

Automation: The Deciding Moment

Many futurists, economists, and high-tech business leaders predict there will be fewer jobs in the future because robots and other machines will be able to do everything humans can do, only better. Concerns about machines putting people out of work aren't new. Historically, it has eliminated some jobs, but automation is also credited with increased productivity, improved performance, and lower costs of products or services. Over the years, automation has increased demand, stimulated economic growth, and resulted in more overall jobs.

However, current advances in [artificial intelligence \(AI\)](#) and [robotics](#) could mean workers will be replaced across all industries at roughly the same time, not just in specific jobs as in the past. Workers will have to do more than change industries to find work; they will have to develop new skills. This represents change on a previously unseen scale.

What Jobs Will Be Automated?

Several recent studies assess the types of jobs most likely to be partly or completely automated. While these studies come to different conclusions in terms of the number of jobs affected, they generally find low-wage jobs and those requiring less education are the most vulnerable.

Two researchers at [Oxford University](#) (Frey, Osborne) determined which of 702 U.S. occupations would most likely be automated over the next 10 years to 20 years. Grouped into high-, medium-, and low-risk categories, Frey and Osborne ultimately decided 47 percent of U.S. occupations fall in the high-risk category. Jobs that are low-wage, require less education, and are in the office and administrative support, transportation, logistics, and production industries are considered the most at risk by Frey and Osborne's analysis.

Conversely, the Organization for Economic Co-operation and Development (OECD) argues while specific duties might be automated, few total occupations will be. Because of this, [OECD](#) estimates only 9 percent of jobs in the U.S. are at high risk of elimination. The consulting firm [McKinsey and Company](#) provides an even lower assessment: It says less than 5 percent of jobs are vulnerable to complete automation, but 46 percent of all tasks U.S. workers perform could be automated. Workers who perform routine physical activities, collect and process data, or are in low-skill, routine jobs — such as filing clerks and assembly line workers — are most at risk.

Other studies focus on the effects of automation on specific occupations. For example, economists at the U.S. Department of Commerce identified jobs most likely to be eliminated by the introduction of [automated vehicles](#).

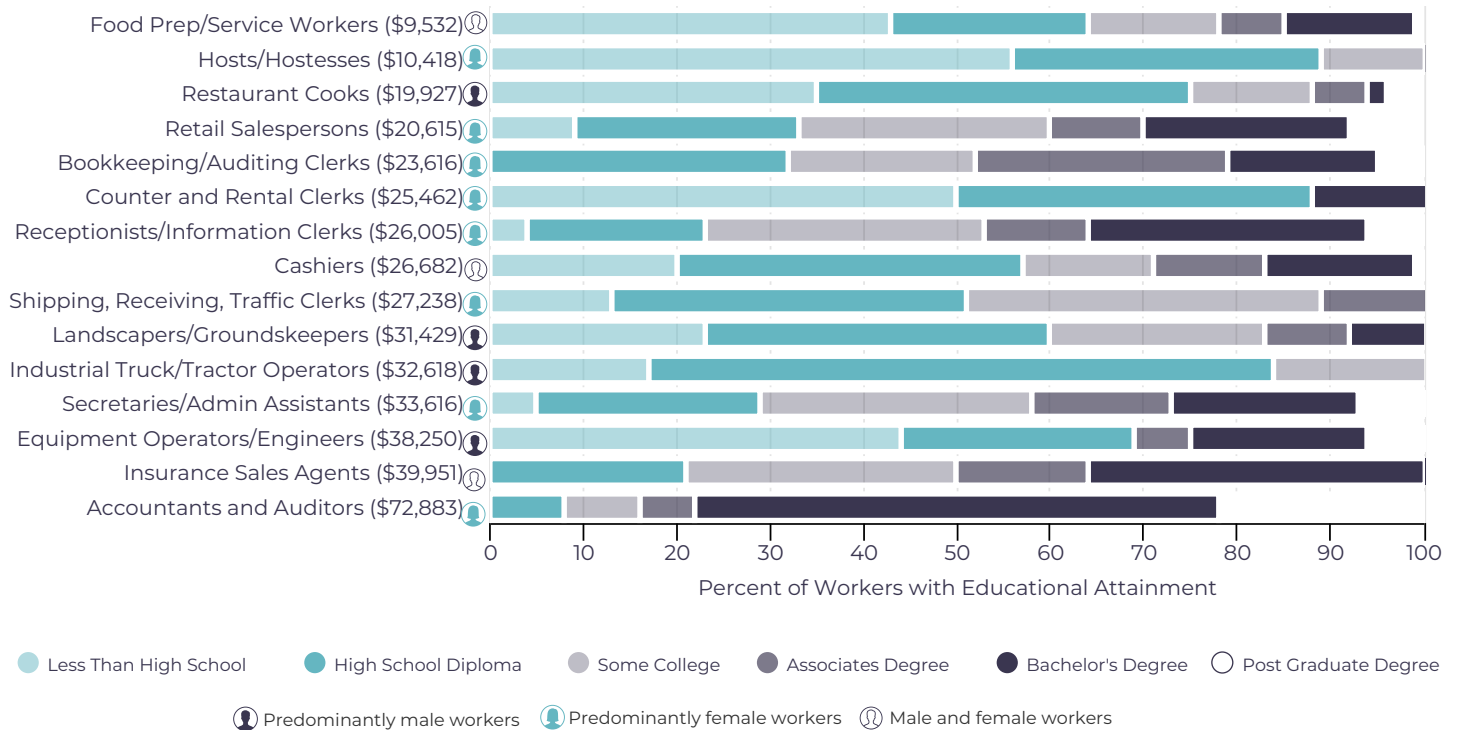
What Jobs in Colorado Are at Risk?

Using the previously cited studies, the Bell identified occupations in Colorado judged to be at high risk to automation. This produced a list of 307 occupations that could have all or part of their functions automated. We then ranked the occupations based on the number of Colorado employees in each occupation.

A total of 1.1 million Coloradans, or 41 percent of the total workforce, are working in occupations judged as high risk of being automated.

We then pinpointed occupations judged by Frey and Osborne to have a 90 percent or higher probability of being automated. This produced a list of 15 occupations, totaling 477,000 Colorado workers.

Workers With Lower Incomes & Less Education In Occupations More Likely To Be Automated



Sources: Frey and Osborne and Colorado Department of Labor and Employment, Labor Market Information, Occupational Employment Projections Unit; Bell Policy Center calculations based on CPS data 2015, 2016, 2017, IPUMS.

This doesn't mean these jobs will be automated out of existence; some may, but it's likely many more will see tasks change in some way and workers will need to learn new skills to evolve in their roles.

As many of the studies suggest, most of these occupations are categorized by low skill with low pay. Over half are occupations with mostly female workers, while two have almost all men. Almost 1 in 5 Colorado workers work in jobs most likely to be affected by automation.

To retain and better prepare these workers for the jobs of the future will require a focus on adult education, skill training, and help in making this retraining affordable. It will also likely mean an investment in work supports and other assistance, such as expanded unemployment insurance payments, to help workers as they transition into new jobs.

Automation Could Promote Economic Growth, Especially in Colorado's High-Tech Industries

Colorado has a relatively high concentration of technology-related firms and workers. These

high-tech industries help drive Colorado's economy and accounted for half of the job growth in 2016. About 13 percent of the total jobs added in 2017 are in industries that are sources of primary and advanced technology jobs. These tech firms include more than those that work on AI, robotics, and business process automation, and Colorado is home to robot manufacturers and others that implement automation processes. Their continued expansion helps propel economic growth and creates jobs that make, install, service, and repair robots, and other forms of automation.

In addition to the effects on high-technology industries, automation can improve the performance and output of firms in other industries. The [University of Colorado Leeds School of Business](#) says increased automation and technological advancements helped Colorado manufacturers add to the state's GDP with a smaller workforce.

[Advanced manufacturing](#) is one of the 14 key industries comprising part of Colorado's sector strategy to promote economic development. It includes companies that may use or develop high-tech processes such as computer-aided design, robotics, and advanced material

handling. Some industries, such as aerospace, electronics, and bioscience (also included in Colorado's sector strategy), are comprised of more advanced manufacturing companies than others, but most industries have some advanced manufacturing components. Advanced manufacturing relies on innovative technology, automated processes and methods to improve product design, and production to gain a competitive edge.

If Colorado doesn't fully invest in robotics, AI, and other forms of automation, we stand to lose jobs and economic growth to states and countries that do. China recently became the largest growth market for industrial robots, with its companies buying twice as many as U.S. companies did in 2015.

Alternative Work Arrangements and Automation

Working full-time at one job with a single employer is how many Americans viewed work for decades, but it may not be how we work in the future.

The percentage of U.S. workers who have engaged in alternative work arrangements, such as temporary help agency workers, on-call workers, contract company workers, and independent contractors or freelancers, rose from 10.7 percent in February 2005 to 15.8 percent in late 2015.

Nationally, 94 percent of new jobs created between 2005 and 2015 occurred in alternative work arrangements.

The number of total workers in "gig" or "sharing" economy jobs totaled 0.5 percent of all workers in 2015.

A recent study by McKinsey Global Initiative (MGI) finds between 20 percent to 30 percent of the working-age population in the U.S. is engaged in some form of independent earning. This could be in the form of second jobs or using online platforms to sell goods and/or rent rooms in their homes. MGI says some choose this approach to work, while others are forced to do it because they cannot find traditional jobs or need extra money. Workers who chose this approach generally report higher levels of satisfaction than those in traditional jobs, while those who take this approach out of necessity report the opposite.

Because independent workers have limited access to the income security protections of full-time jobs, MGI points out, "Labor market policies developed for the industrial era often do not apply to the world of independent work."

Recommendation

Colorado needs to address the disruptive aspects of automation while reaping the economic benefits. Colorado should convene representatives from labor, the technology industry, other businesses, academia, and state and local governments and task them with assessing the impact of automation. This group should also develop recommendations for balancing automation's effects on economic growth with those of affected workers.