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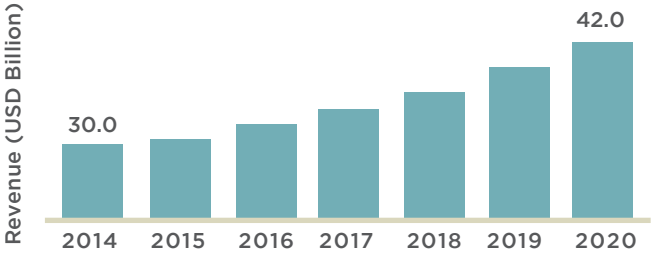
The robots are coming! The robots are coming! Adapting Paul Revere's call to arms, we are told that robots are coming and that they will take our jobs. The capabilities of automation advance daily; however, the significance of the technical challenge looks to be underestimated.

>> Established Robotics Applications Are Growing
>> Significant Technical Challenges Remain
>> Technical Achievements Are Most Evident in Home Appliances

After a long static period, the market for industrial robots has grown for nearly a decade. Robotic arms have proven effective and efficient in welding, painting, slicing, and fastening as long as the robots are stationary and the part to be welded, painted, sliced or fastened is moved into exactly the position that the robot requires. Auto manufacturing makes extensive use of electro-mechanical robots, and food and beverage production and packaging are close behind. Germany's ABB has the largest installed base of these products, and Japan's steady Fanuc and innovative Yaskawa are highly regarded. The big event in this segment of the robotics industry this year is Fanuc opening a new factory in August. Their production capacity is expected to nearly double. The use case for industrial robots is well understood, and the market has grown at a five-year average growth rate near 30% to $35 billion in size. China and Korea have made the most significant financial commitments to industrial robots, taking about half of industry production in recent years. To the extent that robots are taking jobs, it is likely occurring in the Auto and Food industries, mostly overseas.

Global Industrial Robotics Market: 2014-2020 (USD Billion)



Source: Zion Research Analysis 2016

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Overcoming a few early hiccups with patient outcomes, surgical robots have established a market niche in previously difficult and invasive procedures. Like the industrial robots, surgical robots are stationary and their subjects are positioned in a particular place (sedated on a table). Intuitive Surgical is the market leader with share in the 30's, and the American market has the largest installed base of surgical robots. The market for surgical robots exceeds $10 billion in revenues, and it is growing at a mid-teens rate. New developments in the surgical robot industry employ telepresence, a physician operating the robot from a remote location, and if successful, remote operation (pun intended) may justify more than one robot per surgeon. Separate from surgical robots, medical applications for robotic exoskeletons look to be getting development funding. Back to the surgical robots themselves, they have proven effective in selective surgeries and use cases are expanding. Recovery rates are reportedly faster for robotic surgical procedures, so they may be taking a few jobs from hospitals and rehab facilities.

Both industrial robots and surgical robots are, for the most part, stationary. Mobility opens new horizons to robot use, yet balance, change in elevation, and physical obstacles are challenges not yet overcome by the industry. As such, early successes in robot mobility have occurred in airborne, and, more recently, waterborne drones. Estimates put the UAV airborne drone market at $10 billion, with about $8 billion being defense-related equipment. The UAV market is growing at a low-teens rate as the $2 billion commercial market has been slow to develop (regulatory impediments). Advances in the drone market most recently seem to be in the under-sea area where there are many reports of drone submarine prototypes. UAV's may be creating more jobs in the data center than they are losing in the cockpit.

The robotics markets are not very big, $55 billion in total, and only the industrial applications are fast growing. One reason that industrial robots may be attracting more customers is that they are the only robots that currently function in fully autonomous mode. The ultimate goal for robots is that they operate autonomous, without human piloting or intervention. Surgical robots are manipulated by doctors, and UAV's are steered by pilots. Although fully autonomous modalities are only gradually becoming available, the markets remain excited about the independent function potential of robotics. Fully autonomous proficiency is likely necessary prior to robots becoming a significant threat to employment. Currently, fully autonomous only works in controlled environments, making it impractical.

Lab Critters

Functional humanoid robots hit the market in 2017, and they have been used in novelty ways to demonstrate the technologies. As an example, humanoid robots pole danced at the most recent CES trade show. These humanoid robots have the same shapes as human beings, but they lack capabilities at this point. Industry websites are replete with stories of humanoid robots falling over, bumping into things, and lacking a sense of appropriate force. To give a sense of the state of play, Northwestern University reports that one of their biggest achievements in robotics last year was to teach a robot how to pick up a pencil from a group of mixed objects. They had to create Pavlovian-style reward system software and virtual reality training to enable that functionality. It was time consuming and expensive.

Another proud industry achievement in recent months is the development of a weeding robot, designed to travel up-and-down rows at commercial farms and remove weeds. Farmers could justify the six-figure price tag in that they would use less weed killer, but the inventors are keeping the device off of the market due to it "having trouble telling the difference between a weed and a crop." A weeding robot lacking the ability to separate the wheat from the chaff would seem to be a non-starter. In a separate development, MIT announced what it believes to be the ten biggest achievements in robotics technology during 2017. Second on their list was the invention of the autonomous truck. Given challenges both with physical obstacles and autonomous operation, MIT doesn't expect that product to hit the market for 10 to 15 years. Even with that timeframe, Teamsters are already attempting to negotiate labor contracts preventing the ultimate use of these mobile robots. We don't see a threat to farm workers or truck drivers with today's state of robotics technology.

Automation Begins at Home

While this will not likely impress those looking for the machines to take over, the greatest advancements is robotics applications during the last year have likely come in home appliances. Robotic vacuums already generate about $4 billion in annual sales and that market is growing at an estimated 15% rate. Along with proving to be successful cleaners, advanced vacuums are able to map the rooms in your house, and thereby enable other Internet of Things (IoT) applications. iRobot is expected to be able to use these mapping and mobility technologies to produce a mechanized lawn mower in the near future. Also seeing an opportunity in outdoor equipment, iRobot competitors Kobi and Honda have already produced prototype robotic snow throwers. In addition, field tests of Snobot Pro's robotic snow removal equipment have been promising. With near term visibility into robot vacuums, mops, lawn mowers, and snow throwers, home care and lawn care jobs may indeed be at risk.

Conclusion

Established robotics markets are showing growth, and American public companies seem to have an edge in surgical devices. Lack of both tactile control and fully autonomous movement is keeping the service robot opportunity in the novelty stage. Home appliance applications seem to be the right match for the current capabilities of the technology. JAG sees growth investment opportunities in surgical and home appliance robots, and we do not foresee a widespread threat to jobs given the capabilities of the current machines.

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