



## PART 1

# INTELLIGENT AGRICULTURE

**T**HE USE OF TECHNOLOGY IN THE APPLICATION OF precision agriculture is redefining the science of feeding the planet. New levels of production efficiency, societal responsibility, and nutritional awareness are possible through the application of location intelligence and an increasing awareness and use of geo-spatial information.

This awareness comes not a moment too soon. Not only do we face the prospect of feeding an estimated 9.5 billion people by 2050, but the world is reckoning with the unforeseen impacts of agriculture on our health and the environment. Impacts include overuse of water in factory farms, increased greenhouse gases caused by deforestation and livestock methane emissions, ocean pollution caused by aquafarming, and marine ecosystems threatened by overfishing. Genetic modification of crops and animals is among additional concerns.

But GIS and related technologies offer promising solutions to meet these and other agricultural and agribusiness challenges of the 21st century. Using GIS, organizations can collect, maintain, analyze, and share agricultural data and make better in-season decisions. Maps, apps, and dashboards can integrate variables, such as soils, irrigation, yield, production costs, profit, and compliance data. Earth observations, imagery, field data, and real-time

data streams can help create a digital agricultural or farm twin to increase efficiency and profits while supporting the need for sustainable production to feed the world's growing population.

Next, we'll take a closer look at the use of GIS in farm planning and decision-making, mobile work and connectivity, regenerative agriculture, and public and private partnerships.

## Farm planning and decision-making

In response to reduced margins and an uncertain future, agriculture organizations must make planning and decision-making even more efficient to remain competitive. GIS provides these organizations with an integrated digital system for faster decision-making and streamlined operations, aiding them in responding to changes in markets, weather events such as hurricanes, and climate change in general. Organizations benefit from the ability to tune workflows, improve schedules, and model workforce activities in real time, optimizing business performance and ensuring sustainability.

With GIS, agriculture organizations can use data on the locations of crops, workers, vehicles, and processes to establish more efficient workflows and achieve a better balance between profitability and long-term sustainability.

In precision agriculture, the farmer needs detailed information about the field. Key information is gathered from soil testing and yield data to determine the precise amounts of nutrients or seeds to apply. Using precise amounts increases yield and reduces waste, thereby increasing return on investment (ROI). Today, GIS is ubiquitous in precision agriculture. Using spatial information and tracking results year to year, you can meet the goal of precision farming to increase yield and profits in a way that is sustainable for the planet. The use of imagery is also essential in precision agriculture. You can use imagery to detect change through multispectral analysis and understand critical crop status over time.

GIS also helps define planning processes and improve risk management, changing farm management plans from reactive to proactive modeling.

### Mobile work and connectivity

Smart agribusiness companies are finding that using GIS to increase efficiency extends to their field operations. Collecting data, often remotely, and analyzing it in near real time with performance dashboards helps organizations model complex workflows, accelerate response times, eliminate waste, and reduce costs. Location technology can help balance and guide the use of natural resources while improving quality and customer satisfaction.

Integrated field apps can be used to collect detailed information at the source, creating a foundation of current field knowledge. With GIS, you can also coordinate, schedule, and dispatch workforce activities. Assigning tasks, monitoring status, and measuring progress in real time increases productivity throughout each step of the supply chain. Collecting and analyzing information in near real-time performance dashboards lets you model complex workflows and improve response times.

### Regenerative agriculture

Regenerative agriculture is the practice of balancing profitability and sustainability by protecting the environment, improving soil fertility, and optimizing long-term profitability to create greater food security. Increasingly, precision farmers use geoenabled smart devices and cloud computing to understand how cover crops, rotational grazing, no-till (growing crops with minimal disturbance to the soil), and other sustainable practices contribute to better soil health, biodiversity, and carbon dioxide (CO<sub>2</sub>) sequestration.

Bringing location intelligence into regenerative farm management practices leads to new spatial insights, improves decision-making,

and creates more balanced outcomes. Collecting information with mobile field apps helps streamline field communications and creates workflow efficiencies. In a sustainable precision agricultural practice, staff can also use imagery and remote sensing data with GIS to detect change through the analysis of multitemporal datasets. GIS lets you explore an array of data types with analytic tools to uncover new patterns and trends that can lead to greater holistic understanding.

### Public and private partnerships

Feeding Earth's growing population is a challenge that can't be met without cooperation between the public and private sectors. Food producers must grow more crops with higher nutritional quality, while at the same time minimizing environmental impacts related to soil resources, water consumption, and CO<sub>2</sub> emissions. Producers must also scale sustainable practices, which will require connecting smart farm leadership with policy makers at state and national levels through new business models, to ensure long-term food and economic security.

Field operations must become more efficient, which can be accomplished through automation and digitally supported precision farming. The use of the Internet of Things (IoT) in agriculture will help farmers understand current production status and move toward predictive analytic models.

### GIS in action

Next, we'll look at some real-life stories of how organizations are using GIS to meet the agricultural and agribusiness challenges of the 21st century.

# THE BUSINESS VALUE OF SUSTAINABILITY

Nespresso

**I**N OCTOBER 2018, IN QUICK SUCCESSION, THE NOBEL PRIZE in economics was coawarded to a Yale University professor who connected the cost of poor environmental practices to economic health and a United Nations (UN) scientific panel revealed that the world has less than a decade to act against devastating climate change.

The topic of sustainability was once again front-page news.

As governments struggle to find collaborative solutions, businesses are driving corporate sustainability efforts backed by big data analytics and location intelligence.

## UN Sustainable Development Goals

On September 25, 2015, heads of state gathered at the UN headquarters in New York City. At that summit, 193 countries agreed to a new set of global sustainability targets. The UN's Sustainable Development Goals (SDGs) use simple language to lay out an international regulatory framework for necessary challenges to be met globally by 2030.

The SDGs are known as a government initiative, but companies worldwide consulted on their development, and these goals could have an enormous impact on the business world. Their implementation will require investment and support from the private sector. A 2015 report by the UN's Sustainable Development Solutions Network estimates the cost of SDGs at \$1.4 trillion per year until 2030; in 2020, that estimate was updated to as much as \$7 trillion per year. The 2015 report notes that approximately half the investments can be privately financed.

Energy providers, car manufacturers, food purveyors, and other companies that convert natural resources are paying close attention to the sustainability effort. For those businesses, investment in the SDGs could increase the conservation of raw materials of production for decades to come—and result in long-term competitive advantage.

Across the business world, executives can see the implications of supporting SDGs: sustainability could soon become a major business opportunity.

### The role of the private sector

One day after the September 2015 summit, the then UN secretary-general Ban Ki-moon held the UN Private Sector Forum to discuss the role of businesses in achieving the SDGs. More than 200 executives from organizations around the world joined him in New York City, including leaders from Dell, Deloitte, Facebook, Fidelity, PepsiCo, and Siemens AG.

“I am counting on the private sector to drive success. Now is the time to mobilize the global business community as never before,” the secretary-general told business leaders. “Trillions of dollars in public and private funds are to be redirected towards the SDGs, creating huge opportunities for responsible companies to deliver solutions.”

Corporate organizations seem to agree. A 2017 survey by McKinsey Global Surveys found that nearly 60 percent of organizations were more engaged with sustainability than they had been two years earlier, with engagement levels rising to 80 percent in certain industries such as packaged goods and infrastructure.

As climate change continues, companies that rely on natural resources are studying the long-term viability of their products. In some regions of the world, for example, water supplies might soon run out. Reliable cropland could turn fallow as temperatures and weather systems shift. And yet, just 21 percent of business executives

told McKinsey that business growth was a top driver of their sustainability initiatives. One way to read that finding is that a select few industry leaders have figured out that smart, sustainable practices can bring about long-term growth and competitive advantage.

Innovative companies are adopting tools such as artificial intelligence (AI), IoT, and analytics to address the SDGs in ways that also benefit the business—doing well by doing good. According to the McKinsey report, nearly half the organizations using technology to advance sustainability are using big data and advanced analytics, which typically include location intelligence.

### Where sustainability meets opportunity

One such company is Nespresso. An autonomously managed subsidiary of Nestlé Group, Nespresso is known globally for its premium single-serving coffees. Nespresso's success and customer loyalty result from the company's emphasis on—and investment in—the consistency of its coffee's flavor.

Coffee is a delicate crop, frequently grown in developing countries and dependent on healthy ecosystems. Coffee—and companies such as Nespresso—is susceptible to the increasingly volatile effects of sociocultural dynamics and climate change. For Nespresso, acting today to avoid the perils of tomorrow is not just good citizenship, it's sustainable business.

“Sustainability is really at the core of our business. It is an imperative to our long-term business success,” explains Yann De Pietro, operations and sustainability technology manager for coffee at Nespresso. “There have been studies saying that by 2050, Arabica coffee may not be available anymore in some countries if we don't do anything now.”

## Controlling challenges through sustainability

Nespresso has made a deliberate choice to integrate these challenges into its decision-making process and act on them through sustainability programs. These programs help convert liabilities into business opportunities while supporting the farmers and communities that grow coffee.

Nespresso works with more than 100,000 farmers in 13 countries, up from 300 farmers in 2003. In 2003, the company launched its responsible coffee sourcing program, the Nespresso AAA Sustainable Quality Program, in partnership with the Rainforest Alliance. The program is based on the idea that high-quality coffee and the sustainability of farming communities are interconnected and that building trusting, long-standing relationships with coffee producers will benefit everyone.

The company supports the implementation of sustainable agricultural practices at farms by investing in technical assistance, paying premiums directly to coffee farmers, and cofinancing infrastructure improvements.

The company has invested in a network of more than 450 agronomists—specialists who provide coffee growers with on-site technical assistance and training on practices such as pruning, crop renovation, fair treatment of workers, water usage, and biodiversity conservation, all of which can earn farmers industry certifications.

Through its coffee sourcing program, Nespresso in recent years has invested about \$35 million annually in technical assistance and premiums paid to farmers for their quality coffee. The educational program is free to farmers and doesn't require them to sell to Nespresso, De Pietro said. But the benefits help create long-lasting relationships and loyalty.

Nespresso's coffee sourcing program is part of the company's strategic framework called The Positive Cup, which focuses on four



areas: coffee, aluminum, climate change, and engagement. Nespresso has committed to milestones that include sourcing 100 percent of its aluminum from responsible sources certified by the Aluminium Stewardship Initiative (ASI), offering consumers convenient solutions for recycling, reducing the carbon footprint, and reaching carbon neutrality for its operations. In 2016, the company tied those efforts to the UN's SDGs, committing to making an impact on 11 of the 17 SDGs.

### Progress through digital transformation

Although its sustainability program has been in effect for years, Nespresso has seen rapid results because of advances in digital technology.

At Nespresso, “Digital transformation is a key change for sustainability,” De Pietro said. “[We] want to provide maximum impact. So we need the tools to help us to maximize our efforts.”

At the center of Nespresso's digital transformation is location intelligence. The company's monitoring and evaluation system uses advanced digital technology that records, maps, and shares data about farms, farmers, and coffee crops. The system reveals local feedback and insight on the impact of its coffee sourcing program and the status of each farm, including its objectives, achievements, and performance. The digital platform—which is powered by GIS and data analytics—reveals insights into the way farmers deliver coffee beans to central mills to be harvested, an important factor in supply chain productivity and efficiency.

### Bringing intelligence to location data

One of De Pietro's goals is to help farmers get their crop to market more efficiently. An analysis in Colombia exemplified how location intelligence can create business advantage for the company and its partners.

A location analysis revealed that farmers brought their crops to certain Colombian mills—many of them close to their farms—less frequently than projected. De Pietro queried the GIS technology to study the data further so that he could understand these behavioral patterns. What he discovered was a reminder of topography’s effect on time to market.

With basic maps, he said, Nespresso could determine the distance between farmers and mills. But only with sophisticated location intelligence could it fully understand the travel distances to each central mill. The analysis uncovered areas where the terrain required long rides or walks through the mountains to reach certain farms, making frequent visits impractical. De Pietro and his team applied a similar analysis to the travel of agronomists who visit Nespresso’s farms and found a similar pattern. For a company that works with 100,000 farmers, having a digital solution to deliver that kind of intelligence is invaluable.

Location intelligence pointed the way to better business and sustainability practices. If the mills were more centrally located, farmers could get coffee to market more quickly. The ability of agronomists to reach farms faster also increased Nespresso’s capability to source its coffee from sustainable farmers.

Just as retailers and logistics companies use location intelligence technology to identify and plan the most efficient drive times for customers or delivery workers, Nespresso embraces the idea that the distance to a location is less important than the amount of time it takes a customer or farmer to get there.

Nespresso’s use of GIS and location intelligence to build a comprehensive view of farming operations and accessibility across regions is part of its goal of farm accessibility, De Pietro said.

As Nespresso makes progress in Colombia and around the world, the organization maps its efforts back to the UN’s SDGs to organize

and guide strategic decision-making. The coffee sourcing program, for instance, supports SDGs for inclusive growth, sustainable agriculture, eradication of poverty, water stewardship, and more.

### The future of sustainability

The use of location intelligence to reveal the granular details of day-to-day coffee farming benefits Nespresso and farmers. By examining and adjusting locations for farmers, the company frees up precious time and increases productivity. This allows more time for education and strategic planning—the activities Nespresso hopes will sustain its coffee crops for years to come.

Questions remain on ways to implement wide-scale change across industries. The UN reports that, as a whole, its member countries are not on schedule to meet the goals by 2030. “This ambitious agenda necessitates profound change that goes beyond business as usual,” the UN has stated.

Business-as-usual attitudes are among sustainability’s challenges. Some of the largest and wealthiest organizations in the world are not actively participating in sustainability efforts. The UN’s *SDG Commitment Report 100*, released in 2017, found that American companies scored far worse than their European counterparts. Of the 18 companies with no mention of sustainable development themes, 15 were American.

Regardless, there are strong incentives to invest in corporate sustainability strategies, for reasons reactive and proactive.

For instance, a team at McKinsey found that risk-related sustainability issues can impact up to 70 percent of an organization’s earnings. Nespresso’s core product and the heart of its brand—coffee—is at risk from climate change in the coming years. The company is approaching this challenge proactively, using digital technology and location intelligence to find strategic solutions.

Treating sustainability as a guiding principle and an opportunity to gain competitive value may be the way forward for other innovators in the business community.

A version of this story by Chris Chiappinelli originally appeared in *WhereNext* on December 11, 2018.