Automation Everywhere

From manufacturing to intelligent software, technological change is upon us

BY BRENDA WALKER

The variety of automation, robots, and software now available is remarkably vast and diverse. Ever more innovations are being introduced that would have seemed like science fiction only a few years ago, from self-driving cars to self-milking cows and 3D printed buildings.

Following is a list of important innovations and applications, by no means complete but one, which is meant to show the widespread transformation of the workplace and society.

FARMS — Human ingenuity applied to raising food began in pre-history and has been at the heart of civilization. One basic item of modern farm mechanization is the combine harvester, invented in 1834, which was designed to cut, thresh, and winnow grain crops in one pass. Today's models are small factories on wheels that can process up to 1,800 bushels of wheat per hour, for example.

More modern machines have been developed, like the Lettuce Bot, which can rapidly thin a field of greens, as well as locate weeds and bugs via sensor and then spray just those spots with pesticide. Germany's Bosch company has a different approach, where the machine uses a drill to destroy weeds. An automated strawberry picker is being tested, which will free Americans from the worry of who will pick the berries if illegal Mexicans are kept out. A new twist on apple picking is a machine that can identify the ripe fruit and then gently grasp it using a vacuum.

A Japanese company is building an agricultural factory to raise lettuce where machines will plant, water, and trim the greens on floor-to-ceiling shelves. The system will improve efficiency by recycling 98 percent of water and using LED lighting, which should cut energy costs by a third. Also, the controlled environment means no pesticides are needed.

Smart machines in the form of milking robots are lightening the load for dairy farmers, removing the pressure of needing to have someone in the barn every twelve hours 365 days a year. After a little training, the cows walk into the milking contraption whenever they feel like it, and voila — automatic milk. The cows line up to be auto-milked five or six times a day, so they obviously are comfortable with the machines.

Agricultural technology is also a big plus because it relieves farmers of depending on illegal alien labor. For that reason, this application of robotics in this field is welcome, unlike many others.

PORTS AND OCEAN SHIPPING — When globalization was being pitched some years back by economic elites, they admitted outsourcing would send millions of jobs overseas to cheap-labor nations like China, but at least there would be lots of jobs in port cities where the billions of dollars in goods are received. But modern automation is changing that source of employment too, as with so many others. Port operators look to the new smart machines to reduce costs by replacing expensive union workers.

Giant cranes move containers from mega-ships to trucks and trains for shipment of foreign merchandise to shoppers across America. That process can be automated, where a computer tracks the location of all the containers, and enormous driverless straddle carriers (updated fork-lifts) stack them until the containers are loaded onto trucks for land shipment.

The West Coast ports handle about $1 trillion worth of cargo annually, so the workers have a bit of leverage, and have fought against the automation reduction of their jobs. Also, it's expensive to automate a maritime facility, in the high hundreds of millions of dollars, and the investment has been slow to pay off in some instances. So complete automation is not a done deal everywhere and may not be for some time.

The modern port is also set up to service the mega-ships that facilitate global commerce. One example is the biggest container ship ever to land in North Amer-

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***Brenda Walker** is publisher of the websites LimitsToGrowth.org and ImmigrationsHumanCost.org. A resident of the San Francisco Bay area, she is a frequent contributor to* The Social Contract.

ica, the CMA CGM *Benjamin Franklin*, a French-owned ship, which made news when it docked last December at the Port of Los Angeles. Built in Red China, the Franklin can carry up to 18,000 containers, which hold a lot of electronic gadgets from Asia. The ship is a quarter mile long and over 20 stories high, yet has a crew of only 26. So going to sea is not the opportunity it once was for the adventurous job seeker.

MINING — The mining industry is the perfect place to work out some of the kinks in self-driving vehicles. In open-pit mining, the ore is typically dug by an excavator scoop, which dumps the materials into a truck for processing and/or shipment. The routes are simple with no extraneous objects to dodge, as happens on highways. Another strategy being tried out is mobile conveyor belts.

RAILWAYS — When I was a kid back in the last century, one of my father's best friends worked as a fireman on the Erie Railroad, even though diesel engines did not require a man shoveling coal to keep the train running. He earned a comfortable middle-class living for himself and his wife from that job. After World War II, the standard staffing for a freight train was seven workers — an engineer, a fireman, a conductor, and up to four brakemen.

Now efficiency, technological advances, and the demands for maximum profit have pruned the railways' workforce enormously. Like other areas of the economy, smart machines are moving in like gangbusters. A current debate in the railroad world is whether one worker is sufficient to operate entire freight trains, which have grown in length over the years. Naturally the people who know what happens on the ground think the one-worker train is a bad idea because of the myriad of things that can go wrong and require a human to fix. In 2014, the Associated Press reported remarks of CSX engineer J.P. Wright: "These trains are 7,000 tons going 50 mph. You have to have two people.... It's mind-boggling to me that the railroads would go this far with it." Plus, the number crunchers in the boardroom are already looking toward RCO — Remote Control Operation.

MANUFACTURING — Automobile manufacturing began using robots in the 1960s and has been adding and upgrading them ever since because they are cheaper and product quality is more consistent. One estimate is that 80 percent of car production is done by machines.

Today, even smaller businesses can afford to buy a robot for basic tasks: Baxter the robot, a machine introduced a few years ago by the Rethink Robotics company, costs around $25,000 to purchase and can be "trained" by workers moving its arm to do the desired movements. In 2015, the company introduced its more advanced Sawyer model, which is designed for tasks that require additional precision, such as circuit board testing.

CONSTRUCTION — Machines are doing amazing things these days, far beyond basic welding on the factory floor. Construction is another big industry on the cusp of change. The Australian company Fastbrick Robotics has a video online that shows its brick-laying machine building the shell of a house in two days.

The 3D printer has been rethought in a big way for the construction industry. A Google search for 3D Printing House YouTube brings up an assortment of videos that can be quite amazing. The Chinese appear to be focused on simple housing for the masses, as shown in one titled: "Giant Chinese 3D printer builds 10 houses in just 1 day." You see a large hose squirting out gray concrete that gradually accumulates into walls that become rudimentary dwellings. In Amsterdam, a group of forward-thinking architects are building the 3D Printed Canal House, which is quite deluxe and interesting in a design sense. The first section is finished and can be seen on YouTube and also in person, as noted on the project's website: 3dprintcanalhouse.com http://3dprintcanalhouse.com.

MEAT PROCESSING — NPR reported last January that a major meat processor was considering the addition of robots to its production plants. The machines continue to get smarter and are likely to become equipped with sensing technology before too long that allows them to feel where bones are, a vital skill in butchering a carcass. The improving technology means a quarter million meatpacking jobs may eventually disappear.

Meat processing is one of the few jobs that cannot be outsourced and is therefore a popular occupation for unskilled, sometimes illegal, immigrants from Mexicans to Somalis. But they are about to be made obsolete by smart machines, just like many American workers.

A few decades back, meatpacking was a good blue-collar job that could support a family. In 1990, a documentary titled "American Dream" won an Oscar for showing the struggle of Minnesota workers to keep their decent paying jobs at Hormel. Later the companies brought in cheap foreign workers, and wages have been low ever since.

TELEPHONE OPERATION — A week before Christmas last year, the *New York Times* reported about a handful of phone operators who were being laid off from their hotel jobs. Switchboard operators are an endangered species anyway, but it was a rare media look at today's slice and dice of lost employment. The public reads about it when Microsoft lays off thousands, but many of the jobs lost to automation go in smaller increments, one workplace at a time. We don't notice it happening, until one day the employment universe is far smaller and more limited than it once was. Phone operator and related work like receptionist were once jobs available for non-college graduates (around 70 percent of Americans). Now they are becoming obsolete.

These days, we have all experienced frustrating automated phone systems ("Press 3 for English") and wished for a human with whom we could reason. But smart machines are cheaper so they will only increase.

RESTAURANT — Low-skilled food-service work is the choice for a lot of students and persons who want a part-time gig, although more people depend on such positions in today's jobless recovery. However, wage demands of fast-food workers for $15/hour have accelerated the move toward automation. A relatively inexpensive bit of technology is the ordering kiosk, which has been introduced by McDonalds, Chevys, and Chili's are beginning to use tablets stationed on tables to take orders.

A San Francisco company, Momentum Machines, has developed a robot that cooks and assembles hamburgers that can reportedly produce 400 burgers per hour. "Our device isn't meant to make employees more efficient," co-founder Alexandros Vardakostas has said. "It's meant to completely obviate them." Ouch!

Over in Australia, the Domino's Pizza people are thrilled with their robot delivery vehicle about to be rolled out. The well-lit machine is about the size of an ice chest and kadoodles along sidewalks, dodging pedestrians and other obstacles at up to 12 mph. It is equipped with a warm compartment for pies and a cold section for soft drinks. No driver required!

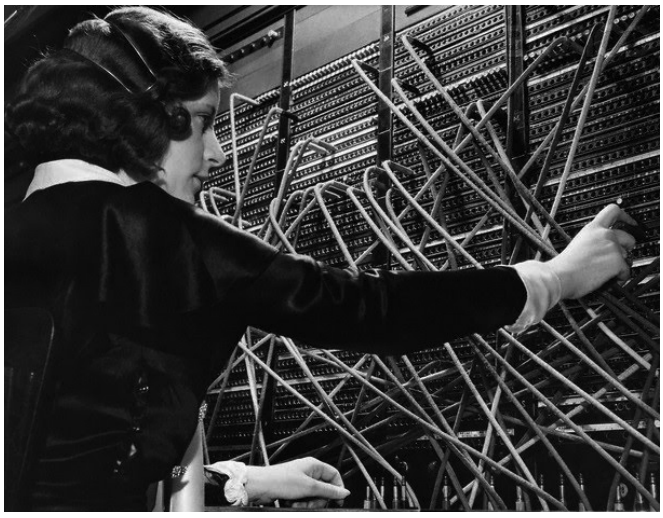
The pizza delivery robot is another example of how rapidly smart machines are moving into the fast-food business, which is not good news for workers. The CEO of Carl's Jr., Andy Puzder, remarked last winter, "If you're making labor more expensive, and automation less expensive — this is not rocket science."

DELIVERY AND TRANSPORTATION — Not all delivery vehicles have to be human-sized cars and trucks. Pint-sized delivery robots are a technology that is coming on strong: they are small, relatively unthreatening to safety, and almost friendly as machines go. Their usage niche is rather limited, however, because of their size and use of sidewalks rather than roads, plus they probably won't work in rough neighborhoods. On the other hand, pizza and food deliveries are an easy fit, along with other local applications like groceries.

In the realm of full-sized vehicles, the march of the major companies to develop the self-driving business has not been dissuaded by the May 7 death in Florida of a man whose Tesla was set on autopilot mode, but which nevertheless crashed. The car's sensors failed to recognize a white 18-wheeler truck against a bright daylight sky and attempted to drive underneath it. The company released a statement that noted, "Autopilot is getting better all the time, but it is not perfect and still requires the driver to remain alert." Apparently so.

The unfortunate spotlight on autopilot shows the gradual implementation of self-driving features: cruise control has been updated and enhanced into autopilot, which is not quite self-driving but may be marketed as such.

More than three million Americans work as drivers, so the advent of self-driving vehicles will have a severe



Directing phone calls was once a human job, with the technological evolution of the transistor and microchip, modern satellites transmit phone calls, text messages, and store information in the iCloud. Robots serve McDonald's customers in Japan; the Baxter robot (opposite page, left column) can do simple industrial tasks like loading boxes on an assembly line; and robots are even changing the medical field, replacing surgeons, nurses, and health care assistants (opposite page, right column).

economic affect on them as well as upon the businesses that serve them, like highway truck stops.

FINANCIAL AND CLERICAL — It's easy enough to see the technological transformation in manufacturing, where mechanical-armed robots rule. However, clever software that lives unnoticed inside computers has eliminated many workers, for example the tax software that performs the calculations once done by human tax preparation experts.

That transformation is occurring at the financial departments of large corporations as well, where offices full of human number crunchers have been cut back considerably. A 2015 *Wall Street Journal* article, "The New Bookkeeper Is a Robot," noted the reductions in corporate finance departments. One company had 80 clerks and salespeople five years ago; now a computerized accounting system enables 10 employees to accomplish the same tasks. The article's assessment: "Automation is threatening to replace swaths of white-collar workers, much as mechanical robots have displaced blue-collar workers on assembly lines."

According to the Hackett Group consulting firm, since 2004, the median number of full-time employees in the finance department at big companies has declined 40 percent.

LAW — Paralegals are being phased out of law offices because case research can be done via algorithms and artificial intelligence. Plus a lot of legal activities are simple items like wills, basic contracts, and divorces that can be performed using do-it-yourself software or books.

HEALTHCARE — Medicine is an elite, respected, well-paid profession. However, it too faces transformational change from smart machines. A 2014 *Washington Post* front-pager headlined "Sedation device could replace doctors" with a cost comparison: $2,000 per anesthesiologist procedure vs. $200 per use of the Sedasys sedation machine.

WRITING — But what about smart machines in the creative arts — like news reporting — you may ask. In fact, the Associated Press allows its robots to write financial earnings report stories as well as sports articles by inserting a data stream. As the software gets more agile, the fewer reporters will be needed in the newsroom, so young people considering a journalism degree may want to reconsider.

AND — Other threatened jobs include meter reader, garbage collector, security guard, secretary, travel agent, retail sales, pharmacist, postal worker, bank teller, clerical worker, and architect.

It's a long and disturbing list. Although it's unlikely whole categories of employment will disappear entirely, serious cutbacks are beginning now and will worsen.

What kind of society will result with half or more of the population unemployed? Many people do not function well with nothing to occupy their time. Proverbs 16:27 says, "Idle hands are the devil's workshop," and that hasn't changed.

We as a nation desperately need to have a conversation about the kind of future that's being created with all this technology. ■