Pastures new
Silicon Valley goes to the farm
Greener growth
Sowing sustainability
Waste not
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The future of food
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Welcome to the February 2018 issue

Food is the subject of the magazine this month, as we examine emerging solutions to growing challenges in the global food system. By 2050 there will be almost 2.5 billion more mouths to feed and we will need to produce almost twice as much food as today.

Yet we cannot feed the numbers we have now with current agricultural practices, nor with the amount of food wasted and lost on the journey from farm to fork. And the impact of climate change, which has already caused Saudi Arabia to buy land in water-stressed California and Arizona will only worsen.

Angeli Mehta looks at how big data is revolutionising agriculture as Silicon Valley comes to the farm gate, with agri-tech start-ups offering technologies to allow food to be grown more efficiently and sustainably for companies such as Kellogg and Campbell’s Soup.

She also looks at the firms, like AeroFarms and Plantagon, that are growing food in urban farms, using significantly less land and water, as well as innovations in alternative proteins for animals and in omega 3-rich alternatives to feed fish.

Eric Marx reports from Berlin on the apps that are helping smallholders in developing countries achieve optimal harvests, and asks whether agri-tech can sow a green revolution for India’s poorest farmers.

We also look at another important solution to food security: the global effort to tackle food loss and waste through the multi-stakeholder Champions 12.3 platform. I interview Liz Goodwin, former CEO of the UK waste reduction charity WRAP, who now heads up the World Resources Institute’s food loss and waste effort, while Diana Rojas reports from Washington on some of the companies, led by UK retailer Tesco, that are doing the most to tackle food waste throughout their supply chains.

Plenty of food for thought.

Terry Slavin
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Waste not
The global effort to stem food loss
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Pastures new for big data

By Angeli Mehta

Angeli Mehta reports on how technology is revolutionising agriculture as Silicon Valley comes to the farm gate

Data is shaping almost every area of our lives. Agriculture has been slow to embrace new technology but even here it’s beginning to have a big impact. There are now hundreds of companies offering everything from farm management and precision tools to bots and drones. Some tractors have computing power that would have turned Nasa’s moon-landing mission green with envy.

What started in farm equipment is moving into the field – at least in the developed world. More and more data is available as farmers use sensors for soil sampling and mobile apps, cameras and drones to monitor pests and diseases. Data science teams are using satellite imagery married with historical records to predict crop yields around the world. A bounty of data for machine learning and image recognition has been supported by continual advances in computing power.

“I’ve lived Moore’s law and that’s happening here,” remarks Dave Stangis, who spent 11 years at chip-maker Intel before moving to Campbell Soup Company.

It was Intel’s co-founder Gordon Moore who, in 1965, predicted a doubling of computer processing power every two years.

To be more productive, farmers need technology to help them make timely decisions. “It’s easy to forget that farmers get one, maybe two chances a year to get it right,” says Diane Holdorf, chief sustainability officer at food manufacturer Kellogg. Indeed their livelihoods depend on it.
Investment in technology is big business. According to AgFunder, an equity crowdfunding platform, agri-tech start-ups raised $4.4bn globally in the first half of last year; 21% of that in Europe. Among them is Lille-based Sencrop, whose rain and wind gauges keep track of temperature, humidity, rainfall and wind in the fields. Overlaid with current and historical climate data, its systems allow farmers to make decisions about irrigation and seeding – even anticipating disease, all from their smart phones.

One of the biggest deals in recent years was Monsanto’s acquisition of The Climate Corporation. This California-based firm started out selling insurance against extreme weather events, and not surprisingly farmers were among its customers. Now it gathers data from sensors and satellites to analyse soil organic matter and nutrients, and monitor crop yields and local weather patterns, to help farmers get the best out of the soil, water, fertilisers, pesticides, and seeds they use.

As its chief science officer Sam Eathington put it in a company blog last month: “Silicon Valley has moved to the Midwest and is at the farmgate.”

Monsanto, itself a pioneer in biotechnology, is moving rapidly into data sciences.

Chief executive Robert Fraley sees advances in both driving the “sustainable intensification” of agriculture around the world, getting more out of existing agricultural land and improving the environment.

The Climate Corporation has plenty of competition. Tractor giant John Deere, cooperative network Land O’ Lakes and seed producer DuPont Pioneer all offer equipment, software tools and services for field management. The Sustain platform – originally developed by United Suppliers and the Environmental Defence Fund – has a suite of “precision conservation tools” to improve soil health and better manage water and nutrients.

Data monitoring on the farm enables them to show retailers, and in turn consumers, what has been achieved. Farmers who grow crops for Campbell Soup and Kellogg, for example, are involved in the programme.
John Deere’s equipment can precisely control seeding densities, determined by detailed data on conditions across a field. Crop yields can be measured as grain flows into a harvester and in conjunction with GPS data, used to map productivity in minute detail.

Last autumn, the tractor firm bought a California start-up that uses machine vision and artificial intelligence (AI) to detect weeds and deliver a targeted dose of herbicide to each weed. Blue River Technology’s See & Spray system of cameras and computers is towed behind a tractor and cuts herbicide use by around 90%, compared with spraying a whole field.

The company’s first machine was a lettuce bot, now being used by growers to weed and thin young lettuce plants.

See & Spray uses similar algorithms to those in facial recognition software, and is “trained” on tens of thousands of images to distinguish weed from crop. It makes 5,000 decisions each minute, and has an accuracy to within 63mm, according to business development director Ben Chostner.

He told a conference audience last year that the data collected while spraying produces mapping for every field so farmers can compare weed pressures over time, and in different parts of a field.

A week later a drone surveys the field to check the weeds have been removed. That learning goes back into the system. Blue River Technology is also working on soybeans, chickpeas, corn and peppers, and anticipates farmers being able to use it to spray fungicides and fertiliser as required across a field.

Trouble with fertilisers
Means to cut fertilisers use are urgently needed. In the UK, farming is the most significant source of water pollution and of ammonia emissions into the air, both of which harm ecosystems. The picture is similar in the US and China. The bulk of nitrogen and phosphorous in fertilisers doesn’t get taken up by
Scientists are working on understanding how gut microbes and selective breeding might cut methane emissions from cattle.
China is striving for self-sufficiency in food production, but consumers have become concerned about the provenance of food

starting to collect analytics from its growers around fruit quality (as determined by solids and sugars) and water use. Every trailer is sampled and, based on quality, they’re called into the plant. All the data is analysed and shared back so an individual farmer can see how he compares and what improvements he could make. More of its farmers are converting to drip irrigation, which works underground to release water at the crop roots. “We’ve seen some great improvements across the board and water use has gone down,” says Stangis.

**More sustainable livestock?**

Facial recognition software for cattle and pigs sounds like science fiction, but it could transform livestock health monitoring, whether it’s keeping an eye on animals about to give birth or spotting early signs of ill health. Irish firm Cainthus has developed a system that can identify cows that are not eating, or are behaving aggressively.

German-based Evonik Nutrition & Care is working on proof of concept with a large US poultry producer to demonstrate on the farm what has been possible in its laboratory simulations of a chicken’s gut. The aim is to cut antibiotic use, saving them only for when disease is real. Scientists at SRUC in Scotland, meanwhile, are working on understanding how gut microbes and selective breeding might cut methane emissions from belching cattle.

**Robots on the farm**

The massive dairy herds maintained in Saudi Arabia are all micro-chipped and data is regularly sampled to try to identify health issues before symptoms actually occur. Robots are appearing in US dairy farms, and improving milk yields.

Besides potentially freeing farm workers from some of the most back-breaking work, there are economic and political drivers. The availability of migrant labour in the UK is in question through Brexit and there are labour shortages in California thanks to a clampdown on undocumented migrants who pick the state’s soft fruit and lettuces. On the other side of the globe, China is striving for self-sufficiency in food production while in Japan a lack of inward migration and an ageing population are pushing innovation forward.
Simon Pearson, director of the Lincoln Institute of Agri-food Technology, believes robotics technology is still developing. “We’re two to three years off really effective robotic harvesting anywhere in the world,” he says. Backed by Innovate UK funding, his team built a broccoli-harvesting system, which it trained to distinguish between weeds and plant; head and leaves.

A follow-on project produced a robot prototype that was successfully tested last year. He argues robotics alone will not be the solution: genetics will be needed to identify traits that make a broccoli head better designed for cropping. Tomatoes and mushrooms could be feasible, but fruit is a far tougher challenge. The proof of concept, he says, is done but processing needs to be faster. “There are a heap of challenges to go from 30 seconds [each fruit] to two.”

The Hands Free Hectare project, led by UK-based Precision Decisions and Harper Adams University, successfully grew barley from seed to harvest without a human in the field. Moreover, the team used only off-the-shelf technology and open source software. Now it’s trying to improve the accuracy of the machinery to get a better yield this year, with winter wheat, and has been exploring applications in India.

**Blockchain**

If big data can make farming more sustainable, consumers could help drive that revolution with a better understanding of where their food comes from. The key to unlocking that challenge may lie with blockchain, most often associated with cryptocurrencies like bitcoin. It’s essentially a means to digitally store and share information about every link in a chain in real time, and the information is kept in perpetuity.

“Blockchain enables data verification through consensus and provenance. By using blockchain, organisations and individuals can attain greater confidence in data on the ledger because consensus of all parties is required for that data to be added, and provenance ensures that the existence of data
can be traced back to its source,” according to Don Thibeau, offering manager for IBM Blockchain.

Last August, IBM announced a collaboration with a group of food suppliers, including Walmart, Unilever and Nestlé, with the aim of strengthening consumer confidence in the global supply chain. Walmart ran two pilots, one with mango, to see how long it would take to trace back through the supply chain to find the farm where the mango originated. Without blockchain, the exercise took almost a week. Using blockchain, it took about two seconds.

Such speed will transform the detection of the source in an outbreak of food poisoning, but Walmart’s vice-president for food safety, Frank Yiannas, says a big driver is transparency. Consumers will be able to discover immediately how an item of food is produced, and whether it is sustainably grown.

Walmart and IBM followed up in December with an announcement that they’d work with Beijing’s Tsinghua University on food tracking, traceability and safety in China. The Chinese government is striving for self-sufficiency in food production, but consumers have become concerned about the provenance and safety of food. Although clearly, China doesn’t have a monopoly on food scandals.

Sepehr Mousavi, sustainability strategist at Sweden’s vertical farming pioneer Plantagon (See: From vertical farms to new proteins) wants to build a blockchain model that shows a consumer nutritional information, and precisely how far a product has travelled. He hopes consumers will be able to scan one of Plantagon’s leafy greens to discover who harvested it, and how old it is.

Holdorf of Kellogg suggests it’s still early days in terms of how blockchain is being applied to track fresh fruit and vegetables, where there is “a clear line of sight” from field to store. But she ponders that it might also provide a tool for increasing the transparency of grains, where a grain store takes the input of many farms. And it works the other way too: “A lot of farmers like to know how their crop connects to food.”

Kellogg has made some big commitments to responsibly sourcing 10 priority ingredients by 2020, and to support climate smart agriculture. With blockchain, its customers may just be able to hold it to account.
How big data is transforming the humble potato

“We’re going from precision agriculture to decision agriculture. And we’re trying to drive that revolution,” states Giri Baleri, VP for marketing at Resson, a university spin out from New Brunswick in Canada. Resson uses imagery combined with farm data to provide a range of analytics to growers.

One goal, he explains, is to detect issues like disease and pests, and preferably before they arrive.

Resson has been working with potato chip producer McCain to improve its growers’ harvests. Thanks to machine learning, its systems can diagnose the presence of viruses and pests, such as the beetles that eat potato foliage and so dent crop quality. This year it will have a limited commercial roll out with potato farmers across more than 10,000 acres in eight different geographies, and separately with a spinach grower in Arizona.

Water is also a target. “Often there’s no rain during an entire summer when plants are growing and ripening, so you have no option but to pump water, which costs money both for energy management and water rights,” says Baleri.

Resson has been working with potato growers in the US and Canada, and in California’s Salinas Valley on a moisture assessment module for their valuable baby spinach and soft fruits crops. Thermal imagery gives a relative water index across a field, which can be correlated with soil moisture readings. Trials with tomato crops are about to begin.

The company has almost 50 people working in engineering and image analytics. Image collection costs are coming down all the time, especially with drones, says Baleri. The data itself provides valuable opportunities for research and development. Analytics costs vary but Baleri argues that $20-30 an acre for a crop value of over $1,000 an acre is a small price if they deliver an 8-10% increase in yield. On top of that, avoiding the application of fertiliser across an entire field can cut costs by more than 50%.

Angeli Mehta
From vertical farms to new proteins: innovating to feed the planet

By Angeli Mehta

Angeli Mehta reports on emerging technologies tackling the threats to food security from diminishing biodiversity, climate change and population growth

We have a problem. By 2050 there will be almost two-and-a-half billion more mouths to feed on planet Earth. To sustain them, we need to produce almost twice as much food as we do now.

Irrigation has been a big contributor to increasing yields, but the challenge of a changing climate means water will not be available where it is needed most.

And farming is itself a big contributor to climate change, generating some 14.5% of global greenhouse gas emissions.

A burgeoning agricultural sector in the developed world has led to diminishing biodiversity, deforestation, soil and water contamination, and air pollution, while elsewhere subsistence farming denies food security to billions. How can we produce more from our agricultural systems – and produce it sustainably?

“There’s a tremendous urgency around connecting the challenges of human health and planetary health and having a really sustainable food system,” says Diane Holdorf, chief sustainability officer at Kellogg.

“The swirl of risk is going to be coming quickly; there’s a lot of work to be done. It’s going to impact everyone even if this is not the sector you work in.”
“Speed is of the essence,” agrees Brande Wulff, project leader for crop genetics at the UK’s John Innes Centre in Norwich. Staff there, he says, are “working in a race against time to ... develop crops better equipped for tomorrow’s climate and more sustainable to grow.”

The challenge cannot be underestimated, he contends, even here in the UK. That’s because we grow a lot less of our own food than we did 30 years ago, making us vulnerable both economically and politically.

With climate change, much of the breeding is just to stand still. “If you take a cultivar [plant variety cultivated by selective breeding] from just a few years ago, the conditions have changed so much it would likely produce less.”

It is not just agricultural researchers who are focused on cracking this issue. According to equity crowd-funding platform AgFunder, agri-tech start-ups raised $4.4bn globally in the first half of last year; 21% of that in Europe. (See: Pastures new for big data)

**Urban farming**

One focus of investment is in urban farming. Siting farms in urban centres cuts at a stroke land and water use, slashes transportation emissions and storage costs. Singapore-based Sky Greens has come up with a water-powered hydraulic system to rotate tiers of growing troughs hung on a 9m-high frame, so plants get equal shares of light and nutrients. Water and soil are recycled and re-used.

In the northern hemisphere, vertical farming is made possible by LEDs (light emitting diodes), which use far less energy than sodium lamps and, crucially, produce light in the wavelengths plants need to produce their own food through photosynthesis.

Growers like New Jersey-based AeroFarms have taken advantage of low energy-consuming LEDs as well as using closed-loop systems to recycle water and nutrients and reduce waste. The farms also offer community benefits and employment opportunities.

• Meeting an increasing demand for animal protein means diverting more land for livestock feed. Evonik, part of sustainable business platform Forum for the Future, has developed amino acids that build proteins in animal crops, helping to free up arable land.

• French firm Ynsect is growing mealworms to produce fish feed. Results suggest the insects create healthier fish, and by-products, such as fertiliser, help increase crop yields.
uses just 5% of the water that would be needed in the field. The plants aren’t grown in water or soil, but rather misted with ideal quantities of water, nutrients and oxygen, called aeroponics.

No pesticide is required. Seeds are germinated and grown on a reusable cloth made from post-consumer recycled plastic. It’s a highly controlled operation: AeroFarms monitors 130,000 data points for every harvest for continual fine-tuning. Founder and chief executive David Rosenberg describes the business as a data sciences company as much as a farming one.

In Stockholm, Plantagon has used crowd funding to help finance the imminent opening in April, of its first city farm in an underground room that once housed newspaper archives. Its green produce is already reserved by Sweden’s largest retail chain ICA for its store just 800m away.

Despite using renewables, the operation is still energy-intensive. Plantagon aims to recover all the heat from the LEDs and send that to the host building in winter, or use it to warm the water in summer. Water use is minimal: a kilogram of lettuce grown outside would use 250 litres of water, explains sustainability strategist Sepehr Mousavi. Plantagon uses on average 1.2 litres.

The ultimate aim is to have a negative carbon footprint. As at AeroFarms, a huge research effort has gone into creating the optimal environment for growing, providing just the right nutrients to ensure yield and taste. Again sensors and big data are key.

The company had hoped by now to have built a hi-tech demonstration facility further south in Linköping, but it was held up for two years by campaigners concerned that migratory birds might fly into the glass walls. What they learnt during the hiatus has been invaluable. “You need a real estate owner and a retailer,” explains Mousavi. “They [the real estate owner] want to know how much money they will make and will it help my sustainability?” The next lesson was having control of the value chain. The big issue is not the growing, but logistics. “You need to shorten the chain from seven to nine actors, to just one or even zero.”
Both companies have a wider social purpose. AeroFarms is contributing to urban regeneration, trying to inspire a local population about the technology on their doorstep, and providing employment to those locals and to ex-offenders. A mini farm in a Newark school has given students a connection to their food, explains Rosenberg, and it’s changed eating habits there.

Plantagon is providing work opportunities for people with disabilities, who find it hard to get employment.

Because Plantagon uses pumice, rather than soil, as a growing medium it can’t achieve organic status. So it is focusing effort on developing a certification system and a means of demonstrating provenance and nutrition.

While LED technology is enabling indoor farming, it could also be used to speed up plant breeding. Going from one generation of seed to the next takes time, which is why Wulff at the John Innes Centre and his collaborators in Australia started to experiment with “speed breeding”.

With each generation of a crop, breeders try to improve wanted traits like resilience to drought and remove unwanted ones like susceptibility to disease. So Wulff is using light to trick plants into staying awake for up to 22 hours a day, and has been rewarded with six generations of wheat in a year as opposed to just two or three. Such research could also have an impact on vertical farms.

The crops still have to be proven in the field, but Wulff hopes to walk into a field in 10 years’ time and see newer and better crops produced with the help of speed breeding. “These are exciting times” says Mousavi of Plantagon. “To meet global sustainable development goals, we need to start somewhere.”

**Competing demands**

The world’s population is also becoming more affluent, which suggests we’ll spend more of our income on protein. In the US and Europe, we eat more protein than we need. Indeed, the UN’s Food and Agriculture Organisation
Evonik is developing the vital amino acids that build proteins in crops for animal feed

expects the daily diet of a 2050 Earth inhabitant will contain more protein and vegetable oils than it does today. At the moment, the most efficient way to get it is by farming animals and fish.

A third of global agricultural land is used for livestock feed production, according to Forum for the Future, a non-profit organisation that tackles sustainable development. Almost all water used in animal production (98%) goes into the feed crops, while more than a fifth of wild fish that are caught go into feed.

One example of the competing pressures comes from Saudi Arabia, where its large and highly automated dairy industry has contributed to a depletion of the country’s water reserves.

In response, the Saudi government has cut domestic production of forage, which means millions of tonnes will have to be imported. As a result, Saudi dairies are buying land in California and Arizona – both with their own water supply issues – to grow hay that will be shipped back home.

“It’s almost impossible to compare different feeds,” says Simon Billing, who leads Forum’s work on proteins. Moreover, he says, “promising solutions are at very small scale...... and there’s very little good practice to point to.” Working with a range of companies in the food supply chain, Forum is developing a sustainability assessment tool to help the industry compare different types of feed that will guide purchasing decisions.

While chickens and pigs produce more meat (and hence more protein) than cows and sheep, more than 70% of their diet could be consumed by humans, explains Thomas Kaufmann, head of sustainability development at Evonik Nutrition & Care, one of the companies working with Forum for the Future.
Soy bean provides ideal animal nutrition, but it’s a major driver of deforestation in the Amazon basin.

“The overarching need is to move from soy bean to locally produced feed as 40-50 years ago,” says Kaufmann. Billing thinks that is, in part, an issue for government, although there is no real policy on feed anywhere in the world: “It’s a big beast that won’t restructure overnight … but we do need to be starting now.”

Evonik’s approach is to develop the vital amino acids that build proteins in crops consumed by animals. Using these as a feed supplement frees up arable land for other crops: its estimates suggest that their use today is freeing up 11.6m hectares of land, roughly the size of Ohio or Malawi. They can also be produced closer to home.

“This is, for us, a business decision, as well as an environmental one,” says Kaufmann of Evonik. “In the past [a growing demand for protein] was good for business – but we have to change.”

There are other solutions for feeding animals and fish. French firm Ynsect has a demonstration plant near Dole where mealworms, larval forms of the mealworm beetle, are grown to produce fish feed, with some unexpected benefits.

Initial trials suggest farmed shrimp nourished with Ynsect’s protein meal had much better resistance to pathogenic bacteria, while in farmed salmon mortality during the stressful transition from fresh water to sea water was lower.

Chief executive Antoine Hubert has theories for the underlying mechanisms, but these need more research. Given that animals and fish eat insects in the wild, they are perhaps well adapted to them.

Ynsect is not wasting any part of the creatures bred on its farms, producing protein, oil and fertiliser as well as chitosan, a sugar that comes from the larvae’s protective exterior and has anti-microbial properties.

Ynsect’s fertiliser is being put through its paces now. A crop of rapeseed sown in September had – by December – grown three times as big as rapeseed treated with chemical fertilisers. Hubert says his firm hopes to start building a commercial production facility next year.
A sea change in the way we farm fish

Unsustainable farming practices are not the only reason for the looming food crisis. The bulk of the world’s fishing stocks are depleted to greater or lesser extents. Fish farming was meant to take the pressure off wild stocks but is itself growing unsustainably and causes environmental damage. It also uses wild fish for feed.

German firm Evonik and Netherlands-based DSM have just begun building a $200m plant in Nebraska that will make omega-3 fatty acid products from marine algae for the salmon farming industry. Usually omega-3 fatty acids, which are important for human diets, are obtained from fish oils, but fish oils are in limited supply. Evonik estimates that 1kg of its innovative algal oil can replace 60kg of wild fish.

In Scotland, the salmon-farming industry aims to double its production by 2030, but a parliamentary inquiry now under way is examining environmental impacts.

These include the medicines and chemicals used to treat infestations of sea lice, which kill large numbers of farmed salmon. The lice have become resistant to the chemicals used to destroy them, and in turn those chemicals – including organophosphates – persist in the environment.

There’s concern, too, that a collapse in stocks of wild salmon and trout in rivers and lochs near salmon farms is due to sea lice transferring to those wild populations as they make their annual journeys to the sea. Excess food and fish waste accumulates on the seabed below the tanks and in lochs, causing algal blooms; while tank antifouling treatments are leaching out with no understanding of long-term effects, or how widespread they are, according to the Scottish Association for Marine Science (SAMS), a marine environment research organisation. A lot of farmed salmon manage to escape and some breed with the wild population: evidence from Norway suggests this genetic intermingling is having an impact on the size and maturation age of their offspring.
Might it be time for the industry to learn from urban farmers and bring production onshore, where the environment can be precisely controlled? Gordon Boyle, chairman of land-based fish farmer Niri Scotland is certain it can. His firm has recently finished proving its test farm – a recirculating aquaculture system (RAS) – at Machrihanish on the west coast. Another firm, which like Niri is Norwegian owned, is building an onshore hatchery that is expected to be producing young fish next year.

Boyle says the salmon are much leaner and healthier than today’s farmed salmon, because they’re forced to swim in the ongoing current. The fish don’t swim in polluted water because waste and uneaten food are drawn to the centre of the tank, where they’re continuously removed and the water is cleaned and recycled. The waste can provide fertiliser for agriculture, or it could be used to produce renewable energy, making it a fully circular enterprise.

There is a big question over energy requirements, which add to emissions unless they can be met from renewables. The experience of recirculating aquaculture systems in Canada suggests energy costs can be 10 times that of pen-rearing, according to research by SAMS. However, Boyle points out that both transportation costs and emissions would be slashed by bringing the farm closer to where its product will be eaten.

An onshore fish farm could also be linked to an indoor crop farm, an approach that’s been taken up on a small scale by London-based GrowUp Urban Farms. In its system, nutrient-rich water from tanks housing tilapia, a species of freshwater fish, is pumped to the roots of its hydroponically grown plants and the cleaned water returned to the fish tanks.

Another option is to head for open water. Norwegian producer SalMar has begun the pilot phase of its world-first “ocean farm”, which is now stocked with fish. It’s aiming to reduce the industry’s environmental footprint and improve fish welfare to make farming sustainable.

Angeli Mehta
Can agri-tech sow a green revolution for India’s poorest farmers?

By Eric Marx

Eric Marx reports on the apps that are helping smallholders achieve optimal harvests in some of the harshest growing areas on the planet.

As digitisation rolls across India, some see the dawning of a second green revolution in the agricultural sector. Whether, how, and with what success it will affect the lives of India’s poorest and most marginal farmers – so-called smallholders, who typically work just over a hectare of land and account for roughly 65% of India’s population – is still an open question.

“India is a very interesting place to be working on digital agriculture because there are so many agri-tech companies getting involved,” says Anthony Whitbread, a research programme director of drylands innovation systems at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), an international non-profit based in India that has been experimenting with the latest in digital technologies in dryland regions across south Asia and sub-Saharan Africa.

Up to now there have been few examples of large-scale impact that have been immediately useful for smallholders.

One is the Plantix App, which uses image recognition technology and self-learning algorithms to enable real-time monitoring of pests and diseases. Another is the Sowing App, which helps farmers achieve optimal harvests by advising on the best time to sow using data about local weather and soil conditions.
Both were developed by ICRISAT, working with private agri-tech partners adept at leveraging the latest advances in big data and artificial intelligence (AI).

Mobile phones and cheap data plans linked to better analytical capacity are helping to drive this new approach to farming, called precision agriculture, says Whitbread. So are improved satellite data (including better resolution, increased frequency rates and lower costs) and cheaper remote collecting devices (including sensors, global positioning systems and drones), powered by the internet of things.

Together, this suite of technologies may hold a key to solving one of humankind’s biggest challenges in the 21st century: ensuring food and nutritional security to a world population that is estimated to swell to 9.3 billion by 2050.

India alone will have to feed 1.4 billion people by 2025, against a background of degrading land and increasingly variable weather associated with climate change.

But given that most smallholders are not digitally literate, typically work with their bare hands in fields lacking irrigation, and have limited access to markets due to poor roads, is it reasonable to think that digital technology can markedly change their prospects?

Whitbread concedes that there is a lot of “hype” around digital agriculture, but adds that there is new evidence of ways to make it more accessible to small farmers.

First, the technology must be simple. Second, governments should work in partnership with the private sector, academic institutions and non-profit research and development groups to keep costs affordable. The key is enabling farmers to get the right advice for free in real-time – and then allowing them to connect with other farmers so they have access to a range of different markets and services.

The Sowing and Plantix apps show the way, though by themselves they will not revolutionise farming, Whitbread cautions. For that to happen there
will have to be a third development: progress in logistical and market-type digital applications, as well as digitised crop insurance.

**Plant damage in the picture**

Public agricultural research institutes like ICRISAT know very well that Big Ag companies are going to come into the picture. In fact, the seed traders and fertilizer salesmen are already there, says Srikanth Rupavatharam, a digital agriculture scientist with ICRISAT who coordinates a network of “photo-hunters”, which are now tagging and uploading images with the Plantix App.

What Plantix does is re-balance that relationship so farmers and government-sent extension workers, whose mission is to educate farmers in the latest in scientific research and agricultural practices, get independent and accurate information that they can use in a timely manner.

Plantix’s core feature is image-recognition software, which uses self-learning algorithms to detect and recognise optical patterns in photographs of plant damage caused by pests, diseases or nutrient deficiencies, explains Bianca Kummer, a co-founder of Progressive Environmental and Agricultural Technologies (PEAT), a German-based company started by young entrepreneurs who first tested the Plantix concept on greenhouse tomato plants three years ago at the University of Hanover.

“At the beginning there was no funding money, only an idea and seven highly motivated people,” says Kummer.

The partnership with ICRISAT has been essential, given the institute’s deep network, including scientists at state agricultural universities and extension workers at the department of agriculture in Andhra Pradesh, a province in south-east India where testing with smallholders is now taking place.

“This is the core thing – getting databases for each pest and disease – because you have to train the network to actually use AI to identify these pests,” said Rupavatharam.

The more data one has, the more complex the probability calculations and, in turn, the greater the accuracy. Plantix currently has a database of more than three million pictures. But for every pest or disease to be approved, Rupavatharam says, 1,000 to 2,000 pictures have to be scientifically tagged.
The app can detect upwards of 340 diseases covering 20 crop types, including rice, wheat, millet, maize, potato, cucumber, eggplant, lentils and ground nuts. For 120 of those diseases the accuracy rates are already as high as 95%, says Kummer.

PEAT will soon expand the service to include a Plantix crop calendar, which takes into account specific parameters given by the farmer, merged with regional data like soil type and weather reporting, alongside a community forum feature so that, in Kummer’s words, “we can accompany the farmer throughout the year starting with seedbed preparation and go all the way to harvesting time.

“Once we have created a bigger reach out, this ‘ground truth data’ will be offered in a processed way to all stakeholders in the agricultural sector who are interested in tracking diseases in their spatial and temporal expansion.”

Possible customers for this data could be micro insurance companies, governments and non-governmental institutions, as well as input companies for seeds and fertilisers.

In a second step, adds Kummer, she and her team can imagine the creation of a digital marketplace that would charge the seller who uses Plantix for contacting the buyer. For the farmer, the app would always remain free, with the diagnostics devoid of any company brand names.

The link to weather forecasting is especially important. “When the crop is close to maturity much of the time you don’t spray or try to control a disease, says Whitbread. “So the crop calendar is important in understanding partly the economic benefit or practicality of trying to treat a disease or pest.”

But that also brings in more complexity, and a big part of the reason for the Plantix app’s quick scale-up has been its simplicity.

**Intelligent advisory tools**

The Sowing App, also referred to as the intelligent agricultural systems advisory tool (ISAT), takes the complexity one step further by modeling historical and actual climate data together with local soil type and rainfall data.
Microsoft helped ICRISAT code the information into an online system that sends push notifications to the farmer. Before the season the farmer gets a message about the likelihood of a good season, plus the optimum sowing times. Once the conditions are exactly right, an additional message is sent, followed by weekly messages about management, cultivation and inputs they should be considering.

“And the idea now – which Microsoft has backed pretty hard – is to scale the project by automating these processes with the use of sensors,” says Whitbread.

To this point ICRISAT has limited the project to one crop, groundnut seeds, while testing it on 4,000 farmers from Anantapur, a semi-arid district in Andhra Pradesh that presents some of the harshest conditions for growing ground crops.

“We think if we can get it right in this area, we can scale it up anywhere,” Whitbread says.

Going forward, ICRISAT and other development groups want to scale up the effort to include more technology and public-private partnerships. According to the institute, the goal is to fund start-up ecosystems in order to launch business models that exist outside of donor and foundation funding. In that way, ICRISAT and its other development partners can head off “private capital [that] may begin to define products and approaches that exclude poorer farmers”.

Central to that effort is ICRISAT’s iHub incubator, which opened in February 2017 and is currently home to 10 companies working on everything from cloud-based seed monitoring and the launch of low-cost weather stations to the production of drones for agricultural operations.

**Empowering smallholders**
Camilla Toulmin, an economist with the International Institute for Environment and Development (IIED), welcomes the new focus on including start-ups that
could help agricultural production and give farmers greater voice, but has reservations about the propensity ICRISAT and its sister institutes have had towards collaborating with “very large companies and not the many small and medium enterprises (SMEs) which might benefit from their knowledge”.

Moreover, what may work in India – where there are highly networked, very tech-savvy people operating in a broadly supportive government environment – may not work so well in other places where there are insecure tenure rights and greater political strife, she says.

“Everybody always thinks, ‘ah, some lovely new technology, that’s going to be brilliant. That’s going to feed the world! That’s going to save poor farmers from poverty.’

“It’s hugely hyperbolic in terms of the promises made, and in terms of what subsequently happens,” says Toulmin. “So I would be a bit cautious. It will take more than new tech to ensure they have the access to the land, water and political power they need to make a real difference to their lives.”

Jerome Bossuet, a spokesperson at ICRISAT in its partnerships division, responds to the criticism by saying that the private sector can clearly see the advantage of having a safe and efficient supply chain for high-value crops such as tea, coffee and tobacco. For other crops, he says, “such systems may help improve farmers organisations’ linkages to the marketplace,” meaning the benefits are going to them directly rather than to intermediaries.

Rupavatharam says at the very least, mobile apps such as Plantix are highly empowering. He says preliminary results from a survey now being conducted by PEAT indicate an upsurge in farmers sharing knowledge about traditional methods once a diagnosis is received from the app. Upwards of 25,000 messages have been posted in a single day.

“I can’t read them all!” exclaims Rupavatharam. “That is one of the most important things that is happening here: it is not yet a magic answer to everything that is happening with plant protection, but at least it’s helping farmers to have a voice. That’s where I see the strength of this app.”
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Championing food security: the global battle against food waste

By Terry Slavin

Liz Goodwin of WRI talks to Terry Slavin about the challenges of tackling food loss and waste at a global level after 15 years at WRAP

When Marks and Spencer’s Mike Barry was asked by Radio 4’s Today programme about the company’s sale of cauliflower “steaks”, slices of cauliflower with a lemon and herb dressing encased in plastic, he said the packaging was recyclable and necessary to prevent food waste - before M&S later that day bowed to the media storm and said it would discontinue the product.

The burgeoning consumer backlash against plastics may be pushing leading UK retailers and brands to cut down on their use of plastic packaging, but it is adding to their challenges in another area of sustainability: their target to cut food waste by at least 20% by 2025 under the Courtauld 2025 commitment.

Liz Goodwin, who heads up the World Resources Institute’s (WRI) food loss and waste programme, knows about the trade-offs between packaging and food waste. As former CEO of the UK waste-reduction charity WRAP she was instrumental in setting up the Courtauld commitment in 2005, a collaborative platform that joined leading retailers, brand owners, manufacturers and suppliers, along with charities and local authorities, to reduce all forms of waste in the food sector.
The commitment, which has 156 signatories, including 95% of all food retailers, is now in its fourth phase (2015-2025), and saw UK household food waste volumes drop by 21% from 2007-2012, and grocery packaging waste drop 10%, according to WRAP.

“It’s tricky,” Goodwin says. “In the vast majority of cases the environmental impact of food waste exceeds the environmental impact of packaging, so packaging that protects from food waste is a good thing.”

She hastens to add: “That doesn’t mean it’s acceptable to have lots of plastic that’s recyclable and not being recycled. Plastics should be recyclable and go back into the system and be recovered.” It’s up to retailers and producers to make recycling simpler by reducing the numbers of different plastics they use, and helping consumers to recycle it, she says.

But food waste is a problem that is far bigger than UK retailers and the brands that supply them. A third of the food produced globally goes to waste, despite the fact that 800 million people worldwide do not get enough to eat, according to the UN’s Food and Agriculture Organization.

Food that has been wasted either at the retail or consumer level, or along the production supply chain, consumes about one quarter of all water used by agriculture, requires cropland area the size of China, and generates about 8% of global greenhouse gas emissions. It also amounts to $940bn in global annual economic losses.

Cutting food waste in half by 2030 is target 12.3 of the Sustainable Development Goals (SDGs). Early in 2016 WRI set up the Champions 12.3 project to mobilise a multi-stakeholder response to meeting SDG target 12.3, the only non-UN agency to co-ordinate action on an SDG, with Dave Lewis, CEO of Tesco, as chair.

Goodwin says the challenge of taking the battle against food loss and waste to a global level was too compelling for her to turn down, and she left WRAP in mid-2016 to head up the Champions 12.3 project for WRI.
Corporate action

The impact of Champions 12.3 in a short time has been impressive, particularly when it comes to corporate action. According to its first progress report last year, 60% of the world’s largest food companies by revenue have now set food loss and waste reduction targets in line with SDG 12.3, and half of those are working with their suppliers to bring them into line. This is an area where Tesco has shown real leadership, Goodwin says, with Lewis announcing last September that he had signed an agreement with his top 25 suppliers last year to target food waste across its entire operations.

But as the report points out, the challenges of achieving a 50% cut by 2030 are immense. The Courtauld commitment succeeded in cutting UK food waste by 21%, she points out. “But how do you get beyond that? That’s what’s worrying me because I know how hard it was to get to 21%.”

In fact food waste reduction in the UK plateaued after 2012, for reasons that Goodwin says are not clear. “It could be that households made changes in the areas where it’s easiest to reduce waste, or that government spending for awareness-raising campaigns has dropped, or the economy has improved and so people aren’t as mindful about what they spend on food. …. It’s hard to pinpoint, but what is clear is that more attention and effort is needed.” (See: The real food waste battle should be on the farm)

One victory for Champions 12.3 on the global level last year was signing up some of the big agribusiness companies, including giants Olam and Wilmar,
through the newly launched Global Agri-business Alliance (GAA), a CEO-led initiative started by Olam co-founder Sunny Verghese and the World Business Council for Sustainable Development’s president Peter Bakker.

Goodwin says the alliance’s food loss and waste resolution last September is “great to have”, and filled an important gap. While the Consumer Goods Forum made a commitment in 2015 to halve food waste among its 400 members by 2025, “there wasn’t the same initiative further up the supply chain”.

She points out that although GAA members span the food value chain, with growers and producers, traders, seed suppliers and primary processors, they only account for a small fraction of the entire global agricultural system.

US giant Cargill, for example, has not joined the GAA, and does not list SDG12 among its SDG priorities, though it is funding food redistribution efforts in the UK in partnership with charity FareShare.

Goodwin says she hopes that others will follow when they see the financial rewards reaped by GAA members for taking steps to monitor food loss and prevent it, including on the farm. A report last year by Champions 12.3 to establish a business case looked at 1,200 business sites across 17 countries and found that 99% earned a positive return on investment, and half saw returns in excess of 14:1.

“The business case for them [agribusiness companies] is even stronger than for the retailers,” says Goodwin. Asked what that is, she says there is a huge amount of variation, and next month Champions 12.3 will be publishing another report doing a deep-dive into different sectors, providing data to support the business case.

Getting accurate and consistent data is one of the biggest challenges Champions 12.3 faces, as Lewis pointed out in Ethical Corporation last year. Tesco was the first supermarket in the world to publish its figures for food waste four years ago, and set up its own methodology in isolation. In 2016 the WRI partnered with the CGF and the UN’s Food and Agriculture Organisation to launch the Food
Loss and Waste Accounting and Reporting Standard. Besides Tesco, it is being used by companies including Sainsbury’s, Kellogg, Nestlé, Campbell’s Soup, Ahold Delhaize and IKEA Food.

The latter, which aims to halve its food waste at all its stores by the end of 2020, is using “smart scales” to keep track of food waste. Co-workers weigh, categorise and register all food waste, and give the reason it arose. The system then calculates the cost. IKEA reported last year that stores that had implemented the system had seen waste reduce by 20% over the first 12 weeks, and broke even on its investment after 20.

The number of companies that are using the standard is still small, but Goodwin says the corporate effort on food waste is picking up steam.

“There are signs that companies are moving in the right directions. The big challenge is to get countries and governments to focus on it.”

**Tackling food waste globally**

While some governments, including the UK and US, measure and report on food loss and waste within their borders, they account for only 7% of the world’s population.

Asked whether other countries should also follow the lead of France, which in 2016 banned supermarkets from throwing away or destroying unsold food, encouraging them to redistribute it to food charities, Goodwin says: “The French approach is interesting. I couldn’t criticise it but my concern about redistribution is that it makes it acceptable to have food waste in the first place.”

She says food redistribution also begs the question of why so many people in western societies need food handouts to survive. “These are tricky questions. None of it is easy.”
It is not only in western societies where food waste is a problem, and Goodwin says Champions 12.3 will be focusing this year on trying to tackle the issue in China and India.

Food security is an increasingly critical issue in the former, yet the 35m tonnes of food lost and wasted annually is enough to feed 30-50 million people, according to a recent report by Future Directions International. Having almost completely utilised the 120m hectares of arable land it has available to grow food, China can not develop new agricultural land to feed the 135 million undernourished citizens it already has – not to mention its predicted population growth, the study points out.

While in China much of the waste is from burgeoning middle class consumers, in India most of the food loss is further up the supply chain, at the level of smallholder farms.

“As India’s middle class grows, though, it will have consumer issues, too,” Goodwin says. “We need to understand where the issues are in those countries, what the hotspots are. If you identify that there are lots of cold storage issues in India, for example, that may require funding for supply chain partnerships.”

One thing she learned from her years at WRAP, she says, is that it is only by getting the different parts of the supply chain to talk to one another and understand how their actions impact others that solutions will emerge. “You have to take a whole-systems approach to it,” she says.

Champions 12.3 last September published a roadmap with three-yearly milestones that should be reached to achieve the 2030 goal. A 5% reduction is targeted by 2018, but the progress report admits the organisation doesn’t know whether this will be achieved because of the lack of available data.

Goodwin says the roadmap “makes scary reading .... But I am still optimistic because there are enough people who care about this, who have potential to influence their organisations, and the organisations they work with. I’m quite an optimistic person – which is why I am still doing this.”
‘The real food waste battle should be on the farm,’ charity says

UK supermarkets are generating vast mountains of food waste through their treatment of the farmers in their supply chains, according to the food waste charity Feedback. Fruit and vegetable farmers who responded to a Feedback survey reported they wasted an average 10-16% of their crop in typical years, equal to 22,000-37,000 tonnes of produce every year, with six in 10 respondents saying they over-produced because of the pressure to meet buyer orders for fear of losing contracts.

WRAP’s own research in 2011 found that supply chain wastage, though less than 10%, can approach 25% in some products. More recent research last year found that 19% of lettuces and 9% of strawberry crops were wasted on the farm due to a mismatch in supply and demand or for quality or cosmetic reasons.

Feedback puts the blame on an asymmetry of power in the food supply chain, which has created a system that is “synonymous with waste”. (See also: We need more companies to join food waste battle) With supermarkets having more than 85% of the UK market, they are able to dictate the terms by which food is grown, harvested and transported, including cosmetic standards such as exact size, shape and colour. Some farmers in the survey reported a loss of up to 40% of their crop because of failure to meet cosmetic standards.

The report quotes Guy Watson, founder of vegetable box delivery company Riverford Organic Farmers as saying: “When I used to supply the supermarkets you generally grew about a third more than you thought you would sell, just to make sure that the supermarket buyer didn’t have a tantrum if you ran short. Routinely you have more than you can sell and so you just mow it off and plough it in – that’s the normal thing to do.”

Some supermarkets, including Tesco, Asda, Morrison’s, and the Co-op, carry “wonky” ranges of cosmetically imperfect fruit and vegetable, but a survey by the Women’s Institute last
year found that most stores (68%) offered only one or two wonky alternatives to customers.

While signatories to WRAP’s Courtauld 2025 agreement, including 95% of UK food retailers, have committed to measure on-farm food waste by this year, there is a lack of data compared to consumer food waste, Feedback says. Tesco is the sole exception, and the supermarket is praised for providing publicly available data of the waste in its supply chain and for its commitment last year to work with its top 25 suppliers to reduce waste by 50% by 2030. However, even Tesco saw its food waste tonnage increase in 2016, to 46,684 tonnes.

“We have consistently argued that the scandal of food waste goes far beyond what consumers throw in their bin. With supermarkets driven to reduce food prices, and the environmental costs of waste externalised, the food system drives both over-production in fields and over-consumption, or over-purchase in stores, with associated waste both pre- and post-retail,” Feedback said.

Liz Goodwin, former CEO of WRAP, who now heads up food loss and waste at the World Resources Institute, said many UK retailers are working to address issues in their supply chains, with Tesco’s CEO Dave Lewis, who is also chair of the Champions 12.3 food waste initiative, “committing a significant amount of time to work on the issue of food loss and waste”.

She agreed that there isn’t enough measurement of waste at the farm level “so we don’t know enough about the scale (or not) of any problem”.

Although the report criticises the Courtauld Commitment, for which Goodwin was responsible during her time at WRAP, for being slow to tackle on-farm food waste, she said: “I wouldn’t be that critical of Courtauld ... The Courtauld Commitment had to be framed in a way that was acceptable to businesses and government. It is still challenging, even if it’s not perfect. It goes a long way further than anyone might have expected.”

Terry Slavin
Tackling food wastage from field to fork

By Diana Rojas

Some 60% of the world’s largest food companies are taking steps to halve their food waste by 2030. Diana Rojas talks to some of the leaders

At its headquarters in Camden, New Jersey, one of America’s poorest cities, the Campbell Soup Company converts bruised or undersized peaches destined for landfill into Just Peachy salsa, which is retailed locally, with profits going to the Food Bank of South Jersey.

At its Wrexham plant in Wales, US-based breakfast company Kellogg captures the corn dust that occurs during production and re-uses it in producing food. “It’s not particularly sexy… but when you’re talking about thousands of kilos, day after day, month after month, it adds up to a hell of a lot,” says Bruce Learner, Kellogg Europe senior manager of CSR and partnerships.

Food waste may not be sexy, but some 60% of the world’s largest food companies by revenue now have targets in line with UN SDG 12.3, which aims to halve the amount of food lost and wasted by 2030, and half of those are working with their suppliers to bring them into line. That is according to a 2017 progress report by Champions 12.3, a 41-member coalition of public and private-sector executives that was launched at the World Economic Forum in Davos two years ago aimed at mobilising action to reduce food loss and waste globally. (See: Championing food security)
Companies have taken initiatives such as donating unsold or surplus foods, partnering with farmers to increase yields and lessen crop losses, encouraging legislation to change food expiry labels, and reaching out directly to consumers to cut down dramatically on food waste.

With an average 14:1 return on investment, there is a solid business case for reducing food waste and loss, Champions 12.3 argues. Last year, the Global Agri-business Alliance – a CEO-led, private sector group – adopted a resolution that has leading agricultural company members committing to reduce their food loss by 50% by 2030.

The alliance’s commitment mirrors that of the 20-member US Food Loss and Waste 2030 Champions, led by the Environmental Protection Agency (EPA) and the United States Department of Agriculture, while the 400-strong Consumer Goods Forum (CGF) made an even more ambitious resolution to halve food waste by 2025.

“No one company, government or NGO can undertake all the changes necessary to eliminate unnecessary food loss and waste,” says Learner. “As one of the first US-based companies to join Champions 12.3 ....we believe in the power of partnerships to bring attention and action in helping to end hunger, achieve food security, improve nutrition and promote sustainable agriculture.”

Tesco, the British supermarket giant and a pioneer in food waste reduction (whose CEO Dave Lewis chairs the Champions 12.3 coalition) last autumn announced that 24 of its largest food suppliers had made agreements with the company to adopt SDG 12.3 in their global operations, a move that has been praised by charities such as Feedback, which says in a report this month that over-production by farmers is a major source of food waste. (See: The real food waste battle should be on the farm)

“The wrong approach would have been to just focus on our own operations,” says Mark Little, Tesco’s head of food waste reduction.
By instead taking a “farm to fork” approach, Tesco links producers with food manufacturers so, for example, wonky potatoes from a supplier can be sold to the company that makes mashed potatoes. In addition, the company markets unattractive but perfectly edible produce as “perfectly imperfect” and focuses on multi-buy promotions of bumper crops.

The company has made a commitment that no food that’s safe for human consumption will go to waste from its UK retail operations by March this year, instead going to local charities. Since 2009 none of its food has gone to landfill. What is not fit for human consumption is turned into animal feed, or biofuels.

Similar programmes are embedded at Kellogg, where food waste (when determined it cannot be sold, donated or turned into animal feed) from its manufacturing locations in Wales is used to generate biofuels rather than trucked to landfills. Learner says a national landfill tax in the UK (introduced in 1996) has helped zero out the company’s landfill waste.

Success encourages replication, and as such Learner says Kellogg’s Polish and Belgian manufacturing sites have also been capturing and processing food waste into biofuels. The US EPA suggests a food recovery hierarchy, which Kellogg follows to prevent waste: first, reduce volume of surplus; next, feed hungry people; then feed animals. If that doesn’t work, convert into biofuels, compost and, last of all, landfill.

“Through the Kellogg’s Origins and post-harvest loss reduction programmes, we consult with and advise farmers on farming and storage practices that aim to reduce losses in the fields, increase yields and mitigate the effects of climate change on their farms,” says Learner.

Melissa Donnelly, Campbell Soup’s CSR manager of sustainability integration and metrics, says joining coalitions allows companies “to leverage our opportunity to do more”. But she notes that the number of companies reporting and accounting food loss and waste has been “a little slower than we anticipated”, in part because while data for some destinations, including animal feed and compost, has been available for a long time, information on other destinations is more difficult to obtain.

“Challenges arise around determining how much food waste is going to landfill, incineration, and sewage, for example,” Donnelly said, adding that organisations have to parse out food waste figures from other waste types.
Tesco admits that quantifying farm waste can be challenging, but notes that baselines need to be measured and targets set if SDG 12.3 is going to be met. “It’s a very challenging target,” he says.

Tesco, for example, began building its food waste reduction programme not as a corporate communications exercise but as a cross-functional approach. It was the first food retailer to publish waste data (in 2013). The company publishes its methods as open source, encouraging other retailers to apply them too.

One of Tesco’s keys to reaching its target of a 50% reduction in the intensity of food waste - tons of waste as a percentage of tons sold - has been in the redistribution of unsold food to charities via its community food connection programme. This was launched in 2016, in partnership with UK food redistribution charity FareShare. Now every UK store uses the FoodCloud and FareShare apps to post unsold surplus food on handheld devices in store and share the information with local charities that can accept (or not) to pick up the food free of charge. Similar programmes exist in Tesco’s central European, Thai and Malaysian stores (with other partners). The commitment is that by 2020 all stores will donate surplus food to local charities, says Little.

Like many other coalition members, Campbell’s has been internally tracking and redirecting food waste for the past decade. “It’s typical of a food company to have been thinking about food waste for a long time because of the many opportunities for food waste reduction in the supply chain,” says Donnelly.

**Consumer waste**

But last month, the company took a step towards addressing what companies and coalitions alike describe as the biggest piece of the food waste pie: consumer waste at home. In January, Campbell’s launched its UnCanned campaign, featuring user-friendly information for consumers about, among other topics, food waste and date labelling. Users click on colourful soup cans emblazoned with questions like: “Is this food waste thing really that big of a deal?”, with iconic yellow school buses scrolling across the screen to illustrate the statistic that the 60 million tons of food waste generated in the US each year could fill 4.5 million school buses. Another question asks: “Are ‘use by’ and ‘best if used by’ the same thing?” (short answer: No).
And during the Christmas holidays, Chicago-based Morton Salt, North America’s leading salt producer, launched its #EraseFoodWaste campaign that invites customers to take a seven-day challenge to cut down on food waste. A companion commercial highlights the absurdity of common food questions like “why don’t we ever have anything to eat?” The company has a goal to eliminate food waste in its operations and offices by 2030.

Globally, nearly one third of food for human consumption is wasted from “farm to fork” according to Champions 12.3, totalling more than $900bn in economic loss. In the US, it’s estimated that households waste a quarter of the food they buy, adding up to losses of some $218bn in the cost of growing, processing, transporting and disposing of food that went uneaten, according to the National Resources Defense Council.

Data analysing the cost benefits of various strategies points to effective date labelling as the highest in financial benefit at $4,547 per ton, according to ReFED, a multi-stakeholder non-profit that is working to reduce food waste in the US. The next highest category, at $4,531 per ton, is consumer education.

Last September, the Consumer Goods Forum and Champions 12.3 called on governments and companies to simplify food date labels to reduce food waste by 2020. They recommend that companies use only one label at a time, noting either an expiration date for perishable foods, or a food quality indicator (like “best if used by”) for non-perishable foods, and that the companies engage in better consumer education on the issue.

Four years ago, Tesco pioneered a national effort (in partnership with WRAP, the Waste and Resources Action Programme) to apply single-date coding to its fresh food and meat produce. Company evidence points to reduction in waste at the consumer level and in its own operations. And in 2016 Walmart, the world’s largest food retailer, required suppliers of its Great Value private label non-perishable foods to use a standardised “best if used by” date label.

With the exception of infant formula, food waste in the US is covered by a patchwork of state legislation, Donnelly says. Federal food date labelling legislation was introduced in 2016 to standardise the issue across the nation. It includes a dual-label system, with one for quality and one for safety, and the elimination of state laws banning the donation of food past the quality date, and consumer education. The bill has not been introduced in the new Congress.
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