

EXECUTIVE SUMMARY

Big picture: The digital agribusiness is real and it's here to stay. Digitization in the agribusiness sector significantly increases the ability to feed the rapidly growing world population in a sustainable way

The Digital Economy in Agribusiness

In the agricultural industry, strong business transformation drivers coupled with major technology trends are leading to new business models.

The challenge to the world population, which will grow to upward of 10 billion people by the middle of the century, is on top of the industry's agenda. Digitization and new technologies, such as drones, connected machines, and field sensors, are becoming affordable and have the potential to drive more efficiency in the agriculture world through innovation.

Breakthrough technology trends have matured and hit scale together: hyperconnectivity, supercomputing, cloud computing, the Internet of Things, and cybersecurity. These trends will fuel the emergence of new business models. The speed of innovation is enormous, and start-ups in the agriculture space have the mission to innovate fast and change every aspect of the industry as we know it today. In 2014 alone, start-ups in the agricultural technology space raised up to \$1 billion on venture capital.³

Agribusinesses are **trying to adopt innovations fast**. If you have no drone in your garage yet, chances are your leading competitors have several of them. But while trying to adopt technical innovations, agribusinesses in all segments (farmers and producers, cooperatives, farm machinery and equipment manufacturers, agrichemicals, originators and traders, food companies) struggle to realize the full value potential for their organizations and customers.

Aware but unsure

Executives know the world has changed. Research shows 90% of CEOs believe the digital economy will have a major impact on their industry, but less than 15% are funding and executing on the plan.⁴

Leaders in agribusiness are learning how to leverage these technologies to:

- Increase farming **efficiency**
- Create transparent and **sustainable** food supply chains
- Manage market and price **volatility**
- Implement new, sustainable **business models**
- Engage with the right partners in **business networks**

Early adopters are winning

Agribusiness leaders need to decide where they stand while business transformation drivers and new technologies disrupt their industry. Research shows that early adopters are seeing significant value, with +9% revenue creation, +26% impact to profitability, and +12% market valuation.⁵



Digital business models are disruptive. The rules in agribusiness have changed.

- **Land O'Lakes**, a major cooperative, acquired Geosys, a company that collects crop data via satellite to develop tomorrow's agricultural technology today.⁶
- **InVivo**, France's number one cooperative, is investing in Big Data to become the European leader in agriculture.⁷
- **Cargill** provides software services that guide farmers on how to best plant crops, helping farmers maximize their output.⁸
- **Nestlé** is not only buying from rural farmers, but is also investing into farmer training to secure sustainable and high-quality supply of commodities, such as specialty coffee.⁹
- **Monsanto** acquired Precision Planting, a manufacturer of precision equipment, and Climate Corporation, a provider of super-local weather information. Monsanto shows that it is serious about precision farming and has now transformed from a seed business to a data science organization, providing the "glue that holds the pieces together."¹⁰
- **John Deere** has 2,600 employees who come in every morning to develop software. John Deere is providing fleet telematics solutions that allow farmers remotely manage their equipment and analyze sensor data in real-time.¹¹

WHAT DOES THIS TELL US?

The road map to relevance requires reimagining business models in agribusiness and proactively evolving before new digital competitors emerge.



1 Hyperconnectivity

In the digital world, everything is connected. Your business partners are connected over the whole agribusiness value chain. Sensors and connected equipment are omnipresent in agricultural production, transportation, storage, and processing, providing a real-time view into the agribusiness value chain.

Imagine agriculture when every machine and piece of equipment provides sensor data. Crop farmers and contractors are connected and able to operate based on precise aerial image data.

Hyperconnectivity in agribusiness requires an exchange of data and digital services between farmers, seed producers, agrichemical companies, laboratories, equipment manufacturers, agricultural service providers, contractors, agronomists, commodity markets and originators, food producers, financial service providers, governmental organizations, and other stakeholders.

Standardization of data services and the establishment of common data standards across the industry are ongoing requirements. Flexible solutions are also required so that participants can simply adapt when new strategic partnerships are established and the ecosystem consolidates technology standards. A neutral network orchestrator that is unbiased and familiar with different industry perspectives can provide an open platform.

Exchange of expertise will be one of the core efficiency drivers resulting from the digitization of agriculture. Data and technology alone will not provide value if there's no exchange of expertise. Digitization provides the technology to share experience locally and globally. Benchmarking and agronomy services will help to identify best practices. Communities and relationships can be strengthened when individuals are connected via the Web or, in developing countries, via SMS, helping farmers to increase their yields and efficiency.

1. Sensors and aerial imagery in farming

Sensors in the field measure soil and weather conditions (e.g., humidity, temperature) and livestock data, while sensors on farming equipment give a real-time insight into yield and quality parameters. Aerial imagery from drones and satellites has become more accurate and affordable and is used to manage huge areas in amazing detail.

2. Robots and drones

Robots are already common in the dairy industry and are entering the farm field space. Drones can collect field imagery and sensor data to detect crop health and growth and support precise farming activities such as dropping beneficial bugs into fields as a natural pest control exactly where required. Robots will soon automate many farming processes and take over tasks such as weeding, fertilizing, seeding, or pruning plants.

3. Track and trace connected goods

Digital transmitters and sensors revolutionize storage, transportation, and processing. Tracking and tracing raw materials and processed goods along the whole agricultural and food value chain will become standard practice.

4. Mobile devices in farm management

Tablet PCs are already commonly used in tractors. Through online connection to the farm management system, the farmer stays informed about planned and completed tasks, often combined with GPS/GNSS and a GIS map of his fields. In developing countries, mobile phones are attractive for farmers, e.g., for micro-payments or agronomy information services.

5. People and communities

Building relationships and communities to share knowledge is key for farmers and their success. Farmers have specific requirements when it comes to the right channel and technology. Whether via omni-device farmer portals with embedded analytics in industrial countries, or SMS communication with farmers in rural areas in developing countries, it is the content and service that drive value and participation within a community.



Agriculture is expected to make up **80% of the potential market for drones in the near term.**¹⁸



60% of farms in the United Kingdom are already using IoT technology.¹⁹



The market for agricultural robots is expected to reach **\$16.8 billion by the end of 2020.**²⁰



2 Super Computing

Digital agribusiness creates a huge amount of data; crop, livestock, machines, and processes are constantly observed with sensors and aerial imagery. Commodity markets are streaming real-time market data around the world, making supply and demand more transparent than ever before. Analyzing this data, drawing the right conclusions, making the right decisions, and executing on them are key to mastering the digital shakeup.

Supercomputing will play a tremendous role in feeding over 9 billion people by 2050. Processing the enormous amount of data that is collected in all parts of the agricultural supply chain is only possible through a huge increase in computation power. Leveraging this data will increase efficiency in agricultural production, commodity markets will become more transparent, and the commodity supply chain more agile.

After eight years of innovation and development, SAP, with the Hasso Plattner Institute and our strategic partners, created a completely new platform that eliminates the separation of transactions and analytics. This technology, SAP HANA, has provided a massive breakthrough to the business world.

SAP HANA will enable agribusinesses to simplify supply chain, finance, and other processes and run them in minutes, not hours or days, changing how people work. Changes such as reorganizations, product launches, etc. can be made in one-tenth of the time. Huge amounts of agricultural data from sensors and machines, about weather and a multitude of other sources together with geospatial information, can be crunched by smart algorithms. This adds tremendous agility and speed to the business.

- **Precision agriculture algorithms**
Algorithms that optimize agricultural production activities will be a key differentiator and competitive advantage when agribusinesses make the transition to digital. By correlating data and applying smart models, algorithms, and machine learning to agricultural data, it is possible to create insight and optimize farming activities such as irrigation, application of fertilizer, and crop protection.
- **Predictive analytics and simulations**
Shortages and disruptions will be predicted before they happen by combining data – both structured and unstructured – from a large range of sources such as field, weather, economic, and market data and agricultural news. Data scientists and quants will become a vital part of businesses.
- **Research and genomics**
Data generation in agricultural production will create huge opportunities for research and genomics. The availability of this data, produced under real conditions, will allow researchers to constantly and more efficiently optimize their models, algorithms, and products.



According to Eduardo Barros, Accenture's Global Products Agribusiness Lead, a six-month pilot study found that precision farming may already directly increase crop size by **15%**, with further potential for improvement.²⁵



The precision agriculture market is growing at over **13% per year**, reaching **\$3.7 billion by 2018**.²⁶



Conventional weather models have a resolution of 12 km. Researchers from IBM and the U.S. Dept. of Agriculture are building weather models on parallel processing supercomputers with a resolution down to **1.5 km**.²⁷

3

Cloud Computing

Cloud computing will accelerate time to value, drive higher adoption of new technologies, and connect value chains in real time. Agribusiness companies need a flexible and cost-efficient IT infrastructure to manage their data on a global scale that includes the knowledge of a distributed network of business partners.

By moving parts or all of the IT infrastructure into the cloud, our customers can innovate with faster time to value and focus on their real business, whether they manufacture agriculture machinery, produce seeds or fertilizers, or raise livestock and plants.

Agribusiness companies are dealing with a network of suppliers and customers that all are sources of valuable data. A shared source of common data allows all players to execute their business in a more coordinated manner based on real-time data.

What if a cooperative, which acts on behalf of hundreds of farmers, provides a single cloud-based instance of all their assets and activities? And what if the individual farmer can access his and his parent company's data directly from his office or even from his tractor? New market and sales data are available at his fingertips, whenever the cloud-held system is fed with new data or functions.

A farmer can make bids and sell his or her products through a farmer portal, thus accessing the world of agriculture without making lengthy phone calls with numerous partners.



Global SaaS software revenues are forecasted to reach \$106 billion in 2016, **increasing 21%** over projected 2015 spending levels.²⁸



Projected **spending on cloud computing infrastructure and platforms** will grow at a 30% CAGR from 2013 through 2018, compared with 5% growth for overall enterprise IT.²⁹



1 2 3 **4** 5

Smarter World

Connected sensors, drones, robots, and artificial intelligence will completely reshape the modern farming business, both for crops and livestock. Affordable and abundant technologies are digitizing the farm and the farm-to-fork supply chain.

The world is becoming smarter with the digital economy, and this is influencing agribusiness and modern farms in dramatic ways. Farmers can leverage Big Data and new technologies to completely change the ways they produce crops and food.

Technology adoption increases as the next generation of farmers takes over responsibility as farming entrepreneurs. It helps these farmers to drive their business towards becoming a sustainable and profitable operation.

All members of the agribusiness network are creating new business models, embedding software in products, and focusing on business outcomes.



There are a number of key innovations enabling the world of agriculture to become smarter:

- 1. Digital farming** smartly combines several technology trends to make farming more efficient, sustainable, and resilient. It relies on the data collected by **sensors and aerial imagery**, bringing this data together with the domain experience brought into **precision agriculture algorithms**. This combination enables predictions, simulations, and optimizations. Digital farming helps to boost yields, increase quality, save input resources, and reduce the impact of negative events like droughts, flooding, or pest infestation.
- 2. Smart procurement and trading**
Originators or traders can develop and adapt procurement and trading strategies by combining fundamental agricultural data with real-time market data, thus reducing their risk exposure.
- 3. Agricultural data and service marketplaces**
Changing business models and partnerships will create the need for flexible, secure ways to exchange and market data and digital services to allow collaboration and integration between all participants in the agribusiness ecosystem. This will help participants monetize the value of the exchanged data and digital services.
- 4. 3D printed food**
A recent technology innovation is the printing of food, which enables a quick and customer-specific food experience. While this is still in early days, it has high potential for disruption in the industry's future and is worth keeping an eye on.



A survey conducted by the American Farm Bureau indicated that the use of precision technologies has reduced input cost by **15%** on average and increased crop yield by an average of **13%**.³⁰



Precision agriculture can improve **Nitrogen fertilization efficiency by 10-15%**. This reduces the required amount of nitrogen fertilizer without an negative impact on crop yield.³¹



According to Eduardo Barros, Accenture's Global Products Agribusiness Lead, data-driven decisions about irrigation, fertilization, and harvesting can increase the profitability of corn farms by **\$5 to \$100 per acre**.³²



With ever-increasing risk of corporate spying and digital theft, cybersecurity must be addressed as organizations in agribusiness set and execute their digital strategy.

Corporate spying and digital theft are on the rise, and organizations need to address cybersecurity at the corporate level. Farmers are increasingly creating and owning valuable and sensitive data, which need to be secured in a business with relatively low margins.

Managing security across your digital business must be accomplished through proper governance. This reduces TCO, business risk, and compliance breaches and solidifies the trust of your customers.



The following cybersecurity elements should be addressed:

1. Securing data

Securing data requires that companies and their partners adhere to data privacy and compliance regulations, understand local data controls, and establish encryption and classification criteria. All data collected from farms requires secure and controlled networks, storage, and distribution. As most agricultural data is geo-tagged, it can be traced back to the farmer. The seed and crop input business also needs to secure highly confidential and competitive data.

2. Securing interactions

Value chain interactions must be secured. Joint SLAs should be in place with partners, checks should be at the application level to prevent wide-spread impact, and connectivity should be safeguarded.

3. Securing identities

Access to digital information should be restricted to authorized users. There should be central authentication regardless of device, and devices must be maintained to prevent hackers from gaining access to your digital IP.

4. Partner with trusted suppliers

Supplier relationships are key in establishing trust as more non-core processes are outsourced. Companies, co-operatives and farmers should build relationships with a few partners who will meet the highest security standards. This will also result in a more simple and nimble architecture.

5. Securing intellectual property

Agribusinesses are investing billions of dollars into research and innovation. Safeguarding intellectual property and patents is a matter of survival. Services and algorithms that are being developed in the new era of smart farming have to be safeguarded.



In 2014, **47%** of adults in the United States had their personal information exposed by hackers.³³



In 2014, five out of six large companies were targeted by cybercriminals, a **40% rise on the previous year.**³⁴

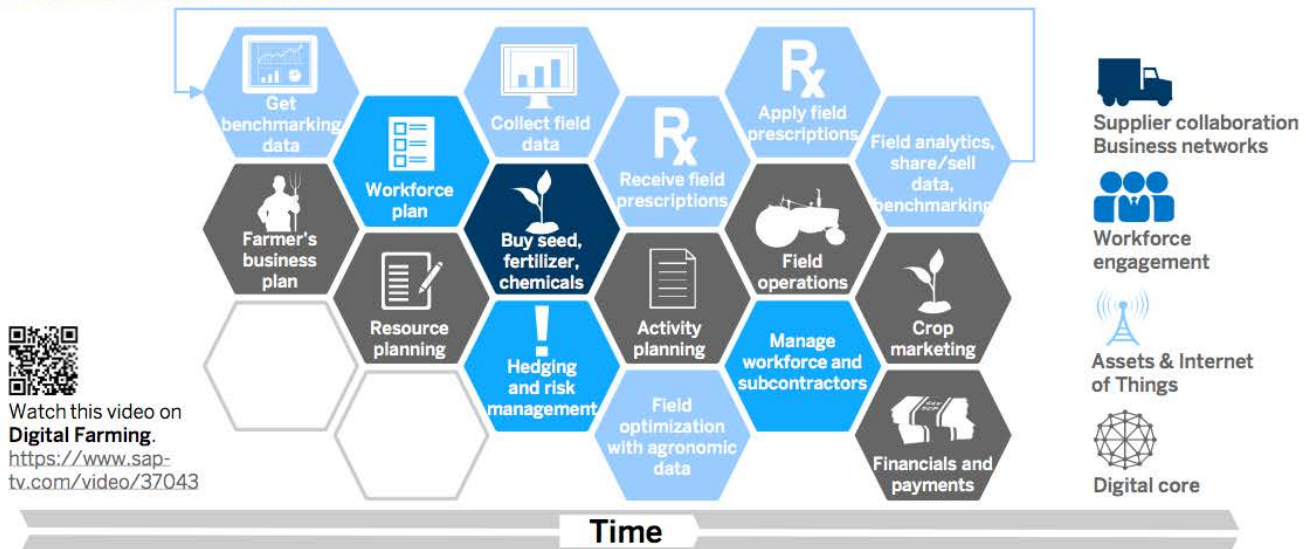


Globally, cyber crime costs businesses **\$375-\$575 billion** annually and a net loss of up to 200,000 jobs in the United States alone.³⁵

HOW DOES IT ALL COME TOGETHER? – EXAMPLE

While the five digital business pillars deliver significant value as stand-alone capabilities, the ultimate goal is to design the next generation of agricultural business processes that will span all the digital pillars.

IOT AND BIG DATA ARE THE KEY DRIVERS OF DIGITAL FARMING AND PRECISION AGRICULTURE. THEY PROVIDE REAL-TIME INFORMATION TO THE FARMER TO OPTIMIZE FARMING ACTIVITIES.



Example 1: Digital farming

The diagram shows how farmers can leverage services and individualized agricultural solutions provided by agribusiness companies.

Agribusinesses can use algorithms on field data shared by the farmer to calculate prescriptions that optimize efficiency for each individual farmer. These prescriptions can be published to farmers with recommendations on irrigation, fertilization, application of crop protection, or harvesting. Based on these prescriptions and recommendations, farmers can choose the services, solutions, or input materials that are best suited to their needs. Prescription and task maps can then be transferred to smart field machines or forwarded to contractors for execution.

Field and actual yield data can be used for benchmarking and developing best practices. Digital farming services can also help farmers comply with the growing number of regulations around farming activities, e.g., the application of crop protection or water consumption, by making the collected sensor data available and consumable for reports and audits.

By leveraging Big Data and connected mobile devices together with a digital farm management application, the farmer can get

a complete and real-time overview of farm operations, from business, workforce, and resource planning, to scheduling farm activities and field operations, to integrated crop marketing and transparent financial execution.

Digital farming helps improve efficiency and provides opportunities within the ecosystem brings, such as:

- More precise application of input products leads to lower costs and higher revenues through better yields and quality
- Holistic digital service, solution offerings, and agronomy advice from cooperatives through the digital agribusiness platform to help farmers achieve optimal prices for input products
- Fertilizer or crop protection producers provide prescriptions and more precise agricultural solutions to farmers
- Machine and equipment manufacturers collect huge amounts of valuable IoT data directly on the field and offer value-adding services and applications
- Originators and food processors and producers offer complementary digital services to farmers, thereby obtaining additional information about available supply to ensure high quality
- Agricultural labs, contractors, or financial services organizations provide digital offerings supporting completely new business processes and outcome-based scenarios