Passage 1: The Cost of Convenience

by Esther Martin

Need dog food, a jump rope, or a hamster cage quickly? No problem. Log into your account, add it to your cart, pay for your items, and it magically appears on your doorstep two days later. But what is the cost of convenience?

Amazon launched its first two fulfillment centers in 1997: one in Seattle, Washington, and the other in New Castle, Delaware. Their sizes? 93,000 and 202,000 square feet, respectively. Almost twenty-five years later, Amazon owns and manages over 110 fulfillment centers in the United States and 185 warehouses around the world. The largest center clocking in at over 4 million square feet. Business is clearly booming.

But how does a company keep up with almost 300 fulfillment centers that ship a collective 1.6 million packages a day? They hire humans to work side-by-side with machines to accomplish difficult tasks. And how exactly do man and machine work together in a sorting or shipping warehouse? Very carefully. In order to keep up with demand, a human has to pack an order every eleven seconds. Then, a robot swoops in to sort the package based on its delivery zip code.

In 2016, Amazon went all in on robots, spending $775 million to buy a robotics company in the hopes of making their shipping process move more quickly. It worked. Packing time was reduced by 75%. Warehouses with robots can store 50% more merchandise. This results in a lower cost to the customer, saving $22 million per warehouse where automation is used to fulfill orders. But there is another side to the story.

Some Amazon fulfillment centers with robots have an injury rate four times higher than any other company. The quotas (or number of orders that must be fulfilled in a certain time frame) placed on human workers are high. There is a dangerous environment of man keeping up with machine. Some warehouses have recorded ten serious injuries (resulting in time off or some form of treatment) per 100 employees. Why? There is a lot of pressure to keep up with the machines or risk being written up or, worse, being fired.

While the number of human workers is currently greater than the number of robots, there is a push for more automation at shipping centers in order to save money and time. Fortunately, there are some skills that humans are still better at. Robots can't easily predict or react to situations without the need for complex reprogramming. As a result, their skill set and purpose remains limited to the basics: scanning, sorting, and transporting heavy items to employees. The next time you select two-day delivery, ask yourself: what's the cost of convenience?

Passage 2: Robots to the Rescue

by Howard Smith

Bomb defuser, sewer scraper, and egg collector are probably not jobs you'd imagine yourself applying for in the future. Why? They are dangerous, disgusting, and dull. Dozens of duties that humans have the skills to perform are being assigned to robots. The labor involved either puts people in danger or is so boring that companies can't find workers to do the job.

Robots to the Rescue

Bomb-defusing robots are important. Their ability to save the lives of law-enforcement and military personnel is invaluable. Relying on bomb squads to take apart dangerous explosive devices puts people at risk. The Department of Homeland Security is improving bomb-breaking robots to better copy the actions of humans. According to the Department of Homeland Security, "These improvements should allow users to perform multiple delicate tasks—such as unzipping a suspicious backpack, extracting detonators, opening doors, using tools such as knives, samplers, and scissors—with greater ease. And the arm is designed to better mimic movements of a bomb technician for quicker device disabling." This will allow law-enforcement to operate the robot from a remote-control device. The downside? This particular robot weighs almost 500 pounds and comes with an almost $200,000 price tag.

Sewer Scavengers

The pipes that lie beneath our streets are important. They have the dirty job of moving waste out of our homes. But what happens when those pipes get clogged? In countries like India, human workers clear blocked pipes by hand. Most have been working as sewer cleaners since they were children. Since 1993, over 600 sewer cleaners have died due to falls or breathing in toxic gases. One company wants to put an end to this unpleasant practice. They've developed a sewer-scraping robot that can clear blocked pipes, filter sludge, and navigate dangerous utility access holes with ease. The problem is the price tag. The Bandicoot robot costs $50,000. A sewer cleaner in India is paid only $200 a month. Therefore, the government is hesitant to replace a sewer cleaning workforce of 50,000 employees, many of whom have never received a formal education, with high-cost robots. The poor who rely on this dangerous job to support their families would be out of work.

Chicken Checkers

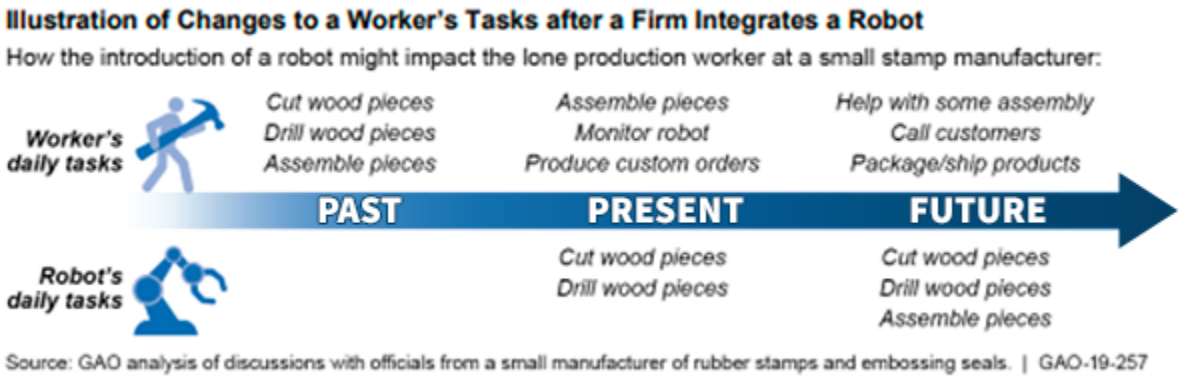
Chicken warehouses can hold thousands of chickens for egg and meat production. With such high numbers, responsible farming can be difficult to maintain. Enter poultry

robots. With heat sensors, GPS locators, and mounted cameras, robots can increase the welfare of flocks. Being at bird level is key. These roaming robots scan the temperature of a bird's leg to know if it's ill. They can sense changing feathers to determine diseases. One robot's job is to take 10,000 pictures a day of chicken droppings to make sure they are healthy. The constant movement of the robot helps to keep the chickens moving, too. There are even talks for a virtual reality system that will allow caged birds to think they are roaming free. Some believe the ability of these robots to constantly see the birds allows for a more positive and healthier environment. Farmers are on board because it is difficult to keep farms staffed, and farm managers are hard to come by.

Passage 3: Artificial Intelligence: Taking Over?

by Lawrence Johnson

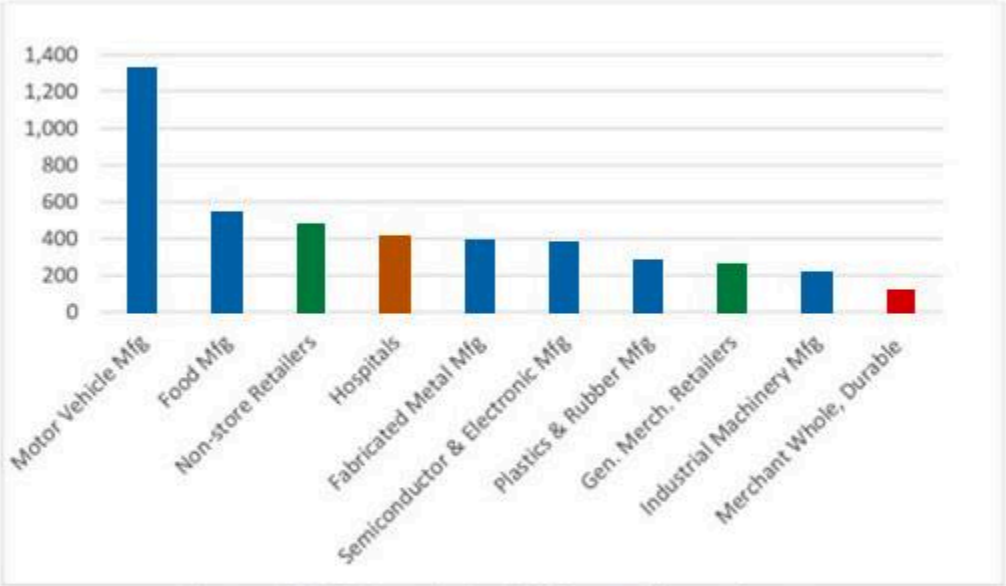
Robots are popping up in industries where saving time and money is important. According to the United States Government Accountability Office, "an automotive parts manufacturer said the firm adopted robots to reduce costs by using fewer workers. A door manufacturer said the firm installed two robots to lift heavy doors onto a paint line to reduce the number of worker injuries. A rubber stamp manufacturer said acquiring a robot allowed it to purchase and process raw materials instead of buying precut materials." This doesn't mean that jobs will be eliminated. It means that workers will have to learn to do things a robot can't.



New technology affects workers differently. Some hospitals now have robots that get rid of waste, like dirty sheets and robes. Some workers lost their jobs. Others took new positions at the hospital. Companies have started using robots to make parts they originally bought from other countries. They've hired more workers to make products.

What does it boil down to? It seems like the workers most affected are those who cannot learn a new trade or skill. The second most affected? Workers who have a high school degree or less. It appears that there is an imbalance between higher education and automation taking over jobs. Another interesting piece of information? Workers in technology-based jobs are far less likely to lose their job to technology.

Figure 2: Robotic Capital Expenditures, Top 10 Industries (dollars in millions)



Source: 2018 Annual Capital Expenditures Survey.
Notes: Estimates are preliminary. Comparisons across NAICS industries were not tested for significance.

The auto industry is most affected by robots in the workforce. The National Institute of Standards and Technology (NIST) found that car manufacturers use robots to do things considered boring, tiresome, or dangerous. Most use them for assembly and jobs with pieces too tiny for people to manage.

So what does the future look like? According to Jeff Burnstein, president of the Robotic Industries Association, robots are becoming more people-like. He says they are "moving out of factories and warehouses to do new things. They're already performing in hospitals, and are working side-by-side with people." What does this mean? According to the NIST, more people will need to be hired to manage robots than to do the work themselves.

Nonetheless, the NIST has a warning. We can expect lower morale and a more competitive job market. Also, learning to work beside a robot with a cartoon face can be awkward. In addition, robots can be expensive. Before jumping into automation, a

company must consider the benefits and drawbacks of the cost. A recent study found software that oversees robots can cost three times more than the robot itself.

Quotations Relating to Human vs. Machine

"One machine can do the work of fifty ordinary men. No machine can do the work of one extraordinary man."—Elbert Hubbard, American writer, artist, and philosopher

"It has become appallingly obvious that our technology has exceeded our humanity."—Albert Einstein, scientist

"Just because something doesn't do what you planned it to do doesn't mean it's useless."—Thomas Edison, inventor

"It is not the strongest of the species that survives, nor the most intelligent that survives. It is the one that is most adaptable to change."—Charles Darwin, scientist