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Harvesting Agricultural IoT's Potential

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The Internet of Things (IoT) has quickly progressed from a technology subject to speculation and hype, to a legitimate target of investment receiving attention from a range of industries and businesses.

The IoT industry has seen a boom in application and solution development, bringing costs down. The declining price of equipment like sensors is likely to result in increased uptake. This trend is likely to continue as 5G applications and connectivity accelerate these technological advances and broaden the possibilities of the IoT's capabilities.

One area where the IoT is gaining traction is the agricultural industry. Precision farming, which utilizes a range of systems for targeted observation and management of land and crops, is being powered by the IoT, which can provide detection, monitoring and control across a range of agricultural farming processes. For an industry facing increased pressure as natural resources are stretched thin and populations increase, this revolutionary approach to farming could have a massive impact on food production and its ecological impact—as long as vital components like reliable connectivity are readily available to this often remotely located industry.

Stark warnings

By 2050, with the global population expected to reach 9.8 billion, food supplies face a precarious situation with demand expected to be 60 percent greater. According to the World Economic

Forum, climate change, urbanization, and soil degradation will shrink the amount of farmable land available, meaning the world faces a food security crisis if the situation isn't addressed.

The United Nation's food envoy has also warned that more people are in danger of food shortages as the coronavirus crisis continues, with the risk worse in 2021 than the period shortly after the pandemic began due to food market closures and rising food prices, among other reasons, highlighting the fragility in some regions of food production and access.

And it's not just food that is at risk of scarcity. Water use has been growing globally at more than twice the rate of population increases in the last century, according to the UN, and the limit for sustainable water delivery has been hit in many areas.

But how can the food and water needs of so many be achieved sustainably when agriculture is also a major contributor to climate change? The farming sector is no stranger to technological revolution. From crop rotation to the advent of mechanized equipment and the introduction of chemical fertilizers and biotechnology, the farming sector has embraced the technological revolution and has been at the center of many technological developments.

These increasing environmental worries are prompting farmers to shift their focus toward more sustainable agriculture practices, to both retain natural resources and more efficiently manage and yield crops. Technological advancements such as 'smart farms' to maximize output and reduce waste are encouraging investment and development in precision farming.

Precision farming and the IoT

Today, IoT is elevating agricultural practices, reducing waste generation and improving profit margins. Precision or smart farming utilizes drones, satellite monitoring and sensor technology to enable farmers to closely monitor their practices and activities and optimize inputs such as water and fertilizers to achieve better crop quality and yield. Digital technology enables farmers to collect data to observe, measure and analyze the individual requirements of fields and crops. This results in reduced waste, due to increased control of fertilizers, herbicides, emissions and soil compaction through a more rational use of resources—thus reducing environmental impact.

Autonomous farming vehicles are also revolutionizing the farming process with technology such as self-driving tractors. Autonomous tractors could totally automate portions of the harvesting process, such as grain handling. Fleets of vehicles that can access real-time data can provide vital information on weather conditions and sensors that alert drivers to any obstacle detection can greatly improve efficiency when using vehicles. Predictive maintenance for vehicles, enabled by data gathered and sent to the farmer, can also reduce costs.

Livestock management is another function where the IoT is taking root. Livestock such as cattle can have their data tracked with sensors to monitor performance and overall health. For example, if an animal is sick or injured, a sensor can send data that identifies this so that they can

be separated from other animals to be treated. This also lowers the risk of disease spreading. Drones are also being utilized to cut workforce costs and take advantage of real-time tracking of livestock.

Moreover, the market is growing. Valued at $6 billion in 2020, precision farming is expected to expand at a compound annual growth rate (CAGR) of 13.1 percent from 2021 to 2028. Thanks to increased adoption of IoT technology and advanced analytics, which uses forecast data to ensure that the crop and soil receive adequate nurturing, farmers are better able to plan and manage their crops. But to deliver these high-level capabilities in typically harder-to-reach, isolated locations, farms and farmers require access to a critical resource—connectivity.

Powering the IoT

The very nature of farms means that they are often located in rural areas, out of reach of terrestrial connectivity infrastructure. This new level of digitalization in agriculture requires uninterrupted, highly reliable communications to operate effectively and there is no one-size-fits all solution for each use case. Different connectivity capabilities will be required to address the full spectrum of applications from monitoring of farm machinery to the provision of Internet access to farm buildings. Use cases will vary in terms of the amount of data required: some will have high data requirements, some low.

Satellite's inherent capabilities—such as its ability to reach remote areas, scale, and to extend coverage for other providers—make it an ideal enabler of IoT. For example, satellite's 'anywhere, anytime' capability enables real-time asset management. This means that IoT sensors can collect data in the field, such as air and water quality, and enable live tracking of weather and environmental circumstances. In doing so, satellite-based IoT solutions provide a highly reliable, cost-effective solution that can reach anywhere. Satellite is also highly scalable, allowing it to serve many remote sites across a wide geographical area.

Use case examples include crop management and weather monitoring. For the former, sensors can gather ground temperature, water potential and soil moisture data. Remotely controlled systems like pheromone dispensers and traps can manage pests and any data collected is sent by satellite to the cloud. Cloud applications can be set to monitor pest activity, potential crop diseases, and growing predictions and send relevant alarms to the growers. For weather monitoring, connected sensors tracking wind speed, direction, rainfall, sunshine, humidity and air pressure collect local data and weather information that are then transmitted via satellite to the cloud. The collected data and cloud application allow for more informed decisions on crop preparation, irrigation, pesticide use and labor dispatch.

Another critical requirement of any IoT solution is ease of use. Time is a critical resource in agriculture, and with no IT manager on a farm, farmers still need to be able to install the systems rapidly and get them up and running quickly. Terminals must also be small, with low power

consumption, offering access to all frequency bands—and the cost of the solution must be affordable. Above all, farmers must see fast return on investment.

A new ecosystem

The success of the IoT's impact on precision farming is dependent on the creation of a robust ecosystem. This involves several steps: harvesting the data from the field, passing it to the cloud and analyzing it using AI and machine learning before making meaningful data available on platforms that farmers can easily access to aid decision-making. Real-time information on weather and environmental factors, for example, will provide key data on when to irrigate. Other tools such as intelligent silos, drone and soil sensors and farm robots provide critical insights, enabling better management of crops and livestock.

The IoT, in both the agriculture sector and other industries, can improve productivity, allow for better asset management and monitoring, enhance security, and ensure accurate data gathering. The IoT's rapid growth is bringing huge improvements in terms of both the abilities and costs of equipment such as sensors and terminal pricing and affordable connectivity solutions. With concerns over the production of food and the availability of water topping the agenda for governments, aid agencies and farmers alike, this means that precision farming can be equipped with the technology to prepare the agricultural industry for the challenges that lie ahead. Satellite-based IoT solutions offer an answer, providing a highly reliable, cost-effective solution that can reach anywhere.