



Technology takes on agriculture

The need for robust, low-latency connectivity to support the future of farming

By David McCall
Chief Innovation Officer
QTS Realty Trust (NYSE: QTS)

Let's do some quick math. Imagine that the world is an apple. If you cut that apple into four even slices, three of those slices represent the bodies of water on Earth. That last slice is the world's land, and only a third of that slice is farmable land—with the apple skin representing the topsoil. I learned that from a presentation given by Steve Rommereim, a fifth-generation farmer and former president of the National Pork Board. Rommereim's presentation hit a cord. While our population continues to grow, the amount of farmable land remains the same.

The numbers are concerning. In the 1930s, a single farmer generated [enough food to feed four people in a year](#). In the 1970s, that number increased to 73, and then to 155 in 2010. In the next 30 years, each farmer will need to feed approximately 264 people to keep

pace with the escalating world population. And, again, this increase in food production must be achieved on that same sliver of land. This already arduous task is compounded by an aging and dramatically shrinking agricultural workforce and the need to be environmentally conscious.

So, how does the agricultural community do it? The short answer is that they need to find innovative ways to use this finite acreage.

Introducing agrotech

This is where agrotechnology comes in. [Agrotech](#), also called Smart or [Precision Farming](#), is the use of technology to improve the efficiency, yield, and, ideally, profitability of a farm, ranch or similar enterprise. By integrating a series of technologies and next-

generation connectivity, agrotech helps farmers do more with less.

Sounds simple enough, right? After all, technology has integrated itself into most businesses to improve efficiencies and business outcomes. Farmers have relied on weather modeling and automated irrigation systems for years to improve their yields. Today, agrotech utilizes a widening scope of IT innovations including artificial intelligence (AI), data analytics, machine learning, robotics, GPS, edge computing, low-earth orbit satellites, fiber and much more to further improve production.

In air, on land and on livestock

Drones and robots

Agrotech has seemingly unlimited potential to help farmers and

ranchers improve their yield and efficiencies, and robots and drones are positioned to be game changers for the industry.

[Automated drones](#) can map expansive properties; evaluate the condition of soil and crops; count, track and monitor livestock; and identify areas that need to be watered or fertilized—all in real-time. This live data allows the team on the ground—whether human or robotic—to react efficiently, triaging issues to address the tasks that need immediate attention and identifying potential issues before they get out of hand. This streamlines responsibilities, allowing farmers to tend to areas with weeds or pest infestations, and ranchers to quickly attend to distressed animals without manually surveying the property on foot. This also saves time and money, and is more environmentally friendly as only the crops that need to be watered, fertilized or sprayed with pesticides receive that treatment.

Two scenarios are particularly interesting to me. First, is a specialized robot that patrols rows of planted produce, assessing the health and needs of the plant as it passes by. Equipped with dozens of cameras, this robot can evaluate the color and size of the produce, spot water, dig out weeds, vacuum pests off leaves and spray micro-pesticide, as needed. And the robot can do this 24/7—up and down, row after row, day after day. The robot submits the collected data to the monitoring tools so the farmer can respond to any identified needs. This helps farmers focus their time and resources where they are most needed, which is good for the bottom line and our planet.

Another scenario uses robots and drones to herd livestock. These



rugged robots are built to traverse the rough terrain, allowing them to navigate pastures and hills to track cattle. To move the herd to the next location, the robot calls out to the cattle in the rancher's voice—and the cattle listen because they are trained to follow the rancher's voice and cadence.

Drones are also being used to herd livestock. While helicopters have been used in this role for years, [drones provide a less expensive alternative](#). [The drone hovers](#) over the pastures and, much like a cattle dog, herds the cattle to their destination. Some drones are fitted with speakers that project a dog's bark or a siren to help drive the animals. Heat sensitive cameras and recognition software are also being considered to help drones find and rescue lost animals.

IT-enabled tractors can also support improved productivity and eco-friendly practices by calculating exact fertilization requirements rather than blanket spraying crops. Many of these IT capabilities can be automated, and all of it can be fed into data analytics tools that continuously evaluate methods to generate the largest yields and the healthiest outcomes for plants, animals and humans. This data also enables improved decision-making capabilities to support better production.

Wearables for animals

In our two-legged world, the [wearables market exceeds 32 billion](#) users. Today, wearables have also found their way into the four-legged world. By fitting ranch animals with wearable devices, farmers can track the locations, health and activity levels of livestock. This biometric data allows farmers to detect health problems and gauge how well rested, hydrated and fed their animals are. One Georgia [dairy farm](#) is using wearables, analytics and AI to do just this. Live data is recorded by the wearables, submitted through the Google analytics engine, and ultimately delivered to the farmer's smart phone and computer. Equipped with important insights into the health and habits of its livestock, farmers can better care for their animals and more efficiently manage resources.

The Obstacles

While these possibilities hold tremendous potential, there are several obstacles impeding progress.

The technology mindset

Frequently, when technology is recommended to improve job efficiency, the immediate concern is that people will lose their jobs. However, with a shrinking workforce, farmers need to supplement existing

labor and fill in widening gaps. By utilizing IT where possible, farmers can redirect workers to other tasks. The University of California's mechanical tomato harvester proved this point in 1979. The university was sued, alleging that the publicly funded invention would put people out of work. As it turns out, the tomato harvester not only improved productivity, but it also created a variety of new opportunities for workers that delivered estimated [gross social gains exceeding 1,000%](#).

Deploying technology in an unpredictable environment

You would think that one of the biggest obstacles to agrotech would be the willingness of farmers and ranchers to change. This is not the case. This community is—and has been—continuously adapting to new conditions and technology innovation, and it welcomes any change that can improve its business results.

What remains a challenge is the upfront costs and complexity of getting technology to a rural area. Those of us in IT know the intricacies of building a Wi-Fi, cellular or satellite environment that can accept a wide variety of devices with built-in redundancy and resiliency. Try to imagine building that same environment, but not for an indoor space with a relatively static infrastructure—for an outdoor space

with harsh, constantly changing environmental conditions. On farms, any number of weather patterns and environmental factors can impact IT performance. Crops grow and are harvested, winds pick up and die down, rain and scorching heat come and go, and animals wander the grounds. All of these factors impact the landscape, making it inconsistent at best.

These variables can also impact the ability to build IT, data analytics and other necessary technology infrastructures. Just morning dew reflecting off the ground or plants can wreak havoc on cameras, robotic interfaces or interfere with drones. What happens when these technologies cannot perform their jobs and collect data? Do all actions that are predicated on that information stop? If a herding robot fails or gets stuck, are the animals left stranded?

Additionally, technology takes maintenance and care. Devices need to be recharged, components need to be replaced, and people need ongoing training on how to use rapidly evolving tools. These are all daunting challenges to be overcome, yet they might not be the biggest hurdle.

The connected environment

The real, lingering challenge is getting the necessary bandwidth

extended to the farm or ranch. A lack of connectivity—or even connectivity without sufficient bandwidth—will cripple any available IT options. To use technology effectively, farmers need robust connectivity that provides uninterrupted, low-bandwidth streaming to access data from a wearable on a goat and to burst large image files to and from a drone or satellite to evaluate heat maps and data recognition in real-time.

However, extending ground- and satellite-based connectivity options is neither easy nor cheap. U.S. fiber deployments can cost hundreds of thousands of dollars from an ISP. These providers are trying to devise a business model that extends high-speed connectivity to sparsely populated areas that is both affordable for the end user and profitable for the provider. In some cases, [electric co-ops](#) are helping to build out the necessary infrastructure and the [USDA has taken the challenge to our nation's capital to convey the urgent need for infrastructure](#).

If ever there was an argument for 5G and edge computing, this is it. These environments require extremely high bandwidth capability with the flexibility of wireless to deliver the necessary performance and cost combination. Agriculture equipment manufacturer [John Deere](#) is putting its weight behind this issue, advocating for upgraded rural infrastructure using 5G. Microsoft is in on it, too, as [The New York Times](#) reported in 2017 that the software giant was planning to utilize unused TV channel spaces to bring broadband connectivity to rural America. Satellites are another option as they are being used extensively to provide precision mapping.





The data center's role in supporting agrotech

Data centers have a role in enabling agrotech, too. Small, remotely managed edge data centers will provide the proximity to rural areas to handle latency-sensitive, locally cached data requirements. These data centers will likely focus on autonomous vehicles, robots and drones that demand real-time updates, and may also support basic data mining and some machine learning. An edge data center could quickly process information to allow a strawberry picker to compare images to determine if a spot on a strawberry is an insect, dirt or disease.

While the edge data center delivers a specific use for low-latency applications, larger data centers that are further away from the source of the data will continue to process the bulk of data mining and machine learning applications as they are better equipped to deliver the serious compute power needed for larger files and intense analytics that are not latency dependent.

Conclusion

Improving farming yield is an issue that impacts all of us. We need farmers to be successful, and as technologists, they need us to help them get there. In addition to developing innovative IT solutions that can help them improve their processes, we need to advocate for and support powerful, yet affordable infrastructure in these rural areas.

Once in place, this community will do the rest. It certainly won't be easy, but I've yet to meet anyone that drives a tractor, rides a horse or milks a cow that has asked for easy. They do, however, ask for a chance.

ABOUT QTS

QTS Realty Trust, Inc. (NYSE: QTS) is a leading provider of data center solutions across a diverse footprint spanning more than 7 million square feet of owned mega scale data center space within North America and Europe. Through its software-defined technology platform, QTS is able to deliver secure, compliant infrastructure solutions, robust connectivity and premium customer service to leading hyperscale technology companies, enterprises, and government entities. Visit QTS at www.qtsdatacenters.com, call toll-free 877.QTS.DATA or follow on Twitter @DataCenters_QTS.