

TECHNOLOGY, JOBS, AND THE FUTURE OF WORK

BRIEFING NOTE • PREPARED FOR THE FORTUNE VATICAN FORUM
DECEMBER 2016

The world of work is in a state of flux. There is growing polarization of labor-market opportunities between high- and low-skill jobs, unemployment and underemployment especially among young people, and stagnating incomes for a large proportion of households. Migration and its effects on jobs has become a sensitive political issue in many advanced economies. And from Mumbai to Manchester, public debate rages about the future of work, and whether there will be enough jobs to gainfully employ everyone.

The development of automation enabled by technologies including robotics and artificial intelligence brings the promise of higher productivity, increased efficiencies, safety, and convenience, but these technologies also raise difficult questions about the broader impact of automation on jobs, skills, wages, and the nature of work itself. Many activities that workers carry out today have the potential to be automated. Job matching sites such as LinkedIn and Monster are changing and expanding the way individuals look for work and companies identify and recruit talent. Independent workers are increasingly choosing to offer their services on digital platforms including Upwork, Uber, and Etsy and, in the process, challenging conventional ideas about how and where work is undertaken.

For policy makers, business leaders, and workers themselves, these shifts create considerable uncertainty, alongside the potential benefits. This briefing note aims to provide a fact base to stimulate discussion. It highlights recent findings from research by the McKinsey Global Institute and others in technology, jobs, and the future of work.

A list of the reports we have drawn upon and further reading suggestions can be found at the end of this note.

Labor markets are under strain, and talent is underutilized

Unemployment and underemployment are high around the world. In the United States and the 15 core European Union countries (EU-15), there are 285 million adults who are not in the labor force—and at least 100 million of them would like to work more. Some 30 to 45 percent of the working-age population around the world is underutilized—that is, unemployed, inactive, or underemployed. This translates into some 850 million people in the United States, the United Kingdom, Germany, Japan, Brazil, China, and India alone. Most attention is paid to the unemployed portion of this number, and not enough to the underemployed and the inactive portions, which make up the majority of untapped human potential.

Almost 75 million youth are officially unemployed. Women represent one of the largest pools of untapped labor: globally, 655 million fewer women are economically active than men. In a “best-in-region” scenario in which all countries match the rate of improvement in gender gaps (in labor force participation, hours worked, and sector mix of employment) of the best-performing country in their region, \$12 trillion more of annual GDP would be realized in 2025, equivalent in size to the current GDP of Japan, Germany, and the United Kingdom combined.

Household incomes in advanced economies have stagnated or fallen, fueling public disgruntlement

The vast majority of people derive incomes from jobs. In the United States, Western Europe, and across advanced economies, market incomes (from wages and capital) stagnated or fell for about two-thirds of households in 2005–14, a period marked by deep recession and slow recovery after the 2008 financial crisis. This was the first time incomes stopped advancing on such a scale since the stagflation era of the 1970s, and it may have helped stir popular opposition to globalization. The recession was a leading cause of the abrupt end to income advancement, but other longer-run factors also contributed, including a decline in the share of national

income that is paid to workers, the so-called wage share. This has fallen across advanced economies despite rising productivity, suggesting a disconnect between productivity and incomes. The decline is due in part to the growth of corporate profits as a share of national income, rising capital returns to technology investments, lower returns to labor from increased trade, rising rent incomes from home ownership, and increased depreciation on capital.

A survey we conducted in France, the United Kingdom, and the United States showed an important proportion of those whose incomes stagnated are worried about their children's economic prospects—a sharp departure after many decades in which it was an article of faith that every generation would enjoy higher living standards than their parents. Middle-income households have been the most affected, and young and less educated people are especially vulnerable. Across all age groups, medium- and low-skill workers have done worse than those with a college education. Many blame governments, global institutions, corporations, and establishment “elites” around the world, and the principles of free trade and open borders are under attack.

Policy makers in the affected countries took action during the downturn to compensate for the income squeeze, in the former of lower taxes and higher transfers, but these were largely one-off measures to buoy disposable income in response to the recession, and not sustainable. While globalization has brought numerous benefits, including lifting millions of people in emerging economies into the consuming class, it has had an impact on jobs in some sectors in advanced economies, and transition support for those affected has not been sufficient.

Skills, jobs, and locations do not always match, limiting income-earning opportunities for many

Educational systems have not kept pace with the changing nature of work, resulting in many employers saying they cannot find enough workers with the skills they need. In a McKinsey survey of young people and employers in nine countries, 40 percent of employers said lack of skills was the main reason for entry-level job vacancies. Sixty percent said that new graduates were not adequately prepared for the world of work. There were gaps in technical skills such as STEM subject degrees, but also soft skills such as communication, team work, and punctuality. Conversely, even those in work may not be realizing their potential. In a recent global survey of job seekers conducted by LinkedIn, 37 percent of respondents said their current job does not fully utilize their skills or provide enough challenge.

Some of the mismatching is locational: where there is demand for work, it does not always match where available and qualified workers are to be found. This

geographic mismatch can be seen across regions within countries, and between countries.

Cross-border migration fills some skill gaps but can create tensions

Cross-border migration has been a natural consequence of a world in which people do not find attractive work opportunities in their country of origin, at a time when other economies are not adequately filling their skills gaps. Migration boosts global productivity, but its consequences are often feared by native workers, who face labor market disconnects and a lack of well-paid jobs.

In 2015, approximately 247 million people lived in a country not of their birth—a number that has almost tripled in the past 50 years. Most have gravitated to places where they believe they will find better jobs. More than 90 percent have moved voluntarily, and about half have moved from developing to developed countries. In the period 2000 to 2014, migration has provided about 40 percent of labor force growth in the Canada, Spain, the United Kingdom, and the United States.

Migrants made an absolute contribution to global output of roughly \$6.7 trillion, or 9.4 percent of global GDP in 2015. However, migrant workers, on average, earn wages that are 20 to 30 percent lower than those of comparable native-born workers. More effective integration approaches could lay the groundwork for economic gains of up to \$1 trillion globally, benefiting both economies and individuals.

In the context of challenging labor market conditions, popular sentiment has moved against immigration. MGI research suggests that a significant proportion of middle- and low-income groups in advanced economies who are experiencing flat or falling real incomes are pessimistic about the future and likely to hold particularly negative views about immigrants.

Many activities that workers carry out today have the potential to be automated

Technological change has reshaped the workplace continually over the past two centuries since the Industrial Revolution, but the speed with which automation technologies are developing today, and the scale at which they could disrupt the world of work, are largely without precedent.

MGI research on the automation potential of the global economy, focusing on 54 countries representing 95 percent of global GDP, has examined more than 2,000 work activities and quantified the technical feasibility of automating each of them. The proportion of jobs that can be fully automated by adapting currently demonstrated technology is actually small—less than 5 percent—although for middle-skill categories that share could

rise to 15 to 20 percent. An additional important finding is that even if whole jobs are not automated, partial automation (where only some activities that make up a job are automated) will impact almost all jobs to a greater or lesser degree, not just factory workers and clerks, but landscape gardeners and dental lab technicians, fashion designers, insurance sales representatives, and also CEOs. We find that about 60 percent of all jobs have at least 30 percent of activities that are technically automatable, based on technologies available today. This means that most jobs will change, and more people will have to work with technology. Highly skilled workers working with technology will benefit. While low-skilled workers working with technology will be able to achieve more in terms of output and productivity, these workers may experience wage pressure, given the potentially larger supply of similarly low-skilled workers.

On a global scale, we calculate that the adaptation of currently demonstrated automation technologies could affect 49 percent of the world economy, or 1.1 billion employees and \$12.7 trillion in wages. Just four countries—China, India, Japan, and the United States—account for more than half of these totals. There are sizable differences in automation potential between countries, based mainly on the structure of their economies, the relative level of wages, and the size and dynamics of the workforce.

As machines evolve and acquire more advanced performance capabilities that match or exceed human capabilities, the adoption of automation will pick up. However, the technical feasibility to automate does not automatically translate into the deployment of automation in the workplace and the automation of jobs. The business case for automation varies among sectors, and the technical potential for it is only one of several elements that must be considered. Another is the cost of developing and deploying both the hardware and the software for automation. The cost and related supply-and-demand dynamics of labor are a third factor: if workers are in abundant supply and significantly less expensive than automation, this could slow the rate of adoption.

The benefits beyond labor substitution—including higher levels of output, better quality, and fewer errors—will need to be factored into the analysis. Regulatory and social issues, such as the degree to which machines are acceptable in any particular setting, must also be weighed. It is for these various reasons that go beyond purely technical feasibility of automation that our estimates for “whole-job” automation are lower than other estimates. We project that it may take at least two decades before automation reaches 50 percent of all of today’s work activities, taking into account regions where wages are relatively low.

Digital talent platforms improve matching between workers and jobs

Digital talent platforms have the potential to improve matching workers and jobs, creating transparency and efficiency in labor markets, and potentially raising GDP. They can raise labor participation and working hours; evidence from around the world suggests that some people would work more hours if they could. A US survey, for example, reports that three-quarters of stay-at-home mothers would be likely to work if they had flexible options. Even if a small fraction of inactive youth and adults use these platforms to work a few hours per week, the economic impact would be significant.

With their powerful search capabilities and sophisticated screening algorithms, online talent platforms can also speed the hiring process and cut the time individuals spend searching between jobs, reducing unemployment. By aggregating data on candidates and job openings across entire countries or regions, they may address some geographic mismatches and enable matches that otherwise would not have come about.

Finally, online talent platforms help put the right people in the right jobs, thereby increasing their productivity along with their job satisfaction. They can draw people who are engaged in informal work into formal employment, especially in emerging economies. Both of these effects could increase output per worker, raising global GDP.

Digitally-enabled independent work is on the rise

Independent work is nothing new: in emerging economies, self-employment is still the predominant form of work. Nevertheless, the modern 9-to-5 job that dates back to the Industrial Revolution is being challenged by technology-enabled independent work. MGI research finds that 20 to 30 percent of the working age population in the United States and the European Union is engaged in independent work. Just over half of these workers supplement their income and have traditional jobs, or are students, retirees, or caregivers. While 70 percent choose this type of work, 30 percent use it out of necessity because they cannot find a traditional job at all, or one that meets their income and flexibility needs. The proportion of independent work that is conducted on digital platforms, while only about 15 percent of independent work overall, is growing rapidly, driven by the scale, efficiency, and ease of use for workers and customers that these platforms enable. Such platforms include Uber, Etsy, Didi, and others. While those who pursue independent work (digitally enabled or not) out of preference are generally satisfied; those who pursue it out of necessity are unsatisfied with the income variability and the lack of benefits typically associated with traditional work. Policy makers and innovators will need to grapple with solutions to these challenges.

Technology creates new jobs and income possibilities

Even while technologies replace some jobs, they are creating new work in industries that most of us cannot even imagine, and new ways to generate income. One third of new jobs created in the United States in the past 25 years were types that did not exist, or barely existed, in areas including IT development, hardware manufacturing, app creation, and IT systems management. The net impact of new technologies on employment can be strongly positive. A 2011 study by McKinsey's Paris office found that the Internet had destroyed 500,000 jobs in France in the previous 15 years—but at the same time had created 1.2 million others, a net addition of 700,000, or 2.4 jobs created for every job destroyed. The growing role of big data in the economy and business will create a significant need for statisticians and data analysts; we estimate a shortfall of up to 250,000 data scientists in the United States alone in a decade.

Digital technology also can enable new forms of entrepreneurial activity. Workers in small businesses and self-employed occupations can benefit from higher income earning opportunities. A new category of knowledge-enabled jobs will become possible as machines embed intelligence and knowledge that less-skilled workers can access with a little training. In India, for example, Google is rolling out the Internet Saathi (Friends of the Internet) program in which rural women are trained to use the Internet, and then become local agents who provide services in their villages through internet-enabled devices. The services include working as local distributors for telecom products (phones, SIM cards, and data packs), field data collectors for research agencies, financial services agents, and paratechnicians who help local people access government schemes and benefits through an internet-based device.

We are only starting to capture the opportunities from further digitizing economies at the sector and company level

Digital technologies are creating major new opportunities for workers and companies, in both advanced and developing economies, but there are significant variations within and across countries and sectors. The United States, for example, has a major opportunity to boost productivity growth from digitization: digitization in just three big areas—online talent platforms, big data analytics, and the Internet of Things—could add up to \$2.2 trillion to annual GDP by 2025, although the possibilities are much wider. The degree of digitization can be measured in terms of assets, usage, and the extent to which jobs and work are enabled by it. Based on these measures, a few sectors are highly digitized, for example financial services, media, and the tech sector itself. These tend to be among the highest productivity

growth and wage growth sectors. Many others are much less digitized, including health care, education, and even retail. These tend to be the largest share of the economy in terms of GDP, and also the lowest productivity sectors. Similarly, companies are digitizing unevenly. Companies that are digital leaders in their sectors have faster revenue growth and higher productivity than their less-digitized peers. Their profits and margins can increase three times as fast, and workers within these companies enjoy double the wage growth. Digitization will continue to change how companies organize work, as well as the mix of work in any given sector. All this will require ongoing adaptation and transition by workers in terms of skills, activities, companies, and even the sectors they work in.

Clearly, we are still in the early stages of how sectors and companies use digital technologies, and there is considerable unevenness. From country to country, too, there are significant divergences. Overall, for example, we estimate that the United States has captured only 18 percent of its potential from digital technologies, while Europe has captured only 12 percent. Emerging economies are even further behind, with countries in the Middle East and Brazil capturing less than 10 percent of their digital potential.

More than half the world's population is still offline, limiting the potential to benefit from digital

Rapid technology adoption can unlock huge economic value, even as it implies major need for retraining and redeployment of labor. In India, for example, digital technologies provide the foundation for many innovations that could contribute \$550 billion to \$1 trillion of economic impact per year in 2025. However, the value of digitization that is captured depends on how many people and business have access to it.

More than four billion people, or over half of the world's population is still offline. About 75 percent of this offline population is concentrated in 20 countries including Bangladesh, Ethiopia, Nigeria, Pakistan, and Tanzania, and is disproportionately rural, low income, elderly, illiterate, and female. The value of connecting these people is significant, and as they enter the global digital economy, the world of work will transform in fundamental ways and at an unprecedented pace. Access to the technology alone is not enough; even in countries where a large majority of the population has access, the literacy and skills needed to capture digital gains are sometimes limited.

Solution spaces

The disruption to the world of work that digital technologies are likely to entail could pose significant challenges to both policy makers and business leaders, as well as workers. There are several solution spaces to consider:

- Evolve education systems for a changed workplace. Policy makers working with education providers (traditional and non-traditional) could do more to improve basic STEM skills through the school systems, and put a new emphasis on creativity as well as critical and systems thinking.
- A role for the private sector to drive training. Companies could face gaps in skills they need in a more technology-enabled workplace, and would benefit from playing a more active role in education and training, including providing better information about needs to learners and the education ecosystem.
- Create incentives for private-sector investment to treat human capital like other capital. Through tax benefits and other incentives, policy makers can encourage companies to invest in human capital.
- Public-private partnerships to stimulate investment in enabling infrastructure. The lack of digital infrastructure is holding back the digital benefits for some emerging economies; public-private partnerships could help address market failures.
- Rethink incomes. If automation (full or partial) does result in a significant reduction in employment and/or greater pressure on wages, some ideas such as universal basic income, conditional transfers, and adapted social safety nets could be considered and tested.
- Rethink safety nets. As work evolves at higher rates of change between sectors, locations, activities, and skill requirements, many workers will need assistance adjusting. Many best practice approaches to safety nets are available, and should be adopted and adapted, and new approaches considered and tested.
- Embrace technology-enabled solutions for the labor market that improve matching and access and bridge the skills gaps. Policy makers will need to address issues such as benefits and variability that these digital platforms can raise.
- Accelerate the creation of jobs in general through stimulating investment and creation in businesses, and accelerate creation of digital jobs in particular, and digitally-enabled opportunities to earn income, including through new forms of entrepreneurship.

Author James Manyika is director of the McKinsey Global Institute and a senior partner at McKinsey & Company, based in San Francisco. MGI partners Michael Chui, Anu Madgavkar, and Susan Lund contributed to this briefing note.

References and further reading

McKinsey Global Institute research reports are available on www.mckinsey.com/mgi. For this briefing note, we have drawn on the following reports.

India's technology opportunity: Transforming lives, empowering people, December 2014.

A labor market that works: Connecting talent with opportunity in the digital age, June 2015.

The power of parity: How advancing women's equality can add \$12 trillion to global growth, September 2015.

Digital America: A tale of the haves and the have-mores, December 2015.

Digital Europe: Pushing the frontier, capturing the benefits, June 2016.

Independent work: Choice, necessity, and the gig economy, October 2016.

People on the move: Global migration's impact and opportunity, December 2016.

McKinsey & Company, *Offline and falling behind: Barriers to Internet adoption*, October 2014.

McKinsey Quarterly, "The four fundamentals of automation," November 2015.

McKinsey Quarterly, "Where machines could replace robots, and where they can't—yet," July 2016.

Other reading

Autor, David, "Why are there still so many jobs? The history and future of workplace automation," *Journal of Economic Perspectives*, Summer 2015.

Autor, David, David Dorn, and Gordon Hanson, "Untangling trade and technology: Evidence from local labor markets," *The Economic Journal*, May 2015.

Brynjolfsson, Erik and Andrew McAfee, *The second machine age: Work, progress, and prosperity in a time of brilliant technologies*, WW Norton, 2014.

Furman, Jason, "Is this time different? The opportunities and challenges of artificial intelligence," https://www.whitehouse.gov/sites/default/files/page/files/20160707_cea_ai_furman.pdf

Milanovic, Branko, *Global inequality: A new approach for the age of globalization*, Harvard University Press, 2016.

Sundararajan, Arun, *The sharing economy: The end of employment and the rise of crowd-based capitalism*, MIT Press, 2016.