

## **Prepared for the Board of Trustees and the Strategic Leadership Team**

This quarter's report will feature a change of pace. Consider it information to ponder during the summer months. April's report ended with a section on robotics. This report will explore in more detail this advancing and innovative field of study. Every article summary has a link to the actual article so that you may read in its entirety. Each section will contain article summaries as well as Possible Implications based upon the materials scanned.

## **How Robots Are Changing**

**Summary:** The first article describes the present state of the industrial robot and the way one company sees that role changing. The author of the first article Rodney Brooks, is a computer scientist and co-founder, in 1990, of iRobot, makers of the Roomba robot vacuum cleaner. He is the founder and chief technical officer for Rethink Robotics, [www.RethinkRobotics.com](http://www.RethinkRobotics.com). Below are some excerpts from his article.

### **The Robots are Coming ----- to Work: Meet Baxter Your Future Co-Worker**

- Many fear that a robotic takeover of manufacturing jobs will keep humans out of work. But one inventor shows how tomorrow's manufacturing robots will be smaller, smarter, and co-worker friendly—and they'll let manufacturers stop chasing around the world for low-wage workers.
- Off-shoring is not sustainable because the standard of living increases in countries that have low-cost labor causing the manufacturer to move to another country with lower labor costs. This is not a sustainable model because we will soon run out of countries with low cost labor.
- Current industrial robots perform repetitive tasks, but cannot work alongside human workers because they do not "sense" the presence of the worker.
- We saw 300,000 small manufacturing companies in the United States with fewer than 500 employees. Almost none of these firms have an industrial robot, for some of the reasons outlined above. Almost all of these firms have relatively small production runs. That means they're constantly changing the design and manufacturing procedures for what they produce.
- We build a robot named Baxter, a new type of industrial robot that sells for \$22,000.
- Baxter is very different from existing industrial robots. It doesn't need an expensive or elaborate safety cage, and factory operators don't need to put it in a part of the factory where it's segregated from the rest of the workers. It's safe to share a workspace with.
- Baxter also works right out of the box. Typically, it takes 18 months to integrate an industrial robot into a factory operation. With Baxter, it's about an hour. Baxter requires no specialized programming. A factory floor worker with only a high-school diploma, someone who has never seen a robot before, can learn to train Baxter to do simple tasks in five minutes. If you're a manufacturing engineer, you can go deeper into the menu system and adjust and optimize settings for different tasks. More-complex tasks require a bit more training.

- Baxter is outfitted with a variety of sensors, including depth sensors as well cameras in its wrists, so it sees with its hands. It's constantly building and adjusting a mathematical model of the world in front of it, allowing it to recognize different objects.
- This means that ordinary factory workers are now empowered to be the programmers. They're not in competition with these machines, because an average factory worker can serve as a supervisor to Baxter. A factory worker can show the robot a fragment of the task she is asking the robot to perform, and the robot infers the rest of the task. And if someone is interacting with the robot or doing part of the task, Baxter can figure out to just do the rest of the task.
- Currently applications for the Baxter, the two armed robot are being considered in research, health care, and elder care.

[Robots at Work: Toward a Smarter Factory](#), *The Futurist*, Rodney Brooks, May-June 2013, Vol. 47, No. 3.

**Possible Implications:** Brook's vision and product has profound impact for the way robots will be used in the future. Rather than robots that have to work in isolation and are difficult to install, Baxter offers an easily programmable solution meant to work alongside human workers. In addition, the robot is much more suitable for the small to medium-sized manufacturers found in the West Michigan Area. Curricular areas that deal with manufacturing, electronics, and eventually health care should prepare students to work with these new robotic workers.

## Robots in Manufacturing and Beyond

**Summary:** Below is a side bar found in the above article. It is included to show the expansion and diversity of robotics in the United States. It also emphasizes the importance that the U.S. is placing on the future of robotics and its affect upon our economy.

### Facts and Figures: The Role of Robots in the U.S. Economy

Robots are the future ... and the present! On March 20, 2013, the U.S. House of Representatives' Robotics Caucus Advisory Committee heard from top luminaries in the field of robotics. Henrik I. Christensen of the Georgia Institute of Technology presented **A Roadmap for U.S. Robotics: From Internet to Robotics—2013 edition** detailing the contribution that robots make to the U.S. economy across sectors. Below are key highlights from the report.

- **Manufacturing:** "The manufacturing sector represents 14% of the GDP and 11% of the total employment. Close to 70% of the net export from the U.S. is related to manufacturing.... The sale of robotics for manufacturing grew 44% during 2011.... Robots have been used as a facilitator to inshore manufacturing for companies such as Apple, Lenovo, Samsung, and Foxconn. The use of robots is shifting from big companies such as GM, Ford, Boeing, and Lockheed Martin to small- and medium-sized enterprises to enable burst manufacturing for one-off products."
- **Medicine:** "Use of robots for surgery can reduce the number of complications by 80% and also allow a significant reduction in the time for hospitalization as well as a significantly faster return to the workforce and to a normal life. Due to the aging of society, the number of expected surgical procedures is expected to double over the next 15 years."

- **Services:** “Robots are used both in professional and domestic service applications. More than 6 million autonomous vacuum cleaners have been purchased, and more than 200,000 autonomous lawn mowers are used worldwide. Robots have also been deployed for personal security applications. Professional service applications include inspection of power plants and infrastructure such as bridges. Service robots are also used in logistics applications such as delivery of beddings, meals, and pharmaceuticals at hospitals. The annual growth in professional service robots is 30%, and in domestic service applications, the growth is 20+%. U.S. companies have dominated this area, and it is considered important to maintain the momentum.”
- **Space:** “Repetitive, high-precision, and extended tasks are all examples of where a robot may offer an advantage over use of humans. In addition, progress in these advanced applications offers important insight into how the same systems can be used in daily lives, which is one of the reasons that NASA and GM have teamed up to design and deploy the Robonaut system in the ISS.”
- **Defense:** “At the height of the intervention in Iraq and Afghanistan, more than 25,000 robotics systems were deployed with a fairly even divide between ground and aerial systems. Unmanned aerial systems allow for extended missions, and the risk to the pilot is eliminated. Today, more than 50% of the pilots entering the Air Force become operators of remotely piloted systems rather than becoming regular airplane pilots.”

Source: A Roadmap for U.S. Robotics 2013. Download the full report at [www.robotics-vo.us](http://www.robotics-vo.us)

[Robots at Work: Toward a Smarter Factory](#), *The Futurist*, May-June 2013, Vol. 47, No. 3.

**Possible Implications:** The full report cited above is very comprehensive. [A Roadmap for U.S. Robotics 2013](#) should be studied further in order to fully understand the implications for education.

## More Applications for Robots

**Summary:** Below are 30 articles which describe some type of robotic device or robotic research. This is a sample of the 75 articles scanned this year on robotics alone. If the link does not work contact [mchampion@gccc.edu](mailto:mchampion@gccc.edu) and a copy of the article will be sent to you.

Date	Title
August 2, 2012	<a href="#">New Navy Fighter Drone Promises Pilotless Future</a>
July 24, 2012	<a href="#">New Wearable Robot Technology Helps Paralyzed Patients Walk</a>
June 23, 2012	<a href="#">Grand Rapids Surgeon Talks Robotics in Japan</a>
August 15, 2012	<a href="#">Solar-Powered Robots to Track Sharks</a>
August 16, 2012	<a href="#">Home for RoboDawgs</a>
August 12, 2012	<a href="#">Robot Removes Gallbladder</a>
September 12, 2012	<a href="#">Can a Robot Get Into the World’s Top Schools?</a>
September 5, 2012	<a href="#">Robot Cars Could Increase Highway Efficiency 273 Percent: Study</a>

September 4, 2012	<a href="#">UK Paraplegic Woman First to Take Robotic Suit Home</a>
September 12, 2012	<a href="#">Robo Recon: Robots Assist Police During West Bloomfield Barricaded Gunman Standoff</a>
September 20, 2012	<a href="#">Baxter: An Industrial Robot That Anyone Can Use</a>
September 18, 2012	<a href="#">NASA Funds 8 Robotics Projects to Push Frontiers of Space Exploration</a>
September 24, 2012	<a href="#">Toyota's New Robot is Handy Household Helper</a>
September 28, 2012	<a href="#">Wall-Ye Robot Does Grunt Work at Vineyards</a>
September 29, 2012	<a href="#">Robots to Keep Farmed Fish Fit and Healthy?</a>
October 15, 2012	<a href="#">Robotic Wheelchair Turns Wheels Into Legs, Climbs Steps</a>
November 7, 2012	<a href="#">Robotic Hand Can Crack Eggs, Pour Beer</a>
November 7, 2012	<a href="#">Bird-Brained Robot Flies Outdoors Without Crashing Into Trees</a>
December 4, 2012	<a href="#">Robotic Cars Will Be Safer, Faster in Traffic</a>
December 12, 2012	<a href="#">Humanoid Robot Flexes Its 160 Muscles for Creepy Realism</a>
December 19, 2012	<a href="#">Window-Cleaning Robot Swipes a Chore from To-Do List</a>
January 2, 2013	<a href="#">DIY Underwater Rover Makes Public Debut</a>
January 23, 2013	<a href="#">Students Treat Robo-Dogs at High-Tech Veterinary School</a>
February 3, 2013	<a href="#">Rick Haglund: Will We Live in a World Ruled By Robots and Computers, and Fewer Jobs for Humans?</a>
April 30, 2013	<a href="#">Robot Finds Mysterious Spheres in Ancient Temple</a>

## A Recent Local Development

**Summary:** The recent news reported in the Grand Rapids Business Journal is further evidence of the importance of understanding the current directions of robotics technology.

**Start Garden invests in... [robotic caregiving](#)**

### Robotic Patient Aid

- The [Start Garden](#) team put \$5,000 into Robotic Patient Aid, which would create a multi-use device to aid those with limited mobility.
- The device could be summoned via a tablet app, writes idea creator Jim Schaddelee on his [Start Garden page](#).
- For years, Schaddelee watched his father take care of his late mother “like a saint,” he said, and his product would give caregivers and patients, people like his parents, more dignity and independence.
- “Soon, 20 percent of the U.S. population will be between the ages of 64-84 and fighting for their independence. The RPA is designed to help caregivers and nurses provide patients with more independent care,” he writes.
- “Our first Robotic Patient Aid is designed to adapt to different patients and has different drive systems to operate in a variety of facilities,” he writes. “Good margins will allow us to buy tooling and decrease costs quickly. The ability to add features and services will only increase our markets.”

[Start Garden invests in interactive wallet and robotic caregiving](#), GRBJ.com, Mike Nichols, June 24, 2013

**Possible Implications:** Again it should be emphasized that many of these robotic concepts are in their infancy. However, changes in the number of elderly coupled with a decrease in the number of working age people in the workforce will drive innovative ways to take care of the elderly's needs. Robotics will be at the forefront of that innovation. GRCC should position itself as an educational institution ready to embrace the future opportunities that will be brought about by this technological revolution.