AUTOMATION AND THE AMERICAN WORKER

Industrial robots have been increasingly used in automobile manufacturing in recent decades.

Since the Industrial Revolution, machines have eliminated jobs, but they also have created new ones. However, some argue today that new automation forms like robots and artificial intelligence are not just affecting jobs, but are becoming the workers themselves.

Automation refers to work done by machines that require little or no worker assistance. The term was first widely used in the automobile industry in the late 1940s to refer to automatic machines and controls that operated assembly lines.

During the English Industrial Revolution of the 1700s, hand weavers and many other craftspeople lost their jobs to machines. Some of these workers rioted and smashed the new machines. But soon people realized that the steam-powered machinery was creating new jobs, boosting wages, reducing prices, and improving the standard of living for all. The new factories divided up the work into many tasks that required less skill but more workers.

For the next two hundred years, most economists welcomed the idea of destroying old jobs and replacing them with better and more productive ones through advances in technology. In the 20th century, electric-powered machinery once again opened up new jobs.

Automation benefited the employer who saw an increase in labor productivity, the average rate of a worker's hourly output. This increased profits. Automation also reduced repetitive, dangerous, and hard physical labor while boosting pay for skilled workers to operate complex machines. Consumers benefitted from cheaper prices. However, there was a potential dark side to automation.

In 1930, British economist John Maynard Keynes predicted that there would be rapid technological progress over the next 90 years. However, he foresaw an emerging problem. "We are being afflicted with a new disease," he warned, ". . . namely technological unemployment." He was one of the first economists to worry that more and more technology may not mean more and more jobs, but fewer of them.

Automation Today

The modern era of automation started after World War II. Then the "computer revolution" in the 1980s followed by the "Internet revolution" speeded up the replacement of worker tasks by machines.

Automation in the U.S. made its first big impact in manufacturing, especially for automobiles. General Motors first introduced industrial robots into its factories in the 1960s.

Industrial robots are machines that do not need a human operator. They can be programmed to do multiple tasks like welding, assembling, and packaging with speed and accuracy, outdoing human capability. They can work 24 hours a day with little maintenance.

The robots today are most often used for routine manufacturing jobs like placing a computer chip into a smartphone. But robots have many other uses such as retrieving items in a warehouse for shipping. Worldwide, there are almost two million industrial robots in operation. In 2017, South Korea was the most automated country in the world with one robot for every 19 human workers.

Other examples of automation are everywhere today:

- Restaurants can enable customers to self-order meals that are prepared by robots in the kitchen, delivered by robot waiters, and paid for on a tablet.
- Machines can read millions of medical research articles and records to diagnose illnesses and recommend treatment.
- Judges can use software to help them make decisions on bail and probation, avoiding human biases and inconsistencies.
- Wall Street computer programs can buy and sell stocks in milliseconds.
- Universities are adopting inexpensive online education systems called MOOCs (massive open online courses).
- In 2018, Amazon opened an experimental convenience store without any checkouts. Customers download a smartphone app that allows them to enter the store where they scan each purchase and then walk out the door. They are billed later.

Automation Tomorrow

Automation is advancing rapidly in the area of "artificial intelligence" (AI). AI attempts to simulate functions of the human mind such as reasoning, learning, problem solving, decision-making, and understanding human speech. AI utilizes algorithms, which are sets of steps usually written in computer software code.

Artificial intelligence is often compared to the earlier general purpose steam and electric power technologies. The goal of AI is to empower machines to think like people and match or even exceed their performance. This is already happening in some activities, such as games like chess and *Jeopardy!*. Currently, over 600 companies are developing AI systems in the United States.

In manufacturing, artificial intelligence is moving beyond traditional industrial robots, which are usually programmed to do a routine task. AI systems can control, manage, and maintain factory floors filled with industrial robots and other "smart machines." Once a machine "learns" a new algorithm from human input, the change can be quickly communicated to other machines that are all networked together. AI developers predict that a fully automated factory would ultimately only need a few on-site engineers and highly trained technicians to keep manufacturing operations running smoothly.

Artificial intelligence is rapidly branching off into many other surprising areas:

- Self-driving or driverless cars can operate and navigate themselves without human assistance.
- Machines are beginning to master capabilities once thought to be exclusively human: writing, music composition, understanding and speaking natural human language (e.g., Siri and Alexa), and, ironically, algorithms that create algorithms.
- 3-D printing is being developed to produce cheap consumer-produced car parts and someday maybe human organs.
- AI-controlled tools are likely to perform surgeries and "edit" malfunctioning genes.
- Robots are being developed to provide care and conversation for elderly persons living alone.

What are the limits of robots, artificial intelligence, and other forms of automation? Some will say there are no limits. But, at least today, the cost of this advanced technology is a barrier. A high-end laser self-driving car system costs up to $75,000, which does not include the car itself. Another barrier is social resistance. Will people accept the wonders of AI if that means lots of people will lose their jobs?

Automation and Jobs

In his 2015 book *Rise of the Robots,* futurist Martin Ford challenged the old assumption that machines are tools that increase worker productivity. Instead,

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Cars Without Drivers?

Probably the hottest topic in artificial intelligence research today is the development of autonomous or self-driving cars, first tested by Google in 2008. Today, most major automakers are racing toward producing a reasonably priced driverless car. Such a vehicle would have to master maneuvers from a simple right turn to making a left-hand turn in heavy city traffic at night in a snowstorm.

One basic system uses sensors to constantly bounce millions of laser beams off objects surrounding the car to control its operation. In 2018, Chevrolet announced it would test its Bolt with no steering wheel, no pedals, and no driver.

Waymo

Driverless cars would be a big benefit for those who cannot drive, such as the disabled, elderly, and children. Moreover, buying and maintaining a car is expensive. Less expensive would be driverless cars that are on-call when needed. Uber has experimented with this.

However, the biggest plus in favor of self-driving cars is safety. About 90 percent of car accidents are caused by people for such reasons as being distracted, drunk, reckless, sleepy, or making mistakes in judgement. Humans also have more trouble seeing in darkness and fog than sensors.

Researchers believe that driverless trucks may become more common on the roads before autonomous cars do. Self-driving trucks make sense especially for long hauls on the interstate highways, stopping only for fuel. Currently, such trucks are being tested with a driver on board, but the goal is to make them completely driverless.

he declared, "machines themselves are turning into workers."

In the past, big manufacturing companies such as General Motors hired hundreds of thousands of low to medium skilled workers. But today's new automated companies like Google and Facebook employ relatively small numbers of tech-savvy employees.

Erik Brynjolfsson is a researcher at the Massachusetts Institute of Technology. He and his colleagues have noticed a set of contradictory trends that they had never seen before in the U.S. economy. Starting in 1950:

- Labor productivity (the rate of worker output) continued to rise;
- GDP (gross domestic product), the output of U.S. goods and services adjusted for inflation, continued to rise; but
- Family income, adjusted for inflation, began to fall in the mid-1980s, and private employment growth slowed around 2000.

In addition, corporate profits increased, except during recessions, while wages as a percent of GDP fell sharply after 2000. In other words, economic productivity has steadily increased while typical workers' jobs and income wavered and began to decrease.

Brynjolfsson and others called this separation of economic indicators "The Great Decoupling." What caused this separation between rising worker productivity, GDP, and corporate profits, but declining worker income, wages, and job growth?

Workers have long blamed companies leaving the country, seeking cheaper labor, as well as expanding U.S. trade with China and deals like the North American Free Trade Agreement (NAFTA). Economists have confirmed these causes to some degree, especially the "trade shocks" with China. But their findings did not account for all the drops in job growth and wages.
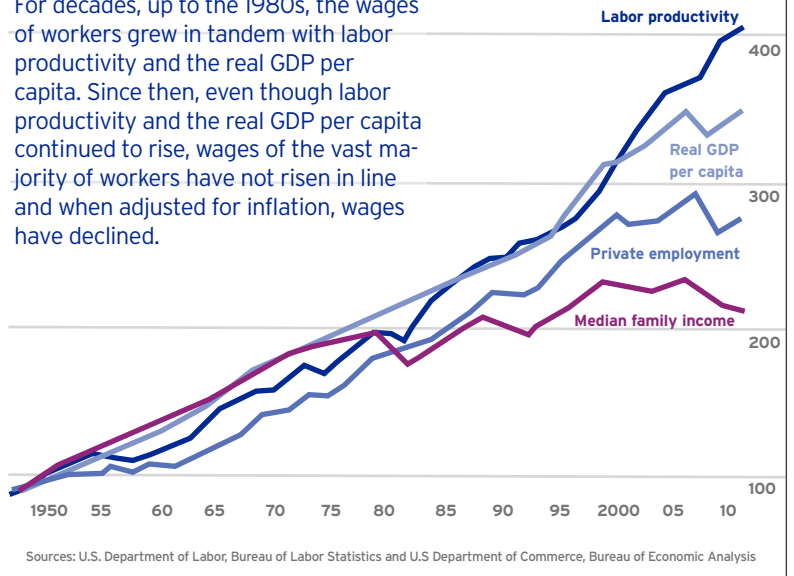
Not until the last few years have studies shown that automation has also been a significant cause of job and wage losses. This was already occurring in the 1980s when the computer revolution gained speed, but before the opening up of Chinese trade and the NAFTA deal. A study reported in *MIT Economics* last year found that the increase in industrial robots between 1990 and 2017 had a "large and robust negative effect on employment and wages."

Erik Brynjolfsson, the "Decoupling" researcher, found that starting in the 1970s labor productivity continued to rise as wages lagged behind. However, he also saw a slowing of labor productivity just before, during, and after the Great Recession of 2008. He saw this as partly due to a decline in the use of technology during those years.

Labor productivity has very recently begun to recover. Brynjolfsson says that AI may take a while to

U.S. Labor Productivity and Worker's Wages

For decades, up to the 1980s, the wages of workers grew in tandem with labor productivity and the real GDP per capita. Since then, even though labor productivity and the real GDP per capita continued to rise, wages of the vast majority of workers have not risen in line and when adjusted for inflation, wages have declined.

Sources: U.S. Department of Labor, Bureau of Labor Statistics and U.S Department of Commerce, Bureau of Economic Analysis

impact the economy in a big way. Fully integrating electricity into American factories took several decades. "But to me," Brynjolfsson declares, "It's dead certain it's going to happen."

At Risk of "Technological Unemployment"

What Jobs Are at Risk?

The McKinsey Global Institute is a think tank that lists industries most likely to be automated with current technology: hotel and food services, manufacturing, warehousing, agriculture, retail businesses, and transportation such as trucking. But, as artificial intelligence advances, jobs requiring higher skills and learning will become more at risk, such as journalism, language translation, medical diagnosis, legal research, and computer programming.

By contrast, areas less at risk of automation are the arts, jobs involving negotiation or persuasion, health care, child care, and skilled trades like plumbing.

Who Are at Risk?

Researchers at the University of Redlands (California) last year completed a study of the risks of U.S. job automation according to education level, race, ethnicity, age, and gender. Americans of all groups have a higher risk the less education they have. Those without a high school diploma are six times more likely than high-school graduates to lose a job because of automation.

According to the study, those aged 16-19 have a 66 percent higher risk of automation job loss than those 35-44. Hispanics and African Americans have a greater risk than whites or Asians. And women are more than two times more likely than men to lose a job that is at high risk of being automated. Other studies show that white, non-college-educated men in the U.S. are most at risk from automation, especially in manufacturing.

How Many Workers Are at Risk?

Since 2013, a number of studies have estimated the proportion of workers in the U.S. at risk from automation to be about 10 to 50 percent. In its December 2017 report, the McKinsey Company's Global Institute stated that up to a third of the U.S. workforce may need to find new jobs as a result of automation. By comparison, 25 percent of workers lost their jobs due to economic conditions at the peak of the Great Depression.

Most occupations today are not likely to entirely disappear, the McKinsey report said, but about two-thirds of them include some *tasks* that could be automated. In any case, virtually all workers will need to adapt as machines and their jobs evolve.

Most economists are convinced that workers will have to be more educated and possess skills that are hard to automate, like critical thinking. Even then, will average workers be able to compete with the quickening pace of artificial intelligence before the robots replace them? Some argue that workers need to prepare to work with AI machines, which will take advantage of the strengths of both.

Visions for an Automated Future

Economists and others who have studied automation mostly hold one of three visions for the future:

- The *boosters* of automation are confident that history will repeat itself and technology will drive economic growth, create more new jobs, and result in an economy beneficial for all.
- The *critics* of uncontrolled automation worry that if no safeguards for workers are put into place, a major unemployment crisis will occur as more and more workers are put out of work by smarter and smarter machines.
- The *futurists* welcome automation and say it will lead to a "jobless society," which will liberate people to explore their talents, revive arts and crafts, care for family, and volunteer for the public good.

Nobody really knows which of these visions will become reality. Currently, the U.S. and most other advanced industrial countries are doing little to prepare for any of these visions.

WRITING & DISCUSSION

1. What do you think is the best thing about automation? What is the worst? Explain.
2. Overall, do you think automation is good or bad for American workers? Why?
3. What do you think is the most important strength of human workers and AI machines? Why?

ACTIVITY: Preparing for the Automated Economy

In this simulation, one group will role play members of a congressional committee whose task is to propose legislation to prepare for the coming automated economy. Three groups, representing the visions of the automation boosters, critics, and futurists, will lobby the committee with their ideas.

1. Each lobby group should plan a presentation to the congressional committee to argue for specific ideas that reflect its vision for the future. The ideas listed below are some suggestions to consider, but the lobby groups may propose other ideas based on information in the article and their own thoughts.
2. The members of the congressional committee should ask questions during each presentation. They will then discuss the ideas they have heard, and pick the ones they will recommend for legislation by the full Congress, taking a vote if necessary. Finally, the committee members should explain why they have chosen them and not the others.

Some Ideas to Prepare for the Automated Economy

- fund basic research to develop advanced automation
- fund tuition-free community (2 year) colleges and online learning to expand technical job certifications and retrain workers
- fund vocational high schools that will emphasize a STEM (Science, Technology, Engineering, and Math) curriculum
- mandate businesses to reskill their workers to work with AI machines

- tax robots and AI machines
- fund a basic guaranteed income for those who are retraining, unable to learn needed skills, or need it in a "jobless society"
- increase taxes for companies and owners profiting from automation
- fund grants for the arts and jobs difficult to automate

On page 9 is a supplemental activity by teacher Christine Endicott. Christine is a U.S. and world history teacher at Saint Cloud High School in Saint Cloud, Florida. She is also a teacher-leader in Constitutional Rights Foundation's Teacher-to-Teacher Collab: **www.crf-usa.org/t2tcollab.**

ACTIVITY
The Business Plan: Artificial Intelligence

Before reading the article, have students think-pair-share about their knowledge of artificial intelligence (AI).

After students read the article, have them think-pair-share again about how their knowledge of artificial intelligence may have changed due to the reading. After one or two minutes of sharing, have each pair join with another pair to form a group of four. Have the pairs exchange their knowledge of AI within their groups. Let them know that they will use their knowledge of AI for the next part of the activity.

Each group now represents a team of partners looking to create a business in one of the categories listed below (A-F). Assign a category to each group. It is fine if more than one group has the same category. Each new business must rely on artificial intelligence as its main source of labor. Groups will have 20 minutes to discuss and write down (a) a name and brief description of the new business, (b) how AI will be used, and (c) the pros and cons of using AI as a main source of labor in the business.

A. Restaurant   B. Clothing shop   C. Landscaping company
D. Hotel   E. House cleaning company F. Supermarket

After 20 minutes, have each group share their new business. Hold a whole-class discussion about the pros and cons of using artificial intelligence as a main source of labor in the new businesses.

Exit slip: On a sheet of paper, have each student answer the following questions: Should our society replace more or fewer jobs with AI? Why?

EXIT SLIP

_____   _____   _____
Name   Period/Hour   Date

Should our society replace more or fewer jobs with AI? Why?

Civics on Call

Discussion of current events and controversial issues is one of the six proven practices of highly effective civic education identified by the Civic Mission of Schools (CMS). "When students have an opportunity to discuss current issues in a classroom setting," reports CMS, "they tend to have a greater interest in civic life and politics as well as improved critical thinking and communication skills."

Civics on Call, is a one-stop web page for classroom-ready lessons on issues of the day. All lessons are free, downloadable, and reproducible for classroom use. We will continue to add lessons here for your easy access, and you will find the following current events lessons at Civics on Call today:

- Guns and School Safety: What is the Best Way Forward?
- What Should the U.S. Do About North Korea's Nuclear Weapons?
- The Emoluments Clause and the President
- How Should We Judge Our Nation's Founders?
- The Syrian Refugee Crisis and U.S. Policy
- Police Body Cameras and the Use of Force
- The Iran Nuclear Deal and Its Critics
- Understanding 'Fake News'
- Youth and Police
- Immigration Enforcement Raids
- and more. . .

www.crf-usa.org/civics-on-call

Standards Addressed

Guns and School Safety

National Civics Standard 26: Understands issues regarding the proper scope and limits of rights and the relationships among personal, political, and economic rights. **Middle School Benchmark 4:** Understands different positions on a contemporary conflict between rights and other social values and interests (e.g., the right of the public to know what their government is doing versus the need for national security; the right to property versus the protection of the environment). **High School Benchmark 2:** Understands different positions on a contemporary conflict between rights such as one person's right to free speech versus another person's right to be heard.

California History-Social Science Standard 12.2: Students evaluate and take and defend positions on the scope and limits of rights and obligations as democratic citizens, the relationships among them, and how they are secured. (3) Discuss the individual's legal obligations to obey the law, serve as a juror, and pay taxes.

California History-Social Science Standard 12.7: Students analyze and compare the powers and procedures of the national, state, tribal, and local governments. (3) Discuss reserved powers and concurrent powers of state governments. (5) Explain how public policy is formed, including the setting of the public agenda and implementation of it through regulations and executive orders.

California History-Social Science Standard 12.10: Students formulate questions about and defend their analyses of tensions within our constitutional democracy and the importance of maintaining a balance between the following concepts: majority rule and individual rights; liberty and equality; state and national authority in a federal system; civil disobedience and the rule of law; freedom of the press and the right to a fair trial; the relationship of religion and government.

Common Core State Standards: SL.6-8/11-12.1, SL.6-8/11-12.3, RH.6-8/11-12.1, RH.6-8/11-12.2, RH.6-8/11-12.3, RH.6-8/11-12.4, RH.6-8/11-12.10, WHST.6-8/11-12.1, WHST.6-8/11-12.2, WHST.6-8/11-12.9, WHST.6-8/11-12.10.

Automation

National U.S. History Standard 31: Understands economic, social, and cultural developments in the contemporary United States. **Middle School Benchmark 1:** Understands how changes in the national and global economy have influenced the workplace (e.g., sluggishness in the overall rate of economic growth, relative stagnation of wages since 1973, the social and political impact of an increase in income disparities, the effects of increased global trade and competition on the U.S. economy, the influence of new technology on education and learning, and the relation between education and earnings in the work-

place). **High School Benchmark 1:** Understands how changes in the national and global economy have influenced the workplace (e.g., sluggishness in the overall rate of economic growth, the relative stagnation of wages since 1973, the social and political impact of an increase in income disparities, the effects of increased global trade and competition on the U.S. economy, the influence of new technology on education and learning, and the relation between education and earnings in the workplace).

California History-Social Science Standard 11.8: Students analyze the economic boom and social transformation of post-World War II America. (7) Describe the effects on society and the economy of technological developments since 1945, including the computer revolution, changes in communication, advances in medicine, and improvements in agricultural technology.

Common Core State Standards: SL.6-8/11-12.1, SL.6-8/11-12.3, RH.6-8/11-12.1, RH.6-8/11-12.2, RH.6-8/11-12.3, RH.6-8/11-12.4, RH.6-8/11-12.10, WHST.6-8/11-12.1, WHST.6-8/11-12.2, WHST.6-8/11-12.9, WHST.6-8/11-12.10.

Warsaw Ghetto Uprising

National World History Standard 41: Understands the causes and global consequences of World War II. **High School Benchmark 2:** Understands the Holocaust and its impact on Jewish culture and European society (e.g., the chronology of the Nazi "war on the Jews," and the geography and scale of Jewish deaths resulting from this policy; personal reasons for resistance to or compliance with Nazi policies and orders; the brutality of Nazi genocide in the Holocaust as revealed in personal stories of the victims).

California History-Social Science Standard 10.8: Students analyze the causes and consequences of World War II. (5) Analyze the Nazi policy of pursuing racial purity, especially against the European Jews; its transformation into the Final Solution; and the Holocaust that resulted in the murder of six million Jewish civilians.

Common Core State Standards: SL.9-10.1, SL.9-10.3, RH.9-10.1, RH.9-10.2, RH.9-10.3, RH.9-10.4, RH.9-10.10, WHST.9-10.1, WHST.9-10.2, WHST.9-10.9, WHST.9-10.10.

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Guns and School Safety

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