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# Maine's Workforce Challenges in an Age of Artificial Intelligence

by Joseph W. McDonnell

## Abstract

Artificial intelligence will improve productivity, expand the economy, and significantly alter many jobs. To accommodate these changes, Maine will have to upgrade workforce skills in a rapidly changing economy. This article recommends policy proposals in response to the rise of artificial intelligence, including (1) training programs for current and displaced workers; (2) revamped postsecondary education programs to provide a wider group of students with the skills necessary in a postindustrial society; and (3) a much closer relationship between government, employers, and educational institutions to develop the future workforce for Maine. The paper also looks at the deliberations about workforce development in the early twentieth century as the United States transitioned from a largely agricultural economy to an industrial one for insights from the past in arriving at educational programs suitable for a postindustrial society.

relationship between government, employers, and educational institutions to develop Maine's future workforce. The article also examines the deliberations over workforce development in the early twentieth century when US society transitioned from a largely agricultural economy to an industrial one, as a way to highlight what we can learn from that experience as we transition to a postindustrial society.

## THE SHIFTING NATURE OF WORK

In her inaugural address, Governor Janet Mills pledged to develop a first-class workforce in Maine to address the frustration of employers who cannot find workers and the dissatisfaction of workers stuck in dead-end jobs without the skills for advancement. The governor recognized the complexity of this challenge by noting that technological innovation will radically alter the way Maine people live, learn, and work, which is why she announced the formation of an Office of Innovation and the Future (Mills 2019).

Over the next decade, the acceleration of the adoption of automation, including artificial intelligence and robotics, will likely exacerbate the mismatch the governor identified between workers and employers. While new technologies will increase productivity and economic growth, they will inevitably result in many jobs requiring new skills and some workers requiring new occupations.

This article explores the policy implications for Maine's workforce from the rise of artificial intelligence and discusses (1) effective transition programs that train employed and displaced workers in new job skills; (2) postsecondary education programs that provide a wider group of students with skills necessary to work productively in a postindustrial society; and (3) a much closer

The globalization, digitization, and automation of the US economy has increased productivity, held down inflation, opened up new markets, created more-efficient supply chains, expanded the economy, and given consumers quality products at lower cost. But these advantages came at the expense of thousands of American jobs, particularly good manufacturing jobs. In the 1980s, manufacturing represented Maine's largest employment sector, but the number of manufacturing jobs in Maine has been cut in half since that time (Maine DOL 2013).

Over the last half century, the United States has shifted from an industrial manufacturing economy to a skilled service economy with an emphasis on finance, education, health care, and information technology. These service fields require higher skills than the jobs in the old industrial economy. Now, two out of three jobs require training beyond high school, often a two- or four-year degree (Carnevale 2016). Most of the job losses from trade took place in the first decade of this century; more-recent losses are coming from automation. Much of the political rhetoric during the 2016 presidential campaign focused on trade and immigration as the culprits upending industries and jobs. But job losses from trade have been eclipsed by the far

greater job losses from automation and artificial intelligence—impersonal forces that are harder to scapegoat, negotiate with, or turn back.

A McKinsey study found that 45 percent of work activities could be automated with current technologies (Chui, Manyika, and Mirenadi 2015). Increasingly, many routine jobs are becoming casualties of automation: robots have replaced factory workers, ATMs have eliminated bank tellers, and kiosks and scanners have jettisoned clerks. In the future, high-skilled jobs will no longer be immune to automation as computer algorithms augment or even replace some professionals in law, medicine, and finance. Ironically, today's workforce shortages may well accelerate the adoption of automation.

Automation drives down labor costs and has been adopted in factories not only in high-cost regions like the United States, but also in lower-cost regions like China and Mexico, ensuring that the combination of automation and low-cost labor will make those regions competitive with any region with high labor costs. In many areas of the economy, employees of the future will be those who manage automated technology.

Artificial intelligence has the power to change the nature of work for many people, but the pace of adoption and the extent of the disruption are still the subject of debate. A rapid adoption of autonomous self-driving vehicles, for instance, could dramatically displace millions of workers, but a more gradual and partial adoption, especially in a growing economy, will have far less impact on drivers.

#### *The Case for Significant Disruption*

As an extreme case, the historian Yuval Noah Harari offers a dystopian vision that imagines artificial intelligence doing to workers what the automobile did to the horse and buggy. In his analogy, many of today's workers will likely be the horse that lost its job and never found another useful function in a motorized economy (Harari 2016).

Harari reasons that the power of artificial intelligence is unlike past work-saving innovations that took over manual tasks and pushed human work up the conceptual ladder. Harari makes the case that innovations from artificial intelligence are radically different from past innovations. He argues that since humans can perform only manual and conceptual tasks, there is nowhere for us to go when artificial intelligence outperforms humans on both manual and conceptual tasks. The algorithms in artificial intelligence already dominate

the stock market, social media, and search engines. Their capacity to take into account millions of variables when making split-second decisions will likely extend to the rest of the economy.

Harari sees the possibility of artificial intelligence eventually taking over the work of millions of people, creating what he calls a “useless” class. What will societies such as Bangladesh do when we can produce products cheaper through automation than they can produce with their low-cost labor? People in Silicon Valley are already envisioning the need for basic universal income because many people will be unable to find employment in an economy dominated by artificial intelligence. Harari makes clear that he is not making a prediction or setting a timetable, rather he is dramatizing the power of artificial intelligence.

#### *The Case for More-Moderate Disruption*

More-moderate positions on the impact of artificial intelligence also predict dramatic change although without massive displacement of workers. A report by McKinsey Global Institute forecasts that 60 percent of current occupations could automate at least 30 percent of their work and as much as 33 percent of work activities could be displaced by 2030 (Manyika et al. 2017). The report predicts that up to 14 percent of workers will have to transition to new occupations. The timetable for these disruptions, however, will depend on the pace of adoption and whether multiple sectors in the economy adopt the technology simultaneously. But even with the adoption of artificial intelligence, the report paints a possible positive scenario of jobs growth if economies expand, incomes rise, use of health care increases with an aging society, and other economic stimuli (such as spending on infrastructure, energy, and climate change mitigation) take place.

In contrast with Harari's position, the argument for more-moderate disruption adopts the traditional view that while innovation disrupts the economy as some jobs and industries become obsolete, new technology ushers in new opportunities and jobs. Both cases, however, share the view that technology will disrupt the economy and that employers, employees, governments, and educational institutions will have to respond to the change.

The McKinsey Global Institute projects continuing decline in jobs associated with physical and manual skills and basic cognitive functions and a shift toward higher cognitive and technological skills, as well as

increased importance in social and emotional intelligence (Manyika et al. 2017). Artificial intelligence will increase the importance of entrepreneurship and problem solving in technologically rich environments (Bughin et al. 2018).

The Brookings report on *Automation and Artificial Intelligence* forecasts 25 percent of US employment will face high exposure to automation over the next few decades and more than 70 percent of current tasks at risk of substitution. Another 36 percent of the workforce will experience moderate exposure, which means that more than six out of ten jobs will see some—or even all—tasks associated with that job taken over by automation. The lowest-skilled workers will be most vulnerable, but they will not be the only ones affected. New technologies will create an urgent need for educational programs that continually upgrade workers skills, or we risk having large portions of the population ill equipped for the work of the future (Muro, Maxim, and Whiton 2019).

Oren Cass, author of *The Once and Future Worker*, offers another moderate voice on the issue of job loss from automation and argues that it is easy to underestimate the complexity of jobs. The process of job loss will be slower and more incremental than many people have imagined, and some automation such as 3-D printers may create new jobs while eliminating some old ones (Cass 2018).

The timetable may be debatable, but artificial intelligence is already playing a big role in changing the nature of work. These studies give us a picture of the requirements for workers of the future. People will need advanced problem-solving skills for performing nonroutine tasks, strong interpersonal skills for dealing with people, and continual retraining for gaining new competencies to stay relevant.

### *Fewer Opportunities for Low-Skilled Workers*

In a de-industrialized economy, workforce talent will replace tangible assets as the primary resource for many firms, shifting the advantage to those with more education and higher skills. College education has become the single-most important pathway into the middle class in the de-industrialized economy. Good jobs in an increasingly skill-oriented economy demand more than a high school diploma, which is why only 20 percent of people with just a high school diploma earn \$65,000 or more a year (Carnevale, Garcia, and Gulish 2017). The gap in earnings between those with college

degrees and those without is wider today than in the past 50 years (Sawhill 2018). Despite these financial incentives, however, formidable barriers and disincentives prevent many people from obtaining a college degree.

Many high school students are simply unprepared for college and do not consider it a viable option. Nationwide statistics indicate that only about 40 percent of high school graduates are prepared for college, so many of them drop out of college (after incurring debt) without securing a degree or the skills to advance their careers (Sawhill 2018). The debt students must accumulate for a college education creates another barrier for many students and their families, and some students hesitate to incur debt because they are uncertain the investment will pay off. Furthermore, the majority of students work while attending school, some juggling full-time work and a full-time academic schedule, which is why many students find it hard to keep up, so they drop out or do the bare minimum to accumulate credits to graduate.

Less than one-third of Maine's population has a four-year degree and less than half has any post-secondary credential. Additionally, according to an article in *Mainebiz*, less than half of Maine's university or community college students complete four-year or two-year degree programs within six years or three years, respectively ("Educate Maine Report: Maine Students Are Lagging in College Completion Rates," December 5, 2017). The persistent high dropout rate is a sign that this type of education is not working for many people and highlights the need for alternatives to college that can help those people who do not pursue higher education make it into the middle class (Sawhill 2018).

## REIMAGINING POSTSECONDARY EDUCATION

### *Lessons from the Past*

One hundred years ago, as the country shifted from agriculture to industry, it faced a similar crisis of shortages of trained workers in a chaotic and changing world. Several educational approaches emerged to address the problem, and reviewing these approaches may help us determine the best way to address today's issues. On one end of the spectrum, David Snedden, an educational reformer, took a practical approach to vocational education by training students for specific jobs—some as professionals like doctors, lawyers, and engineers, others for business, and still others as plumbers, bricklayers, and metalworkers. Snedden advo-

cated the creation of two pathways: liberal education for students bound for college and vocational education for students preparing for a trade (Labaree 2010).

Robert Maynard Hutchins, who served as president of the University of Chicago in the 1930s and 1940s, anchored the other end of the spectrum by advocating a liberal education in the classics to prepare students to become society's leaders. Hutchins responded to the failure of the academic community to anticipate the economic depression of 1929 and the rise of fascism in Europe. Hutchins provided students with an education in the timeless intellectual and moral virtues through the great books, which equipped them to live in a changing and chaotic world armed with the capacity to reason, deliberate, and make intelligent and moral decisions. Hutchins left a legacy for those purists who maintain that an education in the liberal arts, which are free from any practical purposes, serves as the best training for citizenship, leadership, and any professional pathway (Heldke 2005).

Even today, Hutchins's great books education opens minds, shapes moral character, and develops thoughtful members of society. However, it remains a program for the elite with limited capacity to reach the larger society. Similarly, Snedden's approach still has value for learning technical skills, but in an age of artificial intelligence, employers seek workers not only with technical skills but also with the capacity to address complex problems, work effectively in teams, negotiate, persuade, and make decisions.

The philosopher and educator John Dewey forged a position between Snedden's trade education and Hutchins's liberal education by rejecting the liberal/vocational dualism as a false choice. He contested Snedden's trade education as narrowly practical, a scheme of social predestination that served employers' interest in social control rather than the interests of the workers. Dewey also sharply criticized Hutchins for adopting the wrong lesson from the classics by severing liberal and vocational education. In ancient Athenian society, citizens enjoyed a life of leisure and could devote their time to contemplation and citizenship while slaves performed the servile labor. In America, Dewey argued, we are both citizens and workers; a division between leisure and labor perpetuates a distorted relationship between knowing, doing, and making that only came about because of the structure of Greek society. Dewey did not oppose practical trade education as long as it aimed at more than technical efficiency and

gave students the capacity to think for themselves rather than to simply carry out the plans of others. Dewey sought to unite liberal and vocational education by having students master trades and learn the larger context within which that work would be performed, namely, the scientific underpinnings of the trade and the civic, economic, and political system in which it would be practiced. Dewey developed a problem-centered educational program that taught future workers how to learn in a dynamic world. Rather than a curriculum based on Snedden's routine practices or Hutchins's great books, Dewey relied on real-world problems to serve as the impetus for learning. He sought to create a democratic society of inquirers, equipped with a capacity to improve society through creativity, communication, cooperation, and critical thinking.

### *Current Lessons from Educational and Industry Leaders*

Although Dewey's vision of education lost out to the views of Snedden and Hutchins, his vision has been revived recently as educators and industry leaders search for ways to prepare a workforce in an age of artificial intelligence. In *Robot-Proof: Higher Education in the Age of Artificial Intelligence*, Northeastern University President Joseph Aoun addresses today's workforce challenges and reimagines higher education by adopting Dewey's vision of marrying creativity and critical thinking with vocational education.

Aoun (2017) offers three proposals to better prepare students for the needs of today's employers:

- a curriculum that educates all students in data, technology, and human literacy along with capacities in entrepreneurship, systems thinking, and cultural agility
- joint curricular development with employers to align educational outcomes with workforce requirements
- an educational system that provides those in the workforce with continual upgrading of skills, recognizing that in a rapidly automating world, no job will be robot proof

Aoun's vision for a new vocational education model includes a radically different relationship between employers and educators. Employers have served on advisory boards at colleges and universities, but not as genuine partners with shared power in developing the competencies and measurable outcomes they seek in



future employees. As partners, employers and educational institutions could create imaginative learning and earning programs that integrate the content of the classroom with the work of employers. Even though between 70 and 80 percent of students work and 40 percent both go to school and work full time, there has been scant coordination between work and school (Carnevale et al. 2015).

The business community is also looking for a new relationship with government and educational institutions. Large employers are initiating many of the most imaginative educational programs to address the changes in the workplace. IBM Senior Vice President, Bridget von Kralingen has recommended a new model of worker preparation through partnerships:

The most effective way to bridge the skills divide is through innovative new partnerships between governments, business and educators. For example, IBM has changed our paradigm for hiring to accommodate “new collar skills” that can be gained through vocational programs instead of four-year colleges. While new technologies like A.I. are transforming every job in every industry that does not equate to all workers being displaced. What it does mean is that all businesses and professionals will require a mind-set for change. (“Ethical A.I. Is It Possible?” *New York Times*, March 4, 2019)

JP Morgan Chase, the largest US bank, recently announced a \$350 million investment to train a future workforce with increased emphasis on technology. The investment includes \$125 million to “strengthen education and training systems that are necessary to improve collaboration and communication between employers and educators, including community colleges” (<https://www.jpmorganchase.com/corporate/news/news-press.htm>). Google has launched the IT Support Professional certificate, an eight-month program to train anyone interested in a career in information technology support. Amazon’s Web Services division has joined forces with Northern Virginia Community College (NOVA) to train students for careers in cloud computing.

IBM, JP Morgan, Google, and Amazon are experimenting with new models for vocational education in partnership with educational institutions for students who are not seeking a four-year degree. The Greater Washington Partnership has created the Collaborative Leaders in Academia and Business (CoLab) comprised of the major universities and businesses in Washington,

D.C., area to help drive innovation and groundbreaking digital technology. The CoLab represents yet another type of collaboration to bring employers and educators together. Such collaborations between employers and educators will have to overcome differences in organizational cultures and in their goals and the pace of change.

## WHAT MAINE CAN DO

To address both the threat from and opportunity of artificial intelligence, Maine needs to assess the impact of the potentially disrupted jobs and develop continuing education programs that will quickly retrain workers whose jobs have been displaced. The state will have to reimagine K–12, community college, and four-year college curriculums to prepare a new generation with the higher-order skills required for future employment. Maine will need a new relationship between employers, who can assess the skills and performance of newly hired workers, and teachers, who can create curriculum and assess student performance in the classroom. EducateMaine’s (2018) policy brief, *Getting Ready for High Paying Careers in Maine*, outlines a new paradigm for high school education, one that will prepare high school graduates for the workplace.

Maine might open an office of workforce education with resources for pilot projects that bring together employers and educators who will support credentialing programs that prepare students for the workforce. Such programs will help displaced workers update their skills, prepare those seeking to change or advance in their careers, and also create stackable credentials that can be used toward associate or baccalaureate degrees.

Maine will struggle with workforce development until there is greater integration between educational institutions and employers. Educators and employers need to work together to assist students who will never attend college so they successfully advance in the workforce. Colleges and universities must become accountable to their graduates, so those students don’t just receive a diploma, rather they also secure competencies and a career-oriented job. Employers and educators will also have to implement programs for life-long education of the workforce. Since Maine has many small employers who don’t have the resources for continual skills training, the state will likely have to play a larger role in such activities.

Maine faces strong headwinds in developing a skilled workforce to replace its retiring baby boomers,

and globalization and artificial intelligence will bring an accelerated pace of change to the workforce. Maine will need an imaginative partnership between employers and educators who have the resources and courage to break away from the status quo to address this daunting challenge. 🐙

## ENDNOTE

1. The discussion in this section comes from a 2016 talk by Yuval Noah Harari, "The Future of Humanity": <https://www.youtube.com/watch?v=XOmQqBX6Dn4>

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