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How Co-ops Can Lead the Way for DIY On-Farm Broadband



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Key Points:

- As American agriculture grapples with scarce labor and increasing costs, solutions could lie in the efficiency and efficacy of precision agriculture applications. But adoption has been hindered by a variety of issues, most notably the lack of affordable, reliable broadband access in rural America.
- The FCC’s decision to make Citizens Broadband Radio Service (CBRS) spectrum available has enabled a wide range of organizations to build their own carrier-grade private wireless networks at costs that were unthinkable a few years ago.
- With speeds in excess of 100Mbps and options for customization, these networks are a self-sufficient solution to support on-farm broadband demand for precision ag technologies.
- Cooperatives have an opportunity to build and deliver customized, carrier-grade, high speed private wireless networks to their farmer members to help drive the adoption of precision agriculture applications.
- Offering these network solutions could be a new, reliable revenue source for U.S. farm supply cooperatives, helping them to offset the highly competitive and volatile business of fertilizer, chemical, and other production input sales.

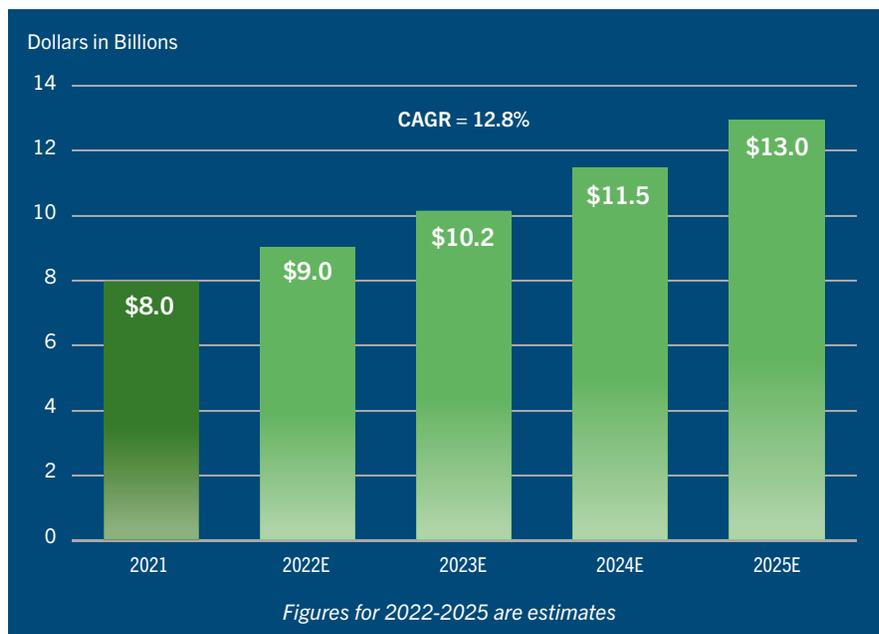
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Introduction

Although precision agriculture has been around for more than 25 years, the past decade has introduced advanced computing technologies such as data analytics, artificial intelligence, connected devices (the “Internet of Things,” or IoT), robotics, and automation. Crop and livestock producers have the opportunity to supercharge operational excellence and efficiency with these technological innovations; the problem is limited connectivity and interoperability stemming from the lack of affordable, reliable broadband access in rural America. Digital precision agriculture tools are expected to be a \$13 billion market by 2025 (*Exhibit 1*) growing at a 12.8% compound annual rate, but it all depends on broadband access.

EXHIBIT 1: Global Precision Agriculture Addressable Market



Source: Precision Farming Global and Statista, 2022

The high cost of deploying fixed-line broadband in sparsely populated markets makes these investments unprofitable for broadband service providers. Numerous government grant programs are providing over \$60 billion to build broadband networks in underserved and unserved areas. However, the emergence of private wireless networks gives agricultural cooperatives an opportunity to build and customize carrier-grade, high speed wireless networks for their farmer members at costs that were unthinkable a few years ago.

Private wireless networks are now a viable option for unserved farmers and ranchers, and agricultural cooperatives have an opportunity to take the lead in building these networks and adding value for their members.

Citizens Broadband Radio Service (CBRS)

The FCC's decision in 2018 to make 150 MHz of spectrum available in the CBRS band was the catalyst for private wireless networks. It essentially democratized building and owning carrier-grade wireless networks, enabling a wide range of organizations to enter the wireless network business. Prior to this, manufacturers, distributors, cities, and schools would either have to

beg the national operators to build coverage where they needed it, or build their own Wi-Fi networks – which are far inferior to standards-based private wireless networks. With CBRS, organizations now have access to the same spectrum, as well as standards-based equipment that the national operators use since CBRS has fostered a broad ecosystem of manufacturers.

Rules governing the CBRS spectrum auction opened the door to a wide range of potential bidders, as spectrum was historically sold in large blocks and only those organizations with access to billions of dollars could participate in the auctions. The auction rules had limited participants

to the large national operators and some the large regional ones. The CBRS band auction sold 80 MHz of spectrum in very small blocks. The billions needed in previous auctions dropped to thousands in the CBRS auction. Even better, the remaining 70 MHz of spectrum was designated as unlicensed, which means anyone can access it.

According to Grand View Research, the North American private 5G network market is expected to grow at a compound annual growth rate (CAGR) of 47.5% from 2022 to 2030. Given this expanded market opportunity, equipment manufacturers and system integrators have proliferated, ready to help organizations build their own networks.

Private Networks on the Farm

Private wireless networks are an essential component to the growth of IoT and adoption of precision ag technologies across all segments of production agriculture. On the farm, private networks can help facilitate the collection, transmission, storage and computation of large amounts of data in real-time. According to FCC Commissioner Brendan Carr, just one plant in a field can provide 18 GB of data, which means the average corn field has about 28 times the amount of

data as the Library of Congress. Collecting this level of data demands an automated wireless network. Without it, the opportunity to drive operational efficiencies and high yields are lost.

Private networks can support numerous precision farming applications, including:

- **Precision Spraying:** Variable-rate applications of fertilizer and pesticides by traditional field sprayers as well as next generation agricultural aircraft, such as drones;
- **Field Monitoring:** Crop surveillance, plant health diagnostics, and prescriptive recommendations to enhance crop production;
- **Precision Planting / Harvest:** Machine learning applications for robots that can identify and measure the ripeness of fruit to minimize fruit decay and spoilage; and
- **Precision Livestock Monitoring:** Diagnostic tools that detect early disease in cattle, hogs and chickens by monitoring specific physiological metrics and changes to those metrics.

The Opportunity for Cooperatives

Agriculture cooperatives are in an ideal position to build and deliver carrier-grade, high speed private wireless networks to their farmer members. Not only can co-ops earn fees for facilitating the service, they can spur greater adoption of precision agriculture applications. With the necessary information technology infrastructure to implement available precision applications, growers can save money while maximizing yields.

While the idea that agricultural cooperatives should take the lead in developing private wireless networks sounds aggressive, cooperatives are in a much better position than individual farmers to do so for several key reasons:

1. **Larger Financial Resources:** Agricultural cooperatives in the United States generated pretax income of \$8.4 billion in 2020 or an average of \$4.8 million per organization for the 1,744 farmer,

rancher, and fishery cooperatives tracked by USDA. This figure dwarfs U.S. farm household median income of approximately \$80,000 for the same year.

2. Broader Domain Knowledge and Expertise:

Cooperatives exist to serve the specific needs of their farmer members and benefit from institutionalized knowledge of farming operations. Medium-to-large cooperatives staffed with full-time information technology professionals can work with regional communication service providers to deploy virtual private networks.

3. Need for Revenue Diversification:

CoBank customers have expressed the desire to develop new and diverse revenues sources that depend less on turbulent ag commodity and fuel prices. Co-ops have faced dramatic volatility in grain and fertilizer markets over the past three years on account of trade tariffs, COVID-19 and most recently, the Russia/Ukraine conflict.

Network Options

A private wireless network can be built in a couple different ways. Farms with climate-controlled space can deploy a stand-alone network core on site. This is a more costly option from a capex standpoint, but it does give the farmer complete control of his or her data and they do not need to backhaul the data to an offsite datacenter. The other option is to use a virtual core located on a public cloud or datacenter where the third party applications managing the data and the network controls are located offsite. This is a cheaper up front option and the network can be implemented more quickly than an onsite standalone core. However, the ongoing operating expenses will eventually surpass the upfront capex of building on premise.

Either network option requires a radio network set up. 5G wireless access points are placed strategically throughout the farm and are customized based on the needs of the farmer. This level of control ensures that applications and the IoT devices in the field are running at optimal speeds, which is especially important for low

EXHIBIT 2: Private Wireless Cost Estimate for 50 Representative Farms

	Per Farm	Number of Farms	Total
Radio Access Network (RAN) Equipment*	\$20,000	50	\$1,000,000
Network Core**	N/A	N/A	\$225,000
Tower (if needed)	\$20,000	50	\$1,000,000
Labor	\$10,000	50	\$500,000
Total up Front Cost			\$2,725,000
Annual Recurring Cost***			\$300,000
Up Front Cost per Farm			\$54,500
Annual Recurring Cost per Farm			\$6,000

Source: CoBank Estimates

*Includes RAN equipment for access point and backhaul and assumes each farm <8,000 acres

**Assumes basic EPC-in-a-box, no voice, SMS, roaming

***Includes power and network operations support/costs

latency dependent applications. Farmers and ranchers would never get this level of customization and control if they relied on third-party networks.

Most farmers and ranchers will be able to use unlicensed spectrum given the lack of network interference in rural America. This reduces the upfront network capex costs, but will require paying a monthly fee to a network service administrator. Radio frequency equipment estimated costs are about \$10,000 per site, with installations and permitting costs at \$10,000 - \$30,000 per site depending on whether a new tower needs to be built. One site should cover a two-mile radius, or the equivalent of over 8,000 acres.¹

Overcoming the Financial Hurdle

To assess the affordability of deploying a private network, we modeled the costs for a cooperative that assumes initial uptake by 50 farmer members or approximately 5% to 6% of a given co-op's base (the average U.S. agricultural cooperative had an average of 973 members in 2016 and is now likely above 1,000 due to consolidation).

We estimate the average upfront cost for an example group of 50 farmer adopters to be about \$55,000 per farm (*Exhibit 2*) with annual recurring expenses of \$6,000. Who pays? One option is for the cooperatives to absorb these costs and offer a network-as-a-service to their members for a fee. Alternatively, the costs could be split between the member and the cooperative with each having an ownership stake in the network. They can also explore applying for grant money available at the federal and state levels designed to bridge the digital divide and to help farmers and ranchers adopt precision agriculture technologies. Examples of these grant programs include:

- The FCC's \$9 billion 5G fund which has earmarked \$1 billion for precision ag grants;
- The \$42.5 billion carve out from the Infrastructure Investment and Jobs Act for new broadband builds in unserved and underserved areas; and
- The FCC's \$20.4 billion Rural Digital Opportunity Fund (RDOF) for unserved and under-served areas.

Considering the benefits that farmers can accrue from reducing input costs and improving operational efficiencies, deploying a private 5G network appears to be financially compelling. With an upfront cost of about \$55,000 and a recurring annual cost of \$6,000 (before grant funds, subsidies or tax benefits), co-op member farms may be able to recoup their investment within 2-3 years.

Conclusion

Precision agriculture applications have the potential to deliver significant operational and financial benefits to cooperatives as well as their farmer member clients and owners. And now with a lower-cost broadband solution to address the persistent connectivity issues, this is the time for agriculture cooperatives to embrace these new technologies. The ability to build carrier-grade, customized private wireless networks at costs that were unthinkable a few years ago is a tremendous opportunity for the U.S. agriculture industry.

The CBRS spectrum band along with the proliferation of equipment manufacturers and system integrators has made building such networks a viable option for a wide range of organizations, including agriculture cooperatives. Cooperatives have the financial resources, customer base, and the ability to work as a liaison between the communications and technology service provider and the farmer to help ensure their member farmers are connected with private wireless networks in high-cost areas. By doing so, farmers themselves can leverage an array of precision agriculture technologies to lower their production costs and capture greater returns. ■

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