Precision Agriculture: Poised for Growth

More Food for More People

Around the world, our agriculture challenges are relentless. The global demand for food increases — but the amount of arable land shrinks. That's putting today's farmers at a difficult crossroads. Meanwhile, the challenge of hiring and training enough field workers can be nearly insurmountable. Whether it's a multi-state mega-farm enterprise spanning hundreds or thousands of square miles, or a niche producer of specialty crops and livestock, virtually every farm operation needs to unlock new ways to increase yields and reduce costs.

Yet there are other equally important considerations and optimization opportunities that are driving decisions by farmers to invest in new technology solutions:

Safety. Farming can mean putting people in risky places to measure tank inventories, check on volatile grain bins, or work in hazardous conditions. Farming operations want to reduce safety risks and their associated costs.

Environmental issues. Whether it's reducing the need to drive vehicles across hundreds of square miles or controlling the use of water, fertilizers, and pesticides, farmers must find new ways to reduce their eco-footprint.

Accuracy. The one-size-fits-all model for agricultural operations such as watering and applying fertilizer on a schedule is long gone. Instead, farms are leveraging technology to optimize the use of every resource for more control and better outcomes.

Automation. From remote operation of frost fans and automated feeding systems to autonomous tractors, automation can improve efficiency across the agricultural landscape.

What Is Precision Agriculture?

Grow with Digi: Pinpoint control, better yields, lower costs

How can you produce more food at lower costs with a smaller eco-footprint and fewer resources? The answer lies in precision agriculture — the use of sensors, edge computing, and wireless communications to gather data and insights from remote systems, automate farming tasks, accelerate processes, reduce waste and costs, improve safety, optimize crop yields, and minimize environmental impact.

Reaching almost every aspect of a farming or ranch operation, precision agriculture provides pinpoint control over everything from irrigation systems to pumps, fertilization, pest management, grain dryers, weather stations, feed bins, soil monitoring, remote cameras, tractor navigation, and much more.

Today's farms are harnessing the power of Digi technology and solutions to bring unprecedented efficiency and productivity to their operations.

Precision Matters

When a farm's footprint expands across hundreds or thousands of acres, a certain level of waste and variability are unavoidable in numerous scenarios. For instance, some crops and fields require different irrigation strategies. Previously, irrigation was largely a "one size fits all" model based on a soil sample or two and a weather forecast. That meant some crops were over-watered, and some crops were underwatered — even though they may be only a few meters or acres apart. The same dynamics apply with fertilizer and pest control. The inevitable result: waste and suboptimal yields.

Tractors can deviate from optimal planting routes, leading to wasted time, increased greenhouse gas emissions, more safety issues, and fewer crops in the ground. In the barn, cattle feed bins require monitoring and replenishment — even though consumption rates can vary based on many factors. Instead of manually traveling from barn to barn and bin to bin, farmers want efficient ways to optimize feeding schedules and amounts.

Today these goals are supported with remote sensing, GPS systems, embedded and edge computing — as well as long-range connectivity technologies — that can transform farming processes to dramatically reduce waste, create consistency, and continually fine-tune processes to optimize outcomes and output.

"We evaluated the market, looking for the best international wireless radios, and we found Digi, which has a proven and mature product family. It was a great choice for us because Digi XBee® is reliable and cost-effective and was especially fast and easy to integrate with our sensors."

— Flavia Paganelli, Director of Engineering, 30MHz

Irrigation/Water Optimization

In an era of climate change, farmers want to make every drop count. Developers of modern irrigation systems can rely on Digi solutions to support everything from soil sensing to connectivity to remote instrumentation of pumps and canals.

Design optimal irrigation schedules. A granular watering strategy lets farmers fine-tune their irrigation based on plant needs, not preset schedules. That eliminates waste and expense while ensuring healthier plants.

Monitor water levels. In tanks or ponds, farmers need up-to-date information on water levels and quality. Sensors can prevent the need to physically measure levels across acreage and help farmers adjust their water inventories as needed. Use of video monitoring can help your workers keep watch for water theft or disruptions.

Remotely open and close gates, valves and more. Automation of remote systems such as valves, gates, pumps, and other hydraulics means you can avoid wasted hours and needless vehicle fuel consumption and emissions. Instead, you can wirelessly activate the water infrastructure to immediately direct water to where it's needed to replenish tanks, ponds and reservoirs, and release water to fields.

Track soil moisture. A portfolio of battery-powered sensors distributed among the crops can wirelessly transmit moisture readings at regular intervals from almost any location through cellular or long-range WAN connections.

The result: Plants get the right amount of water they need to thrive. That means a smarter environmental footprint, lower costs, and healthier plants.

"We tried to create our own FCC-licensed radio product, but it was a big drain on our engineering resources, and we weren't totally happy with the performance. Digi's robustness was far better than the other alternatives we evaluated."

— Jacob Christfort, Founder, Ranch Systems

"We had a lot of confidence in Digi. Thanks to the DigiMesh® protocol, we were able to focus our resources on irrigation functionality — and not worry about networking intricacies. We also liked Digi's long product lifecycles as well. We've had, essentially, the same pin layout and firmware for the past five years."

— Jose Ulloa, Chief Technical Officer, WiseConn

Fertilizing and Pest Control

One of the biggest expenses for today's farms is fertilizer. And, like water, precision matters. Apply too much, and you're over-taxing resources and damaging crops. Apply too little, and you can stunt crop growth and reduce yields. Either way, your farm profitability comes under greater pressure.

Digi solutions help you capture and transmit soil statistics, plant conditions, and weather details. Centralized analytics let you identify the right amounts of fertilizer to apply — for each crop, field, or even individual rows — and automate processes.

Visual analysis. Using satellite or drone photos, AI tools can analyze the conditions of all crop fields to assess plant growth or the presence of pests and determine appropriate granular responses so that the right crops get the right sprays under the right conditions at the right times.

Spreader operations. Sensors attached to tractors or sprayers can wirelessly report on the effectiveness of fertilizer applications. You can monitor operations in real time across multiple fields and respond quickly to any issues that arise — before pesticide or fertilizer runoffs create headaches.

Groundwater monitoring. Farms are under pressure to prevent the release of contaminants that can leach into groundwater and lead to algae blooms, fish kills, and other harmful outcomes — as well as regulatory fines and penalties.

"We are very happy that we went with Digi. Not only are the products superior, but Digi backs that with a lot of support and service. The Digi Wireless Design Services team helped us write gateway code and helped us with data formatting. They were a huge part of our success."

— Mike van Bavel, President, Dynamax

Remote Monitoring — Grain and Feed Bins

Livestock ranchers managing hogs, cattle, sheep, and poultry constantly struggle to optimize feeding cycles for their livestock, facing special challenges and opportunities to ensure an uninterrupted supply of feed for their animals. Of course, animals need a steady diet to optimize their desired weight, health and growth, but feed bin maintenance can be a labor-intensive challenge. It's a similar story in grain dryers — and when workers check on the status of drying cycles, they're often in perilous positions. Today, these farms are turning to automation for operational efficiency and safety.

Feed bins. Traditionally, farmers have traveled from barn to barn manually restocking feeding bins — an expensive, time-consuming, and sometimes imprecise way to feed livestock. Instead of relying on farmers to manually check every bin in every barn and report that they need to be replenished, a combination of monitors, cameras, sensors, and wireless communication devices can remotely check grain bins and report the status. Some solutions can even issue automatic feed orders to ensure adequate inventories and prevent needless shortages.

Grain dryers. These expensive pieces of equipment accelerate farm production and improve quality, but they present safety and cost issues. At best, downtime costs money. At worst, blockages can ignite, destroying harvests and endangering workers. And overdried grains not only ruin crop quality, but they also waste energy. Connected cameras and sensors measuring temperature, humidity and volume can help farmers centrally manage this crucial process right from their phone or tablet.

> **"When we expand to different areas that have different cellular networks, we can adapt very quickly. Digi lets us swap between NB-IoT and LTE, for instance. That's huge for us."**
>
> — Randall Schwartzentruber, Cofounder and CEO, BinSentry

Livestock and Barn Monitoring

When it comes to dairy farming, cow comfort, like feed monitoring, plays a huge role in maximizing output. And smart, connected IoT devices and networks can play a major role.

For instance, connected cameras in barns in barns — backed by sophisticated algorithms, analytics software and Digi's industrial connectivity solutions — can help ensure proper lying time and animal comfort and reduce social stress and herd separation.

They can also monitor stall conditions to alert farmers about excess mud, manure, and runoff that can irritate or inflame udders and expose the herd to more pathogens. Environmental sensors can track temperature and humidity. Controlling these variables can lead to greater milk yields. Similar capabilities can support the health of poultry and other livestock in pens and barns.

> **"Between the rugged durability and reliability of Digi IX routers and the centralized manageability advantages that Digi Remote Manager® gives us, we have the solid connectivity foundation that our application requires."**
>
> — Yazan Senan, Principal Site Reliability Engineer, Cainthus

Livestock Health Monitoring

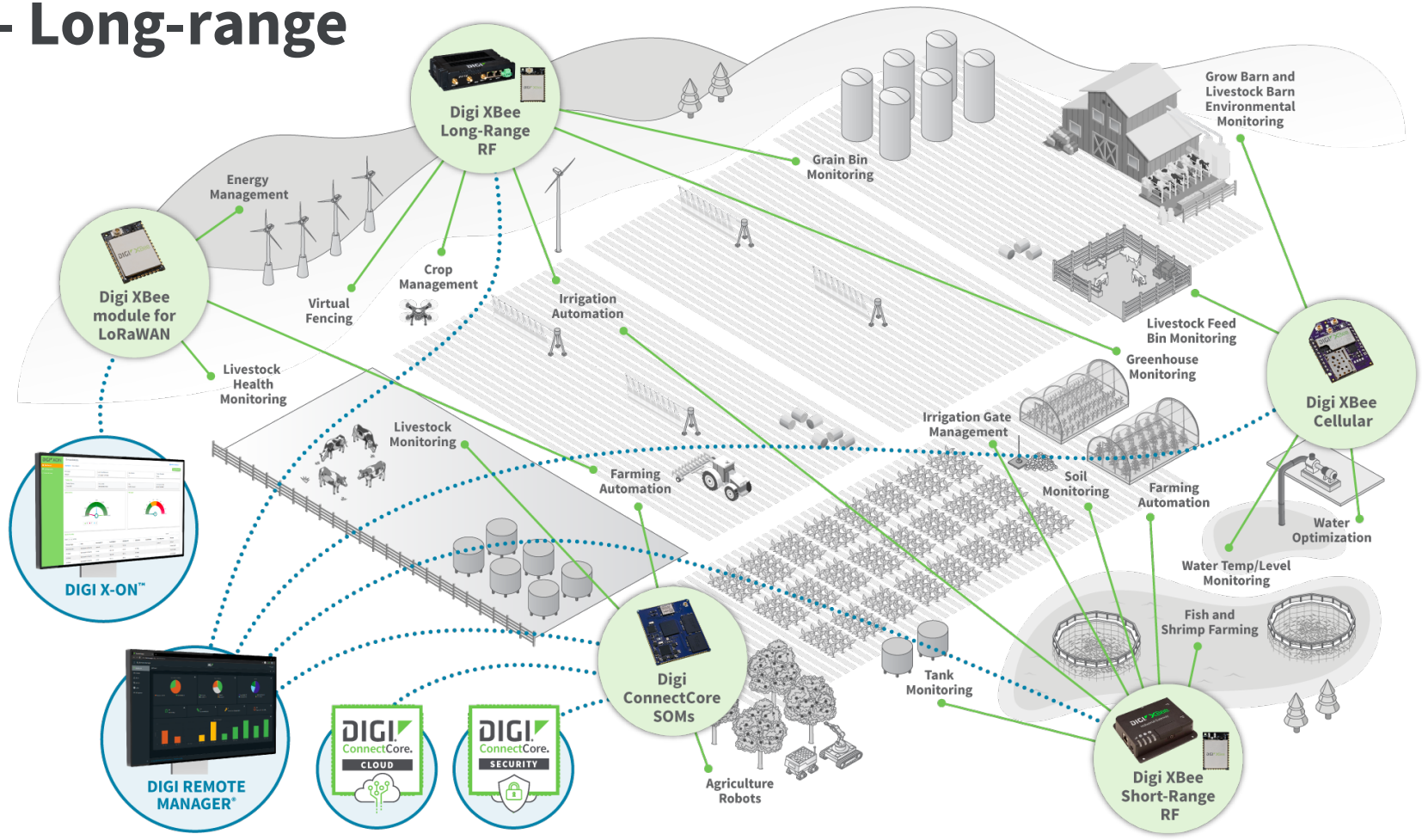
Outside the barn, ear tags with sensors enable farmers to monitor the health and movement of their cattle. That means ranchers can obtain a range of biometrics from their cattle while also tracking location and gaining other needed insights to best manage their herds.

These sensors, based on scalable edge-to-cloud technology empower ranchers, feedlots and dairies to take a proactive and innovative approach to animal health, enabling early detection of illness, and allowing for timely intervention to reduce extensive antibiotic treatments, prevent death loss and disease spread. This not only improves animal welfare but also contributes to the animal's continued weight gain and a more sustainable and responsible approach to livestock management.

> **"With our solution, we can identify and treat sick cattle up to 72 hours before they show signs of illness that you can detect visibly. Anytime you can keep an animal healthy, and eating and drinking, you deliver an immediate financial impact and an ROI to the cattle owners."**
>
> — John Greer, CEO, FeverTags.

Digi Wireless Communication Solutions for Agriculture — Long-range

Digi long-range wireless communication solutions
With line-of-sight ranges up to 65 miles and strong interference blocking, Digi XBee® long-range modules and the Digi X-ON solution offer a combination of reliability and redundancy for OEMs building low-power, mission-critical wireless devices for precision agriculture. These modules leverage unlicensed 900 MHz or 868 MHz spectrum and cellular networks.



Digi Wireless Communication Solutions
for Agriculture — Short-range and Cellular

Digi short-range wireless communication solutions — Digi XBee modules offer one solution for DigiMesh®, Zigbee, 802.15.4 and Bluetooth Low Energy protocols, delivering end-point device connectivity in a compact, low-power, low-profile footprint. These modules offer excellent flexibility, with the ability to switch protocols as needed. Additionally, they provide network stability through self-healing and dense network operation, as well as low operational overhead, making them an excellent choice for low-power, low-cost applications. They are easy to use and share a common hardware footprint for interoperability and scalability.

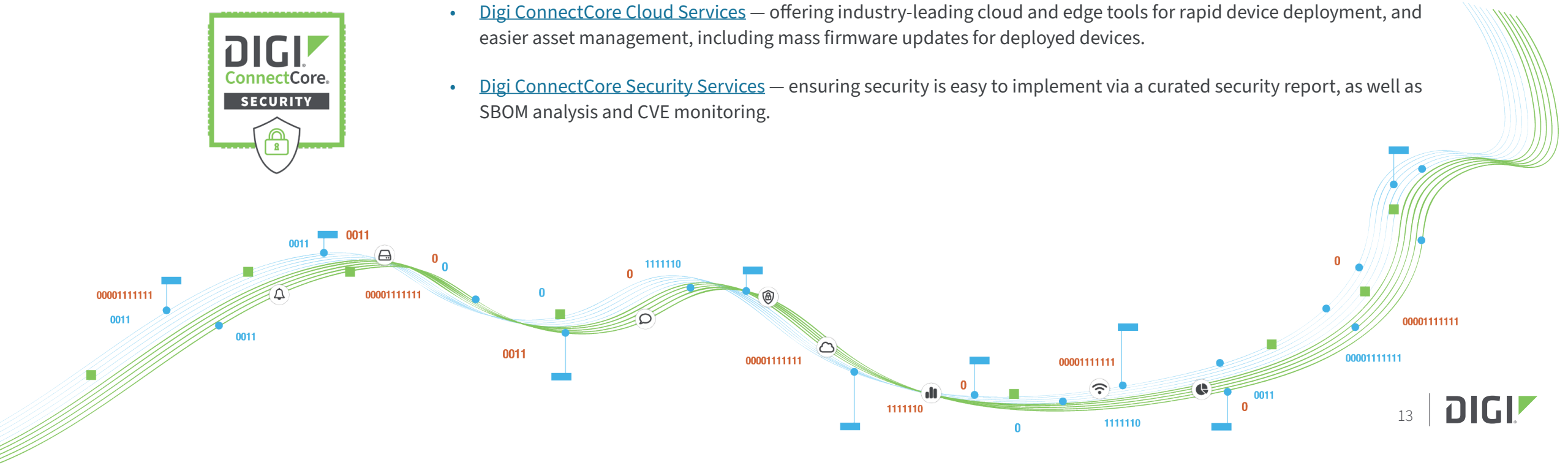
Digi XBee® 3 Global Cellular modules — Digi XBee 3 Cellular modems accelerate time to market by quickly enabling cellular connectivity and easy-to-add functionality. These pre-certified modules provide seamless cellular connectivity without having to go through a costly FCC or carrier end-device certification process. An excellent choice for low-power, low-cost, low-data precision agriculture applications (typically 5 MB per month, where latency is not critical), Digi XBee 3 Cellular LTE-M/NB-IoT, Cat 1 and Cat 4 modules feature a power-saving mode that extends sleep time and battery life.

Digi XBee® gateways — Digi industrial-grade XBee gateways like Digi IX15 connect Digi XBee RF modules to cloud applications over cellular or Ethernet, providing the easiest path to Internet connectivity for Digi XBee devices. These solutions provide excellent connectivity for developers seeking to create applications to deploy in the harsh environments of agriculture settings. For developers needing a highly secure, common platform to cut costs and time-to-market, Digi XBee gateways reduce risk and increase efficiency.

Digi Embedded SOM Solutions for Agriculture

Digi ConnectCore ecosystem — Digi ConnectCore solutions include a range of system-on-modules (SOMs) offering a highly integrated hardware and software platform as well as pre-certified wireless connectivity for rapid time to market. These solutions support a range of precision agriculture needs when scalable features and edge intelligence are paramount. With robust, industrial designs, integrated Digi TrustFence® security, sophisticated open systems software, and device management tools, Digi ConnectCore reduces total cost of ownership and helps OEMs build edge intelligence into precision-agriculture applications. Additionally, the Digi ConnectCore ecosystem includes two value-added services:

- Digi ConnectCore Cloud Services — offering industry-leading cloud and edge tools for rapid device deployment, and easier asset management, including mass firmware updates for deployed devices.
- Digi ConnectCore Security Services — ensuring security is easy to implement via a curated security report, as well as SBOM analysis and CVE monitoring.

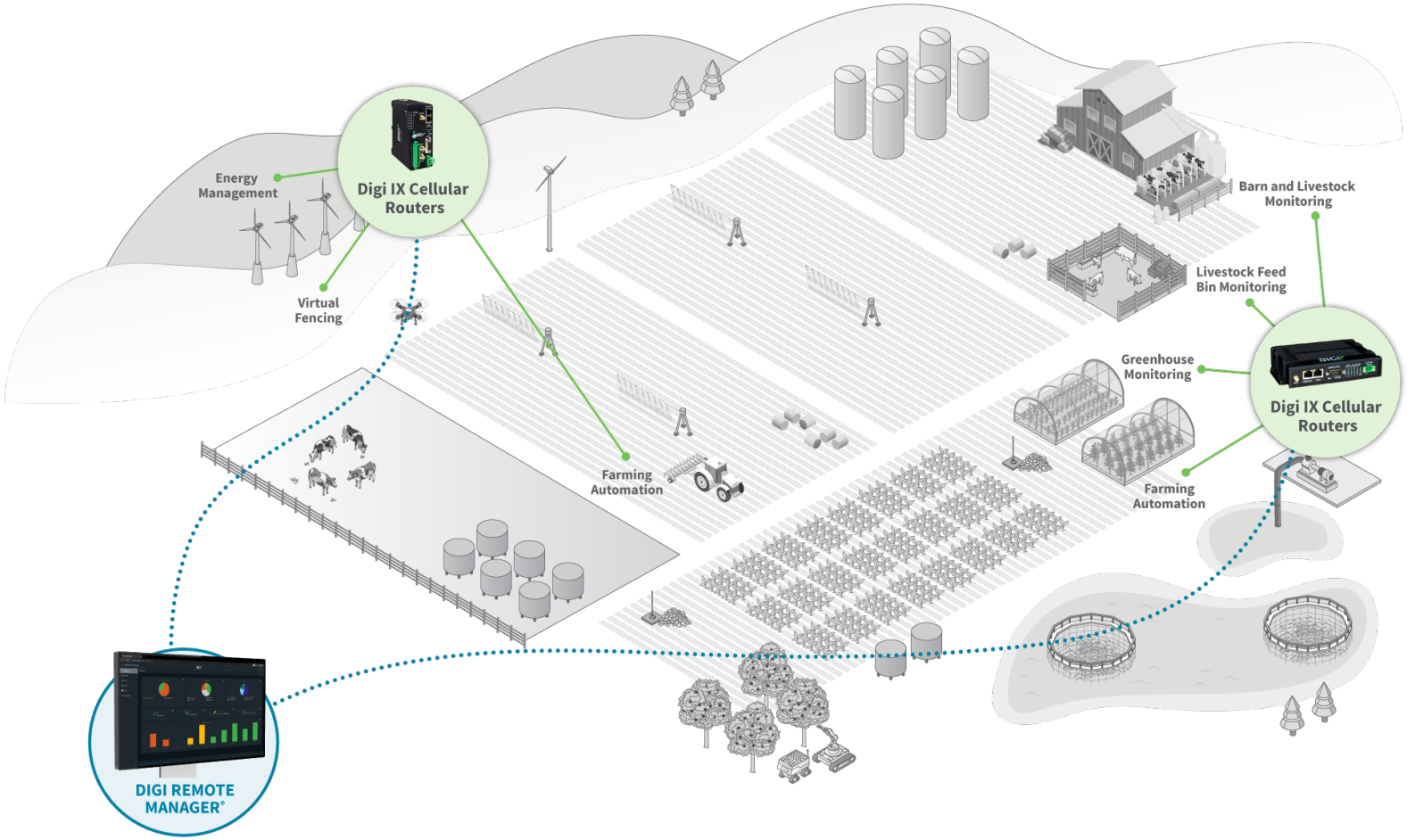


Digi Cellular Communications for Agriculture

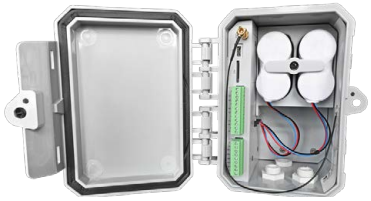
Digi long-range wireless communication solutions

With hardened enclosures and industrial certifications, Digi's IX line of cellular solutions supports a range of agricultural applications — from virtual fencing to livestock and grow barn monitoring to farming automation.

Digi cellular routers are complete solutions under one Digi 360 SKU that includes the device, the Digi Remote Manager remote management and monitoring platform, expert support and an industry leading warranty — everything you need to rapidly deploy, gain insights from your deployed devices, and manage them over their full lifecycle.

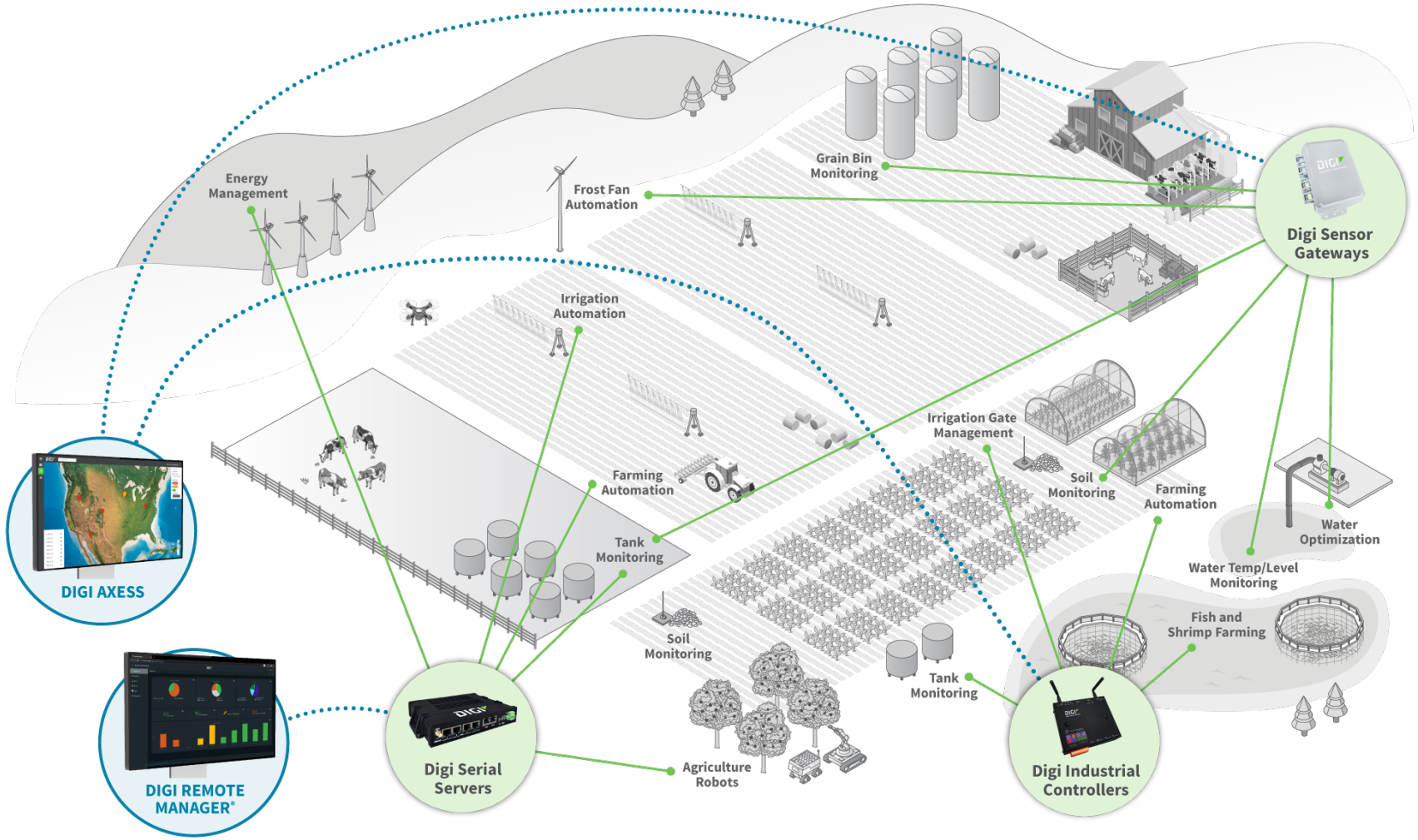


Digi Infrastructure Management Solutions for Agriculture



Digi Connect® Sensor XRT-M

With Digi Connect Sensor XRT-M, organizations can leverage a fully integrated, battery powered cellular gateway with I/O for connecting to a wide range of agriculture and industrial sensors. Designed to work in barns and fields, Connect Sensor XRT-M is excellent for precision agriculture applications that rely on remote monitoring and diagnostics in places where power is not easily available. Easy installation, high reliability, and low data usage make remote monitoring possible in areas where it was previously cost-prohibitive.



Digi Remote Management Solutions for Agriculture

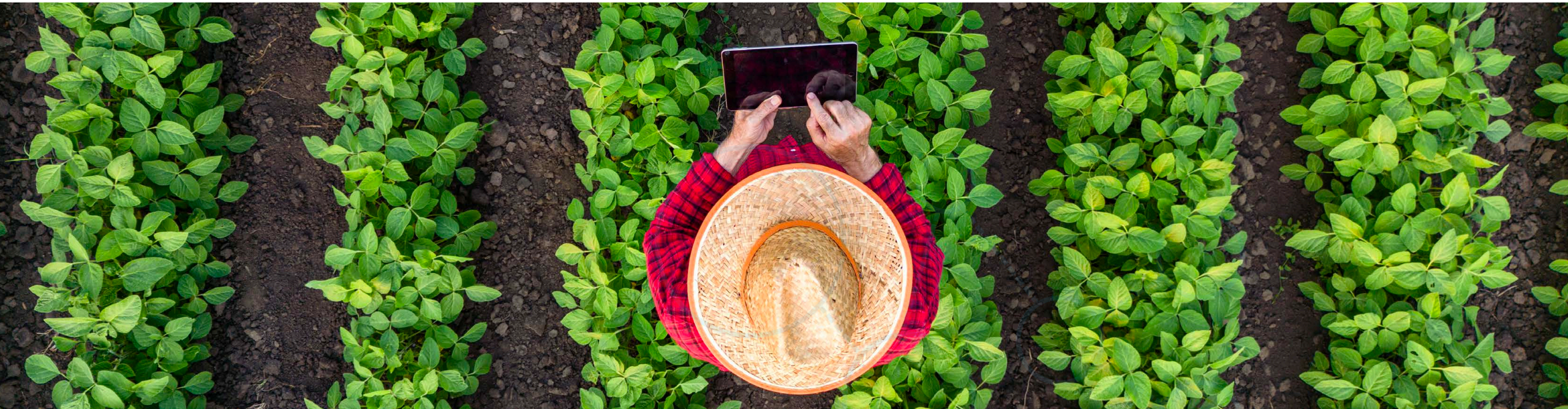
Digi Remote Manager® — The Digi Remote Manager platform allows farmers to securely and fully manage their networks and devices — anytime, anywhere. It transforms the entire portfolio of dispersed IoT devices into a dynamic, intelligent network. Farmers can easily activate, monitor, and diagnose thousands of mission-critical devices, edit configurations, update firmware, schedule and automate tasks — all from a desktop, tablet, or phone. Digi Remote Manager works with Digi cellular routers, Digi XBee Cellular modems and more. See your solution of interest on Digi.com to identify the management system for that product line.

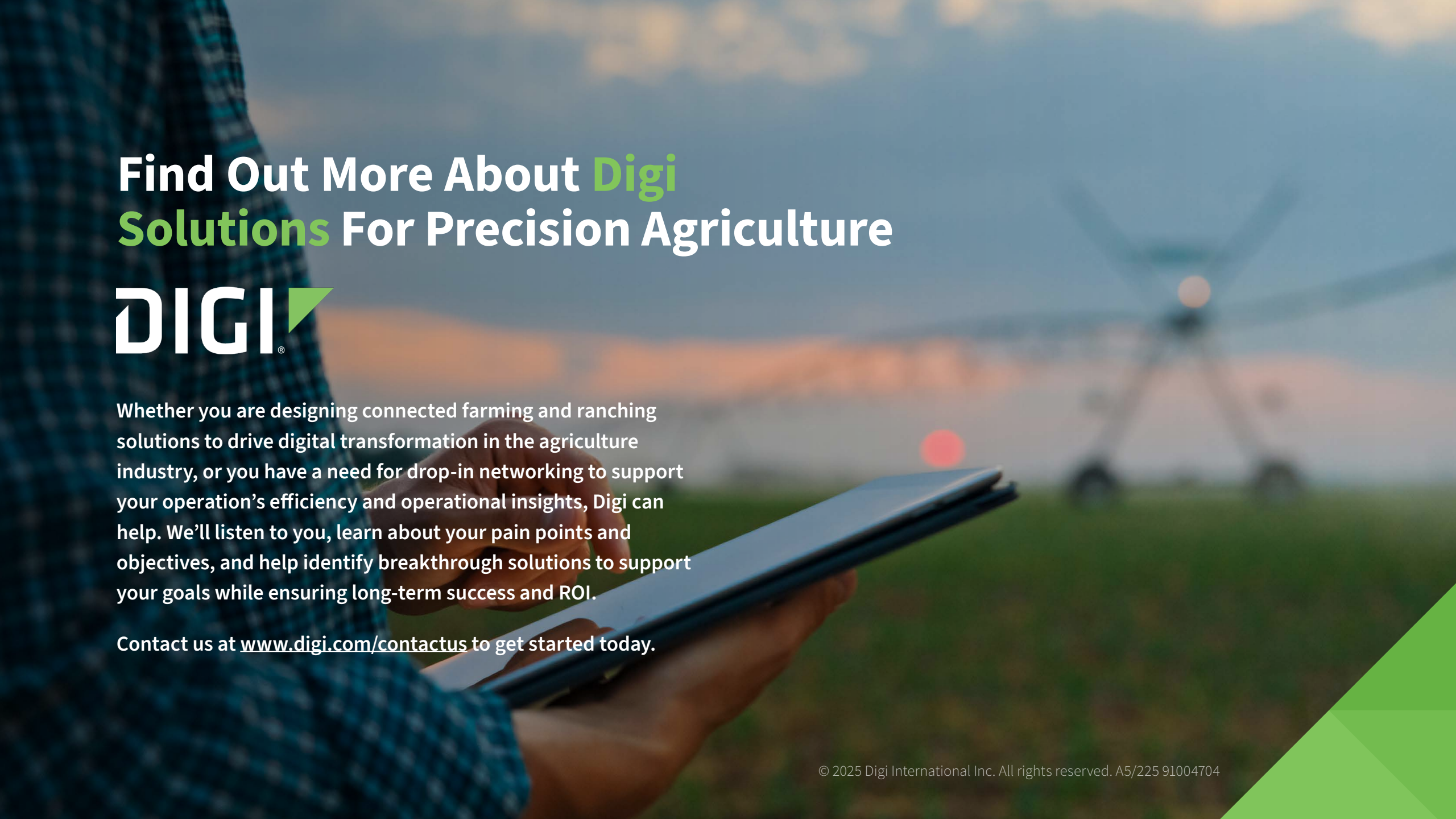
Digi Axess — Elevate your monitoring and control capabilities with Digi Axess. Whether you prioritize edge-based control or the flexibility of cloud-based monitoring, Digi Axess serves as your unified platform, offering an intuitive interface to streamline data management for enhanced operational efficiency.

Digi X-ON™ — Digi X-ON is a complete, scalable and reliable edge-to-cloud IIoT solution offering integrated device-to cloud connectivity, anywhere, with remote monitoring and management to provide the data and control your customers need to optimize operations.

The Digi Advantage for Precision Agriculture

- Industrial specifications
- Reliability and long service life
- Integrated security
- Scalable designs
- Easy installation
- Wireless design and professional services





Find Out More About Digi Solutions For Precision Agriculture

DIGI

Whether you are designing connected farming and ranching solutions to drive digital transformation in the agriculture industry, or you have a need for drop-in networking to support your operation's efficiency and operational insights, Digi can help. We'll listen to you, learn about your pain points and objectives, and help identify breakthrough solutions to support your goals while ensuring long-term success and ROI.

Contact us at www.digi.com/contactus to get started today.