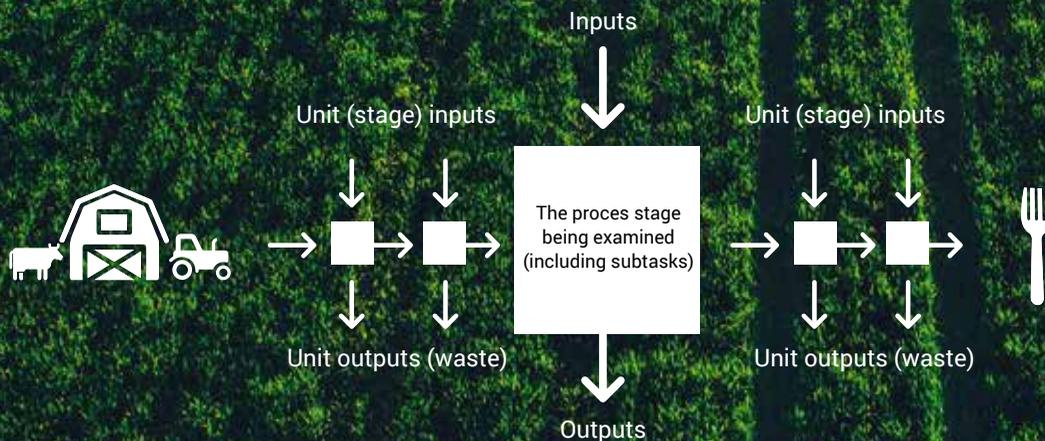# The 'Sustainable Business' and agriculture

Jonathan Scott describes a front-line research project designed to reduce costs, increase revenues and create jobs in agriculture

Inputs

Unit (stage) inputs

Unit (stage) inputs

The proces stage being examined (including subtasks)

Unit outputs (waste)

Unit outputs (waste)

Outputs

Approximately 30% to 50% of the world's food is wasted due to poor work practices and other inefficiencies at various stages of production and storage. If waste is eliminated, total food production output could dramatically increase with little to no need for additional land water and other traditional inputs. The world does not have a food **shortage** *problem, it has a food* **waste** *problem.*

From the Farm to the Fork Every stage of your work process contains waste

The challenges posed by agriculture are becoming more pressing as the world struggles to meet its ever-growing need for food. By 2050, over nine billion people will need to be fed – two billion more than the current population.

Additionally, the spread of prosperity and a longer-living populace, especially in China and India, is now producing increased demand for meat, eggs and dairy products that intensifies pressure to grow more corn and soybeans for a rising number of cattle, pigs and chickens. Indeed, some estimates claim that we may have to expand food production by 70%, including doubling the number of crops grown, within the next 30 years.

Meanwhile, the agriculture industry is among the greatest contributors to climate change, emitting more greenhouse gases than all cars, trucks, trains and airplanes combined (largely from methane released by cattle and rice farms, nitrous oxide from fertilised fields and the clearing of rain forests to grow crops or raise livestock).

Farming is also the single greatest consumer of water supplies and a major water polluter in the form of run-off from fertilisers. And agriculture continuously accelerates our planet's loss of biodiversity as areas of grassland and forest are cleared to enlarge the size of farms.

The overall result is a miasma of crop stress, job loss and even human displacement. For example, Homeland Security officials in the US have reported that a puzzling increase in the number of families showing up at the US border seeking asylum appear to be fleeing a hunger crisis in Guatemala's western highlands.

Years of meagre harvests, drought and the devastating effects of "coffee rust" fungus on an industry that employs large numbers of rural Guatemalans is speeding up an exodus of families from villages now bereft of jobs and food.

Solving agriculture problems on the front-line

"Precision agriculture" involves detecting various forms of crop stress (for example diseases, pests, water issues, soil deficiencies and on) and applying corrective resource inputs (water, fertilisers, pesticides, herbicides) at the most opportune time and in the most effective and economical quantity, to plants or parts of a plant or crop.

To accomplish its goal precision agriculture combines the science and technology of GPS, aircraft, satellites and specialised cameras to provide growers with the information they need to make informed decisions as early as possible – often *before* problems arise.

Undeniably, the economics of early detection are a major benefit of "precision ag", revealing potential financial and resource losses that humans may not notice until it is too late.

Aerial imaging is the key

According to Chenghai Yang, a leading agricultural research engineer with the US Department of Agriculture (USDA) and its Aerial Application Technology Research Unit (AATRU), the cost savings that aerial imaging provides are significant.

For example, a grower can save over $10,000 on fungicide costs if he or she has to spray only 30% of a 300-acre plot rather than 100% of the same area.

Put another way, if a fungicide product costs $50 an acre, it would take $15,000 of product to spray the entire field, versus $4,500 to spray 90 acres, or 30%, of the field.

Further south in Costa Rica, a precision ag multi-spectral imaging programme at Universidad EARTH worked with a local farm/owner and operator to help increase his harvest by 33% and his profits by $200 per hectare.

The farmer had been growing sugarcane, grass and rice on his land for 21 years but in 2012 he began looking at ways to protect the fish populations living near his plantations by growing rice without synthetic pesticides.

The result was so successful he converted 300 hectares of his land into a pesticide-free operation for which the Ministry of Agriculture and Livestock in Costa Rica awarded him the *Medalla del Mérito Agrícola* (Agricultural Merit Medal) in 2016. In a recent interview, he said that precision ag also enables him to add more nutrients exactly when they are needed to boost the productivity of his soil.
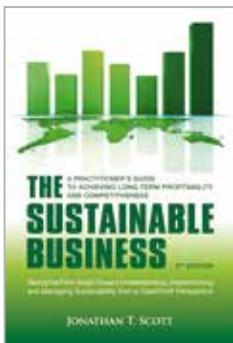
The cost of solutions is part of the problem

Although agricultural aerial-imaging is projected to become an $18 billion global market, it remains largely untapped because few farmers know how to read aerial images and/or do not know where to go to learn such skills. Lack of access to cost-effective aerial platform tools that provide images create additional cost challenges.

Satellites, for example, can produce pictures that cover massive areas of land but satellite usage is costly and sometimes difficult to schedule due to competition from other users. And satellites are never useful if the window of opportunity is missed due to weather or timing issues (for example the Landsat satellite covers the earth once every 16 days).

At the other end of the spectrum are drones, which can deliver detailed, high-resolution images in a multitude of settings. If flown low enough, drones will produce incredible images in which a single pixel can reveal a 1 cm x 1 cm area on a plant or flower.

Yet despite the benefits of a low-flying camera, the USDA's resident researcher on remote sensing and aerial imaging says that "from a practical standpoint, high-resolution plant-level or leaf-level details are not necessary for most field applications".

To add to their limitations, drones are also bound by restricted flight ceilings heights (by law, drones must stay below 122 metres) and small payload weights that limit the size (and capability) of the on-board camera.

The time-consuming chore of piloting drones is yet another headache. USDA research shows that it can take 80 flight-time minutes to photograph a two-square-kilometre area with a drone, which amounts to less than 1.5 sq km per hour — and that does not include travel time to and from the area being photographed.

Also, because the batteries that power multi-rotor drones only last 15-25 minutes (fixed-wing drones can stay aloft up to 45 minutes), multiple expensive batteries must be used, which adds to overall costs (high-end drones can have a purchase price of $100,000 or more).

Re-examining solution costs

After years of research, AATRU has concluded that manned aircraft are usually the best way for farmers to obtain aerial images. For example, an aircraft equipped with two cameras can cover 83 sq km in about 40-minutes. Compare that to a drone, which would require two work-weeks to complete the same task.

Equally important is the weight and cost of the camera(s) involved. Prices for small multi-spectral cameras range from $5,500 to $9,950 or much more depending on the image/data required and the payload capability of the aerial platform.

Manned aircraft, however, can carry multiple imaging equipment (as well as additional items) because camera weight is not an issue. The USDA, for example, works with two different camera systems each of which it built for $1,500 apiece.

Of course, the downside of manned aircraft is costs. Much imaging work with manned aircraft is

Above:
Jonathan T. Scott piloting a Cessna 152

Above right:
The 'Sky Arrow' is one of the planes being examined

122m

Drones are also bound by restricted flight ceilings heights, by law, they must stay below 122 metres

16

Satellites, for example, can produce pictures that cover massive areas of land but infrequently, for example the Landsat satellite covers the earth once every 16 days

done with a standard four-seat or six-seat single-engine aircraft, which, when new, can cost hundreds of thousands of dollars to purchase and $100-$200 per hour to operate. Purchase price, maintenance costs, storage fees, insurance, pilot fees and more quickly add up, which puts such aircraft far beyond the reach of most budgets.

'The Sustainable Business' enters the picture

Late in 2019, I asked the USDA why it uses a six-seat Cessna 206 (which consumes 64 litres of leaded aviation fuel per hour) to collect aerial images.

Using *The Sustainable Business* and its template of analysing purchase price, operation costs and disposal costs to eliminate and prevent waste, I explained that the USDA could easily begin a basic waste-elimination programme by replacing one or more of the planes in its current fleet with a small two-seat aircraft that can fly at low speeds (some as low as 45 kph, which is ideal for imaging) and take-off and land on a patch of grass.

Also, because small two-seat aircraft consume less than half the fuel that four-to-six seat aircraft require, and use automobile petrol as their fuel source (which costs half the price of aviation fuel), they can fly at a cost of $10-$12 per hour.

The result is not only a profound reduction in expenses but fewer carbon and other emissions and other when compared to the distance a vehicle must travel to transport a drone over a two-week period to cover the same 20,480 acres that a small plane can photograph in 40 minutes.

Several two-seat aircraft even have the ability to fold their wings after use, which means they can be stored in a garage, not an expensive airport hangar. Additionally, the purchase price of some two-seat aircraft is less than the cost of high-end drones.

To my surprise, the head of aerial imaging replied within a few hours and invited me to bring my plane to the USDA testing facility in Texas to gauge the fuel and other cost savings that a small manned aircraft can generate.

I don't own a plane, so the search began to round up a few aircraft for testing. One manufacturer told me it doesn't conduct research and development and most of the others didn't want to get involved unless I bought one of their planes!

After many months of investigation, three aircraft have now been lined-up and testing is scheduled for mid-July (the date may change due to the COVID-19 pandemic). *Global Focus* is keen to broadcast the results throughout 2020 as a means of highlighting the benefits of front-line research – with aerial imaging being just the first link in the chain.

Watch this space!

gf

About the Author

Jonathan T Scott is the author of several books including The Sustainable Business *and* The Entrepreneur's Guide to Building a Successful Business. *He has taught at numerous top-50 business schools and is currently exploring ways to eliminate waste and increase production (and revenues) in agriculture*

The COVID-19 experience will accelerate digital transformation even further says **Martin Moehrle**

Corporate learning as an accelerator of digital transformation

Digital transformation challenges traditional ways of organising work, of defining careers and work identity, of understanding competition within clearly defined boundaries, and of experiencing products and services. It requires organisations to somehow reinvent themselves and, thereby, to recognise that transformation is more about people than technology.

Corporate learning has a dual role to play here: on the one hand, to transform itself and digitise the learning experience and, on the other, to enable the transformation of the enterprise.

This article would like to shed light on the second aspect: corporate learning as an accelerator of digital transformation.

To perform this role effectively, learning and development (L&D) has to evolve from the identity of a service provider (we deliver flawlessly what the business asks us to) and being a strategy enabler (together with the business we agree the best way to build the capabilities required to execute strategy and deliver accordingly) to become a transformation agent, challenging the business and the status quo. At this stage, corporate learning must lead, not lag. This is not a small request (see Figure 1).

As a transformation agent, corporate learning must seek answers to questions such as (see Figure 2):
• How to activate leadership and mobilise the entire workforce for a different future?
• How to allow everyone to recognise their digital skills gap and how to close it?
• How to take innovation outside R&D and make it everyone's job?
• How to promote agile ways of working?
• How to rethink work as human augmented intelligence?

1. Engaging leadership and mobilising the workforce

Digital transformation asks for a different way to lead. Today's leaders increasingly recognise that in order to credibly transform their organisations, they must transform themselves and their teams. This time, leadership development must start at the very top and not one or two levels down. And it must entail a process of deep reflection about the changes ahead and the capabilities required for continued success. This might include a review of the current leadership model.
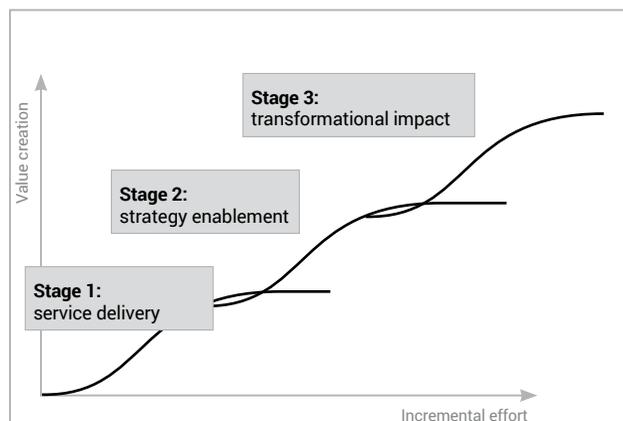

Figure 1 Three stages of value creation for corporate learning

In a comprehensive study, MIT — in collaboration with Cognizant — found an emergence of new and an erosion of traditional leadership competencies in addition to a set of enduring competencies that stand the test of times of digital transformation (see Figure 3).

Empowerment and inspiration will replace command and control as leadership imperatives.

It takes courage and insight to imagine a leadership model that pulls toward a digital future yet is simple and memorable and to then embed it in relevant people processes and engage leaders at all levels to embrace it and overcome cultural inertia. The engagement must be at scale and both top down as well as bottom up.

In addition to engaging an organisation's leadership, the entire workforce must be mobilised and prepared for a decade of reskilling and upskilling. All jobs, clearly some more than others, will be impacted by automation and artificial intelligence (AI). For some, it will be a matter of incremental learning. For others, it will mean changing professional identity and starting another career.

It will be a major effort to motivate associates to take stock and ownership of their future employability. Concepts such as life-long learning and adaptive personalised learning have to be turned from idea into reality. Corporate learning must orchestrate an ecosystem of internal and external learning partners and resources to cope with such a singular challenge and it requires top management commitment and sponsorship.

Increasingly, companies set aside a dedicated fund of significant size to finance the forthcoming reskilling wave, as this would surpass the means of normal learning budgets that get allocated at business unit level.

These funds are held at enterprise level and facilitate internal mobility in line with the shifting demand for new skills. For example, Shell just announced a large-scale deal with the online learning provider Udacity to provide online education on AI for 2,000 employees.

Novartis offers its employees a free online masters degree programme in data science via Coursera, another provider of online education. And Siemens launched a Fund for the Future that facilitates a bottom-up approach to creating new qualification projects.
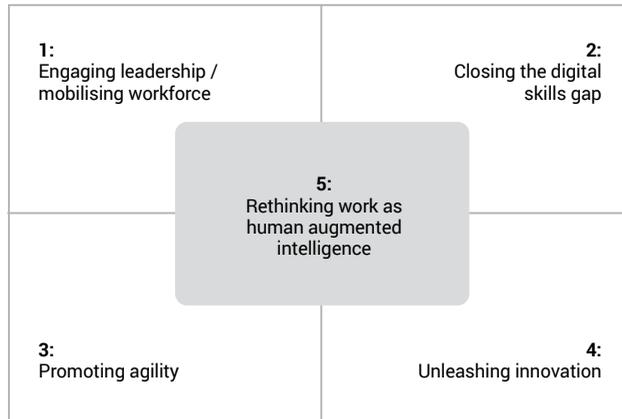
1: Engaging leadership / mobilising workforce	2: Closing the digital skills gap
5: Rethinking work as human augmented intelligence	
3: Promoting agility	4: Unleashing innovation

Figure 2 The five action areas for L&D to accelerate digital transformation

(E) ERODING	(E) ENDURING	(E) EMERGING
Asks for permission	Creates a clear vision	Is purpose-driven
Has no-exception protocals	Focuses on performance	Nurtures passion
Reinforces command and control	Maintains a profit orientation	Makes data-driven decisions
Manages top-down	Is customer-centric	Demonstrates authenticity
Avoids transparency	Leads by example	Demonstrates empathy
Micromanages	Demonstrates ethics and integrity	Employs an inclusive approach
Creates rigid long-term plans	Takes risks	Shows humility
Takes one-size-fits-all approach	Leads change	Works across boundaries

Figure 3 The new leadership playbook for the digital age

2. Closing the digital skills gap

In the past few years, companies have been defining skills required in the context of their digital transformation. Based on this digital skills model, many provide a self-assessment tool for experts and for everyone else. This can happen in the form of an app to understand the level of digital literacy or mastery and to identify respective gaps and how to fill them. Competency models are updated and amended accordingly.

Digital academies are launched to bundle learning offerings for digital skills. The academy scope can be broad to include communities of practice for areas of expertise such as data analytics and data science. Reverse mentoring programmes allow, for example, digital natives to teach senior management how to develop a social media footprint.

2k

Shell just announced a large-scale deal with the online learning provider Udacity to provide online education on AI for 2,000 employees.

3. Unleashing innovation

Digital transformation requires an organisation to experiment and innovate at scale across businesses and functions. Along with the business model canvas, design thinking has become the method of choice for the development of products and solutions in the digital age.

Corporate learning supports the penetration of design thinking through tutorials and workshops and embeds the underlying principles in its learning architecture through customer journey mapping; frictions in the customer experience are eliminated and the overall experience improved; customer segments are described by personas and there is a continuous interaction between the design team and targeted user groups; solutions aim at combining technical feasibility, economic viability and human desirability; and new ideas are evaluated differently, to enable experimentation and learning from failure.

L&D is often the co-owner of innovation labs and incubators that allow for the promotion and testing of internal and external ideas, collaboration with start-ups and for the engagement with critical stakeholder groups. Some organisations launch digital accelerators to develop a digital customer experience next to their existing business and task corporate learning with developing appropriate capabilities.

4. Promoting agility

The agile movement has brought about new ways of working that rely on the principles of trust and empowerment, self-organisation, cross-functional collaboration, user experience and customer value, experimentation and speed. A wealth of new work hacks and agile methods are spreading through organisations, to provide transparency about work priorities and about what everyone is working on, and that define work as a team effort, such as daily stand-ups, Kanban boards, objectives, and key results or retrospectives.

Corporate learning provides plenty of assets to learn about and experiment with new methods. It might even consider the launch of an agile academy to develop agile coaches and accelerate the diffusion of new work practices and to facilitate the sharing of experience and best practice.

5. Rethinking work as human augmented intelligence

Advances in AI and automation will reduce the demand, first for isolated and repetitive then for more advanced physical and cognitive skills. Therefore, machines have often been regarded as a threat to employment. However, organisations must cultivate those capabilities that will enable humans to add value where machines fall short: in problem solving and critical thinking; in managing ambiguity; in creativity and imagination; in empathy, communication and collaboration.

Only a positive attitude toward smart machines and AI and its use to augment human intelligence will allow companies to unearth new and formidable sources of productivity and competitive advantage. It is not a question of either machine or human, but of a symbiotic integration of both.

This integration will become a new and seminal arena for corporate learning. It means nothing less than proving those wrong who predict the fourth industrial revolution to lead to mass unemployment, and instead unlocking new opportunities for humans to learn, grow and excel.

gf

About the Author

Dr Martin Moehrle is a Management Consultant and Director of Corporate Services and of CLIP at EFMD