DXC LEADING EDGE
PLATFORMS | AGRIBUSINESS

3 ways digital technology can help to **feed the world sustainably**

DXC Leading Edge examines how to create more food with less environmental impact

Over the next few decades, regions of the globe will face individual challenges, but often they revert to one imperative: transforming farming to feed the world sustainably.

The current challenge for farmers is a conundrum. They must produce more food on less land while promoting biodiversity, reducing carbon emissions, protecting natural habitats and conserving resources using regenerative agriculture practices.

Doing this requires optimizing many areas at once. And it's happening—there is progress. It's happening where traditional, bio-friendly methods are complemented by something new: the power of digital technology.

For those looking at the state of flux in the world around us, it's possible to feel concern and sense opportunity in the same breath. How can we see things as they are but also envision the potential to do better? The changing climate brings challenges to people, places and economies every day. Environmental stressors are front and center. Consider water: in 2022, more than 2.3 billion people are facing water stress and almost 160 million children were exposed to severe and prolonged droughts.[1] Then look at crops: in the US alone, crop losses in 2022 totaled $21 billion, and $10 billion was not insured. Heatflation[2] and dry July depressed European yields, without counting the impact of the loss of Ukraine's bread basket.

Our food supply is not evenly distributed—much is wasted and many still experience hunger. In the UK, 26,082 tons is wasted every day. You can be forgiven for lacking optimism.

We recognize that our ability to deliver mechanisms to protect the planet for the future is being hampered—at least in part—by the urgent needs of today. Yet, we cannot defer creating new systems and solutions to protect the planet, especially the land which provides sustenance.

Some companies are busy decrying green concerns. But the truth is that we must find ways to make progress while still protecting the environment. We must answer these questions:

- How do we feed the hungry, reduce food waste AND replenish the soil?

- How can we produce affordable AND local options?

- How do we focus on diversifying farms and farmers to create supportive biologies and integrated nature-based solutions?

AGRI-TECH WILL POWER A FARMING TRANSFORMATION

The planet can't afford an agricultural business as usual option. Neither can humans. Current farming methods cannot keep pace with growing demand and shrinking resources. The mix of crops in the US is at a dangerous low, with half of the acreage given to corn and soy.[3] In fact, this is an issue in the UK, EU and around the world: A global monoculture approach (growing a single crop over large acreage)) has caused a rise in plant diseases, increasing pathogens and decreasing disease resistance.

We've learned that these old ways of working also increase runoff, decrease soil moisture and degrade the soil so it requires constant supplementation.

The monoculture problem is compounded by the loss of farmers and farm acreage. **"The world will lose about 250 million crop-production acres by 2050[4],"** according to estimates from the Food and Agriculture Organization of the United Nations. This means we must transition from simply measuring the profitability per acre and return to the productivity per acre.

Transformative changes are required, and soon— and digital solutions can help all farmers up their operations and their operational knowledge. This is especially true as we seek to close operational and cost gaps that hamper smaller, local and regional farms who have been set at a disadvantage by large factory farm operations.

Agri-tech moves what was a chemical business into a technology powerhouse using information to power farmer decisions. Instead of depletion, it's addition.

Consider drones used to inspect crop health, satellites and sensors that measure and compare crop cover, IoT sensor networks working well with automated irrigation and weather forecasts, pest detection, soil health and disease prevention; all driven from intelligent software.
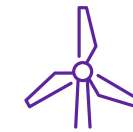
Some major agricultural suppliers already use digital technology:

Cargill is testing wearable devices on cows, aiming to lower their methane emissions by up to 53%.[5]

ADM offers GrainBridge, a free digital dashboard for farmers to view online information including grain prices and contracts.[6]

CNH's Case and New Holland brands are focusing on the equipment side of precision technology and data capture, creating a billion-dollar business for operations, data and alternative power.[7]

Many innovations that we see are impressive but they're scratching the surface. So far digital technology has been used mainly for point solutions. In the next 18 to 24 months, we will see a tech-led transition to support sustainable, intelligent, integrated operations. This happens in three broad areas:

1 SUPPORTING THE AGRICULTURE ECOSYSTEM

2 PUTTING FARMERS AT THE CENTER

3 PROVIDING SOLUTIONS AT SCALE

As we change how we look at the crops we plant and develop companion plantings that lift yields naturally, we find both smaller and larger players can contribute.

Consider the EU-funded "Diverfarming" collaborative featuring farms and consumer brands. They've released a free decision support tool[8]

- To put the "research results in the hands of end users ...

- Who are guided to tailor the most suitable diversified cropping system ...

- Low-input practices and most adapted machinery ...

- To improve land productivity, revenues and ecosystem services, with mechanisms ...

- To adapt their value chains to new agribusiness models and market demands."

1. SUPPORTING THE AGRICULTURE ECOSYSTEM

The agriculture industry needs to exchange profitability at all costs for productivity of all crops for a time. The goal? To restore land health for humans and livestock; offering food crops, as well as clothing, industrial biofuels and turfgrass.

Technology can deliver smart automation. Some agricultural processes managed with human labor can be automated, which can help address the growing worker shortages. However, we must go beyond automation for profit—we need to manage for food diversity and field equilibrium. Using platforms, applications and tools to recommend profitable companion crops (such as marigolds or oregano to promote pest resistance) can lead to more effective yield management and control. Harnessing old knowledge, increased crop science and technology on the same team can lead to better outputs on healthier land which lead to better yields.

In-field sensors can automatically collect and record soil conditions, then send this information to AI-powered systems. Where sensors detect the soil is too dry, the AI system triggers an automated irrigation system to provide water to a targeted spot, without wasting an increasingly valuable commodity.

Nirvana is a digitized knowledge base, connected through modern digital platforms and pipelines, capable of analyzing measures and observations collected from in-field sensors, farmer-contributed and exogenous data like weather systems; and deliver an instantaneous, integrated, informed response. Organizations like Syngenta are spearheading this approach.

2. PUTTING FARMERS AT THE CENTER

Farmers are decision makers. Through all the stages of a crop's production, a farmer confronts a vast number of questions: When is the best time to sow seeds? How much water and fertilizer are needed, and when? Should we harvest now, or wait?

We are losing a wealth of regenerative farming knowledge that is highly localized, in silos and, more often than not, leaving a difficult profession. We need to elevate the position of farmers, and encourage sharing of practices including nutrient testing, regenerative farming and direct-to-consumer channels.
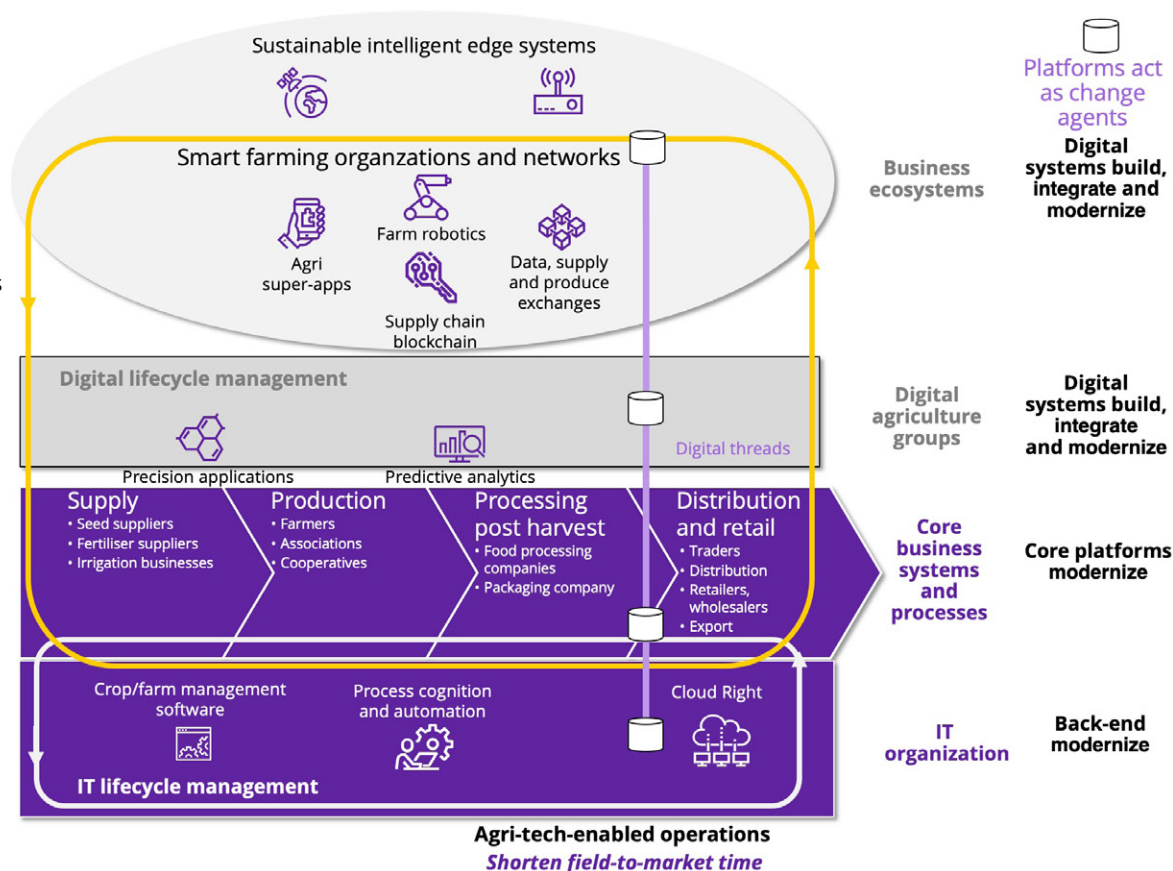
AI-driven analysis can process data collected from individual landowners, their sensored fields, equipment and systems, enabling farmers to make decisions based on actual data rather than gut instinct or past practices.

One agricultural supplier is developing digital tools that farmers can access from PCs, tablets, smartphones and in-cab displays. These tools draw on information collected from systems that include underground soil sensors and in-field weather stations. These wireless-connected farm-management systems use the data to support farmers' decisions and actions. Nearly 180 million acres of cropland are already covered in this way.

AI can also help with post-production, on yields, pricing and outlets, not just by maximizing what happens in growing but by helping farmers attain fair margins and fewer intermediaries.

Ways digital technology can help feed the world sustainably

Smart digital systems analyze large volumes of information from the intelligent edge to identify conducive weather conditions and soil, creating more accurate forecasts, so the production process is more predictable.

Sustainable intelligent edge systems

Smart farming organzations and networks

Agri super-apps

Farm robotics

Data, supply and produce exchanges

Supply chain blockchain

Digital lifecycle management

Precision applications

Predictive analytics

Digital threads

Operations are streamlined to increase ROI

Supply
- Seed suppliers
- Fertiliser suppliers
- Irrigation businesses

Production
- Farmers
- Associations
- Cooperatives

Processing post harvest
- Food processing companies
- Packaging company

Distribution and retail
- Traders
- Distribution
- Retailers, wholesalers
- Export

Crop/farm management software

Process cognition and automation

Cloud Right

IT lifecycle management

Agri-tech-enabled operations
Shorten field-to-market time

Platforms act as change agents

Business ecosystems — **Digital systems build, integrate and modernize**

Digital agriculture groups — **Digital systems build, integrate and modernize**

Core business systems and processes — **Core platforms modernize**

IT organization — **Back-end modernize**

By implementing and integrating the right applications, the Syngenta Digital Agriculture solutions team aims to build a digital agronomy toolbox that provides a seamless experience from planning to harvest.

The toolbox, AgriEdge Excelsior already incorporates several elements to help the grower throughout the season:

During planning, growers can analyze the previous year's data at a sub-field level to determine how they can be more sustainable and profitable, with the benefit of custom-crop forecasts based on historical data. Growers can share plans directly with their advisers who in turn can provide product recommendations.

Once the crop is in the field, growers can use digital tools to stay ahead of potential threats. Using the recently acquired FarmShots™ satellite imagery, growers can locate potential problems. Robust software analytics identify the specific cause, and the grower's adviser can send a recommended agronomic solution.

When a plan of action is put into place, purchases or applications are recorded into Syngenta's Land.db for record keeping, data analytics and regulatory reporting.

At harvest, growers see historical data at a field level. By looking at live local prices, along with the historical data, growers can measure the overall potential profitability. The data can be instantly sent to Land.db to be used in next season's planning.

"Retailers, resellers and agronomists will play a critical role in the future of digital agriculture. Digital agriculture is revolutionizing and will continue to revolutionize the way they scout, recommend products and communicate with their customers. Growers' confidence in their advisers will continue to increase, as they see the results backed up by data evidence."[9]

Aaron Deardorff
Formerly Head of Digital Agriculture Solutions
Syngenta

DIGITAL FROM START TO FINISH: SYNGENTA'S AGRI-EDGE

The UK is leading by example with its Food Data Transparency Partnership (FDTP).[10] This multi-year partnership brings government, industry, academia and society together to improve access and understanding of key health, animal welfare and sustainability metrics. As an indication of the transformation data can bring to food systems, the partnership has even named a director of openness, data and digital at the Food Standards Agency (FSA).

Global food production has to grow by 70% to feed the predicted world population of 9.1 billion in 2050.[11] To achieve changes of this scale, the agricultural industry needs to create, adopt and support industry digital systems that work synergistically. Governments, non-profits and NGOs need to work together.

A vital area of interest is supply-chain traceability. Being able to understand the chain of custody, location and freshness of food is of national and even international importance. Tracing a US listeria outbreak with lightning speed, identifying the source of tainted meats mixed in a UK factory, or an EU effort to track sources for palm oil—these all require solutions that reach beyond one enterprise. As regulation increases, so too will the need for collaborative solutions.

Another effort in this direction is the AgGateway consortium.[12] This global nonprofit organization's mission is to develop the resources and relationships that drive digital connectivity in global agriculture and related industries. The consortium's 200 members include agricultural retailers, distributors, manufacturers, grain and feed companies, specialty chemical makers, and software and data-services providers (including DXC Technology. Two current projects are the creation of an ag-industry component identification system and a digital toolkit that enables different hardware and software to work together.

CONCLUSION

Action items: Promoting crop diversity, collaboration and data-driven solutions for empowered and sustainable Agriculture.

Educate the marketplace on food and food production: It's important to educate people about food and its production. While not everyone may be interested, gathering information for sustainability efforts in retail and food manufacturing is powerful. Michael Pollan, bestselling author of the Omnivore's Dilemma, said, "Imagine if we had a food system that produced wholesome food, restored the land, and allowed us to know what we're eating, where it came from, how it reached our table, and its true cost. In that reality, every meal could be perfect." Understanding the origins and production of our food empowers us to make positive changes and contribute to a more sustainable future.

Increase crop diversity for increased food production: examine incentives, planning approaches and digital methods that pursue crop diversity and beneficial pairings to enhance food production. Encourage farmers, businesses, and governments to collaborate in adopting practices that support and promote a wide range of crops, leading to more resilient and productive farming systems.

Foster synergy among business, farmers and governments: Build collaborative efforts between businesses, farmers, and governments to achieve sustainable and productive agricultural systems. Encourage partnerships and information sharing to leverage the strengths and resources of each stakeholder group, leading to mutually beneficial outcomes. Increase efforts to build the next generation of farms and farmers, leveraging technology and innovation to create new food systems.

Enable data sources for empowering farmers: Support the development and utilization of data sources and digital tools that empower farmers with valuable insights and information. Advocate for the integration of advanced technologies and data-driven solutions to enhance decision-making, optimize resource allocation, and improve overall farm productivity.

By fostering crop diversity, facilitating collaboration, and empowering farmers with data-driven solutions, we can create a sustainable and prosperous future for agriculture. These actions address key challenges, promote sustainability, enhance productivity, and build resilience in our agricultural systems.

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