**Why Precision Agriculture Will Change How Food Is Produced**

**Jennifer Kite-Powell**

**Contributor**

A Braintree Technologies Sdn. drone flies during a pesticide aerial spraying demonstration in this aerial photograph above a palm plantation in the Universiti Putra Malaysia Research Centre in Serdang, Selangor, Malaysia on Friday, May 12, 2017. The tropical tree fruit that yields palm oil is harvested mostly by hand and in dangerous conditions that lead to a lot of waste. In Malaysia, where about $1.2 billion of oil may be left in the field this year, the industry is working on new technologies like electric cutting machines and pesticide-delivering drones to boost output. Photographer: Sanjit Das/Bloomberg

Food waste during the production process is costly to the environment and economically. According to a McKinsey & Company report in 2016 on how big data will revolutionize the global food chain, about one-third of all food is lost during production each year globally in developing and emerging countries, while at the same time, 795 million people go hungry. Food loss and wastes cost about $940 Billion and have a carbon footprint of 4.4 Gt CO2-equivalent which is more than eight percent of global greenhouse-gas emissions.

Precision agriculture is predicted to target this problem, and by 2020, this market is expected to grow from $730 Million to $2.42 Billion by 202o. Technology like drones, radio frequency (RF), autonomous tractors and IoT applications are playing a role in the transformation of agriculture.

In March 2018, the Federal Aviation Authority (FAA) released a statement indicating that the number of commercial drones and drone operators will quadruple over the next five years with almost a half a million drones in action by 202o. Combined with the advancements in drone technology and the impact the technology can have on farm production and irrigation, the commercial drone market is quickly expanding to cover new industries and applications like agriculture.

RF technology, invented in 1895, has seen consistent advances over time and is now being applied to precision agriculture in drones, smart sensors, and autonomous tractors.

According to Kim Niederman, CEO, Freewave, RF tech provides the communications backbone for autonomous vehicle Real-Time Kinematics (RTK), drone deployment and smart sensor ecosystems.

"Real-Time Kinematics comes from the combination of RF and GPS which allows autonomous tractors to navigate and course-correct throughout crops with up to one-centimeter of accuracy. A wireless Machine-to-Machine (M2M) network with wireless RF devices installed has the potential to solve major connectivity issues in autonomous agricultural settings," said Niederman. "An RF-powered drone can help optimize resources such as fresh water, fertilizers, and pesticides as well as identify healthy and unhealthy crops and irrigation problems."

Niederman says that smart sensors can be applied to soil monitoring to pivot irrigation but that RF is more efficient and affordable in remote sensor ecosystems that need to transmit data beyond cellular or Wi-Fi range.

"While automation isn't new to the agriculture industry, the use of drones to make farm production more precise is still in its infancy," said Niederman. "As human populations increase, utilizing every centimeter of arable land and conserving resources is paramount to meet demand and for sustainable agriculture systems."

Niederman says that for agriculture, especially as it relates to irrigation, it makes sense for farmers to begin leveraging RF to help boost production, lower costs and conserve precious resources like water.

"Farmers can deploy drones to get real-time data of their fields to identify issues such as irrigation problems or poor performance areas," added Niederman.

For example, if a sensor in the field detects crops are being over or under-watered, or if the soil doesn't have enough nutrients, it can automatically alert drones to be deployed to scope out if it's an issue with the irrigation system, what the soil condition looks like, or even if it's a false-read. Or, when the drone flies over farmland, it can also send back video and multispectral images that can observe the differences between healthy and unhealthy crops and then notify resources to be deployed accordingly. This helps farmers see issues they may not be able to see regularly, especially if they have survey hundreds of acres.

Michael Chasen, CEO, PrecisionHawk, said that to optimize farm management decisions, farmers continuously have to make trade-offs based on different parcels of land.

"For example, say a farmer can only collect data over half of their fields in one day using the ‘old’ method. The farmer looks at half the fields and decides to fertilize field 14. Unfortunately, field 22, which the farmers didn’t get to that day, is the field that needs to be fertilized immediately," said Chasen. "By capturing data over your entire operation, you can catch the most pressing issues early enough to make an adjustment. When you are flying in visual line of sight, you just cannot acquire all that information in one day."

Maxime Carre, a young farmer, connects his tablet to a high-speed radio internet network (THD) before working in the fields on April 3, 2018, in Allerey-sur-Saone, Burgundy, central France. (Photo credit: PHILIPPE DESMAZES/AFP/Getty Images)

Chasen adds that a critical agricultural trend to consider is the fact that farms are continuing to consolidate.

"Farmers need technologies that can provide impact at scale. But as farms get bigger they cannot trade growth for sub-optimal decision making, or they won’t achieve the efficiencies or outputs expected through the consolidation," said Chasen.

Niederman points out that accurate positioning of equipment is essential to conserve resources and target needed areas of the field. Poor to non-existent wireless coverage in rural areas has prevented the adoption of smart sensor networks and process control in irrigation and other agricultural processes.

"With smart device connectivity over long ranges and low power consumption, RF provides reliable connectivity for pivot and smart irrigation systems," adds Niederman

"In just a few years, drones have emerged as a transformative force for business intelligence and operations—a 2017 study by Price Waterhouse Cooper found the value of drone-powered solutions is more than $127 billion," said Chasen. "There is exceptional value for applications in agriculture—these small unmanned aircraft had allowed us to see farther and gather information before that was too expensive, dangerous or impractical to get. However, some of the most valuable applications of drone technology in agriculture remain impossible to execute without with ability to fly drones Beyond the Visual Line of Sight (BVLOS)."

Flying drones over long distances, imperative for inspecting hundreds of acres of crops, has been difficult to-date because the FAA requires very high safety standards from operators seeking to fly drones beyond where they can visually be seen (BVLOS).

Under the FAA-sponsored initiative, the Pathfinder Program, PrecisionHawk gathered data over a three year period to better understand the expansion of Unmanned Aircraft Systems (UAS) operations and create recommendations for BVLOS training and technology to maximize safety for the next wave of drone use.

According to Chasen, PrecisionHawk believes that expanding drone operations to BVLOS will change the game for farmers.

"In agriculture today, drones are being used on a field-by-field basis. This creates a logistical challenge for large farming operations. Flying drones BVLOS allows the grower to gather data across his/her entire operation at one time," said Chasen. "Of course, this saves time and money simply regarding how a grower gets around his field, but the real power lies in collecting a one-to-one comparison of each field at the same point in time."

Chasen hopes the blueprint provided through the final Pathfinder Report will allow businesses to fly BVLOS so the sizeable sophisticated farm can achieve both scale and consistency from an information-gathering perspective.

"That being said, this isn't just a technology development that will help larger operations in their farm management decisions. This expansion of drone operations will equally support the crop consultants who work for family farms and generally are paid by the acre," said Chasen. "The ability to fly drones BVLOS will allow the crop consultant to scale their own operation."

"Instead of reaching 10 farms a day, they can reach 100, thereby reaching more growers across more land, but at the same cost. This will allow them to then deliver those cost savings back to the family farmer who is now getting better, more consistent data to manage their operation at a lower cost," adds Chasen.

As automation and connectivity continue to make their way into agriculture, and agriculture companies like John Deere create technology ecosystems that combine unmanned tractors, drones, and other

precisions equipment, farmers will be making smarter production decisions, increasing crop yields making farms more efficient.

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I'm a writer who looks at innovation and how technology and science intersect with industry, environment, arts, agriculture, mobility, health. I've been called the tech ...