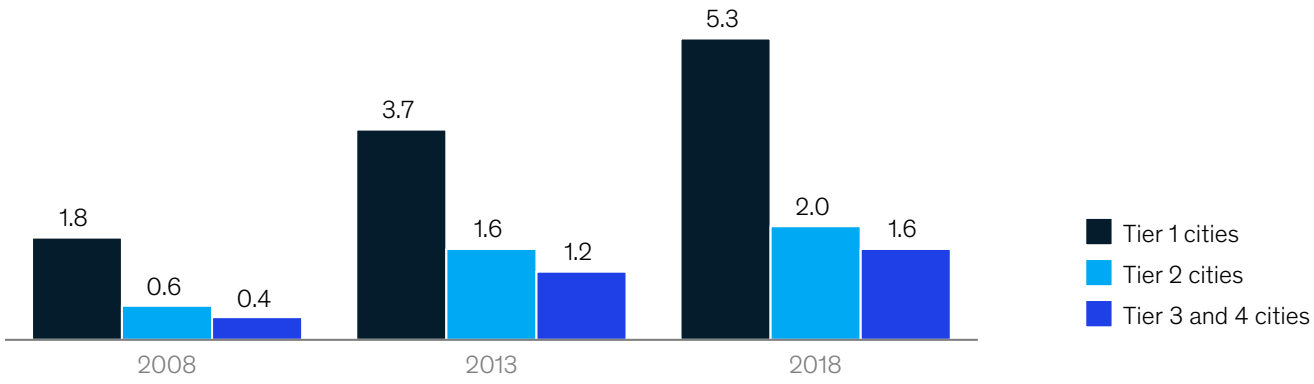
Access to training is particularly lacking for low-skill workers, many of them migrants among whom job turnover is high. According to official statistics, three million migrant workers out of 291 million total completed some technical and vocational training in 2019. The share of migrant workers born after 1980 was 50.6 percent in 2019, according to official statistics. A 2020 survey conducted to understand the new generation of migrant workers found that 78 percent of the nearly 6,000 respondents had parents who were also migrant workers, and close to 40 percent were "left-behind" children when their parents migrated for work. Work hours are long, at an average of ten to 12 hours a day, six days a week, and overtime is the main route to higher pay. Frequent changes of jobs are common—the survey indicated that more than three-quarters of respondents had switched jobs at least three times. More than one-third of respondents thought their jobs are meaningless, with a further quarter saying they were unsure whether their jobs had meaning. Only 16 percent were satisfied with their current jobs.[116] In a survey conducted in rural areas of Guangzhou, the reasons migrants cited most often for not participating in training were lack of time, being too old, and having too little education to understand training.[117]

Although disparities between cities are narrowing, public expenditure on education is 3.3 times higher in tier-one cities than in tier-three and tier-four cities (Exhibit 23). This reflects the fact that large cities have greater fiscal capacity to invest in education and training. Fiscal revenue as a share of GDP in the country's four tier-one cities—Beijing, Guangzhou, Shanghai, and Shenzhen—is about 16 percent, compared with seven percent in tier-three and tier-four cities. Because larger cities have more money to invest, they attract more students, and educational resources become concentrated in them. For example, the tier-one cities have about one-third of China's Project 211 universities, roughly 100 institutions that the government has designated to enhance China's global competitiveness.

Exhibit 23

Intercity gap: Although the gap is shrinking, large and small cities differ widely in public education expenditure per student.

Public fiscal expenditure on education per student, 2008–18, $ thousand



Source: Chinese General Social Survey; McKinsey Global Institute analysis

[116] "A survey of the life and mentality of the new generation of migrant workers: How far are they from integrating into the city," *China News*, October 9, 2020, chinanews.com.
[117] Jungui Xie, *Land-expropriated farmers: Occupational change and supporting mechanisms*, Social Science Literature Press, February 2013, pishu.com.cn.

China has been assiduous in reforming education, with many positive results. Now, however, it faces the imperative of equipping its people for a dynamically changing labor market in an evolving postindustrial economy. China's education and skills development systems face several challenges that will need to be overcome if they are to suit a dynamic, fast-evolving, modernizing economy. Vocational and in-work training are limited in scope and quality, and there is, as the government appears to desire, large scope to expand provision. The quality and character of educational content need to be improved and adjusted, and access to education and training is needed for all—whatever they earn and wherever they live. In the next chapter of this report, we turn to pilot projects for experimentation in the period to 2030, focused on four major levers.

The quality and character of educational content need to be improved and adjusted, and access to education and training is needed for all—whatever they earn and wherever they live.

3. Pilots based on four levers could start the skills transformation

To continue to improve the living standards of all of its people, China needs to sustain GDP and wage growth. Unleashing productivity growth through innovation and talent development will be the key to driving the next phase of growth, and achieving a productivity revolution will require reimagining China's education and skills development systems. In this chapter, we discuss how expanded use of digital technologies, public-private partnerships for skills development, flexible and competitive vocational education, and a shift in mindsets could be levers deployed as the core of China's transformation. Scaled up, these levers could be part of China's efforts to attain skills consistent with the needs of the changing economy and with an aspiration for continually rising living standards to 2030 and beyond. The initiatives would kick-start the transformation of talent development with experimentation to ascertain what works and what doesn't, and what might be best practices across the entire system. The explanation of pilot projects along these four levers arises from a survey of best practices in talent development around the world, including China. We note that China has solid foundations for pulling each of these levers.

Managing a transformation on the scale needed and suggested is a huge challenge that involves all of Chinese society, and it arguably makes sense to minimize any disruption and unintended consequences by establishing best practices in relatively small-scale pilots before scaling up to the national level. Given the variety in economic development, industry structure, endowment of educational resources, presence of local employers, and acceptance of students and workers across various geographies and sectors, it will be helpful to accumulate experience from pilots and experiments, facilitate learning for different stakeholders, and discuss how to scale those that have achieved high impact. This has been a traditional Chinese approach to reform and transformation, ranging from special economic zone programs in the late 1970s to hukou reform in recent years.

Unleashing productivity growth through innovation and talent development will be the key to driving the next phase of growth, and achieving a productivity revolution will require reimagining China's education and skills development systems.

China has solid foundations for a transformation of education and training in pilot projects centered on four levers

Based on an extensive local and global literature review and interviews with employers, educators, nongovernmental organizations, and experts, we identified four areas where taking action in the form of pilot projects could enable China to meet the challenges discussed in chapter 2. These measures focus largely on developing and refreshing the skills of the workforce by 2030 (Exhibit 24).[118] First, the adoption of digital technologies can transform traditional textbook-based teaching methods into more engaging, multichannel learning and teaching. Second, sustainable collaboration between educators, employers, and the government can narrow the gap between the skills and capabilities that the current education system develops and employers need. Third, China can develop competitive vocational training programs that produce the high-skilled talent that will meet future demand. Fourth, a shift in mindsets accompanied by effective incentives could create a culture of lifelong education and training. These types of interventions more or less equally apply to China's agenda for 2050—preparing students with the skills they will need in the future. In each of the four areas, interventions are designed to build on China's strengths, overcome current bottlenecks, and reimagine the education and talent-development systems.[119]

Exhibit 24

China could transform education and skills development by deploying pilot programs around four levers.

	From →	To
Digital technologies	Largely traditional teaching and learning model based on textbooks and one-size-fits-all methods	Transform traditional learning model into a **more engaging, multichannel hybrid model**
Collaborative ecosystem	Gaps separating educational outcomes and skills from employers' requirement	Forge a **strong partnership** uniting education providers, employers, and governments
Enhanced vocational tracks	Perceived as a second tier track, outdated instruction, and quality gaps in teaching staffs	Design **competitive and flexible pathways** for vocational education while developing **high-quality educators**
Mindset and incentives	Individuals stop learning journey after school education while employers perceive training as expense rather than investment in human capital	Build **society for lifelong learning** for individuals and employers

Source: McKinsey Global Institute analysis

[118] For a discussion of skill shifts needed globally in light of automation specifically, see *Skill shift: Automation and the future of the workforce*, McKinsey Global Institute, May 2018.

[119] We acknowledge that education systems are highly complex, and changing them not only has an economic dimension but also involves history, philosophy, society, and culture. We have not attempted to design interventions that encompass all of those broader aspects, but rather focus on economic dimensions, specifically skill shifts.

If China is to meet its ambitious goal of reshaping the talent-development and training systems, a range of stakeholders will need to drive change. Technology companies can provide digital solutions that enhance teaching and learning, and platforms that enable more efficient and flexible delivery of educational and training content. Educators can design flexible skilling and reskilling pathways, adopt technologies, and improve educational programs to match the changing demands of employers. Employers can strengthen provision of training opportunities and shape attractive career-development pathways based on skills improvement; in this regard, effective school-industry partnerships would be useful. Governments can facilitate collaboration among different players, ensure that intellectual property protection for digital content is in place, and develop a social and economic environment that enables and encourages lifelong learning. Last but not least, individuals can be more proactive in pursuing learning opportunities and updating their skills to meet demand from the labor market as it evolves.

A successful transition to a new model for talent development implies significant changes on the four dimensions. The scale of impact of interventions in each could be enormous (Exhibit 25). In each case, China already has a strong foundation for taking action.

Exhibit 25

Four levers could lead to significant impact on education and skills development by 2030.

Digital technologies	**900M+** individuals reached through tech-enabled learning platforms	**2M+** individuals deliver microcurricula through digital platforms
Collaborative ecosystem	**300K+** school-enterprise partnerships, covering **11K** vocational schools and **27M** students	
Enhanced vocational tracks	**All** application-oriented universities open to flexible paths (eg, “3+4” program) for vocational students	**>80%** of vocational educators with industry experience
Mindset and incentives	**220M** people benefiting from information platforms to navigate occupation transition[1]	**All** eligible for subsidized training programs[2]

1. Early adoption automation scenario.
2. Singapore's Skills Future program typically offers SGD$500–SGD1,000 over a 5-year period to all aged between 25 and 60.

Source: McKinsey Global Institute analysis

China's economy is significantly digitized and can use digital technologies to transform education and skills development system for a very large number of people

The benefit of using digital technologies is that doing so can reach a large number of people, provided they have access to the internet. China currently has more than 900 million internet users, and more than 95 percent of them access the internet via mobile. Adoption of innovations such as online-to-offline, social commerce, and livestreaming has been rapid in China, and the COVID-19 pandemic accelerated their use even further. One online education startup providing tutorial services, Zuoyebang, saw its number of monthly active users rise from 106 million in January 2020 to 157 million in March 2020 according to QuestMobile data, for example.

China already has a globally competitive position in digital technologies, including in consumer-facing segments such as education.[120] In recent years, China has experienced booming investment in education technology (see Box 4, "China's education technology investment boom"). The challenge now is to turn that surge in investment into a sustainable education model enabled by technology.

These strong digital foundations mean that the vast majority of people who receive education and training in China could have access to high-quality digital content to refresh and modernize their learning journey.[121] At the same time, anyone can become a producer of educational and training content and fill current gaps in provision and effectiveness. Digital technologies enable education and training to be much better tailored to the needs not only of individuals but of the economy; they make the crafting of microcurricula possible.

>2M

people could deliver microcurricula through digital platforms by 2030

An estimated one million producers of content related to education and skills are currently active on social media platforms in China. By 2030, there could be more than two million people delivering microcurricula through digital platforms that are not usually covered by traditional textbook-oriented curricula. That's double today's number assuming the number of users on education and training platforms follow the typical growth pattern of other technology platforms, and the ratio to content providers remains constant.[122] Most of the training hours could be enhanced by applying digital technologies. For example, social media platforms could offer on-demand programs that are flexible for workers who have limited money and time for training. On the Kuaishou platform alone, more than 200 million education-related short clips were shared in 2019.[123] AI can personalize training, gamification can make content delivery more engaging, and augmented and virtual reality can enhance efficiency.[124]

China's dynamic corporate ecosystem has a track record of collaborating with government; this model can be extended to education and training

China has dynamic, successful companies and a strong ecosystem. About 120 Chinese companies are in the Fortune 500, and some 4,000 listed companies are on the Shanghai and Shenzhen stock exchanges. China has a track record of partnership between government and the private sector—together they are pushing toward the modernization of the economy. We have already seen the government working with the private sector. According to the National Development and Reform Commission, in 2019 there were nearly 7,000 public-private partnership projects related to urban infrastructure, social affairs, transportation and ecological environmental protection.[125] The collaboration goes beyond traditional infrastructure. The government has worked closely with leading technology companies on a national effort to develop an AI industry worth about $150 billion by 2030.[126] During

[120] *Digital China: Powering the economy to global competitiveness*, McKinsey Global Institute, December 2017.
[121] Jake Bryant, Christine Heitz, Saurabh Sanghvi, and Dilip Wagle, *How artificial intelligence will impact K–12 teachers*, January 2020, McKinsey.com; Jake Bryant, Felipe Child, Emma Dorn, and Stephen Hall, *New global data reveal education technology's impact on learning*, June 2020, McKinsey.com; and Jake Bryant, Emma Dorn, Stephen Hall, and Frederic Panier, *Reimagining a more equitable and resilient K–12 education system*, September 2020, McKinsey.com.
[122] Assuming five to ten percent annual growth, which is typical for the user base of digital platforms.
[123] "The 2019 Kuaishou Education Ecological report is released!" *Kuaishou Daily*, October 17, 2019, dy.163.com.
[124] By March 2020, 904 million people had access to the internet, according to China's Cyberspace Administration.
[125] "China has nearly 7,000 PPP projects underway," *Xinhua*, November 16, 2019.
[126] "National AI plan to drive development," *China Daily*, October 22, 2019.

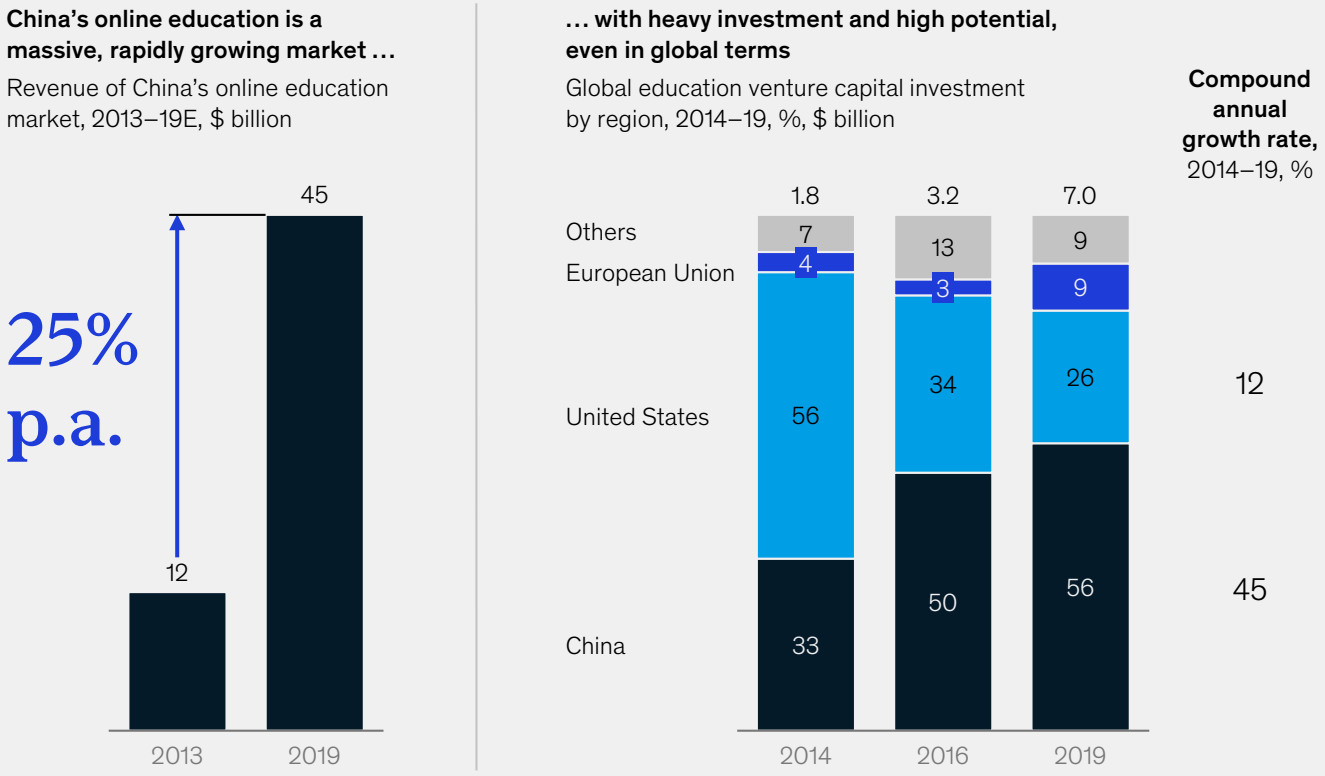
Box 4

China's education technology investment boom

China's educational technology, or edtech, market is massive and growing rapidly, and surging investment suggests high potential (Exhibit 26).[1] Since 2013, the revenue of China's online education market has grown from $12 billion to $45 billion—an average compound annual growth rate of 25 percent.[2] Edtech solutions that could address many of the gaps in China's education system have proliferated. Growth in investment has been even more significant. From 2014 to 2019, venture capital going into China's education technology sector grew at a compound annual rate of 45 percent to total $3.9 billion. It is noteworthy that in 2019 China accounted for 56 percent of global venture capital investment in education technology.[3] These trends demonstrate that China has huge potential to continue to innovate in education technology and further drive the adoption of technologies and their integration into teaching and learning.

Exhibit 26

Educational technology is already a huge, rapidly growing market in China, with high potential.



Source: HolonIQ; iResearch Global Group; McKinsey Global Institute analysis

[1] Daisy Christodoulou, *Teachers vs tech?: The case for an ed tech revolution*, Oxford University Press, March 2020.
[2] *Share of K12 in online education market rose to 20.7 in H1 2019*, iResearch, October 22, 2019.
[3] *$4.5B global edtech venture capital for 1H 2020*, HolonIQ, July 10, 2020.

the COVID-19 pandemic, the government collaborated with Alibaba and Tencent to deploy a national health code.[127]

Now such partnerships could be applied to the challenge of modernizing education and training. A more collaborative ecosystem could enable the creation of more than 300,000 school-industry partnerships. According to official statistics, there are about 700,000 large companies in China based on specific revenue threshold by sector.[128] We assume that about 40 percent of them could participate in school-industry partnerships.[129] In Germany, vocational schools had partnerships with some 430,000 companies, and more than 80 percent of large companies had apprentices as of 2018.[130] Companies can provide input on the skills that are needed to stay competitive and can offer internships, interview opportunities, and rotational programs for teaching staff and researchers. These partnerships could benefit 11,000 vocational schools with 27 million students. Government can facilitate the formation of these partnerships specifically and of a collaborative system more broadly by setting the overall strategy for the transformation of education and training, acting as convener for disparate stakeholders, allowing bold experimentation, and backing pilots with resources. We see scope for public-private partnerships to target ten key manufacturing sectors where China appears to face a shortage of more than 30 million skilled workers, identified by governments.

China's government is increasingly emphasizing vocational training, and the landscape is already beginning to change

For many years, the vocational track has been viewed in China as a second-best choice for students, and workers have had limited flexibility in returning to school, receiving training, and pursuing higher-skill jobs. But this may begin to change as new policies increase investment in vocational tracks (there is also scope to embed more vocational content even into nonvocational tracks to make them more relevant to the job market), and pioneering partnerships between training institutions and companies are emerging. China can build on these new beginnings. In 2019, the State Council announced funding of 100 billion renminbi ($14 billion) to spend on raising the skills of the workforce as well as a plan to provide vocational training to 50 million people in the next three years. The funding applies to all vocational training institutes, including vocational schools and private and public training institutions. At the same time, leading vocational schools in China have developed partnerships with about 200 corporate partners and have demonstrated successful development of skill sets and placement programs. China needs to scale up such efforts across the nation.

China could also make the vocational track more attractive to students. One option is offering a "3+4" secondary-undergraduate model that enables them to go directly to higher vocational or application-oriented universities without taking the national gaokao college entrance exam. Shandong and Zhejiang provinces are already piloting this approach with secondary vocational schools and are partnering with local universities to create 3+4 programs. To provide more options to vocational students, this model could be expanded to all application-oriented universities in China, including ones that the government is expecting to convert from traditional universities. Today, there are about 1,200 universities in China and the government plans to transform existing higher vocational schools or ordinary universities into about 600 "application-oriented" universities. The purpose of the reform is to equip students with both theoretical knowledge and practical experience.

To enhance the vocational track, China may push for quality starting with a small number of schools. They can receive greater hardware investment such as new equipment and access to high quality teachers to help students build successful careers by developing in-depth

[127] Oliver Tonby, Jonathan Woetzel, Noshir Kaka, Wonsik Choi, Jeongmin Seong, Brant Carson, and Lily Ma, *How technology is safeguarding health and livelihoods in Asia*, May 2020, McKinsey.com.

[128] For industrial and wholesale companies, it is more than 20 million renminbi revenue per year; for retail, five million; for restaurants, two million; and for other services, ten million.

[129] NBS.

[130] Paul Hockenos, "How Germany's vocational training and education system works," *Clean Energy Wire*, November 16, 2018.

industry expertise in the skills that are in demand. Graduates of these schools may be able to access even more attractive commercial rewards and careers than their peers in academic universities and gain respect as skilled experts in their fields. The lessons learned and best practices from the top-quality vocational schools could be shared and eventually scaled up to all schools, raising the quality of the vocational track. Gradually, more success cases can be generated and China may be able to correct the social bias against vocational training. This program could be also managed as part of a broadening of industry-school collaboration.
On the academic track, China has made similar efforts. It selected 137 academic universities, about 10 percent of the country's total, for the Double-First-Class initiative in 2017 to cultivate high-quality universities.[131] Project 211, initiated in 1995, aimed to cultivate about 100 higher education institutions to advance attainment in social and economic fields. Similarly, the aim of Project 985, launched in 1998, was developing world-class universities for the 21st century. By 2004, the program had expanded to include 39 institutions.[132] China today is home to 22 of the global top 500 universities, up from 11 in 2016.[133]

Enhanced vocational-training institutions will need qualified teachers. More than 80 percent of dual vocational educators—equipped in both theory and practical industry experience—could be nurtured through closer industry collaboration. Today the ratio is only 32 percent for secondary and 40 percent for higher vocational schools. In Germany, dual qualification is a prerequisite. This in turn could create a virtuous cycle to improve the quality of teaching, raise training outcomes, and eventually enhance the competitiveness of the vocational track.

China has demonstrated considerable adaptability, suggesting that mindsets can shift toward nationwide lifelong learning and continual reskilling

220M

people could benefit from information platforms to guide lifelong learning

To transform education and skills development in China may require a systematic shift in mindset to embed lifelong learning into society. Given that the impact of automation will be far-reaching across all sectors and jobs, almost all of the workforce could receive some forms of skilling and reskilling each year. Individuals can actively leverage information platforms to forge pathways to pursue relevant jobs and acquire the necessary skills. The platforms could benefit 220 million people who would need to make an occupational transition by 2030 under our early automation adoption scenario. Individuals can also actively leverage microcredential programs to constantly refresh their skill sets.

Companies need to reconsider how they treat investment in training, shifting their mindset to think of it not as a cost but as an investment in human capital that will pay off in reduced worker turnover and an accumulation of know-how and skills that can boost not only productivity but the bottom line.

The government has already set a new strategic direction. In 2013, China included the concept of lifelong learning into the nation's mission. In the national medium- to long-term educational reform and development plan for 2010 to 2020, it proposed the creation of a "comprehensive and open system for lifelong learning." The 18th National Congress emphasized the importance of an inclusive, prosperous "learning society." When there is a market failure, government will need to step in to facilitate the shift of mindset and incentives toward lifelong learning. MySkillsFuture, a government-sponsored program in Singapore, offers courses, career information, and employment services, and allows content providers to post certified courses online. An important feature of the program is the government's provision of training accounts with money that individuals can choose how to spend. This gives them ownership of their learning journey. The training account typically offers 500 Singapore dollars to 1,000 Singapore dollars over a five-year period to citizens aged 25 to 60.

China's government, companies, and the population have repeatedly proven that they are highly adaptable. Consider, for instance, the fact that the entire nation shifted from being

[131] *The announcement on the development of first-class universities and first-class discipline initiative*, Ministry of Education, Ministry of Finance, National Development and Reform Commission, September 2017, moe.gov.cn.
[132] Project 985 was announced by President Jiang Zemin on the 100th anniversary of Peking University on May 4, 1998. The project's aim was to promote the development and reputation of the Chinese higher education system by founding world-class universities in the 21st century. The name derives from the date of the announcement, May 1998, or 98/5 in Chinese date format. Project 985 sponsored 39 universities.
[133] *The Times Higher Education World University Rankings 2021*, timeshighereducation.com.

a largely agrarian economy to an industrial one. Four decades ago, agriculture employed 75 percent of workers; today that share is only 25 percent. Since 1978, more than 600 million people are estimated to have left rural areas and moved to cities. Another example is the fact that an essentially state-driven economy embraced the private sector; again, the transformation was rapid. In 1995, the private sector accounted for only 18 percent of urban employment; today, that figure is 87 percent. Over the past decade, China has transformed itself into a highly digitized economy and its people into voracious consumers of digital technologies.

This adaptability now needs to fuel a shift toward lifelong learning. In the new skills development system, the whole workforce should be able to access training every year with the intensity and nature of training varying by individual. This would help the labor market to become much more flexible.

In the rest of this chapter, we discuss each type of intervention in some depth.

Digital technologies: Traditional textbook-based learning can be transformed into a more engaging, multichannel hybrid model

Technology has changed China in the past ten years, and that change has, if anything, been accelerated by the response to the COVID-19 pandemic as social distancing triggered a shift to remote working on an unprecedented scale.[134] However, there is huge potential for the broader use of digital technologies in education and training to transform the effectiveness of educational supply and delivery, broaden access, and transform learning in the process.[135] To achieve this, digital technologies need to be embedded in curricula and be understood by teachers and students. Digital is not meant to replace teachers, but to enhance their efforts. It is not sufficient simply to provide every child with a laptop and an education app.

The education and training systems have a number of shortcomings that need to be overcome in the provision of content, its delivery, and the quality of learning. The necessary change in each area is significant. The current supply of education and training comes largely from teachers using traditional methods; with digital technologies, supply can be radically decentralized and tailored to students and learners. Delivery of education and training in China today is largely textbook based, and there is little tailoring. With more use of digital technologies, education and training can be delivered in a more engaging and productive way, with scope for more tailoring. If these digital-enabled transitions occur on a large scale, learning can be transformed. From geographically-fixed, physical centers of learning, students would have the flexibility to learn anytime, anywhere using social media and digital platforms. By giving students and workers who are reskilling more flexibility, the system becomes more inclusive (Exhibit 27).

To be clear, technology cannot replace teachers, but it can play an enabling and supporting role. A McKinsey analysis of the use of information and communications technology during the school day showed significant variations in performance depending on the type of technology and how it is used. Broadly, ICT systems that are fully integrated into the curriculum and supported by teacher professional development and coaching are most effective.[136] The ideal outcome is likely to be a hybrid model that combines face-to-face teaching and digital technologies. Technology players and content providers need to develop business opportunities in vocational skills training, leveraging digital technologies and platforms. Investors need to put money into digital for vocational training and incubate promising startups in this area. Training institutions, teachers, and employers can enable product trials and experimentation by adopting new technologies. The government can

[134] Raphael Bick, Eric Hazan, Hamza Khan, Sébastien Lacroix, Hugo Sarrazin, and Tom Welchman, *The future of work: Reskilling and remote working to recover in the "next normal,"* July 2020, McKinsey.com; and Raphael Bick, Michael Chang, Kevin Wei Wang, and Tianwen Yu, *A blueprint for remote working: Lessons from China*, March 2020, McKinsey.com.

[135] *Digital technology and inclusive growth*, Luohan Academy, 2019, luohanacademy.com.

[136] Li-Kai Chen, Emma Dorn, Marc Krawitz, Cheryl SH Lim, and Mona Mourshed, *Drivers of student performance: Asia insights*, January 2018, McKinsey.com.

Exhibit 27

Digital can transform traditional textbook-based learning into a more engaging, multichannel, decentralized model.

	From → To			
Content provider	Uneven distribution of high-quality teachers	Empower decentralized content providers to deliver microcurricula	**Decentralized** 	Everyone can create their own content and share with others
Delivery	Traditional textbook- and lecture-based delivery approach	Embrace emerging technologies for more engaging, personalized, and productive delivery	**Engaging** 	AR/VR Gamification Social media
			Personalized 	AI/machine learning algorithm
			Efficient 	Image/text/voice recognition
Learner	One-size-fits-all learning pace	Encourage adoption of tech-enabled learning methods for more flexible and inclusive learning environment	**Flexible** 	Learners learn anywhere and anytime
			Inclusive 	Unlock learning opportunities for mass population, especially underprivileged groups

Source: McKinsey Global Institute analysis

ensure that intellectual property and data privacy are protected and can regulate in a way that enables broad adoption of digital technologies in education and training.

China can consider ways of using digital technologies to create improved content delivered in a decentralized way in microcurricula

Social media and online platforms are growing significantly in China, and a clear opportunity exists to use these channels for educational purposes. Doing so could decentralize education and training and hugely broaden access. It is estimated that one leading video-sharing platform has about one million producers of education content. There is a potential for this number to exceed two million by 2030 if the number of users on education and training platforms follow the typical growth pattern of other technology platforms, and the ratio to content providers remains constant. Booming use of digital technologies coupled with rapidly expanding smartphone coverage could boost access to education and training to more than 900 million people who are already online.[137]

[137] *The 45th China statistical report on internet development*, China Internet Network Information Center, April 2020, cac.gov.cn.

>900M

views of vocational training videos

Anyone who has a mobile phone can access paid or free classes via a mobile platform. For example, Lizhiweike, a mobile application, enables any user to create microcurriculum content. A training session typically lasts less than 20 minutes. Lizhiweike currently offers about four million courses on topics such as personal-wealth management, career planning, and language and vocational skills.[138] EduSoho, another online provider of education solutions, offers a platform for content management and marketing services to educational institutions and corporations. Any training institution, higher-education institution, or company can use the open API and infrastructure to create customized online learning programs for their students and employees, with a tracking and management system. Short clips and streaming are already being used to deliver content. It is increasingly the case that anybody can provide educational content, and many more people can learn, anywhere, anytime at an affordable price. In 2019, on the Kuaishou app alone, more than 100 million people viewed educational content each day. A cumulative 734 years of livestream watching of educational content have been registered. Vocational training videos have become increasingly popular, with more than 900 million views, 1.9 million comments, and 21 million "thumbs up" per day. More than half of producers of educational content are providing paid-for material, and more than 1.6 million people have paid for content. The transition from free to paid content is happening on a broad front. More than 310,000 users pay for vocational training content. Over 50,000 farmers pay for agricultural skills training.[139]

Social media is highly suitable for delivering education and training content for early- to mid-tenure workers. For instance, of 600 million registered users of short-clip apps, more than 80 percent are aged between 18 and 40.[140] Moreover, social media can be accessed cheaply, as evidenced by the more than 84 percent of users of short-clip apps who earn less than 10,000 renminbi a month.[141]

Digital can be used to make the delivery of education and training more engaging, personalized, and productive

Digital technologies offer effective ways to improve education and training. Today, the traditional delivery method is an offline model. According to a survey, 78 percent of respondents said they learn from internal lecturers compared with 20 percent online, and 10 percent via microlearning platforms.[142] In a study of migrant workers, more than 30 percent of workers who were surveyed said that they had difficulty understanding standardized training materials because they had low education levels.[143] Use of augmented and virtual reality (AR and VR) and gamification can make learning more engaging; AI and machine learning tools can personalize learning; and image, text, and voice recognition can make teaching and lessons more productive.

— **AR, VR, and gamification can be used to create more engaging content through virtual training and simulating real-world practice.** One major part of vocational training today is practice in physical facilities—using physical equipment—and this is therefore subject to capacity constraints and takes considerable time out from work for individuals taking such courses. AR, VR, and Internet of Things devices can be used to create immersive training with hands-on practice opportunities anytime and anywhere. One example illustrating the potential use of these technologies for vocational training is the Tulsa Welding School in Houston, Texas.[144] The school's 360-degree VR video makes students feel as if they are actually present in a variety of workplace scenarios. With the help of VR, instructors can give students more opportunities to practice essential skills at a low cost and without the risk of working with actual welding equipment, and offer instantaneous feedback on their performance. These technologies can be used to

[138] Lizhiweike.
[139] *Kuaishou education ecosystem report (2019)*, Kuaishou Big Data Research Institute, October 2019.
[140] *Annual report on the development of the netcasting industry in China (2018)*, Cyberspace Administration of China, November 2018, cac.gov.cn.
[141] Xiaoxiao Li, *Short video platforms user survey report (2019)*, 36Kr Research Institute, May 2019, 36kr.com.
[142] "China training industry report 2016–2017," *Training Magazine* and OnDemand Consulting, June 2020.
[143] Jungui Xie, *Land-expropriated farmers: Occupational change and supporting mechanism*, Social Science Literature Press, February 2013, pishu.com.cn.
[144] Tulsa Welding School, tws.edu.

enhance vocational training in many other fields including auto and machine repair and agriculture. There is also an opportunity to gamify training materials. Studies have shown that game mechanics improve the ability to learn new skills by 40 percent.[145] They also improve the completion rate.[146] One example of the benefits is the language-learning app Duolingo, which accumulated 300 million active users by providing game-like learning modules for more than 30 languages; 34 hours of Duolingo playing is equivalent to a first-semester Spanish course.[147]

— **AI and machine learning can be used to personalize vocational learning and assessment.** Traditional curricula offer only one-size-fits-all learning that does not serve different groups of students and workers with a variety of needs in a rapidly changing economy. AI and machine learning algorithms can be tailored to people with different proficiency, needs, and incomes—as early as in schools. By collecting data on learning behavior, algorithms can personalize learning material, schedules, and support, adapting each of these to the individual's proficiency and learning curve. One example of these technologies in action is the Knewton adaptive learning system.[148] One study found that using Knewton led to an increase of 10 percentage points in the proportion of assignments completed, and an increase of 6.6 percentage points in the average score for all quiz or test items related to the learning objective.[149] This technology could be adopted in China and scaled up to improve education and training for the wide variety of students and workers.

— **Image, text, and voice recognition could make teaching and learning more productive.** The format of teaching material matters for the student's experience and results. Easy mutual conversion between different formats including text, image, audio, and video can diversify learning scenarios, free educators from paperwork, and enhance learning, including learning of languages. In China, there has been some early success in using voice and text recognition in learning Mandarin.[150] Using this approach in the Zhaojue country of Sichuan Province, where 98 percent of residents have limited Mandarin fluency, the TAL AI Putonghua free Mandarin training program improved test scores by 70 percent in a year.[151] In the future, these technologies can be used to improve teaching and learning productivity by, for instance, converting chalkboard lectures into video presentations and using audio clips for textbooks.

More students would be reached by flexible, inclusive approaches enabled by digital technologies

900M+

internet users could benefit from expanded digitization of education and training

Expanded use of digital in education and training in an era of almost ubiquitous smartphone use and booming digital technologies could significantly broaden access, potentially reaching more than 900 million internet users.[152] The provision of skills training is extremely uneven in China today. Many workers, particularly in underprivileged groups, do not have access to sufficient training.[153] Government subsidies of training for migrant workers cover less than 4 percent of the cost.[154] At the same time, more use of digital technologies can enable a shift from a one-size-fits-all model to one that is tailored to the needs of Chinese people.

[145] Vivian Giang, "Gamification techniques increase your employees' ability to learn by 40%," *Business Insider*, September 18, 2013.
[146] Gabriela Kiryakova, Nadezhda Angelova, and Lina Yordanova, "Gamification in education," *Proceedings of 9th International Balkan Education and Science Conference*, 2014.
[147] Roumen Vesselinov and John Grego, *Duolingo effectiveness study*, Duolingo, December 2012, static.duolingo.com.
[148] *2017 student data insights*, Knewton/Alta, knewton.com.
[149] Rebeca Wolf, Clayton Armstrong, and Steven M. Ross, *Study of Knewton online sources for undergraduate students: Examining the relationship among usage, assignment completion, and course success*, John Hopkins University Center for Research and Reform in Education, August 2018.
[150] *Using AI language teaching system to innovate language learning of under-resourced students*, AI Teacher, Tomorrow Advancing Life, aiteacher.100tal.com.
[151] Xinxin Zhang, Zhile Shi, and Qi Zhang, *An exploration into innovative practices of targeted poverty reduction through education using information technology – taking the "AI Teacher" program as an example*, China Information Technology Education, November 2019, en.100tal.com.
[152] *The 45th China statistical report on internet development*, China Internet Network Information Center, April 2020.
[153] *China migrant workers statistical report (2017)*, NBS, April 2018, stats.gov.cn.
[154] *Statistical report on human resources and social security development (2019)*, Ministry of Human Resources and Social Security, June 2020, mohrss.gov.cn.

Vocational training suffers from geographic, physical, and time constraints. Today, such training is mostly provided by educators within companies or in specialized training institutions. Most teachers are graduates with academic degrees and prepare teaching materials in a traditional way—on paper and chalkboard. This is no longer suitable for a very large workforce that has considerable physical and time constraints and finds it hard to attend courses in person. Broader use of digital technologies can decentralize the provision of educational and training resources, thereby overcoming both current uneven distribution and the constraints faced by workers. Shifts that occurred in response to the COVID-19 pandemic clearly demonstrate how quickly habits can change and how rapidly providers and consumers can adapt to and adopt new technologies. During the first five months of the pandemic, Ding Talk, for instance, supported more than 140,000 schools, 130 million students, and six million teachers, facilitating 60 million learning hours.[155]

High-quality educational and training content can be provided through online platforms—sometimes for free. For instance, students in the villages of Guizhou enrolled in courses run by Harvard University through a massive open online course (MOOC). Looking ahead, China could make fuller use of remote communication platforms, including MOOCs, and use them more heavily for vocational training. Scaling up this method of reskilling and raising the skills of the workforce is a priority for the future. China can also increase its use of remote communication platforms such as Zoom, Tencent Meeting, and Ding Talk. Education and training content providers can gear real-time communication platforms to vocational training and can promote vocational training on existing education platforms, including MOOCs, as well as social media channels such as WeChat and Weibo, short-clip apps such as TikTok and Kuaishou, and paid knowledge platforms such as Dedao and Ximalaya.

Digital technologies can help address accessibility issue in rural areas

There has been much discussion in China about how to address issues with access to education for people living in rural areas by using digital technologies. As noted, these technologies are available and are no longer a major bottleneck in rural China, because the government has acted to improve the digital infrastructure in these parts of the country and has published a plan for enhancing connectivity further (see Box 5, "Improving digital infrastructure in rural China").

The most significant challenge for the education and training systems is whether they adopt available digital technologies. Teachers in rural areas need to adapt to using these technologies and teach in a hybrid online-offline model, and the technologies must be deployed in a way that offers practical benefits to students, equipping them with the skills they need either in their local economies or in urban areas if they choose to migrate for work. We explore the following three ideas:

— **Train teachers in rural areas to adopt a hybrid model.** New models of digitally enabled teaching are already emerging in urban and rural areas, with two kinds of content providers. The first is urban schools. One example is Future China, a nonprofit organization that has collaborated with Chengdu No. 7 High School, one of the highest-rated high schools in Sichuan province. One dedicated class at the school is videotaped and streamed through Future China's digital platform to collaborating high schools in rural areas in southwest China. For these rural students, the content from Chengdu No.7 High School has replaced all offline traditional classes, and local teachers simply provide help after class. The second type of provider is nongovernmental organizations (NGOs) that tend to cover only one or two subjects rather than systematically replacing all classes, as urban schools do in some cases. One example of an NGO active in this area is QingXiYuanShan, a nonprofit organization that focuses exclusively on improving rural students' English-language capabilities. The approach is similar to that of urban schools. A certified English teacher conducts lessons from his or her office, and the class is streamed to rural schools using the organization's digital platform; local teachers are responsible for after-class facilitation. Although the distance-learning model seems to

[155] Chen Hang (CEO of DingTalk) public presentation, May 17, 2020, news.sina.com.cn.

Box 5

Improving digital infrastructure in rural China

The technological infrastructure in China's rural areas has improved significantly (Exhibit 28). By 2019, 99 percent of rural villages had installed networking broadband, and 98 percent had installed 4G fiber optic networks.[1] Internet coverage jumped from 28 percent in 2013 to 46 percent in 2019—a compound annual growth rate of 9 percent and double the rate of increase observed in urban China.[2] A technological infrastructure gap between rural and urban areas persists, but the government aims to close it by 2035 and to build "digital villages" by 2050.[3] It plans to complete the initial development of digital villages by the end of 2020 with 4G internet accessible to more than 98 percent of administrative villages and the digital economy rapidly growing in rural regions. By 2025, the government aims to establish entrepreneurial and innovation centers in rural areas. Its target is to complete the modernization of rural areas (and agriculture) by 2035, ensuring that urban and rural residents enjoy equal public services. By 2050, the government intends to complete the development of all digital villages. To make these plans a reality, it plans to accelerate the construction of IT infrastructure in rural areas, upgrading internet facilities and information services.

Exhibit 28

Technical infrastructure in rural areas has increased significantly.

Technical infrastructure coverage in China, 2019, %

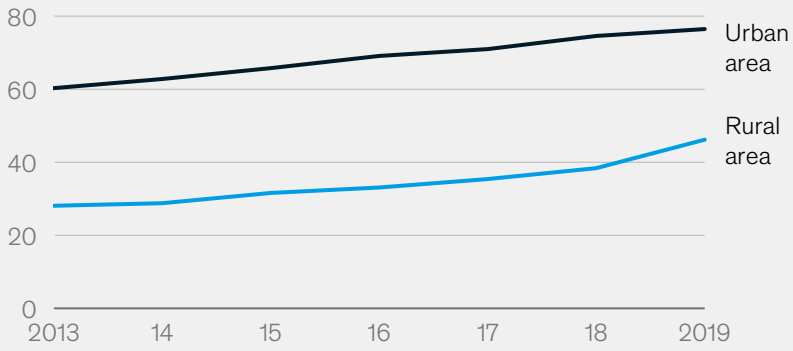
98%

of rural area villages have installed 4G fiber optic network

99%

of rural area villages have installed networking broadband

Internet penetration rate in China, 2013–19, %



1. The internet penetration rate is the percentage of the population of a country or region that uses the internet.

Source: *State Council digital village development strategy outline*, May 2019; *The 45th China Statistical Report on internet development, 2020*; McKinsey Global Institute analysis

[1] *The 45th China statistical report on internet development*, Office of the Central Cyberspace Affairs Commission, April 2020.

[2] The internet penetration rate is the percentage of the total population of a given country or region that uses the internet. Internet World Stats defines an internet user as an individual who has the capacity to use the internet with access to an internet connection, and the basic knowledge to use web technology.

[3] *China plans to boost rural development via digital technologies*, State Council of the People's Republic of China, May 17, 2019, english.www.gov.cn.

make sense, in reality it faces operational challenges. Teachers in rural areas tend to be unprepared for the shift from traditional teaching to the hybrid model, and they will need to be trained not only in technical skills but also in new teaching skills such as conducting review sessions and facilitating discussion sessions. To overcome teachers' potential reluctance, one option would be for governments to recruit more people to fill support roles, such as teaching assistants, preservice teachers, or volunteers from NGOs.

— **Help rural students to elevate skills that match the needs of the local economy.** Students can acquire locally relevant skills through digital platforms, potentially encouraging more of them to stay in local industries rather than migrating to cities, and thereby upgrading local economies. Many examples of this approach are in action in different geographies. In Estonia, the government-led platform Põllumajandusuuringute Keskus (PMK) uses big data technology to enable more efficient and precise resource management in farming.[156] The platform provides online and offline training in agriculture for farmers and tailored programs for K–12 students. In Taiwan, The Farmers' Academy is a government-led one-stop platform offering agricultural training, job matchmaking, job shadowing, knowledge sharing on innovation in agriculture, and even e-commerce.[157] One of the main focuses of the platform is coaching young people, an important effort because the country's agricultural workforce has aged significantly. The aim of the platform is to help upgrade Taiwan's agriculture through digitized means, attracting young people from rural areas to work in, and improve, agriculture in their home villages or towns.

— **Help rural students to establish pathways to urban jobs.** Even if more students gain skills relevant to their local economies, many of them will still migrate to urban areas for work, and they would benefit from additional education and skills training on top of the conventional K–12 education. Digital platforms are a useful way for students in rural areas to explore career opportunities in cities, understand which jobs would suit them best, gain practical skills, and be prepared. Platforms are emerging that offer a range of services beyond matching students to potential jobs, including training, career exploration, and experience sharing. In China, Ayibang is a nationwide hiring platform focused on housekeeping services (such as cleaning, tidying, cooking, babysitting, plumbing, and maintenance) that offers end-to-end services, from job search to hiring to training. At the job-search stage, the website lists openings in different categories and their requirements. For candidates not familiar with housekeeping services, it offers offline training with a fast and efficient online sign-up procedure, and certificates for those who complete the instruction. For qualified candidates, Ayibang makes matches with suitable jobs. Although Ayibang focuses on only one segment of the job market, it is a model that can be replicated for others. A second example is Tomoroe, a nonprofit digital platform offering vocational training to students through video clips and online streaming that users can access via mobile phone. Tomoroe recruits volunteers from all fields to provide career-related insights and training to middle school students. To date, the platform has benefited more than 2,000 students from 50 schools; over 1,000 volunteer teachers have been recruited. Tomoroe works with schools in rural areas by connecting with students largely through a digital device located on campus.

[156] PMK, pmk.agri.ee.
[157] The Farmer's Academy, academy.coa.gov.

Collaborative ecosystem: A sustainable model of collaboration can help address the gap between workforce skills and employers' needs

Some of the quality gaps and instances of unclear pathways from education and training into employment reflect a lack of interaction between the two worlds, which could be eased by more collaboration.

China can build a more sustainable collaborative model for its education and skills development systems to address the current disconnect between education providers and the government on the one hand and employers on the other hand. This disconnect is present largely in the realm of vocational training, but also, to a more limited extent, in education. It often seems that different players operate in parallel universes, and this has the effect of perpetuating a large gap that separates educational outcomes and skills learned from what the economy really needs. Education and training providers tend to develop content with little regard for what employers are looking for, and those employers have little input. Curricula sometimes tend to be outdated and impractical. In one study, a majority of vocational school representatives in China said the schools' content needed to be improved so that it aligns with industry.[158] Some of the key issues of a failure to collaborate and bridge the divide between educators and the market include the following:

— **Lack of facilitation in fostering partnerships.** In one study, representatives of about 39 percent of vocational schools said they find it difficult to forge successful cooperation with employers.[159] Most vocational schools have a restricted view of employers' needs and have insufficient resources to develop relevant knowledge. For researchers and professors, there are limited opportunities to commercialize frontier technology developed in the lab or in an academic institution, largely because of regulations and a lack of incentives. Before 2016, the entire faculty of higher education institutions was prohibited from working in industry, even part time. In 2016, the State Council loosened these restrictions and enabled some researchers and professors to work part time in industry, but the restrictions were left in place for others.[160]

— **Insufficient time spent outside the classroom on internships.** China's current vocational education system is largely a "2.5+0.5" model. In a three-year program, students spend 2½ years in classrooms learning foundations and theory, and only six months on internships or work experience with employers. In most cases, cooperation with industry goes in only one direction—schools contact enterprises and send students to them for internships. Once students arrive at the businesses, all vocational training is handled by the company with little input from the schools. Interns often undertake simple tasks with little genuine training, and they leave with little improvement to their vocational skills and professionalism.

— **Lack of private-public collaboration to address specific areas of skills shortages.** China's Ministry of Education has identified 15 sectors that are facing skills shortages in the period to 2030 (see below for more detail). The government has announced policies to develop skills in these key sectors, but there is more room to enhance collaboration between the private and public sectors to address current shortages. Limited collaboration between academia and industry leads to supply-demand mismatches in core skill areas. Take China's booming integrated circuit industry as an example. According to a State Council paper, the industry is growing at 20.3 percent a year but faces an annual shortage of 100,000 people with the right skills.[161] There are, in fact, 200,000 college graduates who have studied relevant majors, but fewer than 30,000 of them go into the industry. This largely reflects a widespread lack of awareness about opportunities because information channels between the higher education institution and industry players are limited. There is potential for more collaboration between universities

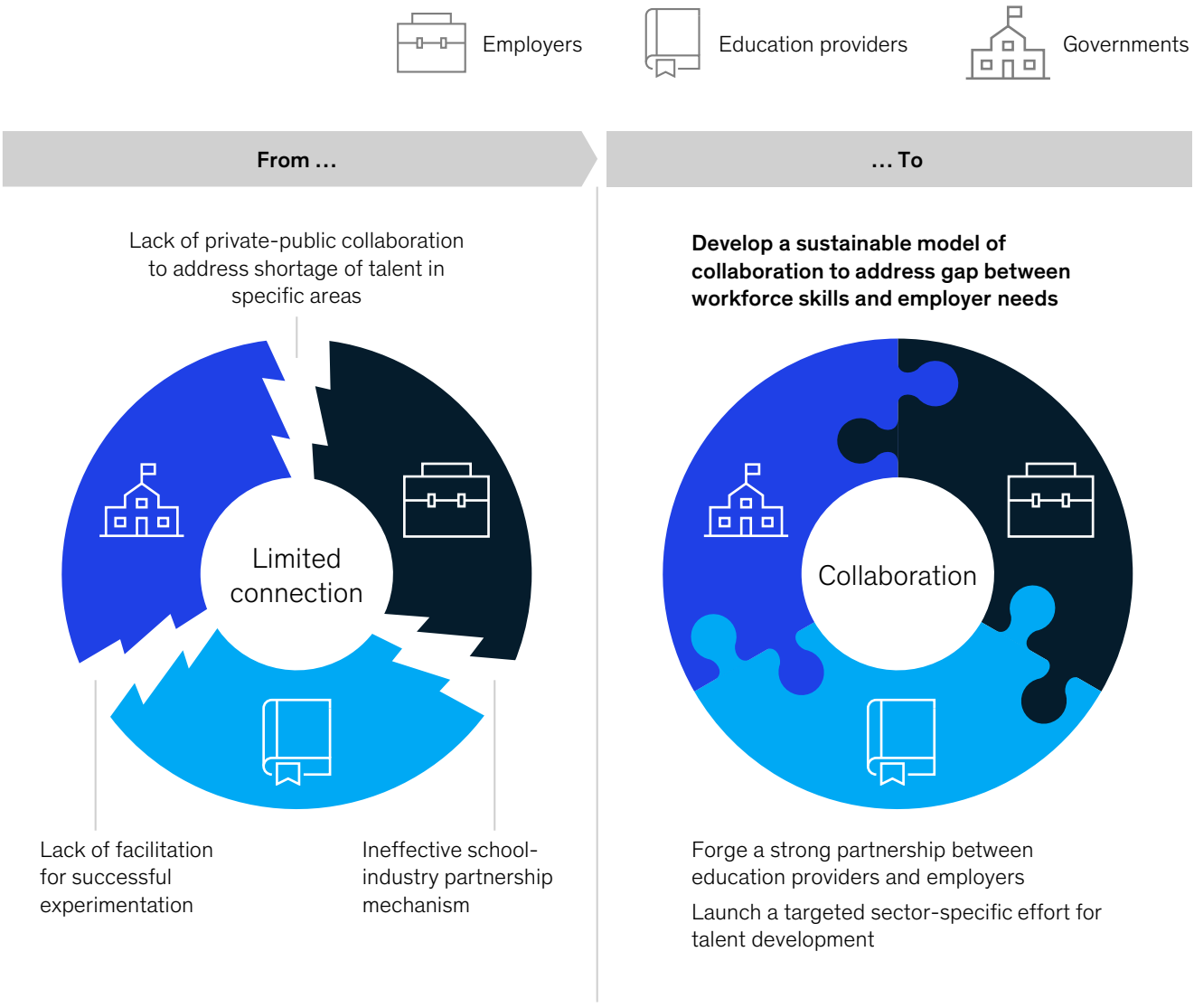
[158] *Welcoming Industry 4.0 white paper on the development of Chinese vocational education*, TÜV Rheinland, September 2018.
[159] Ibid.
[160] *Several opinions on the implementation of a distribution policy oriented to increasing the value of knowledge*, State Council of the People's Republic of China, November 2016, gov.cn.
[161] *China's IC industry white paper (2017–2018)*, State Council of the People's Republic of China, August 2018, gov.cn.

and employers—for instance, short internships with companies could be embedded into the academic curriculum.

China's government has already taken steps to address gaps in collaboration but has thus far not succeeded in establishing a model that works. Two priorities stand out that could be part of a sustainable long-term partnership model: (1) forge a strong partnership between education, especially vocational training providers, and employers; (2) launch targeted sector-specific efforts to plug skill gaps and encourage experimentation in priority cities and clusters (Exhibit 29).

Exhibit 29

Broad benefits would come from sustainable partnership among employers, education providers, and governments.



Source: McKinsey Global Institute analysis

Forge a strong partnership between education and training providers and employers
Two potential measures highlighted here could help to meet the need for more and more effective partnerships between education and training providers and employers:

— **Form a coalition of 300,000 vocational training institution–industry partnerships.**[162] Enterprises need to play a more significant role in vocational education, committing themselves to participating in the design of curricula, training, and recruiting. China's National Vocational Education Reform Implementation Plan calls for businesses to have a role in running schools, for qualified enterprises (especially large ones) to offer high-quality vocational training, and for the establishment of vocational colleges and training institutions such as joint-stock and mixed ownership systems.[163] China has, in truth, been calling for companies to have a substantial role in vocational training since it started opening up the economy, but more can be done. Enterprises have generally been regarded as being outside the vocational education system; therefore, it is now key that companies assume a central role (see Box 6, "Case study: China MCC5 Technical School").[164] Multinational companies can also play an important role in developing a collaborative ecosystem for skills development. NIIT, an Indian company that focuses on IT training, offers curricula in more than 150 Chinese universities and colleges, and has worked with local governments on operating more than ten IT training centers in software parks and industry hubs. Over the past 20 years, more than half a million students have been trained in IT and tech skills.[165] The government can act as a bridge between educators and employers, encouraging collaboration. In Singapore, for instance, the government offers a program called Career Trials, in which job seekers can gain experience through a short-term trial in different types of jobs. Participants receive a competency evaluation from the employer, and the government rewards the company if it retains the worker for more than six months. Employers pitch in some of the funding and enjoy the first option on hiring—and can avoid recruitment costs, which is an attractive byproduct.[166] Some similar models are operating in China. For instance, the Beijing Fengtai Ministry of Human Resources and Social Security established an employment center to train large numbers of unemployed housewives in a range of roles, from taking care of newborn babies to advanced housekeeping skills.[167]

Box 6

Case study: China MCC5 Technical School

The China MCC5 technical school was established in 1965 by a subsidiary of the China Metallurgical Group (MCC), a large state-owned enterprise headquartered in Beijing that is a world leader in iron and steel and construction. The school has been a lasting success because of its close relationship with MCC.[1] It was well resourced and affords access to experienced professionals—70 percent of the school's 2,300 educators have both academic knowledge and mid- to senior-level credentials in the industry. Moreover, students have a very high chance of being employed by MCC; over the past five years, the employment rate of MCC5 students has been 98 percent.[2] The school has nurtured more than 40,000 graduates who are employed as technical professionals in 20 cities in China. In 2019, 10,000 students were enrolled. Upon graduation, students receive at least three years of mentoring.

1 MCC5 Staff University of China, zgwyzd.com.
2 Popular College Enrolment Information Network, schkxy.net.

[162] This assumes about 200 partnerships per school for each of the roughly 1,400 tertiary vocational schools.
[163] *National vocational education reform implementation plan*, State Council of the People's Republic of China, gov.cn.
[164] MCC5 Staff University of China, schkxy.net.
[165] Russell Flannery, "This Indian company has provided IT training to more than 500,000 Chinese," *Forbes*, September 9, 2018.
[166] *Career Trial*, content.mycareersfuture.sg.
[167] *Fengtai district's new initiatives to help citizens get new jobs*, Fengtai District People's Government of Beijing Municipality, bjft.gov.cn.

— **Develop a dual vocational education system.** Germany's dual vocational training system is recognized around the world for its combination of classroom-based study in specialized trade schools and on-the-job work experience that accounts for a significant share of vocational training in the country. Over the course of two to four years, apprentices spend a couple of days a week, or even blocks of several weeks at a time, at a vocational school where they obtain theoretical knowledge. They tend to spend 60 percent of their time in the workplace under the supervision of a certified trainer and 40 percent in the classroom.[168] The system is highly effective because students have opportunities to practice vocational skills and therefore have robust practical abilities. World Bank research has found that the dual training system leads to a significantly higher rate of return on labor-market earnings than classroom-only programs.[169] Moreover, employers enjoy lower recruitment costs. China could adopt this model. The government could introduce policies and incentives to foster a dual system, codeveloping the new model from educational centers to teachers, defining the roles and responsibilities of stakeholders, and embedding a mechanism that provides for instant feedback on content and teaching methods to ensure quality and effectiveness. China's Taicang secondary vocational school has already pioneered the dual system with considerable success (see Box 7, "Case study: Taicang secondary vocational school").

Box 7

Case study: Taicang secondary vocational school

The Taicang secondary vocational school has successfully adopted Germany's dual training system, developing partnerships and setting up training centers such as DAWT.[1] Established in 2001, DAWT is co-owned by the school, the Taicang government, and leading auto engineering companies Kern-Liebers and Mubea. The German government worked with the government of China to facilitate the project, ensuring that the Chinese version of the dual system drew directly on Germany's experience. The school and the two engineering companies codeveloped the curriculum, guidelines, and evaluation model, as well as sharing training costs; each spent on average 60,000 renminbi per student. Overall, partner firms fund the school to the tune of 57 million renminbi, which is just over half of total funding.[2] The Chinese government backed the scheme with 20 million renminbi a year as an incentive for firms to invest in, and partner with, vocational schools. Grants of two million renminbi are available for creating a dual training system platform. Schools also receive 15,000 renminbi for each student enrolled, which is the equivalent of 20 percent of an enterprise's total cost. The split between classroom and in-work study is the same as in the German system. The school has achieved a 100 percent pass rate on the AHK, a rigorous German-standard engineering exam, and a 95 percent employment rate in students' desired professions.[3] More than 90 percent of the school's mechanical engineering teachers have mid- to high-level credentials.[4]

1 DAWT, kern-liebers.com.cn.
2 Jiangsu Taicang Secondary Vocational School, tczz.news.tcedu.com.cn.
3 *2019 report*, Jiangsu Taicang Secondary Vocational School, tczz.news.tcedu.com.cn.
4 Ibid.

168 Paul Hockenos, *How Germany's vocational educational and training system works*, Clean Energy Wire, November 16, 2018.
169 Takiko Igarashi and Pablo Ariel Acosta, *Who benefits from dual training systems? Evidence from the Philippines (English)*, World Bank, Policy Research working paper WPS8429, May 2018.

— **Deepen partnerships between industry and universities to drive frontier innovation and enhance skills development through targeted programs.** Collaboration between academia and industry has long been known as an important lever for driving innovation and improving student outcomes, and it is particularly relevant for any long-term innovation agenda. In other regions of the world, academia increasingly collaborates with industry on research. Joint patent applications are a typical indicator of such collaboration. For instance, the number of European Patent Office applications filed jointly by education providers and industry grew by 6 percent, compared with 1 percent in university-owned patent applications, during the period from 2005 to 2014.[170] In the United Kingdom, Imperial College receives corporate funding for a wide range of activities, including research, and employs faculty-based contract negotiators who confer with companies. The university has attracted more than £200 million over the past five years from corporations.[171] Sweden's Uppsala University explicitly invites companies to commission research—a practice known as co-creation—as part of its funding mix. The university holds "access days" during which researchers and companies (especially small and medium-size enterprises) meet to learn about one another.[172] UU Innovation runs a business incubator in its business development program.[173]

Some examples of collaboration between universities and industry partners have emerged in China. Many ideas from research in universities are put to use through collaboration with firms. Others reach the market through licensing or startup companies. China has four types of academia and industry collaboration that could be emulated and scaled up.

- **Research focused.** Corporations support contract-based research by faculty members at academic universities largely by helping them with funding. For example, DJI, a commercial drones maker, launched a joint innovation laboratory with the Hong Kong University of Science and Technology to drive further advances in unmanned aerial vehicle technology.
- **Curriculum design and teaching.** Universities provide expertise in course design and bring useful perspectives from students and faculty members to industry players. In exchange, employers provide the latest market insights and real-world experience, and spend some of their time teaching courses while working in industry. For example, Tencent and Beijing University of Posts and Telecommunications codeveloped a course on social media that targeted new students majoring in information systems.[174]
- **New programs.** Academic universities and employers form a strategic partnership in which they jointly recruit, design courses, conduct research, and collaborate on job placement for students. For example, in 2016, Baidu and Xi'an Jiaotong University codeveloped a big data/AI program that included online and offline courses along with competitions in which students analyze case studies.[175]
- **New schools.** Academic universities and employers co-found a new school that offers multiple degrees. For example, Alibaba Group and Hangzhou Normal University co-founded Alibaba Business School with four bachelor degrees: e-business, international business, marketing, and supply-chain management.[176]

[170] *University-industry collaboration: New evidence and policy options*, OECD, 2019, doi.org.
[171] *Industry partnerships*, Imperial College, London, imperial.ac.uk.
[172] *Advice and support for contacts and collaborations*, UU Innovation, Uppsala University, uuinnovation.uu.se.
[173] *Innovative spinoff companies from Uppsala University funded by Vinnova*, Uppsala University, May 29, 2018.
[174] *Partnership between BUPT and Tencent to accelerate the application of emerging internet technologies in schools*, Tencent News, January 2019, new.qq.com.
[175] *Strategic partnership between XJTU and Baidu on talent development in AI industries*, XJTU News, August 2018, news.xjtu.edu.cn.
[176] Alibaba Business School, abs.hznu.edu.cn.

15

sectors face skills shortages in period to 2030

Launch a targeted sector-specific effort for talent development

As noted, China's Ministry of Education has identified 15 sectors that face skills shortages in the period to 2030. Ten of these are industrial sectors, namely next-generation IT, advanced computer numerical controlled machine tools and robotics, aviation and aerospace equipment, marine engineering equipment and high-tech vessels, advanced rail transport equipment, new energy vehicles, electric power equipment, agricultural machinery equipment, new materials, and biomedical and high-performance medical devices.[177] These ten sectors are facing a talent shortage of nearly 30 million people according to government estimates. Five are service sectors, specifically the traditional Chinese medicine health industry, housekeeping services, eldercare service health management, and childcare and education. One way to meet the challenge of these shortages would be to form public-private partnerships focused on developing the talent needed and industry associations devoted to reskilling.

— **Form public-private partnerships in key sectors.** Public and private players could work together to develop and launch talent incubation programs in the ten manufacturing industries that face skills shortages over the coming years, together identifying what talent is needed, conducting workforce planning, and developing curricula with educational providers. One example of a successful partnership along these lines was the Brazilian Oil and Gas Industry Mobilization Program (Prominp), set up by a coalition of government agencies, private companies, industry associations, and unions in 2003.[178] The members of Prominp included Brazil's minister of mining and energy and minister of development, industry, and international trade; the presidents of Petrobras, the country's largest oil company, and the Brazilian National Development Bank; the Brazilian Institute for Petroleum; and the general director of the National Organization of Industry. The objective of this partnership was to plan systematically for the staffing and skills requirements of the country's oil and gas industry. The partnership detailed how many people and what skills would be required when and where in the industry across Brazil by analyzing a five-year pipeline of projects in the industry. Prominp then identified a provider with a strong track record in each field to work with selected companies to develop a curriculum. It sponsored about 30,000 students a year and, by the end of 2012, had awarded qualifications to 90,000 people in 185 professional categories, from the basic level to the graduate level; about 80 educational institutions were involved.

— **Industry associations can step up to provide reskilling programs.** Transformative partnerships are made up of leading companies in specific sectors forming an industry association and working with education providers to develop training standards, design adaptable and high-quality training content, and provide training and human resources consultancy services to small and medium-size enterprises. An example of such an industry association is the Society of Motor Manufacturers and Traders Industry Forum, established in 1996 by the government of the United Kingdom.[179] Initially, the association focused exclusively on the automotive industry, but it then branched out to represent companies in other industries including aerospace, electronics, food and drink, industrial components, and industrial products. The forum has ten partners, including the Automotive Council UK; Germany's automotive industry association, VDA; and the Japan Institute of Plant Maintenance, as well as more than 800 corporate members. It provides consultancy services on topics such as competitive strategy and supply-chain management. It is active in 30 countries on five continents, has delivered consultancy to 400 companies, and has trained 25,000 people.

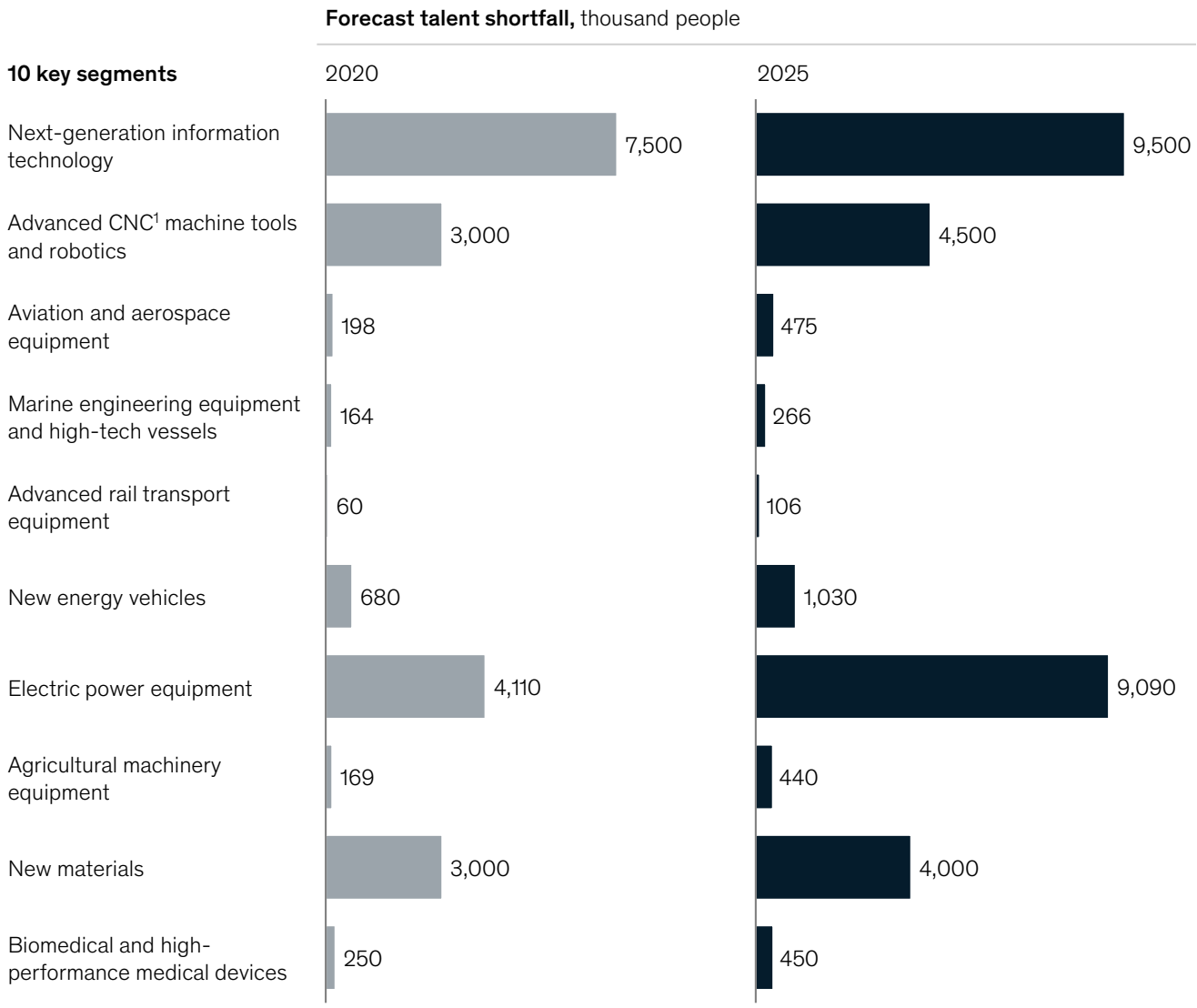
[177] *Manufacturing talent development planning guide*, Ministry of Education, Ministry of Human Resources and Social Security, and Ministry of Industry and Information Technology.
[178] *Education to employment: Designing a system that works*, McKinsey Center for Government, January 2013.
[179] *Our history*, Industry Forum, industryforum.co.uk.

— **Encourage targeted efforts at local level.** Given that each city has a different context, industry profile, and development plan, pilots can be designed at the local level. For example, we identified 30 cities that had high manufacturing-sector GDP in 2018 that could be relevant, especially to fill the talent gaps in the ten sectors identified (Exhibits 30 and 31). Special training zones could also be scaled to cover service sectors.

An example of the kind of approach that could be pursued is the Sichuan Deyang high-tech experimental zone, established by the Sichuan government in 2013, which serves as an incubation hub of manufacturing and industrial companies (see Box 8, "Case study: Sichuan Deyang high-tech experimental zone"). [180]

Exhibit 30

Talent shortfalls are forecast in key areas of the manufacturing industry.



1. Computer numerical controlled.

Source: Ministry of Education; Talent Development Planning Guideline for Manufacturing Industry; McKinsey Global Institute an alysis

[180] Deyang National High-Tech Industrial Development Zone, gxq.deyang.gov.cn.

Exhibit 31

Cities across China can launch programs to address talent shortfalls in key manufacturing segments.

Cities with potential to drive sector-specific efforts

Note: The boundaries and names shown on this map do not imply official endorsement or acceptance by McKinsey & Company.
Source: McKinsey/United Nations (disputed boundaries); Ministry of Education; Talent Development Planning Guideline for Manuf acturing Industry; McKinsey Global Institute analysis

Box 8

Case study: Sichuan Deyang high-tech experimental zone

The Sichuan Deyang high-tech experimental zone is a three-way partnership between enterprises, vocational schools, and the provincial government that collaborate on a variety of projects. For instance, the local government of Deyang worked with Siemens in Shanghai and the Sichuan Engineering Technical College on the construction of the German company's high-end equipment-intelligence manufacturing innovation center, where vocational training is also on offer. In 2014, there were 641 enterprises and 236 factories in the zone, as well as two technical schools, five higher vocational schools, and 30 secondary vocational schools. Many schools have contracts with enterprises guaranteeing students employment. Sichuan Engineering Technical College has partnered with 800 employers, offering 47,000 positions, and received 135 million renminbi of investment from enterprises for innovations in education. The school greatly benefits from the enterprises in the experimental zone (and vice versa) and has a 96.2 percent employment rate among its graduates. Examples of companies that have contracts to give jobs to students at the Sichuan Engineering Technical College are Geely Holding group (signs 107 graduates), China Construction First Group (60 graduates), and Beijing Automotive Group (39 graduates).

Vocational tracks: Competitive, flexible educational pathways and making educators with industry experience the norm could more effectively develop talent

Vocational education and training in China face a range of challenges that need to be overcome, including the broad problem of social bias against this pathway. The specific challenges include the following:

— **Quality gaps and inflexible pathways.** As noted previously, vocational training in China suffers from a social bias toward academic education, outdated curricula, and the difficulties faced by workers who lack the time and money for vocational courses. Adults who are already in the job market have limited channels to receive retraining, upgrade their skills, and transition from low-skill jobs to higher-skill positions. Although there are unconventional ways to acquire a degree or skills—through distance learning programs, for example—companies do not tend to give full credit to those degrees. This means that workers have limited mobility to improve and switch careers. More flexible pathways—that are acknowledged by employers—are needed.

— **Shrinking pool of educators and a lack of industry expertise.** The number of full-time educators in secondary vocational schools fell from 867,000 in 2010 to 842,000 in 2019, a decline that partly reflects the fact that local governments have withdrawn support for secondary vocational schools that have poor qualifications and facilitated merging some schools. Teachers in vocational schools tend to lack industry experience and expertise as noted.[181]

[181] *Welcoming Industry 4.0 white paper on the development of Chinese vocational education*, TÜV Rheinland, September 2018.

To overcome these challenges, we see two priorities. First is to design a competitive and vocational education pathway to equip students with skills required in industries while allowing multiple entry points into vocational training, with more flexibility to help ensure access and feasibility for many more workers. The second is to develop a larger number of talented teachers with industry experience and to cultivate relationships with the business community so that those instructors can stay up to date with practical knowledge.

Design a competitive path for future industry experts

China can take action to improve public perception of vocational education by enhancing the competitiveness of the programs and elevating the status of skilled workers. One option that may help to attract more middle and high school graduates to the vocational track could be to introduce a secondary-undergraduate "3+4" vocational model that does not include gaokao testing. Students who enroll in such programs could go directly to application-oriented universities after three years of study at secondary vocational school. Application-oriented universities will still offer bachelor's degrees, but the curriculum and training will focus less on theoretical knowledge and more on practical skills. China's Ministry of Education has announced that it will transform hundreds of traditional academic universities into application-oriented universities. Such a model could encourage students who are not particularly suited for academic paths to go for an option that gives them clear job opportunities at the end of their training. This model is already being pioneered in China by Shandong and Zhejiang provinces. In Shandong, 41 secondary vocational schools are partnering with 21 local universities to create secondary-undergraduate 3+4 programs.[182] Students who finish three years of secondary vocational education and are accepted onto the program do not need to take a gaokao test, instead going directly into a four-year bachelor's degree at a partner university. In 2020, 2,690 students in Shandong are targeted to enroll in the 3+4 program, and many more are expected to do so in the years ahead.

41

secondary vocational schools in Shandong partnering with 21 local universities on 3+4 programs

Develop vocational training programs with multiple entry points that offer flexible pathways

The hurdles that many Chinese workers face when contemplating whether they should join a vocational training program include the time it takes and the difficulties of getting to a particular geographic location. Flexibility is therefore key, and a system with multiple entry points is needed. Programs need to be flexible and relevant in their design to make them worthwhile for those who are already employed, and of high enough quality to overcome misgivings about the usefulness of vocational training. There are examples of vocational training institutions that are designed specifically for the adult student, including the University of Phoenix in the United States. Established in 1976, the University of Phoenix is North America's largest private university whose core mission is higher adult education. The entire curriculum and learning modules are designed for adult learners. Courses tend to be five to six weeks in duration and largely conducted online. There are no scheduled meeting times, and therefore coursework can be juggled with work and family life. Courses can be accessed by anybody with an internet connection, and the university offers a digital library from which students can download textbooks and journals. The university conducts an assessment of previous learning so that students can use credits from employment (including working for the military) and life experience to count toward their degree.

[182] *Notice on the issuance of the 2020 vocational schools and universities pairing and segmented training pilot*, Shandong Provincial Department of Education, May 2020, edu.shandong.gov.cn.

8.6M

students enrolled in web-based distance learning programs in 2019

China has similar programs. Since 2000, the Ministry of Education has approved proposals by 68 higher education institutions to establish online colleges. In 2019, 8.6 million students enrolled in web-based distance learning programs, and 2.3 million students graduated.[183] While officially recognized by the Ministry of Education, distance learning education does not have the same level of public recognition as regular universities. Moreover, it typically takes 2.5 years to five years for students with a postsecondary education to graduate. In a 2019 government policy discussion, the Ministry of Education highlighted several problems in distance online education. For instance, some schools haven't set proper admission policies or criteria, instead prioritizing profit by promoting and offering online programs to anybody willing to pay. Curricula are sometimes outdated and not designed to maximize students' potential or promote vocational skills. The evaluation system doesn't properly reflect the knowledge acquired or skills developed by students. All of these factors not only undermine students' learning experience but also affect the public's recognition of a degree or diploma.

Another important element is embedding career planning and apprenticeship programs into the work of vocational institutions so that students have the information they need about what jobs might be available as well as counseling on what type of career might suit them. One institution that has a particularly strong career service is the Pittsburgh Institute of Aeronautics in Pennsylvania, United States.[184] This technical school embeds a career services center into its vocational program, with good links to local employers. Students regularly have one-on-one meetings with career services staff members, who assist them with career decisions, expectations, and planning, looking at the industry's past and future trends, salaries, wage fluctuations, and demand for particular skills. In 2019, 95 percent of the school's 207 graduates were employed.

Expand the pool of high-quality educators

To attract more high-quality teachers into vocational education, measures can be considered to improve their compensation as well as their exposure to industry practice and up-to-date knowledge. Other countries have taken action on these fronts. In Germany, the vast majority of teachers are employed by state schools and are categorized into pay grades A12 to A16. Vocational teachers are often in higher salary groups (A13) than teachers at secondary schools (A12). Moreover, because vocational teachers tend to have more work experience and are more likely to take a senior position, they earn more.[185] In the Indian state of Goa, vocational teachers' pay has increased to match that of high school teachers.[186]

To improve and update the industrial knowledge and expertise of vocational instructors, schools could collaborate with enterprises to provide on-the-job training and coaching programs in a company environment, as Finland's Telkkä program does.[187] The program "enables instructors to develop their pedagogical skills by cooperating with teachers while teachers benefit from instructors' up-to-date knowledge of recent technologies and working practices" through two months of on-the-job training in a company environment. Through Telkkä, teachers update their curricula to incorporate new practices and knowledge, so students can benefit by having more relevant classes preparing them to enter their careers. Similar efforts are made in China, too. Vocational schools in Zhangjiagang in 2020 put more than 200 professional teachers covering fields as diverse as accounting, electrical engineering, finance, logistics, and computer engineering through an enterprise internship program.

[183] Wei Li and Na Chen, "China," in *Open and distance education in Asia, Africa and the Middle East*, Olaf Zawacki-Richter and Adnan Qayyum, eds., SpringerBriefs in Education, Springer, 2019.
[184] *The value of a PIA education*, Pittsburgh Institute of Aeronautics, pia.edu.
[185] Julia Holzapfel, *How much does a teacher in Germany earn?*, Academics, May 2017, academics.com.
[186] *Vocational teachers with over 5 years to be regularized: CM*, Herald, August 12, 2015.
[187] Pia Cort, Auli Härkönen, and Kristiina Volmari, *PROFF – Professionalisation of VET teachers for the future*, Panorama series number 104, European Centre for the Development of Vocational Training (Cedefop), 2004.

It is important to encourage skilled workers to teach at vocational schools to share industry insights and experience with students. This is the approach taken by the Teach Too program in the United Kingdom, which is funded by the Education and Training Foundation.[188] The program runs initiatives that encourage cooperation between schools and companies. It has supported and evaluated 17 demonstration models and more than 40 development projects in the first two phases. For instance, Carshalton College collaborated with Mirobot, a small robotics company, to develop the IT curriculum, raise the skills of the teaching staff, and encourage workers to teach at the school. Students were more motivated by listening to and learning from an industry specialist, and they greatly improved their grades.

These changes can improve the outcome of training, which, in turn, creates a virtuous cycle to make the vocational track more competitive. Social bias against vocational training may be even stronger in Asia than in other regions because educational credentials are more closely tied to social status than is typically true elsewhere. In Singapore, vocational education was for a very long time viewed as targeted to less gifted students, and the government set out to dispel this perception from the 1980s onward with a program of boosting the profile of vocational training through public relations campaigns and substantial investment in technical schools. This effort proved successful—today, equal numbers of students choose to enroll in universities and polytechnic schools.[189] Healthy competition among vocational schools can also lead to the creation of top-tier vocational learning from which graduating workers can access commercially attractive jobs. If this model were pursued, it could help to overcome the current stigma of vocational courses and attract more students to them.

Design multitrack options for faculties in higher education to drive frontier innovation while enhancing the quality of teaching

China could refine incentives designed to encourage faculties to explore different combinations of scholarly activities and collaborations with industry. Multitrack career ladders could be established, with corresponding key performance indicators and collaboration with industry being a performance metric, an approach taken by the National University of Singapore. The university introduced a multitrack system in 2007 that recognizes different types of scholarship and skills.[190] The tenure track requires both teaching and research. For teaching, performance is evaluated based on student feedback and peer reviews made by other professors sitting in on their colleagues' classes and lectures. For research, performance is evaluated based on peer reviews in the form of letters of reference by experts in the field as well as impact of research contributions (for instance, publications, grants, and awards). There is also an educator track devoted almost 100 percent to teaching in which performance is evaluated entirely based on instruction. The university also offers a practice track for those who have professional skills and expertise in industry that complements teaching and research at the institution. Individuals on this track may be senior industry experts and top managers. Clinician-scholars at the university's medical school spend about 60 percent of their time teaching and the other 40 percent on clinical activity. Finally, the university has a research track for scholars who spend more than 60 percent of their time on research and have a much lower teaching requirement than those on the tenure track.

[188] *Teach Too: Carshalton College with Mirabot*, YouTube, March 2, 2016, youtube.com.
[189] *The Phoenix: Vocational education and training in Singapore, International comparative study of leading vocational educational systems*, Center on International Education Benchmarking, October 2012.
[190] The National University of Singapore, nus.edu.sg.

Another opportunity is enabling mobility between faculties and industry—in both directions—through staff exchanges, part-time positions, sabbaticals, honorary positions, and financial or statutory incentives. This can help students learn cutting-edge, relevant knowledge from industry. In Belgium, for instance, the Interuniversity Microelectronics Centre introduced an "industrial residents" concept that allows workers from industry to pursue academic work to refresh their knowledge—a model known as a research hotel. This approach also is a way for industry and academia to exchange knowledge and enable researchers to move between the two.[191]

Mindset shift and incentive schemes: Individuals and employers need to be enabled to have a lifelong learning journey

The importance of skills needs to be further elevated, and a culture of lifelong learning needs to be developed and nurtured to help motivate a broad-based increase in skills. To achieve such a transition will require a shift in mindset to one that acknowledges the importance of continually learning, training, and refreshing skills throughout life. In the current model, a person's learning curve gradually flattens out after graduation and skills all too easily become outdated, limiting career advancement and opportunities to transition to different types of work. In the lifelong-learning model, the individual's learning curve would evolve continuously, enabling a more dynamic career path.

We see two main interventions that could help drive a shift toward lifelong learning. The first is developing a platform that can offer relevant information for students and workers to help them navigate the journey of lifelong learning. The second is encouraging—and designing—an alternative microcredential system that can be recognized and used for skills development and for those transitioning between jobs.

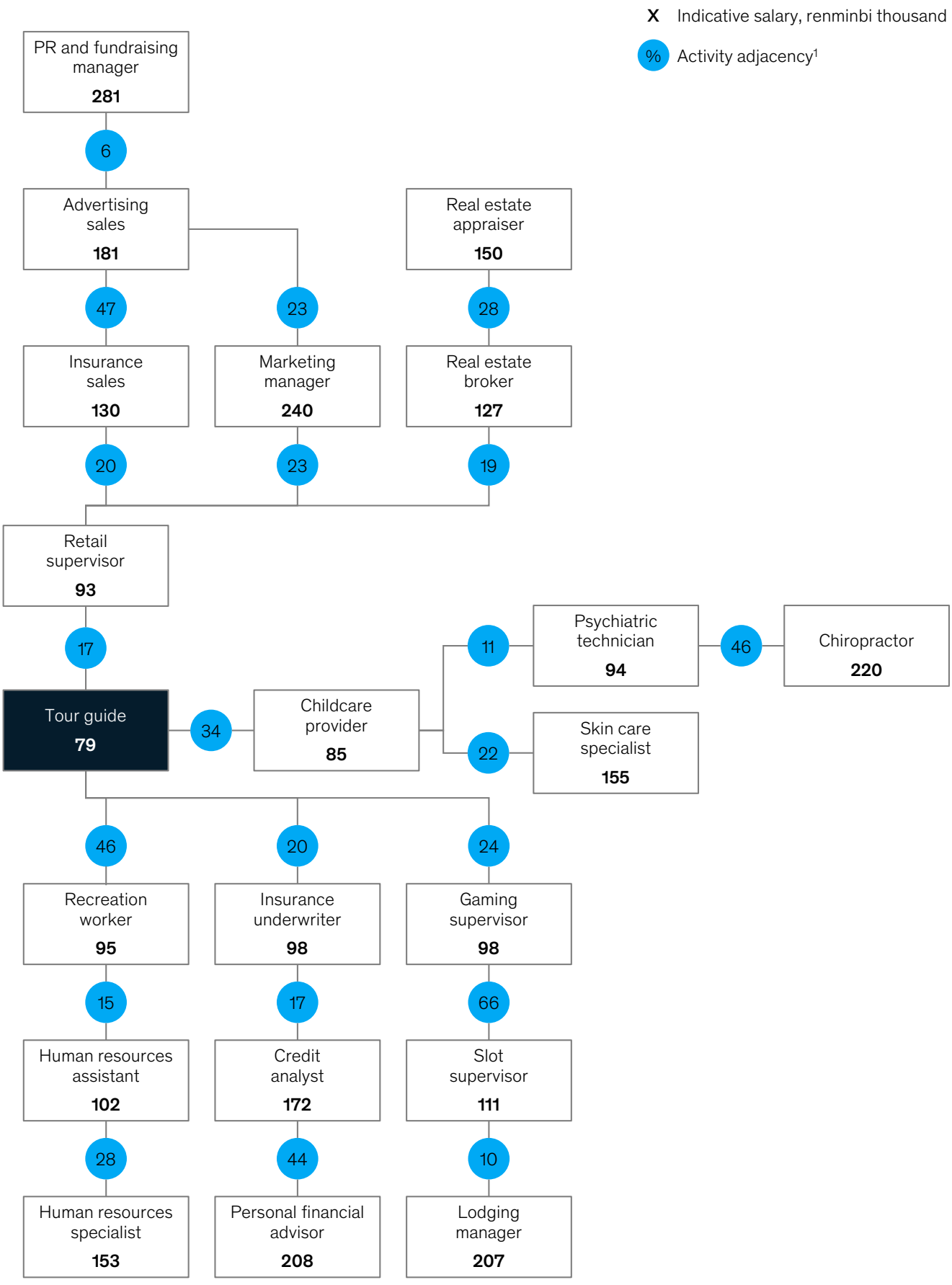
Individuals can leverage various tools to shape their lifelong learning journeys
Capability and information platforms can help individuals navigate the potential journey of career transition, obtain relevant information on where and how to acquire skills that are in demand, and make informed decisions about career choices. It can significantly change workers' lives. In many cases, individuals do not even know how to start the journey. Information platforms that help navigate pathways and build necessary capabilities can guide workers to shape their lifelong learning and successfully manage necessary skills transitions. As an illustrative example, we picked the case of a tour guide who experienced a substantial loss of income due to COVID-19. A navigation platform can offer multiple pathways based on adjacent activities. A successful transition could triple the travel agent's salary. A platform can show the path as well as where to acquire relevant skills (Exhibit 32).

[191] *Mobility of researchers between academia and industry: 12 practical recommendations*, European Commission, 2006.

Exhibit 32

Information platforms can guide pathways for job seekers.

Illustrative



1. Minimum time worker in each occupation spends doing activities performed by its adjacent occupation.

Source: O*Net; McKinsey Global Institute analysis

Individuals can shape learning journeys and career paths using information and career navigation platforms

Public- and private-sector players can provide information platforms at the same time that they strengthen the skills training they offer, and individuals can actively leverage the platforms to shape their lifelong learning journeys. When individuals are informed about their career options at an early stage, their chance of getting a job can improve. China could benefit from building an information platform to help students and workers with improved career planning and a better way of matching their skills to job openings. Government-sponsored career services have been around for a long time. For example, Job Bank, Canada's national employment service, can be traced to 1918, when it helped soldiers returning after World War I find work and reintegrate into civilian life.[192]

In recent decades, career information platforms sponsored by governments have emerged around the world, and the spread of digitization has enabled their growth and expanded the range of available services. Many platforms now offer three types of service: (1) quizzes and gamified assessments to help users establish their interests, personalities, and strengths and identify occupations that may be a good fit; (2) job profiles and market-trend analysis that goes beyond a standard list of jobs available to include detailed descriptions of tasks, the skills and educational attainment required, analysis of market trends such as wages and industry outlook by province and region, and posts by employers on industry or positions; such information enables users to narrow down career options and develop tangible learning plans; and (3) employment services, specifically job postings by employers and a job-search function, that give employers a new channel to advertise, brand, and recruit, and allow job seekers to identify opportunities.

Canada's Job Bank launched a modernized website in 2014 and a mobile application in 2018. Job Bank has expanded its offerings to include analysis of job-market trends and updated career planning featuring quizzes and assessments. In Singapore, the government sponsors the MySkillsFuture program, which offers learning and career information to all citizens. In addition to employment services, job market trends, and assessments, SkillsFuture enables education providers to post certified courses online.[193] Similar platforms are available in Australia (Job Outlook) and the United States (Career One Stop), which all offer the trifecta of assessments, job-market trends, and employment services. In the United States, people who lost their jobs due to COVID-19 used Talent Exchange, a platform launched in April 2020, to find alternative work. The platform uses AI to match candidates with available jobs.[194]

Companies can also offer tools to help individuals navigate the lifelong learning journey. In 2020, Microsoft launched a reskilling initiative that aims to help 25 million people around the world learn the digital skills they will need. The initiative offers a range of data sources that help people identify jobs that are in demand and the skills they need, obtain free access to learning, and pursue low-cost certification for those seeking work.[195]

[192] Job Bank, jobbank.gc.ca.
[193] MySkillsFuture, myskillsfuture.sg.
[194] *New at McKinsey*, "A new AI-powered network is helping workers displaced by the coronavirus crisis," blog entry, April 8, 2020, McKinsey.com.
[195] *Official Microsoft Blog*, "Microsoft launches initiative to help 25 million people worldwide acquire the digital skills needed in a COVID-19 economy," blog entry by Brad Smith, June 30, 2020, blogs.microsoft.com.

Individuals can use microcredential systems to acquire practical skills (beyond diploma programs)

There are, as we have noted, talent shortages in many areas of China's economy. Today, an academic degree is the primary way that companies can judge prospective employees, but clearly a broader way of judging applicants is needed. One option would be to elevate the non-academic degree into that evaluation and use a skills-based approach.

The United Nations Educational, Scientific, and Cultural Organization (UNESCO) has advocated for national qualification frameworks for technical and vocational education and training (TVET) for more than five years.[196] In this spirit, China has developed a "1+X" vocational training certification system, encouraging students to acquire required skills in addition to a degree. The Open University of China runs a credit bank system in which individuals can register and become certified with 518 training units and credits in 12 industries. These approaches have begun to embed the idea of a broader competency evaluation system, but more work needs to be done to persuade employers to recognize such evaluations. Singapore has a Workforce Skills Qualification framework that allows all workers to gain credentials in technical skills for 31 industries, from aerospace to waste management, and nine types of generic skills, from business management to occupational hygiene. The system offers bite-sized training modules to enable learning at the individual's own pace. Upon completion of each module, a statement of attainment is awarded. Citizens who attain a qualification are eligible for a cash award.

80%

of individuals who attended tech-company boot camps found a job using their skills

World-leading tech companies now partner with educational institutions to offer coding boot camps, for instance. These involve three to nine months of intensive work, at the end of which participants are deemed job-ready. Eighty percent of individuals who have attended such boot camps found a job that used their skills, and on average earned a salary of more than $70,000, far higher than the average among recent US college graduates of just under $50,000.[197] The United States has many different types of coding boot camps, which cost $12,000 to $20,000. Some of these camps are conducted in collaboration with employers, and the curriculum is often tailored to meet their specific needs. Many camps are experimenting with a deferred payment model in which learners pay a small fraction of the training fee at the beginning and the rest when they find a job. The coding bootcamp mechanism helps create an ecosystem in which employers, training institutions, and individuals all benefit from the flexible pathway and more skilled labor. Bootcamps are a relatively recent innovation, and more rigorous evaluation of their long-term benefits will be needed.

[196] *TVET qualifications frameworks*, UNESCO, en.unesco.org.
[197] Liz Eggleston, *2017 coding bootcamp outcomes & demographics report*, Course Report, December 2017.

Employers can enhance their reputation in the job market and boost productivity due to stronger skills and lower turnover among workers

The perception among employers in China is that investing in training and skills development may not offer a worthwhile return, but this misses the broader point that skilled workers are more productive, drive faster revenue growth, and accelerate the creation of value.[198] Armed with skills that help boost earnings, workers would be more satisfied. In other words, the short-term investment can offer significant benefit in the medium to long term if the programs are managed well. We conducted a simulation based on a hypothetical manufacturing company. This exercise suggests that a company that invests more aggressively in reskilling could achieve a 5 percent increase in net present value of profit over the next ten years (Exhibit 33). Investment in training can benefit the company in many different ways. Previous research has shown that the productivity premium for a trained worker is an estimated 23 percent, and that this premium leads to faster revenue growth and higher profit margins.[199] By investing in training, a company also benefits from lower turnover. Research suggests that direct replacement costs can reach as high as 50 to 60 percent of an employee's annual salary, and total costs associated with turnover range from 90 to 200 percent of an annual salary.[200] Investment in employee training can also confer a range of intangible benefits on the company. For instance, a company that provides sufficient learning opportunities to its employees will become more competitive in the job market and be more attractive to individuals with the skills the company may need.

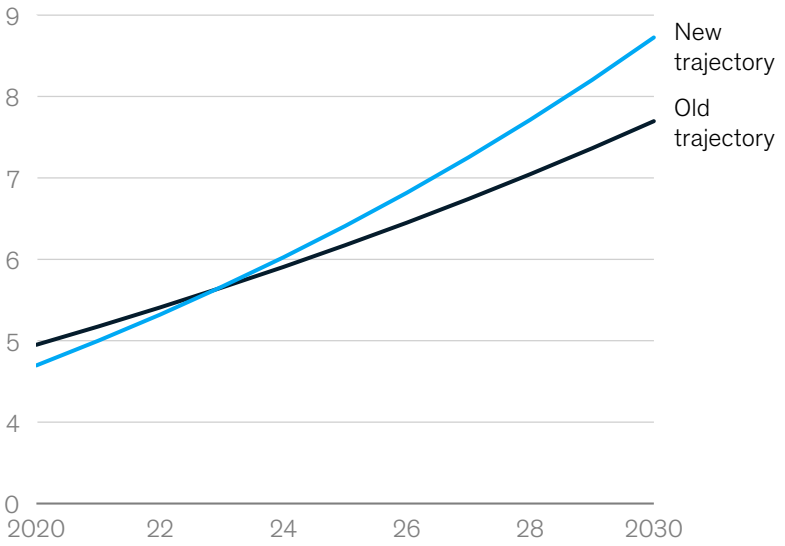
Exhibit 33

Mindset and incentives: Simulation of the company perspective.

Illustrative case: Manufacturing company

Investment in employee reskilling leads to more sustainable profit growth in the long term

Net profit, $ million



- Investment in reskilling may lead to the same net profit level in year 3
- With government subsidy, the timing may accelerate

What we need to believe to make the business case work

5–10% higher productivity of employees who receive training

Lower turnover rate leads to lower cost (avoiding severance, recruiting)

Other benefits include reputation in the job market and improved employee satisfaction

This could lead to a **3–5% boost** in net present value of net profit in 10 years

Source: McKinsey Global Institute analysis

[198] Thomas Zwick, *Continuous training and firm productivity in Germany*, ZEW Leibniz Centre for European Economic Research, ZEW discussion paper number 02-50, 2002.
[199] Jozef Kornings and Stijn Vanormelingen, *The impact of training on productivity and wages: Firm level evidence*, IZA discussion paper number 4731, January 2010.
[200] David G. Allen, *Retaining talent: A guide to analyzing and managing employee turnover*, SHRM Foundation Effective Practice Guidelines Series, 2008, shrm.org.

Employers can strengthen the provision of training and adjust evaluation schemes

A substantial body of research suggests that in the long term, the cost of recruiting is higher and less flexible than the cost of retaining and upgrading the skills of existing employees.[201] Some leading players have set up mechanisms to provide required training. For instance, in the United States, Walmart has expanded its assistance to all workers pursuing degrees online in either business or supply-chain management. For such programs to be effective, companies can promote them to their employees, evaluate their progress, and reward, or at least recognize, those who complete training modules.[202] Employers could even make training and reskilling mandatory for workers, in other words "opt out" rather than "opt in." In China, Haidilao has launched a corporate university that is now part of its promotion system (see Box 9, "Case study: Haidilao").

Box 9

Case study: HaiDiLao

Haidilao, an established Chinese hot-pot chain restaurant with a reputation for service and the quality of its staff, put in place a system of employee compensation in which the level of skills and training determines status and pay. Only by gaining more skills can an employee move up into a different category that pays more; this works as a significant incentive for employees to continually increase and refresh their skills. For example, to be considered for a position as a midlevel waitress, an entry-level waitress needs to complete a manicure training. Only by collecting sufficient skills credits can an employee move up to become a branch manager. Employees who are deemed not to be suitable for management positions can attend Haidilao University and become trainers. The university is funded by employees, and the quality of training is high because everyone recognizes that this is the only way to move up within the company and boost their earnings. The results of this system are impressive. The average salary is double the industry average, and the entry-level employee earns 30 percent more than the average. The company's turnover rate is estimated to be one-third of the industry average.

Effective implementation of training programs is needed, as is investment in them, and many companies are failing on this front. According to one analysis, only 10 percent of corporate training is effective.[203] One reason for this appears to be that companies have not been able to make a change in mindset stick. To embed different attitudes more successfully, a mix of different types of learning modules has been shown to work. They are known as the three Fs: (1) forums to learn and absorb new content through online and offline channels such as classrooms and workshops; (2) fieldwork to apply knowledge in the real world through assignments, field projects, and on-the-job training; and (3) feedback through coaching, assessment, and reflection. Most reskilling programs tend to focus on the forums but neglect the other two. Some providers have adopted a hybrid model that embraces all three. For example, Boost is a leadership training app that integrates the three Fs to enhance learning. Instead of listening passively to management seminars, users interact with 3-D characters in real-life role-playing to learn and practice leadership skills. The app is able to track individual performance and provide real-time, personalized feedback. Of those who register, 90 percent

[201] Michael Craig, "Cost effectiveness of retaining top internal talent in contrast to recruiting top talent," *Competition Forum*, 2015, Volume 13, Number 2.

[202] Beth Davies, Connor Diemand-Yauman, and Nick van Dam, "Competitive advantage with a human dimension: From lifelong learning to lifelong employability," *McKinsey Quarterly*, February 2019.

[203] Roberta Holland, "Companies waste billions of dollars on ineffective corporate training," *Forbes*, July 25, 2016, forbes.com.

become monthly active users and say they believe they are likely to use the skills learned in their jobs.[204]

Policy incentives can help facilitate the employers' investment

Despite the fact that skilled workers raise firms' performance and productivity, provision of in-house skills development remains relatively low. Clearly, market failures are a factor. One of the key failures is a perception that firms that invest in training do not always reap the benefits because their workers can all too easily change employers. One study, for instance, highlighted a "poaching externality" that reduces the incentive for employers to train their employees, because they bear the cost but another firm may reap the benefits.[205] Another argues that when firms do not appropriate all the gains from the on-the-job training they provide, then training subsidies may be required.[206] To overcome companies' short-term reluctance to invest in skills, government subsidies could be used initially, and then scaled back. This happens in different forms around the world. "Co-funding" is widespread and delivered using different models. Australia, Denmark, Finland, and Germany provide direct funding to employers in the form of grants or training vouchers, but uptake has proved to be relatively low. Austria, Canada, France, and Italy take an indirect route to funding of employer training through tax allowances, credits, exemptions, and reductions. Uptake is easy and therefore high, but there have been concerns about the quality of monitoring outcomes to ensure that value for money is being created. The most widespread model of co-funding is the levy system adopted by countries including Singapore and South Korea.[207] China has implemented several policies with this aim in mind, including one that increased the tax-free employee training expense cap from 2.5 to 8 percent.[208] There have been pilots of a number of different types of subsidy programs. For instance, the Ministry of Human Resources and Social Security in Guangxi, an autonomous region in south China, issues coupons to employers to spend on training their workers.

The four broad levers described in this chapter could go a considerable way toward achieving the transformation of China's talent-development system that will be fit for purpose for the new economy. But as in all major reform efforts, the key will then be implementation. We turn to this in the final chapter.

To overcome companies' short-term reluctance to invest in skills, government subsidies could be used initially, and then scaled back. This happens in different forms around the world.

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[204] Boost, playboostnow.com.

[205] Giorgio Brunello and Maria De Paola, *Market failures and the under-provision of training*, prepared for EC-OECD Seminar on Human Capital and Labour Market Performance in Brussels, Belgium, December 8, 2004.

[206] Alison L. Booth and Dennis J. Snower, eds., *Acquiring skills: Market failures, their symptoms and policy responses*, Cambridge University Press, 1996.

[207] Joel Marsden and Peter Dickinson, *International evidence review on co-funding for training*, UK Department for Business Innovation & Skills, BIS research paper number 116, July 2013.

[208] *Notice on the tax refund for enterprise employee training budget*, State Taxation Administration, May 2018, chinatax.gov.cn.

4. Moving China forward

Making the transitions discussed in this report will require substantial investment in workforce skilling and lifelong learning. Even to achieve the reskilling needed to keep pace with changing labor-market requirements associated with automation and digitization, China needs to spend more. Transformation of the entire system for a postindustrial economy would require far more investment. While a shift toward more digital provision may mean that provision is cheaper, the considerable expansion of training to the entire workforce implies a very large expansion in investment. The returns are potentially very large, but China needs to incorporate investment needs into its planning and consider carefully what investment mix may be most effective, how much the public and private sectors and even individuals could contribute to the effort, and how a system of workable incentives might be designed to achieve a new era of workforce training and lifelong learning.

Automation, AI, and adoption of new technologies will affect every industry and every job in countries around the world—and the disruption and opportunity may come even sooner than anticipated before the COVID-19 pandemic, which has accelerated adoption. Because of China's scale and the size of its population, the transitions and skills revolution required could, as we have noted, amount to about one-third of the global effort needed. In this report, we have analyzed the current state of China's education and talent-development systems and found both strengths and areas for improvement. We have discussed a menu of potential pilot programs around four major levers that, in combination, could transform the current system in a way that makes it fit for purpose for a modern, advanced Chinese economy.

In this chapter, we explore some ideas for how China could execute this transformative program in institutional terms at both the national and the local level. We also discuss the potential contribution of educators and an expanded role for the private sector in broadening provision of workers and emerging opportunities to invest in talent development.

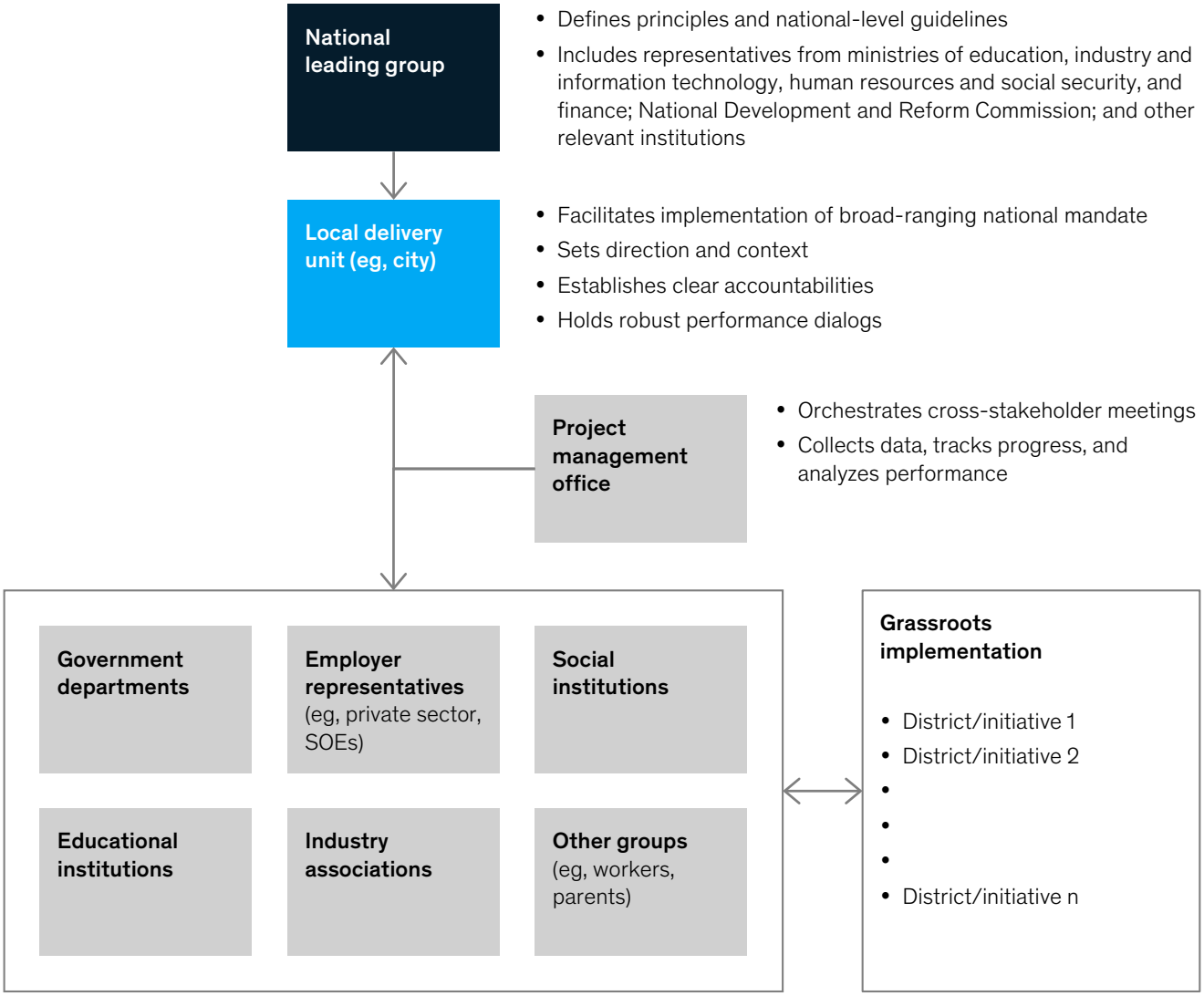
Institutional arrangements for executing a skills transformation program need to include a wide range of stakeholders

The government of China has already begun to explore the parameters of a new strategic direction, with new policies on vocational training and lifelong learning. At the heart of this effort will be collaboration between all the major players—government, companies, educators, social institutions, and students, whether in school or in vocational training. The implementation of the national plan will happen at the local level; the question is what operating model is likely to be effective.

We explore two ideas to develop a national strategy and translate it into execution at the local level: (1) setting up a national leading group focused on the future of work; and (2) forming delivery units at the local level (Exhibit 34). It is vital that employers, especially private-sector players, become more engaged in this national effort, both as a source of market information for educational institutions so that they can match curricula and training to the jobs that are likely to be on offer to students, and as active participants in education and skills development.

Exhibit 34

Reskilling China—a potential institutional structure for implementation.



Source: McKinsey Global Institute analysis

A leading group focused on the future of work may be needed at the national level

Education and skills development make up a system and therefore require a joined-up, national, integrated approach. A leading group is needed to navigate system change, put in place a radically transformed model, and coordinate the interventions detailed in chapter 3 as well as others that may prove effective. China has launched a number of leading groups or cross-departmental teams to tackle different slices of the national agenda.

From innovation to economic reform to cybersecurity and dealing with pandemics, a group based on the power of coalition across multiple stakeholders at the national level can be a vehicle for tackling complex, cross-sector issues that involve a wide range of actors. It could therefore be considered the most obvious institutional group to coordinate an effort to transform education and training. This leading group could undertake a number of tasks, including coordinating and integrating major activity, from designing strategies and programs to ensuring a holistic approach with collaboration at its core. It is vital that the group seeks input from key stakeholders who will drive the transition in the educational and talent-development model.

Representatives from a number of ministries can be involved to coordinate a complex and broad agenda that incorporates continuing educational reform, addressing the training needs of migrant workers, improving access to and the quality of vocational training, and promoting a culture of lifelong learning. The Ministry of Education will need to be involved in issues of school curricula, upgrading the quality of teaching staff, evaluation mechanisms, incentive schemes at the level of K–12 education and academic universities, and the development of a long-term pipeline of talent development. The Ministry of Industry and Information Technology will be needed for its expertise on technological innovation and adoption, sectoral transitions, the impact on the economy of using digital tools, and the skills required in an increasingly digitized economy, as well as for its view on what infrastructure might be needed to support the transition, including digital infrastructure. The Ministry of Human Resources and Social Security can contribute its perspective on the impact of large-scale occupational shifts on people's welfare and job prospects, and, specifically, the implications of labor-market transitions for hukou and the reskilling of migrant workers. The Ministry of Finance has a role in working out how to provide resources for the transition, what monetary incentives may be needed, and the tax implications. The National Development and Reform Commission could play an overarching role that coordinates all the other players.

The group can collect feedback from various stakeholders. Employers' representatives from a wide range of sectors can share their views on what skills different industries will need in the future and identify gaps by occupation and industry. Educational institutions and subject-matter experts can contribute their views on future curricula, content, delivery models, and evaluation systems.

Another important task for the national leading group is to build a database that includes information on the supply of and demand for jobs, skills requirements, and future trends. One vital component of any effort to retool the education and talent-development systems is ensuring that all players have access to reliable information and analysis of that information. One established model was the OECD Program for International Student Assessment set up in 2000, which enables countries to benchmark their performance against one another. As noted by McKinsey in its 2013 report, education-to-employment systems lack data of PISA's quality.[209] In 2016, the World Bank published a new data set, the STEP Skills Measurement Program, quantifying skills in low- and middle-income countries. This initiative provides data policy makers can use to improve their understanding of skills required in a labor market. The data show backward linkages between the acquisition of skills and educational achievement, personality, and social background, and forward linkages between skills acquisition and living standards, reductions in inequality and poverty, and economic growth. The data include surveys of households and employers.[210] The group can explore the data required to inform the transformation effort and build China's own high-quality data set. It can also explore new sources of data. Digital job-matching platforms can offer helpful insights on skills mismatches at the local level, while information gleaned from downloads and the use of education platforms can offer helpful information about user demand.

China then can consider launching local units to ensure effective delivery of a national strategy at a micro level

Using a leading group at the national level to craft overall strategy is only the first—albeit important—step; the next challenge is implementing policy not only in educational and training institutions and companies, but also at every administrative level. Top-down polices designed at the central government level may not take sufficient account of local differences. The direction set at the national level needs to be tailored to the local level.

Local governments often have adopted a small leading groups approach. For instance, to implement the strategy of New Style Urbanization, Hubei Province formed a leading group that included more than 30 members from various local government units. Jiangsu Province launched a small leading group to implement a poverty eradication strategy. The group

[209] *Education to employment: Designing a system that works*, McKinsey Center for Government, January 2013.
[210] *Education for Global Development*, "New report makes it easy to explore data on skills development," blog entry by Viviana Roseth and Alexandria Valerio, July 20, 2016, blogs.worldbank.org; the STEP Skills Measurement Program, World Bank. microdata.worldbank.org.

regularly convenes to discuss employment and supportive policies in education, healthcare, finance, and industrial development.[211]

To implement a broad transformation of education and training, a local delivery unit that is effectively a coalition of key government officials, educators, and, importantly, employers could be formed, dedicated to crafting strategy tailored to local positions and then implementing change.[212] The key tasks of the local delivery unit would include the following:

— **Setting the direction and context.** Each city has its own strategic vision. For instance, Shenzhen opted to prioritize seven sectors: information technology, biology, advanced manufacturing, medicine, finance and economics, materials, and transportation. The vision will define future skills requirements and therefore the current skill gap that needs to be filled. The local delivery unit can define skills pathways for the local market and offer them as a navigation tool for workers in the city. The unit can use digital platforms and local employment databases to mine job postings and applicant data and to conduct analysis of current and future trends.

— **Establishing clear accountabilities.** Each city has different endowment of industry, employers, educational providers, and fiscal health. Some cities have a high concentration of large and private manufacturing companies, and others have high density of small and medium-size exporters. Large companies can afford to establish their own corporate university programs, but many small and medium-size enterprises cannot. Some areas are blessed with many strong educational institutions, including top-tier universities and leading vocational schools, while others may have a shortage. The local delivery coalition can define clear roles for different stakeholders and determine who will do what: a pathway navigation platform to guide the reskilling journey, curricula content development, online and offline delivery, the technology infrastructure to enable broad access, funding and subsidy programs, and supervision of quality and job placement are examples.

— **Holding robust performance dialogues.** One challenge typically observed in implementing bold multiple-stakeholder transformation programs is a lack of clear targets and mechanisms for performance management. In several cases, targets tend to be somewhat vague and unmeasurable, and have unclear time horizons. The delivery unit can define ambitious but realistic targets to guide the transition, such as penetration among target workers, completion rate, job placement ratio, and feedback from employers. Targets can be structured to reflect a gradual trajectory over several years. The delivery unit can also establish a regular routine of check-ins among the responsible groups. Monthly meetings can largely focus on progress and clearing bottlenecks affecting emerging issues, while quarterly meetings focus more on implementation trajectories and performance of accountable units. Biannual meetings can incorporate debate about bold decisions to shift priorities, cross-department coordination, and reassessment of resources.

— **Building awareness.** The delivery unit can also design and drive awareness campaigns that could help change the way individuals think about education, vocational training, and lifelong learning. The campaigns could inform people about the trajectory of the economy, technological advances, and the changing mix of skills that will be required; everyone can be made to feel that they are invested in this journey. To address the challenge of COVID-19, campaign tools were adopted to enhance awareness of the coronavirus and to inform people of risks and counter-risk measures such as hygiene requirements and dining etiquette. Various means were used to deliver the message to the nation, including television, posters, video clips on social platforms, and targeted information sharing through WeChat. A similar approach could be used to prepare people for a skills revolution.

[211] Zou Jianfeng, "Jiangsu provincial leading group for poverty alleviation convenes a meeting to promote work implementation," *Xinhua Daily*, June 23, 2017, jsnews.jschina.com.cn

[212] Michael Barber, Paul Kihn, and Andy Moffit, *Deliverology: From idea to implementation*, February 2011, McKinsey.com.

Educators can contribute to the transformation of the system

Teachers can be more open to collaboration with employers in order to better understand changing patterns in demand for skills, working with companies to improve the design of curricula, and strengthening pathways from education and training to employment. For example, China has started to include courses on AI as an elective for high school students, and some leading tech companies have participated in the process. The first AI textbook, *Fundamentals of Artificial Intelligence*, was published in 2018, and 40 pilot high schools were selected from across the country.[213] As noted, some educational institutions have partnered with leading tech companies to drive joint research. They have, for instance, established joint labs on AI, codeveloped new courses on information systems, launched new programs on big data and AI, and even set up new schools.

Teachers need to be reskilled if they are to be effective in their use of digital technologies and adopting a hybrid online-offline model. A recent initiative led by The Open University of China and internet giant Alibaba aimed to improve teachers' ability to use digital technologies in teaching and class management. The training program was designed to last for two months and to be available to more than 1,000 teachers in primary and middle schools.[214] The thrust of the effort was supporting the digitization of education in light of the COVID-19 pandemic, but initiatives of this sort can expand to improve the digital skills of teachers more broadly and encourage them to augment their capabilities and embrace a hybrid learning model to enhance their impact.

China can revisit incentives for educators to ensure that they are encouraged to embrace new approaches to developing educational content and adapt to delivering it in new ways. Since its introduction in the 1990s, suzhi education, which emphasizes the comprehensive development of students, has been discussed widely. The education evaluation reform plan announced by the Ministry of Education in October 2020 included teachers' involvement and their contribution to students' extracurricular activities (such as career coaching, instruction on social studies, and interest groups) as part of the evaluation.[215]

The final priority is to expand training capacity in order to support the development of lifelong learning, especially for workers who will continually need to refresh their skills. Although many leading universities have set up continuing education schools that are open to adults, this track is still underrepresented within higher education.

The private sector can play a larger role as a provider and investor in China's talent-development system

In a modern economy, it makes sense for training to be undertaken by a mix of stakeholders, both private and public. There is a strong incentive for companies to undertake training in-house or outsource it to vocational training institutions because, as we have noted, this helps them to ensure that they have people with the skills they need and, as a by-product, increases their ability to retain workers. Indeed, many companies in China and around the world already provide training. The issue is spreading company provision more widely. In China, as we have noted, meeting the training and skills needs of a modern economy may require tripling the scope of provision by 2030. This is a huge challenge, which implies that many more employers and private-sector players can be brought into the mix (see Box 10, "A CEO checklist").

[213] *AI education reform—ready to go*, Ministry of Education, June 2018, moe.gov.cn.
[214] *The open university of China partners with Alibaba DingTalk to train 1,000 teachers in digital capabilities*, 36Kr, 36kr.com.
[215] *The overall plan for deepening the reform of education evaluation in the new era*, Ministry of Education, October 2020, moe.gov.cn.

Box 10

A CEO checklist

To kick off the journey, business executives can consider a checklist of priorities to keep in mind (Exhibit 35). As a thought exercise, we developed a list of seven items to consider, each of which could apply differently depending on the industry and the characteristics of particular companies. Actions include identifying skill gaps and devoting more management time to the broad issue of training workers, developing partnerships with educators, and ensuring that training is an integral part of companies' government relations effort.

Each action has tools that decision makers can use. To identify skill gaps, for instance, companies could conduct extensive assessments of employee skills and construct a heat-map visualization with one axis showing skill categories and the other showing different roles within the organization. Based on the results, the company can then design and roll out training programs targeting the different competencies that each group needs to improve the most.[1] On improving content, companies can scale up their efforts using digital technologies such as microlearning for customization, simulations and gamification for practicality, and virtual coaching for rapid feedback.[2] To track impact, companies can conduct pre- and post-training surveys or collect feedback from peer observation. A more analytical and quantitative approach can be enabled by defining the right metrics and assessing the performance of workers against industry benchmarks or the organization's own goals.[3]

Exhibit 35

To kick off the skills development journey, business executives can consider a checklist of priorities.

Key actions	Potential approach
Prioritize worker skills. Identify skills gaps and devote management time and budget to closing them	• Skills and competency mapping • Competitive benchmarking
Expand skills training. Provide training needed to cover all workers, preferably with tailored content	• Digital platform • Cohort-based programs
Ensure incentives to train are in place. Introduce training "opt out" system and link with performance evaluation system	• Corporate credit banks • Revised evaluation metrics to reflect learning
Adjust training content. Offer a mix of "forum, field, and feedback" to improve the effectiveness of learning	• Digital technologies (eg, gamification) • Field trips and on-the-job training
Track impact. Ensure that effective evaluation systems are in place to track effectiveness of training and value for money	• Pre- and post-training assessment • Peer observations, self-reflection
Develop partnerships. Explore partnerships with educators to offer competitive, up-to-date programs and content	• Corporate universities • Public-private partnerships
Integrate training into government affairs efforts. Ensure that training provision is integral to government relations	• Policy monitoring • Public program application

Source: McKinsey Global Institute analysis

1 Pierre Gurdjian and Oliver Triebel, "Identifying employee skill gaps," *McKinsey Quarterly*, May 2009.
2 Bryan Hancock, Kate Lazaroff-Puck, and Scott Rutherford, "Getting practical about the future of work," *McKinsey Quarterly*, January 2020.
3 Jenny Cermak and Monica Mcgurk, "Putting a value on training," *McKinsey Quarterly*, July 2010.

Employers and private-sector players can become education and training providers

Companies can strengthen provision through their corporate universities. These emerged more than 60 years ago mainly to train employees—GE's Crotonville in the 1950s, McDonald's Hamburger University in the 1960s, and the Motorola University in the 1970s.[216] More recently, corporate universities have been evolving as companies and business leaders engage in educating and training more directly. Neusoft, an information and technology provider, set up multiple universities in cities including Chengdu and Dalian in the early 2000s, enrolling 10,000 students in each school. Tech companies such as Alibaba, Bytedance, Meituan, and Tencent have been operating or have announced plans to launch training programs to cultivate entrepreneurs and teach practical skills required in businesses.[217] However, many more employers, and private-sector players in particular, can drive similar initiatives. One study found that companies that have these universities generate 9 percent higher shareholder returns than an equity index of 3,000 firms over a ten-year period.[218]

Companies can also work with external partners to offer effective training for workers. In the United States, for instance, Starbucks partnered with Arizona State University to offer its employees a chance to earn a bachelor's degree and covered their tuition. Through its Career Choice program, Amazon reimburses 95 percent of tuition, fees, and materials to associates (even those with only one year of tenure) for a broad range of degree programs.[219] China has examples. For instance, JD.com has worked with Beihang University to offer its employees opportunities to obtain higher education degrees through joint programs.[220]

Building on existing mandatory courses covering, for instance, compliance and security topics, companies can consider making reskilling programs mandatory. Most employees juggle many priorities, and training can fall down the list as they seek to meet short-term deadlines (despite the fact that training can be beneficial). As we have noted, employees in China often display a lack of urgency about skills training. In this context, companies can make training an important criteria to be eligible for compensation changes and promotion. In other words, the training system can be "opt out" rather than "opt in." Arranging sessions by cohort could be used to create peer pressure and mutual learning.

Companies can also use subsidy programs to fund employee training. A growing number of cities have been offering incentives. In 2016, the city of Shenzhen began a pilot in which it issued vouchers to be spent on vocational skills training. In that year, vouchers worth 50 million renminbi were issued to companies in industries the city classified as emerging, future, modern services, and traditionally advantageous.[221] In 2018, companies in Qingdao received subsidies of 600 renminbi per qualified person for training new employees.[222] In 2019, authorities in Jiangxi Province published a plan for 2019 to 2021 that required companies to carry out vocational skills training on a large scale. The aim was to conduct more than 1.6 million subsidized skills training sessions during that period and, by 2021, increase the share of skilled workers to 25 percent of the total number of employees.[223] In 2020, as part of its response to COVID-19 and the priority of maintaining employment through upgrading skills, a number of China's largest cities offered one-time training subsidies ranging from 600 renminbi to 1,000 renminbi per employee.[224]

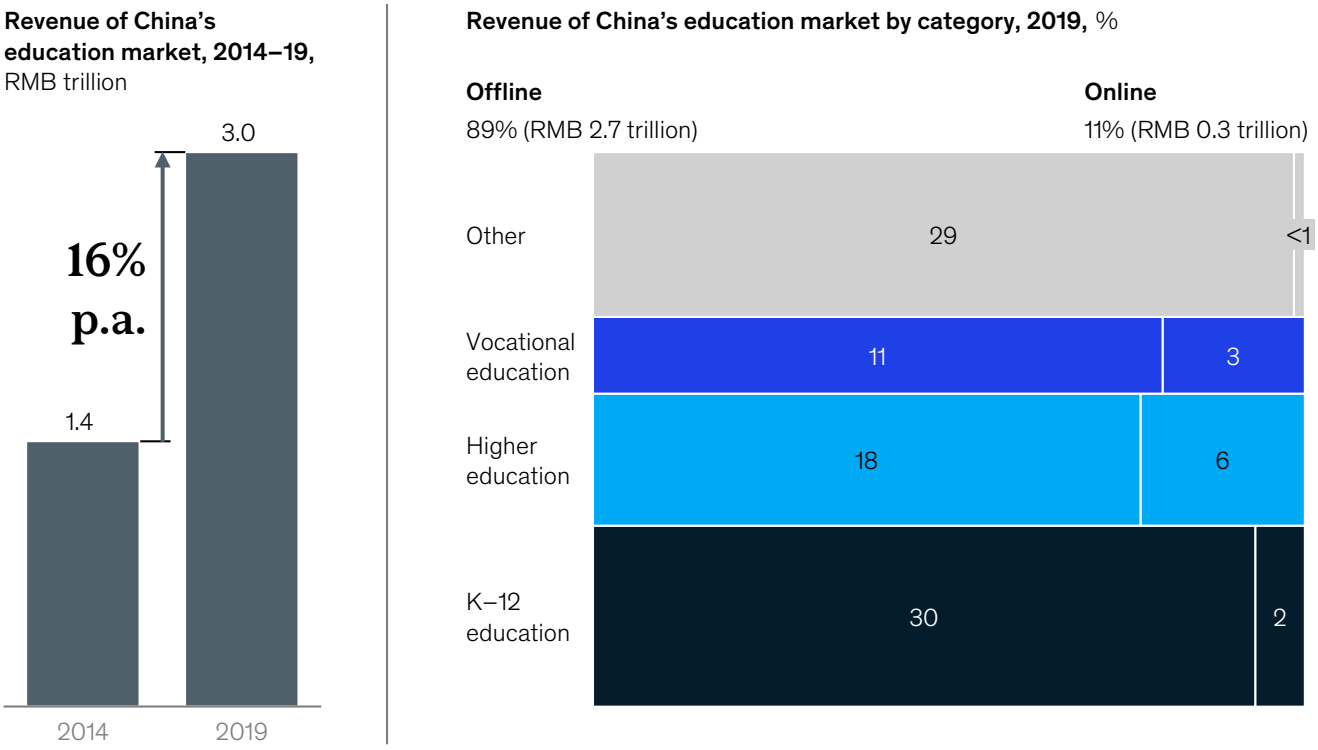
[216] Ave Rio, *The future of the corporate university*, Chief Learning Officer, May 3, 2018.
[217] Li Xuanmin and Shen Weiduo, "Rise of corporate universities in China," *Global Times*, November 4, 2019.
[218] Peter McAteer and Mike Pino, *The business case for creating a corporate university*, Corporate University Xchange, September 12, 2011.
[219] *Jobs lost, jobs gained: Workforce transitions in a time of automation*, McKinsey Global Institute, November 2017.
[220] *Join hands with Beihang Jingdong to help employees*, Sina Education, 2014, edu.sina.com.cn.
[221] Xu Tian, *Enterprise training employees can apply for subsidies*, Shenzhen News Net, September 6, 2016, szsb.sznews.com.
[222] Xiao Lingling, "Qingdao: Enterprises can receive subsidies for training new employees and receive a subsidiary of 600 yuan for each qualified person," *Peninsula New-Peninsula Metropolis Daily*, November 16, 2018.
[223] "Jiangxi: Employees and companies participating in job skill training can receive subsidies," Xinhua News Agency, August 7, 2019.
[224] *Hurry up and receive training subsidies! Each employee can receive 1,00 yuan*, 51shebao.com, July 28, 2020, 51shebao.com; *Employees receive subsidies for participation in training! 1000 yuan per person in Beijing, 600 yuan in Shanghai, 1000 yuan in Anhui…*, March 2, 2020, sohu.com.

Private-sector players can become investors to fund the system

Overall, China's education market has been growing rapidly. According to iResearch, the total market in 2019 was 3.0 trillion renminbi, up from 1.4 trillion in 2014, growing at 16 percent per year. However, vocational education is estimated to be only about 14 percent of China's total education market in 2019 (Exhibit 36). The investment opportunity related to a hugely expanded work skills program is multiple times greater. A large share of the funding can come from government, as it does in many countries around the world. The government of China has earmarked 100 billion renminbi (about $15 billion) for an expansion of vocational training.[225] However, a great deal of investment could come from private sources. They can introduce education and business services models to the market and can invest in other companies.

Exhibit 36

Revenue of China's education market reached three trillion renminbi in 2019, of which vocational training accounted for 14 percent.



Note: Figures may not sum to 100% because of rounding.
Source: iResearch Global Group; McKinsey Global Institute analysis

Chinese tech companies have been investing heavily in the education sector. Tencent launched a new online education platform, Tencent Classroom, in 2014; according to QuestMobile, the platform had an estimated 7.6 million weekly active users in March 2020. In addition to launching new businesses such as Fudao QQ, Tencent has made 45 investments in education-related companies since 2014 that together total 4.2 billion renminbi. Alibaba has invested 340 million renminbi in five companies. Net Ease invested 39 million renminbi in three companies and launched NetEase Online Open Courses and NetEase Cloud Classroom.[226]

[225] *China's vocational education industry ushering in a golden era*, GETChina Insights, October 1, 2019.
[226] *2020 Q1 mobile internet dark horse list: Giants fighting in business services, education and learning*, QuestMobile, April 15, 2020, 36kr.com.

Education and training companies are growing rapidly, and today account for 11 of 118 unicorns in China, according to CB Insights. According to Capital IQ, as of November 2, 2020, there were 60 listed Chinese companies with total market capitalization of $154 billion in education services. A number of Chinese vocational training specialists have been expanding, including Sunlands Technology Group, which was listed on the New York Stock Exchange in 2018. Sunlands offers vocational courses for the accounting, human resources, teaching, and finance industries and uses a one-to-many streaming model that helps students learn anytime, anywhere.[227] Beijing-based Huikedu Group, which developed a co-building model that connected schools with tech giants (Alibaba's cloud computing, Tencent's Internet+, and Baidu's AI), has become a unicorn with a valuation of more than $1 billion in just eight years.[228]

Companies can offer financing plans to help individuals fund training and education. Students already make a financial contribution to their own education in countries including the United States and the United Kingdom. The United States has income-share agreements in postsecondary education in which students agree to pay a certain percentage of their future incomes in exchange for funding.[229] In the United Kingdom, university students receive loans that are paid back after graduation, with amounts dependent on income.

China's continued prosperity and economic dynamism as well as the livelihoods of its people hinge on wide-ranging reform to the skills of the nation. Today, China's workers are well oriented to an industrial economy, but arguably not fully ready for the kind of economy that is now evolving: digitized and driven by consumption, services, and innovation. The necessary transitions are huge, indeed unprecedented, requiring nothing less than a total system refresh, a hugely complex task. China begins with some strengths, including a government that has effectively driven transformational economic reform, an adaptable population, and large and dynamic companies. Its digital economy is growing in sophistication and reach, and its people are enthusiastic adopters of digital technologies.

The work needs to start now, given the scale and urgency of the task of expanding and reinventing learning and skill development throughout people's lives. If China successfully manages the transition, it will not only have equipped its people with the skills they need to match the demands of an economy evolving in new directions, and companies with the talent they need to drive success, but will also have handled one-third of the global transition to the future of work. If China gets this right, best practices and models could offer a helpful reference point to other economies.

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[227] *Ministry of Education report reveals strong growth and interest in adult continuing education, vocational training, and master's programs*, Sunlands Technology Group, June 11, 2020.
[228] *Huikedu Group*, Unicorn Republic, unicornrepublic.co.
[229] Dubravka Ritter and Douglas Webber, *Modern income-share agreements in postsecondary education: Features, theory, applications*, Federal Reserve Bank of Philadelphia, discussion paper number 19-06, December 2019.

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McKinsey Global Institute
January 2021

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