



WHITE PAPER

Workforce readiness in the 21st century



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The convergence of robotics, traditional automation and AI is rewriting the rules for manufacturers and their employees.



**12.5
million**
manufacturing
workers in the
United States

There are nearly 12.5 million manufacturing workers in the United States, accounting for 8.5 percent of the workforce and 11.7 percent of GDP in 2016 [1]. If the U.S. manufacturing sector were a country, it would rank as the ninth largest economy in the world. Manufacturing remains a vital part of the U.S. economy, but the sector is beginning a dramatic change.

In a December 2017 report entitled “Jobs Lost, Jobs Gained,” McKinsey estimates that 60 percent of all occupations today are susceptible to nearly one-third of their work activities being automated. The report also projects that 8 to 9 percent of the labor force in 2030 will be employed in new occupations that have not previously existed. Meanwhile, employment data provider Paysa estimates that U.S. companies spent more than \$650 million in 2017 on salaries for 10,000 new jobs, all within artificial intelligence (AI). [9]

The net effect of automation on employment in the coming years will be profound, but not in the way many people think. The World Economic Forum reports that while automation will displace 75 million jobs globally by 2022, it will create 133 million new ones. [8]

The challenge, then, lies not in the number of jobs but in the nature of work. Connecting workers with jobs, though, will require significant effort from all stakeholders.

With a high rate of automation adoption, 14 percent of the global workforce will likely need to transition to new occupational categories and learn new skills, though the effects of automation on workers will vary by sector and region. [2] Without sufficient and accessible training and placement assistance, the new jobs of the future will remain unfilled and unemployment could rise, despite job openings.

We've seen this before

There are many historical examples of technological disruption leading to economic disruption. In most cases, initial fears about workers being replaced by machines were tempered by the increases in both productivity and employment that these innovations brought about. For example, despite fears of tremendous job loss, the arrival of the personal computer is estimated to have created 15.8 million net new jobs in the U.S. since 1980. [2]

More recently, automation has started to shift toward making workers more productive in the jobs they already have. This is perhaps the most fundamental difference between the automation of the past and that of the future.

Robots, for example, are still assembling cars, but today they are doing much more. Pharmaceutical firms, for example, use robots to maintain hygiene in the packaging process, using them even to clean other equipment.

In 2018, ABB introduced Txplore (Fig 1), a submersible robot about the size of a football designed to perform internal inspections of large power transformers without draining the insulating oil. The unit streams video in real time for analysis using cloud-based applications. The robot displaces the labor needed to drain the insulating oil, and lowers environmental and safety risks. It also creates a need for trained technicians and engineers to interpret the data and support advanced maintenance programs.



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01 ABB TXplore™ robot

Automation vs AI

Artificial intelligence and automation, strictly speaking, are two separate things, but AI underlies the fundamental shift in automation currently underway. Where automation makes processes faster and more consistent, AI allows machines to make evaluations, provide actionable intelligence for decision support, and even make decisions automatically in pre-defined contexts.

As a recent Accenture report demonstrates, the most significant impact of AI won't be on the number of jobs but on the content of those jobs. [3] The report estimates that human/AI cooperation could boost business revenues by 38 percent in the next five years, generating higher levels of profitability and employment. For the average S&P 500 firm, that equates to \$7.5 billion in new revenue, \$880 million in profits, and a 10 percent increase in employment.

Reaching this potential, however, will require major changes in how we view, fund and prioritize education and worker training.

Education, (re)training and the skills gap

To fully realize the opportunities being created by today's rapidly developing automation technology, we need a concerted approach to re-think education and training at every level. That is one of the findings in the Automation Readiness Index (ARI), an ABB-sponsored study conducted by the Economist Intelligence Unit in 2018.

The study assesses the position of 25 countries with regard to their ability to adapt to the new

realities of a digitalized, automated workplace. It notes that education should be a continuous lifelong process, that more of it should focus on vocational programs, and that the development of "soft skills" is just as important as STEM education.

Soft skills refers to things that are difficult to automate, and as the ARI report observes, the workers who possess and develop these skills (e.g., interpersonal communication, analysis, creativity) will be better positioned for employment opportunities in the workplace of the future. Educators, however, often lack the training, experience, classroom technology or curriculum to best serve their students' needs with regard to future employment.

So, what about employers? According to a 2018 McKinsey study, American employers are aware they have a training mandate. Of the more than 300 executives surveyed (all at companies with more than \$100m in revenue), 64 percent said they will need to retrain or replace more than a quarter of their workforce between now and 2023 due to advancing automation and digitization. [5]

The same percentage said they believe corporations, not governments, educators or individual workers, should take the lead in trying to close the looming skills gap. The government still has a vital role to play, however, in working with employers to fund training programs and structure their curriculum. The key is partnership.

Nevertheless, there is a significant gap between the investment required and what is being done. Between 1993 and 2015, U.S. spending on workforce training programs as a percent of GDP fell by 62 percent. [2] This raises questions about why spending doesn't seem to be keeping up with what the business community agrees is necessary in this time of tremendous change.

A report in the *Atlantic* magazine [4] points out that publicly funded training programs, as currently implemented, rarely succeed in moving large numbers of workers into new, better jobs. This is often due to a misalignment with employer needs. Meanwhile, many workers aren't aware of available programs, or are excluded from them either by rule (e.g., if they worked in an industry not targeted for re-training) or by circumstance (e.g., due to a lack of transportation).

Taking action

The U.S. has met workforce challenges before. The high school movement in the early 20th century drove investment in expanding secondary education and for the first time required all students to attend. The results were dramatic: enrollment of 14- to 17-year-olds rose from 18 percent in 1910 to 73 percent in 1940. [2] The returns to a worker for having achieved even one year of high school or college were substantial. As early as 1915, this amounted to around 11 percent higher income for men and 12 percent for women. [7]

In the post-war period, the GI Bill had a similar impact at the college level, allowing millions of veterans to earn bachelor's and advanced degrees, and it's still working. The post-9/11 update to the GI bill boosted college enrollment by three percentage points, according to a 2017 study conducted by New York University. [6] It will take a commensurate effort to address the skills gap challenge of the early 21st century.

There are success stories at the local level, but these will need to be scaled up and magnified. Pittsburgh, for example, remade itself after the collapse of the U.S. steel industry through a transition to a knowledge-based economy and now is home to a variety of firms in biotech and other sectors. Other regions have made similar transitions by harnessing local intellectual capital, often found in universities, coupled with private sector R&D and local governments willing to ensure workforce training meets the new demand.

Following are policy recommendations centered on re-thinking and expanding our notions of training and education to address the employment skills gap challenge.

- Broaden funding—including employer tax credits—to include more technical education, two-year programs, professional certification programs and apprenticeships.
- Increase outreach to younger (e.g., middle school) students to encourage awareness of and interest in STEM related programs when they reach high school
- Involve industry in curriculum development, especially at the high school and post-secondary levels, to ensure it addresses employers' needs
- Increase funding for apprenticeship programs for both high school and community college students

The challenge U.S. workers and employers face is significant, but we have successfully navigated similar technological disruption before. We are well-positioned to succeed again as there is already broad agreement on what the problem is and how to address it. We need only exercise the will—political and otherwise—to put proven solutions into action.



Endnotes

- [1] [“Manufacturing Facts,”](#) NAM website, August 2018
- [2] McKinsey, [“Jobs Lost, Jobs Gained,”](#) December 2017
- [3] Ellyn Shook and Mark Knickrehm, Accenture, [“Reworking the Revolution,”](#) 2018
- [4] Lolade Fadulu, [“Why is the US So Bad at Worker Retraining?”](#) The Atlantic, January 4, 2018
- [5] Pablo Illanes, Susan Lund, Mona Mourshed, Scott Rutherford, Magnus Tyreman, McKinsey, [“Retraining and Reskilling Workers in the Age of Automation,”](#) January 2018
- [6] [“Steinhardt Study Finds More Veterans Have Enrolled with Post-9/11 G.I. Bill,”](#) NYU website, August 9, 2017
- [7] Economist Intelligence Unit, [“Automation Readiness Index: Who is ready for the coming wave of automation?”](#) 2018
- [8] [WEF press release,](#) September 17, 2018.
- [9] [“Automation Jobs Will Put 10,000 Humans to Work, Study Says,”](#) fortune.com, May 1, 2017.

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