

A close-up photograph of a person's hand holding a smartphone. The phone's screen displays a green field of crops, likely soybeans, under a bright sky. The background is a blurred green field.

RURAL BRO DBAND AND THE AMERICAN FARMER

CONNECTIVITY CHALLENGES
LIMIT AGRICULTURE'S ECONOMIC
IMPACT AND SUSTAINABILITY

A woman with short brown hair and glasses, wearing a light-colored button-down shirt, is standing in a field of green soybean plants. She is looking down at a tablet computer she is holding in both hands, with her fingers touching the screen. The background is a soft-focus field of green leaves.

**RURAL BROADBAND AND
THE AMERICAN FARMER**

**CONNECTIVITY CHALLENGES
LIMIT AGRICULTURE'S ECONOMIC
IMPACT AND SUSTAINABILITY**

Executive Summary

For agriculture, a data-intensive U.S. industry, **slow, unreliable internet is the norm**, according to the United Soybean Board study, Rural Broadband and the American Farmer: Connectivity Challenges Limit Agriculture's Economic Impact and Sustainability. Like any business managers in the U.S., farmers rely on internet connections in their offices. However, with today's technology, they also need connectivity in their fields. American farmers get online for everything from market and weather information to banking and need connectivity to process soil fertility data, use autosteer and much more.

The study found that nearly **60% of U.S. farmers and ranchers do not believe they have adequate internet connectivity to run their businesses**. Their productivity contributes **nearly \$133 billion¹** to U.S. gross domestic product, according to the U.S. Department of Agriculture Economic Research Service. That means farms that contribute nearly \$80 billion to GDP run on limited internet connections.

Slow, unreliable internet connection is common, regardless of connection type and location. The study investigated fixed, satellite, cellular and hotspot connections and found that farmers do not agree that their internet access provides value for the cost either in their offices (65%) or in their fields (77%). And because their farms can't move, **78% do not have another viable option to change service providers**.

The study also found that most farmers plan on (59%) or are considering (28%) **incorporating more data into making day-to-day decisions** within the next year. These daily decisions support their economic and environmental sustainability. However, they **face internet-related barriers**, including slow speeds (21%), costs (20%), reliability (16%) and lack of access (15%). In the 18 months before being surveyed, nearly one-third said internet connectivity has impacted purchase decisions to upgrade farm equipment.

American farmers feel the impact of poor connectivity, including limitations on improving farm economic and environmental sustainability and reinvesting in their businesses. They want to do the best things to preserve and improve their farms and natural resources, but lack of clear data to make decisions hampers their

continuous improvement. And **farmers' needs for internet access are projected to grow**. They value they bring to the U.S. economy could multiply significantly with fast, reliable internet.

More than 2,000 primary and secondary farm operators responded to a combination of online and mail-in surveys to participate in the study, sponsored by the United Soybean Board. Participants represent a cross-section of U.S. agriculture throughout the country, including field and row crops such as corn and soybeans (86%), livestock (55%) and specialty crops such as fruits and vegetables (21%). In-depth telephone interviews also were conducted with participants in eight states.



60% OF FARMERS HAVE SLOW INTERNET SPEEDS



60% OF FARMERS DON'T HAVE ENOUGH CONNECTIVITY TO RUN THEIR BUSINESS



78% OF FARMERS DON'T HAVE A CHOICE IN OFFICE INTERNET SERVICE PROVIDERS

Rural Broadband: Productivity, Profitability, Prosperity

Fast, reliable internet access is synonymous with getting work done throughout the United States. From email and finding information to processing data and understanding markets for goods and services — and even managing the [estimated 1.1 billion industrial connections](#)² on the U.S. internet of things — online connectivity supports the [\\$21.34 trillion](#)³ U.S. economy.

The U.S. internet penetration rate was [95% as of January 2019](#).⁴ Between wired infrastructure, wireless networks and 4G- or 5G-enabled smartphones, the internet can be accessed almost anytime, anywhere. Even airplanes have become more connected.

When these connections are interrupted or slow, especially for work, the world seems to stop. Basic tasks take longer. Lack of information makes other jobs impossible. Water cooler conversations complain about dependence on technology.

And, productivity — and profitability — plummet.

A 2016 IHS study found that North American organizations lose [about \\$700 billion per year](#)⁵ due to server, application and network outages or degradations, mostly due to lost employee productivity. Most businesses and organizations quickly solve these problems and take steps to minimize the potential for downtime.

But for one major data-intensive U.S. industry,

slow, unreliable internet is the norm, regardless of device and connection type. Agriculture, food and related industries contributed [\\$1.05 trillion, or 5.4%](#),¹ to U.S. gross domestic product in 2017, according to the U.S. Department of Agriculture Economic Research Service. This industry segment depends on the productivity of America's farms, which contribute [nearly \\$133 billion](#)¹ of the GDP total.

To better understand the realities of online connectivity for U.S. farmers, the United Soybean Board sponsored an in-depth quantitative and qualitative survey of more than 2,000 farmers and ranchers. Rural Broadband and the American Farmer: Connectivity Challenges Limit Agriculture's Economic Impact and Sustainability investigated how and why farmers currently access the internet, and the implications that access has for farm business decisions, economic viability and overall sustainability. **Nearly 60% do not believe they have adequate internet connectivity to run their businesses.**

How can that be?

Federal Communications Commission data from 2017 shows that almost [110 million U.S. households](#)⁶ had fixed broadband internet access, an increase of 4 million households in one year. And [FCC broadband maps](#) show the vast majority of the rural U.S. has access to at least one fixed residential broadband provider.

Despite the U.S. reporting [132.9 mobile broadband subscriptions per 100 inhabitants](#),⁷ research acknowledges a [gap between rural and nonrural connectivity](#). In 2019, rural residents were [12% less likely](#)⁸ to have broadband access. Though that gap is narrowing, a 2018 survey found that [24% of rural adults](#)⁹ say getting access to high-speed internet is a major local problem.

While useful, this data doesn't adequately delve into farm-level internet connection needs of the agriculture industry. In these studies, the [definition of rural](#) mimics the U.S. Census Bureau: any population, housing or territory not in an urban area, which is defined as less than 2,500 people.¹⁰

Farmers represent just a portion of rural residents. But as small-business owners, they use the internet differently than the average "household." The \$133 billion farmers contribute to the U.S. economy often serves as the economic lifeblood of their communities. Their business successes and struggles — including online connectivity — impact their regions and every link in the agricultural and food supply chain. With almost 60% not having adequate internet, that means farms that contribute nearly \$80 billion to GDP run on limited internet connections.

Rural Broadband and the American Farmer

This study confirmed that, like any U.S. business managers, farmers rely on internet connections.

“We use the internet for anything and everything,” said Alan H., an Illinois soybean and corn farmer who participated in the study. “We get online for information, parts ordering, filing tax forms and things like that. In the field we use GPS, autosteer and field mapping.”

From the farm office, usually in their home or in a farm building, farmers get online for office tasks like banking, purchase research, taxes, payroll, recordkeeping and USDA reporting.

But today’s farmers also use internet access in their fields, literally in the middle of nowhere.

There, they rely on connectivity to share and process data like yield and soil fertility maps, identify and treat crop and livestock problems and find solutions to fix machinery. With technology like autosteer, drones, sensors and more, farmers also continue breaking ground in the internet of things. That’s why 67% of farmers believe it is at least moderately important to be able to transfer data wirelessly from the field.

Both in their offices and fields, farmers want real-time access to commodity markets, weather, their historical and current production data, continuing education and other information that directly impacts daily business decisions.

“My first source of information is to look online,” explained Wade W., a soybean, corn and beef cattle farmer from Nebraska. “We follow commodity

markets to make sure we’re up to date on prices throughout the day.

We monitor our soil moisture sensor data. Or, if something breaks or electronics stop working, we look online for solutions.”



67% OF FARMERS BELIEVE IT IS AT LEAST MODERATELY IMPORTANT TO BE ABLE TO TRANSFER DATA WIRELESSLY FROM THE FIELD

Study Methodology

To better gauge internet connectivity for farmers across the country, the study collected a combination of online and mail survey responses from 2,054 respondents, primary and secondary farm operators, during spring 2019. They represent all of U.S. agriculture, with 86% growing field or row crops such as corn and soybeans, 21% growing specialty crops such as fruits and vegetables and 55% raising livestock. In-depth telephone interviews were conducted with participants in eight states in July and August 2019.

The results were sobering.

Farmers want to use technology, much of which relies on internet connectivity; more than 50% plan to incorporate more data into their operations within 12 months of being surveyed to make better decisions. But slow internet speed, high costs and unreliable connections are barriers to using that data.

More than 60% of respondents consider internet connections — both from their farm offices and in the middle of their fields —

inadequate, poor value, slow and/or unreliable.

Alan H.'s online access mirrors many U.S. farmers. "Our broadband signal is more reliable than dial-up, but we still have issues," he said. "Our cellphone service is also come-and-go. We're quite a distance from any major metropolitan area, so we don't have strong signals. That means I'm reluctant to buy technology that requires good service or connectivity everywhere. If I can't be guaranteed internet access, then it's not of value to have the new piece of equipment, either."



OVER 50% OF FARMERS WANT TO INCORPORATE MORE DATA IN THEIR OPERATIONS, BUT LACK THE CONNECTIVITY TO DO IT

ONLY 32% OF FARMERS CONSIDER THEIR OFFICE INTERNET RELIABLE



Internet Access

Farmers get online with multiple devices. The study found that 92% use smartphones, and 59% use tablets. In their offices, 66% use a laptop and 58% use a desktop computer. And 29% access the internet with their machinery. Most use two or three devices, but some have even more.

Internet connection, strength and speed depend on location, topography and provider options. Most rely on cell signals or hotspots to connect to the internet, but two in five, or 40%, do have a fixed internet connection, and others rely on satellite connections.

"Our cellphones are pretty sketchy. We've got to get 5 or 6 miles from home before they start to work fairly well," mentioned Cory W., a soybean, wheat and canola producer from North Dakota. During his qualitative phone interview for the study, the call dropped three times.

"For computers, we have regular desktops to laptops," said Rich C., a Pennsylvania farmer who raises soybeans, corn, wheat and pigs, and runs a seed business, with the help of several employees. "We have several tablets and, of course, smartphones. We use technology that lets the combine drive the grain cart while unloading on the go in the field. We use autosteer in all our equipment and capture input and yield data for future decisions."

"I built a wireless network on our farm, and it's pretty decent," Rich C. continued. "But the reliability or speed of the internet that feeds it becomes a challenge. We've improved, but it still isn't 100%. And I'm using the internet all day, depending on what's going on."

More than 90% of farmers access the internet on their smartphones, which they agree is most reliable. But even that can be challenging.



9 IN 10 FARMERS USE A CELLPHONE FOR INTERNET ACCESS IN THEIR FIELDS

MOST FARMERS USE 2-3 DEVICES; SOME USE MORE



**92% SMARTPHONES
57% TABLETS
66% LAPTOPS
58% DESKTOP COMPUTERS
29% MACHINERY**

Economic Implications

Technological advances have helped farmers improve efficiency and save input costs, the study found. Farmers respond more quickly and effectively to markets, address problems in their fields and gather data for future improvement.

Rich C. highlighted the value autosteer and swath controls bring to his farm, which consists of many 20- to 25-acre fields. "Swath control helps pay the bills," he said. "Technologies allow us to prevent overlap and use variable rates for inputs. We're saving on seed, fertilizer and chemicals, and that's the biggest dollar advantage to me right now. But we also capture that information and yield data."

That data informs future decisions. According to the study, 59% of farmers plan to incorporate more data into day-to-day decisions within the next year, and another 28% are considering using more data.

In giving drivers or reasons to use data, 37% cited having better information to aid with decisions, 19% noted efficiency and 10% said cost savings. However, farmers also noted internet-related barriers to incorporating more data, including slow speed (21%); costs (20%); reliability (16%); and lack of internet access (15%).

"In the field, we use a program that provides field health maps, rainfall and more data for all our fields," said Cory W.

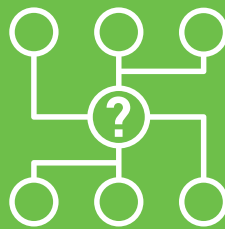
"When we bought tablets to access it, we chose ones without 4G service because we don't have it. We are very satisfied with having the data to make decisions, but we are forced to bring our tablets home every night to upload all the information to the cloud."

REASONS WHY FARMERS USE DATA



37% BETTER DECISIONS
19% BETTER EFFICIENCY
10% COST SAVINGS

REASONS WHY FARMERS CAN'T USE DATA



21% SLOW SPEED
20% COSTS
16% RELIABILITY
15% LACK OF INTERNET ACCESS

Fickle Internet Access Stymies Innovation

Dependence on slow, unreliable internet connections costs the entire agriculture sector.

For example, in just the last 18 months before being surveyed, nearly one-third of study participants said internet connectivity has impacted purchase decisions to upgrade farm equipment.

Michael H., who owns a soybean farm in south-central Louisiana, is looking at data-intensive equipment technology. "But without the right support network, we can't even consider taking advantage of getting real-time information from one piece of equipment to another," he said.

Farmers experience effects similar to the economic impacts of outages or poor connectivity noted in the [IHS study](#). For a weather- and time-sensitive industry, those costs add up quickly.

"We use technology so much that when it doesn't work, it pretty much shuts down the whole operation,"

said Wade W. from Nebraska.



"For instance, if the GPS signal goes out when you're planting, the whole operation shuts down. There's really no way for us to get around that."

Cory W., from North Dakota, described the costs of insufficient internet access to do grain marketing from his fields, especially during seasons when he's out 8 a.m. to 5 p.m., or even 6 a.m. to 11 p.m. "The market can move so much so quickly that I'd like to be able to monitor it more closely than just via text updates that provide snapshots," he explained. "If I can't connect, I might miss out on a profit of 10 or 15 cents a bushel, and that's huge for the bottom line."



33% OF FARMERS SAY LACK OF INTERNET HAS AFFECTED THEIR EQUIPMENT PURCHASES



\$13 BILLION IN ANNUAL FARM EQUIPMENT PURCHASES ARE IMPACTED BY LACK OF RURAL INTERNET

Sustainability Implications

The study also uncovered direct links between connectivity-driven technology that farmers want to use and the sustainability of their operations. Farmers often define sustainability as both environmental and economic.

“We need both financial sustainability and sustainability of the land,” explained Vonda K., an Arkansas soybean, cotton and corn farmer. “We keep improving the land every year. We make better management decisions and learn more about best practices to improve our soil and environment because this is where we live. We would like to allow one of our kids to farm, if they choose. So we need to take care of it. But if we don’t stay in business, there won’t be a farm. These aspects work hand-in-hand.”

As farmers maximize efficiency and steward their resources, reliable internet access strengthens decision-making. And in many cases, those decisions lead to improved environmental sustainability.

Vonda K. described several apps that support these goals. A soil type app helps her monitor how different soils behave throughout the growing season and what areas have similar soil types. Another app helps her calculate

pesticide rates to protect crops and minimize impact. She used an app that supported cotton traceability until her gin discontinued it.

And, she controls some in-furrow irrigation remotely.

But she would like to do more.

“I would like to have more moisture sensors, to know exactly what’s going on,” she explained. “We have a couple of wells that we can shut off remotely, but I would love to have everything online. Then we could see how much it rained and where, and then shut off wells accordingly. But most of our wells can’t work that way because the farms don’t have the connectivity needed. It would save water and fuel to control remotely instead of driving out to do it manually. If it rains a lot really fast, we physically cannot get to them, and we waste water, fuel and energy.”

She continued, “I would also like to have better access to the data that’s coming from our edge-of-field nutrient monitoring that goes to the university.” This information would help inform decisions to manage nutrients and minimize their loss.

Nebraska farmer Wade W. uses similar technology. “We have several center irrigation pivots that are capable of being controlled from the internet,” he explained. “Our soil moisture sensors report data so we know when and where to irrigate. So if our internet connection is down, all of the devices that are connected to it are down as well.”

For many farmers, connectivity enables new levels of sustainable practices. For his Louisiana farm, Michael H. developed a proposal to expand technology use, including drones, location data and RFID, to improve the accuracy of farming operations.

“Flooding has been a problem the last two years, and this type of data will help plan for better drainage and fertilizer efficiency, so we can better prevent runoff,” he said. “Data also helps enhance and increase crop yield, because that’s the only way we stay in business.”

But lack of connectivity prevents implementation of sustainable practices for many farmers.

“I was dragging my feet on this precision equipment because of internet being so bad here,” said Chad D., who raises crops and pigs in Iowa. “I knew it takes internet to run this.”

He started using some variable rate technology, but because of his poor connectivity, he pays his local co-operative to manage data and load maps to his equipment.

Reality of Slow, Unreliable Access

The study consistently found that slow, unreliable internet connection is common for U.S. farmers, regardless of connection type and location.

In their offices, 60% do not agree that they have adequate internet to run their businesses, and that percentage increases to 71% in their fields. Only 22% classified office internet as fast, and 32% called it reliable. In their fields, just 19% and 22% described their internet service as fast and reliable, respectively.

Is that type of internet access sufficient to support more than 5% of the U.S. economy?

That's why farmers, as business managers, do not agree that their internet access provides value for the cost, that being the case for 65% in their offices and 77% in their fields. Because

their farms can't move, 78% do not have another viable option to change service providers.

“I live 3 miles from town, but there are days I turn the internet on, and it won't run at all,” said Chad D. “I make five or six troubleshooting calls to my provider every month. Looking up something or checking weather is a struggle. I use my phone more because its internet access is a little better, but lately it has been very, very slow, too.”

In exploring differences between connection types, satellite provided the least value for the

cost, though it does help with field access. For those with satellite, 75% do not agree they have adequate internet to run their business at their offices, but in their fields, that number drops to 56%. Satellite access is considered fast and reliable more often in their fields, with respective ratings of 28% and 31%. In their offices, just 13% called it fast and 26% considered it reliable. As a result, 83% do not agree that it provides value for the cost in their offices, compared to 73% in their fields.

“Our satellite connection is awful,” said Laura W., a cattle and sheep rancher in Texas. “I've had a grasshopper on a dish cause me to not have internet.”

HOW FARMERS RATE THEIR OFFICE INTERNET
22% FAST 32% RELIABLE

HOW FARMERS RATE THEIR INTERNET IN THE FIELD
19% FAST 22% RELIABLE



78% OF FARMERS DON'T HAVE A CHOICE IN OFFICE INTERNET SERVICE PROVIDERS

HOW FARMERS RATE SATELLITE ACCESS IN THE FIELD
28% FAST 31% RELIABLE

HOW FARMERS RATE SATELLITE ACCESS IN THEIR OFFICE
13% FAST 26% RELIABLE

Cell service or hotspots provided somewhat more reliable connections, according to the study. In their offices, 31% of farmers labeled these connections fast, and 37% called them reliable. In their fields, 30% said these connections were fast, but just 26% said they were reliable. And so again, farmers do not agree that these connections are adequate for their business — 69% for office connections and 63% for field connections. When considering both office and in-field access, 71% did not agree that this type of connection provided value for the cost.

“My cellphone service also is marginal,”
Laura W. added. “I’ve done speed
checks on the area 4G network with an
app on my phone, and they’re all bad.”

Overall, fixed connections in farm offices provided the best internet access. The study found that 49% agreed that their fixed office

connections are adequate to manage their businesses. Thirty-seven percent called it fast, and 48% called it reliable, higher than any other form of connection. Thus, 45% did agree that these connections provided value for the cost.

Such connections are a first step for helping farmers. “I’ve got great access at home,” said Cory W. “In January 2018, I got a fiber-optic cable coming to my house in North Dakota. But once we leave the house and the yard, we struggle because we don’t have great cell coverage.”

However, [FCC broadband maps](#) don’t always match reality.

Laura W. shared struggles to get internet access in her area of Texas. “One company runs repeater antennas to help you get better broadband. Technically — and you look at their map — they should cover this area. But in reality, they don’t,” she said. “Though this area is fairly flat, we have trees and little dips in the terrain, and the towers aren’t built high enough

to go over them. When they came out to our house, they went up to the second story to see if they could get a signal. And they couldn’t. But other companies see that this area is covered and allegedly has internet. So no other company is going to come here.”

In Ohio, Dan O., who has a small soybean, corn, hay and livestock farm, has similar challenges. “Two companies report to the FCC that my farm is covered by broadband,” he explained. “My farm is covered by cellular, but neither company will provide broadband access to this farm. I was willing to trench it to bring in cable when the first company came in, but their engineer said my co-cost would be \$28,000 for a quarter-mile of cable. That’s not economic or sustainable.”

<p>HOW FARMERS RATE CELL SERVICE OR HOTSPOTS IN THEIR OFFICE</p> <p>31% FAST 37% RELIABLE</p>	<p>HOW FARMERS RATE CELL SERVICE OR HOTSPOTS IN THEIR FIELDS</p> <p>30% FAST 26% RELIABLE</p>
---	---



ONLY 49% OF FARMERS BELIEVE THEIR FIXED OFFICE CONNECTIONS ARE ADEQUATE TO MANAGE THEIR BUSINESS

Conclusion

Farmers need internet access, and rural broadband can be a key part of the solution. Slow, unreliable internet handicaps an industry segment worth nearly \$133 billion in GDP. And that segment is the foundation of agriculture, food and related industries that contribute [\\$1.05 trillion, or 5.4%,¹](#) to U.S. GDP.

American farmers feel the impact of poor connectivity, as noted by the one-third of respondents who said that the issue impacted purchase decisions in the past 18 months — which translates to limited business reinvestments. They also expressed limitations to improving farm economic and environmental sustainability due to lack of connectivity.

Farmers want to do the best things to preserve and improve their farms and natural resources, but lack of clear data to make decisions hampers their continuous improvement.

And farmers' needs for fast, reliable internet access are projected to grow.

The study showed most farmers want to incorporate more data into their decisions in the next year or are considering it, but they face real connectivity barriers. As technology gathers more data that supports daily farm decisions that impact profitability, sustainability and transparency, online connectivity to access that data is imperative.

Rural Broadband and the American Farmer: Connectivity Challenges Limit Agriculture's Economic Impact and Sustainability brings deeper understanding to how and why farmers require online connectivity — and how they reap economic and sustainability benefits from their current substandard access. That value could multiply significantly with the fast, reliable internet that most U.S. industries can depend on to keep moving forward.

As it is for other U.S. industries, fast, reliable connectivity will be the linchpin in the American farmers' future success.

¹ [What is agriculture's share of the overall U.S. economy?](#), U.S. Department of Agriculture Economic Research Service.

² "How Many IoT Connections will there be in North America in 2023?" graphic created by [Dailywireless.org](#), data from GSMA Intelligence.

³ [Gross Domestic Product, Second Quarter 2019 \(Second Estimate\); Corporate Profits, Second Quarter 2019 \(Preliminary Estimate\)](#), Bureau of Economic Analysis, U.S. Department of Commerce, August 29, 2019.

⁴ "Which Countries Had the Highest Internet Penetration Rate as of January 2019?" graphic created by [Dailywireless.org](#), data from Internet World Stats, ITU.

⁵ [Businesses Losing 700 Billion a Year to IT Downtime, Says IHS](#), January 25, 2016.

⁶ "How Many Households in the United States Had Fixed Broadband Internet Access?" graphic created by [Dailywireless.org](#), data from ITU, Federal Communications Commission.

⁷ "Which Countries Had the Most Mobile Broadband Subscriptions per 100 Inhabitants in 2017?" graphic created by [Dailywireless.org](#), data from ITU.

⁸ [Digital gap between rural and nonrural America persists](#), Pew Research Center, May 31, 2019.

⁹ [About a quarter of rural Americans say access to high-speed internet is a major problem](#), Pew Research Center, Sept. 10, 2018.

¹⁰ [Urban and Rural](#), U.S. Census Bureau.