

EVOLVE UK

Post-COVID Sector Analysis Opportunities & Risks in the UK Agricultural Industry

July 2020

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Foreword

This report has been written by **Primary Access**. It has been our objective to identify and analyse key opportunities and risks in the agricultural industry as we emerge from the Covid-19 pandemic. The information presented in this document has been collected from a number of sources, including interviews.



Like most industries the agricultural machinery and agritech ecosystem has experienced a very difficult 2020 to date. Designated as a critical service, most of the sector remained operational throughout the Covid-19 pandemic, supporting and supplying farmers as they approached the busiest time of the year. With supply chains now back online, social distancing being practiced on all factory floors and travel restrictions being reviewed on an ongoing basis, this report investigates the current market status and what the future might hold.

The report approaches the industry from three key areas;

1. Market Update

We examine the current state of the market for agriculture generally, in terms of demand and business confidence measures. We look at the effects Covid-19 has had on the demand for agricultural machinery and investigate recent technology advancements which have entered the commercial marketplace.

2. The Revolution Coming to the Farm

In this section we take a high-level look at the Agri-Food and AgTech industry. We look at the trends, opportunities and developments which are starting to emerge, and perhaps more importantly, investigate what are the driving influences behind this change.

3. Policy, Trade, Tariffs & Brexit

The elephant in the room. This section looks in detail at Brexit - examining the potential effects that policy and trade agreements will have on the industry. We look at the new UK Agricultural Bill and what changes this will bring. Throughout this section we speak to stakeholders from across the industry including the NFU, ADHB and most importantly farmers themselves.

The report concludes with a feature length interview with Dr David Rose - Elizabeth Creak Associate Professor of Agricultural Innovation and Extension. In this interview we speak to David about all three areas mentioned above and look at potential opportunities for enterprises operating within the sector.

Brian Hourihane

Market Adviser, Agricultural, Enterprise Ireland



Key Findings

- The Covid-19 pandemic has resulted in unprecedented falls in measures of activity and confidence within the agricultural manufacturing sector, and significant drops in new equipment registrations;
- The collapse of the hospitality sector has contributed to surplus supply in critical parts of the food chain, with dairy, beef and potatoes experiencing price falls and a squeeze on margins;
- While welcomed by important players, including the NFU, the impact of certain elements of the recently published UK Agriculture Bill remain unclear, the ELMs component notably so;
- Investment and innovation within the industry has grown extensively in recent years: technological evolution in machinery will be largely incremental while in data a revolutionary era is promised. Some of these developments are in widespread usage, but second & third waves will be necessary to improve farm productivity should shortage of labour become acute;
- The Irish beef and dairy industries are badly exposed to a poor or no Brexit deal. There have been numerous academic models of possible implications for the UK sector equivalents in certain scenarios but visibility in terms of future EU and world trade is far from clear;
- Expectations for a general 'V' shaped recovery may be over-optimistic - polling in the UK reveals a polarised public opinion with a significant cohort expressing a fearful disposition to further removal of lockdown restrictions. As a staple industry provider the farming sector will be less exposed than others, but this could have a more sustained impact on overall economic activity and slow the speed of recovery.



Market Update

In this section we examine the current state of the market for agriculture generally, in terms of demand and business confidence measures. We then consider interesting technologies which may become important drivers of future farm productivity and profitability. Our third segment reflects upon how the potential trade, tariff, policy and Brexit scenarios will play out.

+ Market Demand & Covid-19 Effect

[CEMA](#) is the principal trade representative body for manufacturers of agricultural machinery in Europe and it publishes a monthly survey of members' experience and expectations. The charts below featured in their May Business Barometer report with the sub-heading 'Business Climate remains deeply negative'. (That for April had the sub-heading 'Shock in the European AG Machinery Industry'.) While May 2020 relative to April 2020 readings registered a marginal recovery, the measures for both index development and business cycle are at levels not seen in the series' history.

In the UK, new tractor registrations, as recorded by the [Agricultural Engineers Association](#) (AEA) fell sharply year on year in both April (-50.6%) and May (-41.9%). March is generally the peak month in any given year and a smaller drop (-4.2%) may have been recorded as formal lockdown wasn't announced until quite late in the month. The UK & Ireland had the latest planting season in many years due to the wettest recorded February in history. If this had some bearing on new registrations, one would have expected some level of pent-up demand within the system which, if the case, makes the numbers for April and May decidedly more concerning for the industry.

Business Climate

Index Development

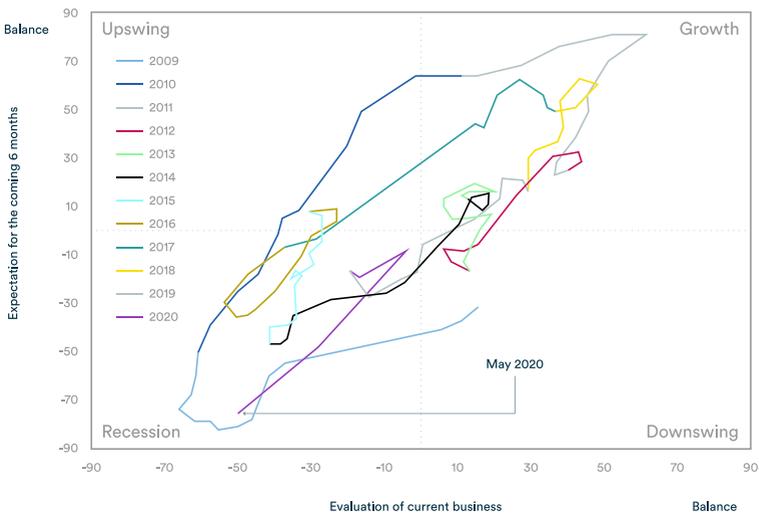
CEMA Business Climate Index (CBI) - Total



Source: CEMA Business Barometer

Business Climate

Illustration of Business Cycle



Source: CEMA Business Barometer, each value as an average of the last two months

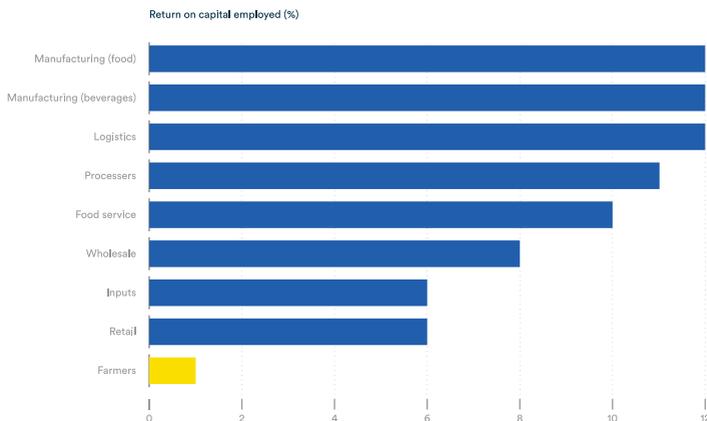
These business surveys and registration details are particularly unsettling as a backdrop for the machinery industry, but will in no small measure also reflect concerns of farmers, especially at a time when they will have additional worries about UK agricultural policy and external trading relationships post-Brexit.

+ Technological Advancement in Agriculture

In the context of an industry which persistently generates very modest return on capital employed, even marginal reductions in income are going to make farming no longer viable for many. What these estimates do suggest, however, is any innovation which can drive up yield, improve efficiency and, importantly, drive down cost, is very likely to be embraced.

Agriculture is an essentially evolutionary industry, a point reinforced by the prevalence of farms which have been in the same family hands for generations. As one of our interviewees later in this report reveals he, a dairy farmer, thinks in terms of a 25-year plan. In similar vein, reflecting upon what emerges from the annual AgriTechnica Innovation Awards, many of the victors in various medal categories present solutions which are in many ways incremental rather than revolutionary per se, presenting marginal benefits in terms of cost and performance. Some, indeed, are highly specialised in nature and, while inherently valuable, may only be of interest to a relatively small audience.

Compared with other parts of the food chain UK farmers make low returns on investment



Source: National Food Strategy

However the sector has significant potential and is one which is currently embracing technological change driven by increased productivity, profitability, environmental concerns and regulation. Companies are deploying products which embed precision farming technologies such as GPS linked to variable rate control onto their equipment.

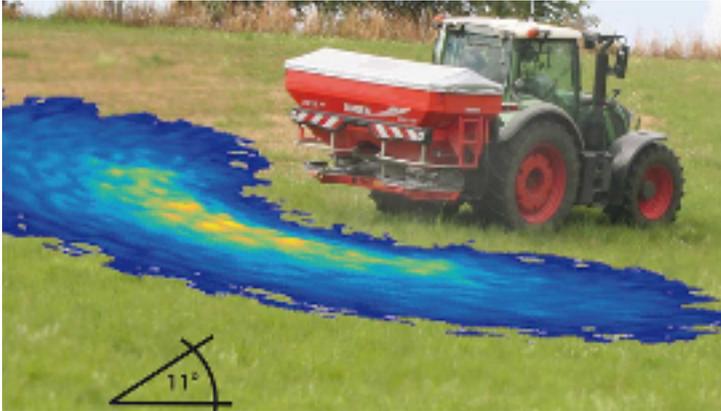
The introduction of these technologies will greatly reduce the impact farming is having on ground water quality, GHG emissions and will help the farming sector comply with new EU directives. These technologies will also reduce input costs, while improving crop yield and quality and ultimately providing the farmer with a positive ROI. This year's AgriTechnica awards were dominated by examples of precision agriculture and environmental enhancing solutions which incorporated these incremental technology improvements. Many of the winning products were focused on advancements in seeding and spraying machinery, however a few others stood out:



For the first time, Samson now offers a system for determining nitrogen, phosphorus and potash in manure, which is based on a Nuclear Magnetic Resonance (NMR) sensor. It enables an analysis of manure ingredients without matrix-dependent calibration requirements. Sensors based on NMR technology promise fewer errors in manure analysis. Initial laboratory tests also show a good alignment with laboratory values.

The eAutoPower gearbox for the new 8R large tractors from John Deere, the electric motors have been specified so that they not only supply the drive, but can also provide up to 100 kW of electric power for external consumption. The resulting possible tractor-implement electrification was demonstrated with a system solution for spreading manure developed together with Joskin, where two axles on a tridem spreader are electrically driven. There are many other potential implement applications for such an electrical supply.

One example which caught our eye as relevant to farmers with undulating or hilly ground - much of the UK and Ireland - was the HillControl Control System:

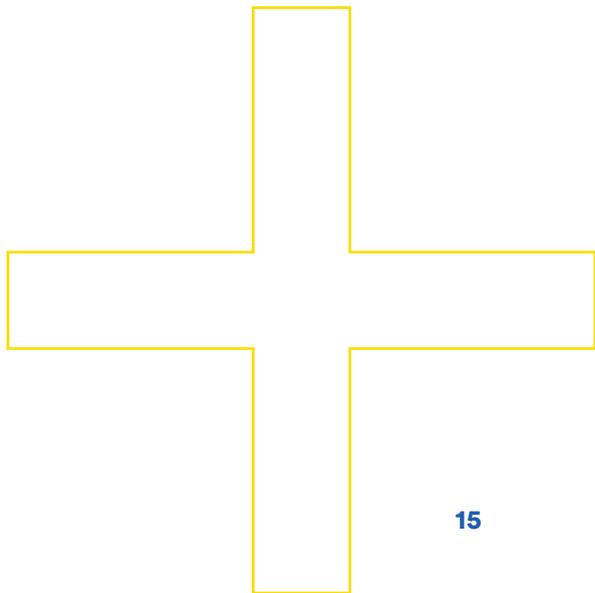
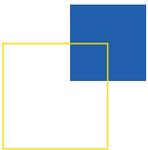


Current solutions attempt to keep the change in the point of application when spreading fertiliser on a slope to a minimum with a low drop height between dosing and the spreading disc or with forced guidance of the fertiliser on the spreading disc. The HillControl Control System is software that improves the distribution accuracy when spreading fertiliser, especially on hilly terrain.

It functions in conjunction with an inclination and yaw rate sensor on disc spreaders by changing the point of application, disc speed and dosing quantity. As a result, the spreading distance and direction of the fertiliser pellets during spreading is changed with a controlled adjustment of the point of application, therefore correcting the distortion in the spreading pattern.

While not, strictly speaking, directly relevant to technological advancement, we thought the [announcement](#) by large OEMs, traditionally great competitors, to collaborate on an industry database to be of some potential significance. From the press release: "Farmers and contractors operating fleets of machinery from different brands will in the near future be able to securely exchange and view machine data through a common interface called DataConnect."

“DataConnect allows for the secure viewing and handling of these basic machine data elements, including current and historical machine location, current fuel tank level, working status and forward speed. Multiple machines or fleets from different brands can be viewed from a single portal, and no additional hardware or software components are required. The four companies are members and supporters of the Agricultural Industry Electronics Foundation (AEF). They will share their experiences with AEF in an effort to support a standardized data interface architecture, similar to ISOBUS, across the entire ag equipment industry.” Such examples of co-operation, while illuminating, are open to interpretation for the motivation behind them. Could it be part of a wider defensive strategy aimed at limiting disruptive activity from outside the traditional farming model? Here are some reasons to consider why.



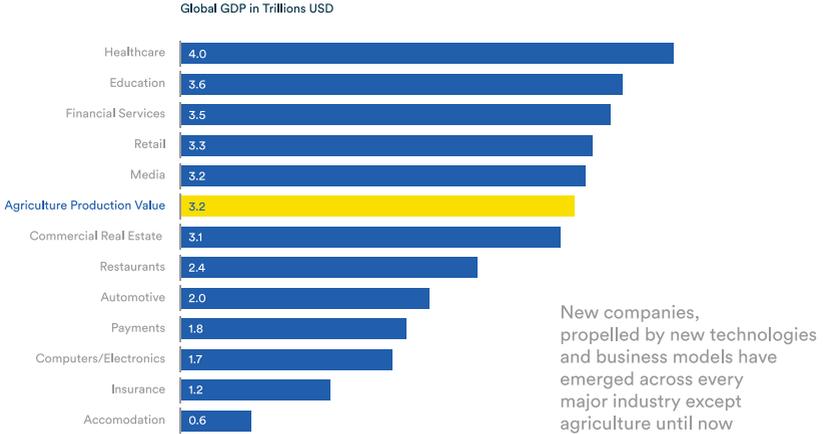


The Revolution Coming to the Farm



+ Change Drivers

Agriculture is the largest industry where analog leaders are **not** being challenged by digital natives



Since Q1 2012 in excess of \$80bn has been committed to investment in Food & Ag tech with the stated objective to ‘improve or disrupt the global food and agriculture industry’. Outside of the US, the UK has seen the second largest investment into disruption of this nature. In the context of an estimated \$8T agrifood industry globally, this may be seen as ‘small potatoes’, but, to us, these trends, unequivocally, demonstrate the direction of travel.

The Wall Street Journal published an [article](#) entitled ‘Six technologies that could shake the food world’ which for a period went viral. Products showcased included ‘fake’ shrimp made from algae, 3D-printed chicken nuggets, fruit encased in edible coverings to prolong freshness, and technology applying AI facial recognition to analyse the well-being and productivity of barn-based dairy cows. Cainthus is the Irish-based owner of the vision recognition technology and has secured financial backing from Cargill, one of the world’s leading agricultural commodity processors and traders, in a deal likely to be widely replicated across the industry as incumbents seek either to limit the scope of disruption or participate in that process in the form of outsourced R&D.

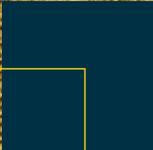
Agri-food tech – most of these investments are in food related sectors rather than agriculture per se – is the small but growing segment of the

start-up and venture capital universe sponsoring these initiatives. As with all industries technology is playing an increasingly pivotal role in driving innovation as today, according to a McKinsey report, agriculture is the least digitised of all major industries.

The need for agrifood tech innovation is, perhaps greater than ever, as legacy manufacturers and food production struggle to keep pace with a fast expanding global population, climate change and environmental degradation, changing consumer demands, constraints on natural resource, food waste and chronic disease such as obesity and diabetes. Agrifood tech has an important role in addressing these issues, while also providing some of the answers to CO2 emissions, chemical residues and run-off, drought and widespread labour shortages.

[Global Food Security](#) (GFS) is a multi-agency programme bringing together the main UK funders of research and training relating to food. GFS publications provide balanced analysis of food security issues on the basis of current evidence, for use by policy-makers and practitioners. In their 'Game changing technologies in Agriculture' thought piece, agricultural machinery scarcely rates a mention. This is also the case in the priorities of others.

The World Government Summit launched a report called Agriculture 4.0 – The Future Of Farming Technology, for the 2018 edition of the annual event. The report stated: 'Future agriculture will use sophisticated technologies such as robots, temperature and moisture sensors, aerial images, and GPS technology. These advanced devices and precision agriculture and robotic systems will allow farms to be more profitable, efficient, safe, and environmentally friendly. Many of these types of solutions are in common place usage today, and will be sure to gain prominence in future.'



+ AgTech Advancements

For a glimpse into what future innovation may have in store for the farm Alltech is as good a place as any to start. Founded by the late Dr Pearse Lyons, the organisation's Accelerator initiative was launched at the beginning of 2017.

AgTech investment quadrupled from 2014-19, but studies show agriculture is still the world's least-digitised industry. Robert Walker, CEO of [Keenan Systems](#), an affiliate, describes some of the issues facing agricultural start-ups: *“more AgTech funds have been created in 2016-19 than in 2003-16. \$1.5bn invested in 2017, >\$2bn in 2018. That is very small in the larger scale when you consider Uber's last funding round generated \$8bn. But it gives you some idea of where AgTech can go.”*

The Pearse Lyons Accelerator 2019 class featured:

- [SomaDetect](#) (Canada): In-line sensor that measures every critical indicator of dairy quality (fat, protein, somatic cell count, progesterone and antibiotics) from every cow at every milking;
- [Higher Steaks](#) (United Kingdom): Using state-of-the-art cell culture techniques, a small sample of cells from an animal will be expanded by feeding these cells. When these cells have grown, they become the desired meat product;
- [SwineTech](#) (United States): SwineTech is the world's leading solution to reduce piglet crushing and pre-weaning mortality, and also for monitoring sow health;
- [Breedr](#) (United Kingdom): The world's first app for livestock farmers that uses shared data to optimize yield, quality and profitability;
- [Biome Makers](#) (United States): Measuring crop health and functional biodiversity by using DNA sequencing and intelligent computing;
- Global Resonance (United Kingdom): Bringing real-time data from the start to the end of the food supply chain directly into business systems;
- [FarmCloud](#) (Portugal): Allows plug-and-play integration with climate and feeding controllers from a wide range of manufacturers;
- [Terra NutriTECH](#) (Ireland): **Adding precise amounts of feed supplements into the water systems on farms, reducing labour and improving returns;**
- [FOLIUM](#) (United Kingdom): Removal of feed bacteria via CRISPR; and
- [InTouch](#) (Ireland): **Online feed management solution for dairy farmers.**

The prevalence of shared data, DNA sequencing, CRISPR & cell culture techniques represent significant further advances in agricultural innovation, as Mr Walker comments: *“we have seen a change in application type over the past three years. At the beginning, we saw a lot of companies coming in that were all about drones, hardware and surveillance, practical on-farm applications. This last year, there were lots of applications around integrating data, blockchain type approaches, it was about connecting the data to various players in the industry. I think that change indicates a certain amount of maturing in the segment.”* The appearance of Irish start-ups and scale-ups on highly regarded innovative platforms such as this is a measure of the strong support and endorsement of Enterprise Ireland schemes to encourage research and development in the sector.

Such applications will also have widespread relevance in horticulture and arable based farming, with techniques such as ‘Precision’ & ‘Vertical’ farming sure to become more prevalent also. While GM has been consistently rejected by both EU consumers and policy-makers alike, the evolution in food-based science has progressed considerably over the past decade resulting in some phenomenal breakthroughs in otherwise unimagined areas – the stock market success of Beyond Meat being perhaps the most high-profile example of how consumer tastes are changing away from meat-based proteins (the local equivalent is probably the extraordinary uptake for the Gregg’s vegan sausage roll) - but both are demonstrative of the rising consciousness of environmental awareness, especially so among western millennials, and how this is applying pressure on traditional farming practices.

In order to understand where future innovation might lead us, we spoke to Robert Berendes, Executive Partner at [Flagship Pioneering](#) and former Head of Business Development at Syngenta.

What technologies do you see as driving the Agriculture industry in the coming years? How will they change the industry?

“From my perspective, the Covid-19 crisis is providing a great lens on the value creation opportunities associated with early-stage businesses that transform the agricultural value chain by offering disruptive technologies, by being more digitally-enabled and less asset-intense, and in particular by establishing systemic solutions that span multiple steps of the chain. There are three main contributions that the most game-changing companies will enable:

- 1) They will be putting more profit back into farms along multiple dimensions;*
- 2) they will de-commoditise agricultural production; and*
- 3) they will deliver a step-change in ag and food sustainability (in particular for the major commons, i.e. water, soil, agricultural land, carbon dioxide).*

“I would highlight technologies such as Inari’s gene editing approach that is progressing rapidly in order to fully harness the potential of plants; as well as Indigo’s systemic solution encompassing the plant microbiome, novel agronomic practices combined with digitally enabled marketplaces for (specialty) crop harvests and carbon credit trading that significantly increases the value of crops and thus farmer profits; and CiBO’s farmland management tool that creates unprecedented transparency about the value of farmland from the parcel to the national level.”



+ Precision Farming

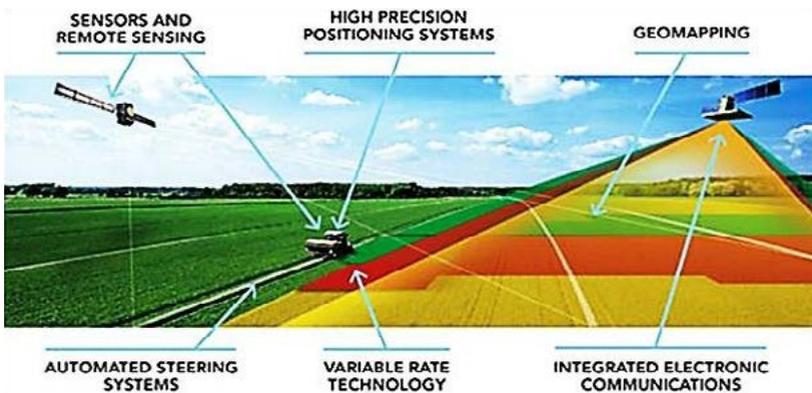
Precision farming is likely to be one of the most important technological enablers in future agriculture. Practices largely unchanged since the 1960s have seen arable farming in particular stagnate and yields across the globe plateau. Farmers paint a picture of an industry over-reliant on chemicals and gigantic machinery squeezing the life out of once-rich soils. But a wave of new technology is helping the sector reverse the decline.

Technological innovations in data gathering and robotics/machinery miniaturisation mean that farming no longer need concentrate on ‘averages’ but can cater to the health of individual plants – the essence of precision farming. The increased accuracy with which resources like fertiliser are used means costs can be lowered, and environmental side effects rolled back. Some estimate that 90% of chemicals used today in British farming are unnecessary, and a few envision a future where innovations strip out this ‘middleman’.



Since 2016, Harper Adams University has been running research on autonomous farming, using small, retrofitted tractors and harvesters alongside drones and AI. Known as the [Hands Free Hectare](#), the project produced its first crop of spring barley in September 2017, with six tonnes of winter wheat following a year later. In May 2019 the project was extended for another three years, scaling from a single ‘perfect’ hectare to 35 hectares across five different fields, and relabelled as the Hands Free Farm.

Precision crop spraying uses computer vision assisted by drones in detecting weeds and delivering herbicide in the same pass. Proprietary software can work with existing camera products. *“If you’re able to spot spray those weeds, there’s an excellent economic benefit because you’re using less herbicide, and there’s obviously that massive environmental benefit at the same time, because you’re not over spraying and getting run-off.”*



Intercropping and precision harvesting are other techniques being developed. The former relates to the idea that multiple commercial crops can be grown alongside each other; the latter is to do with harvesting at staggered intervals as crops ripen at different times. Precision harvesting technology isn’t quite there yet, but it could be the final piece of the puzzle, allowing the fundamentals of farming to be rewritten. Different crop varieties could be co-planted to combat disease or encourage pollination, changing the entire face of the agricultural landscape.



+ Vertical Farming

Vertical farming (VF) as a concept emerged out of restricted land availability in, typically, urban locations, but has attracted wider interest as [awareness](#) of both its practicalities and environmental benefits has grown.

Vertical farming permits crop production all year, it minimises the need for pesticide or hands-on human supervision. UK farmers appear likely to become early-adopters given the country's regular experience of droughts and flooding. LED light source is the principal energy requirement providing multiple wavelengths of light depending on what benefits certain crops at certain times. By some estimates VF was worth £1.7bn in value added terms in to the UK economy in 2018, a figure predicted to be £10bn by 2026.

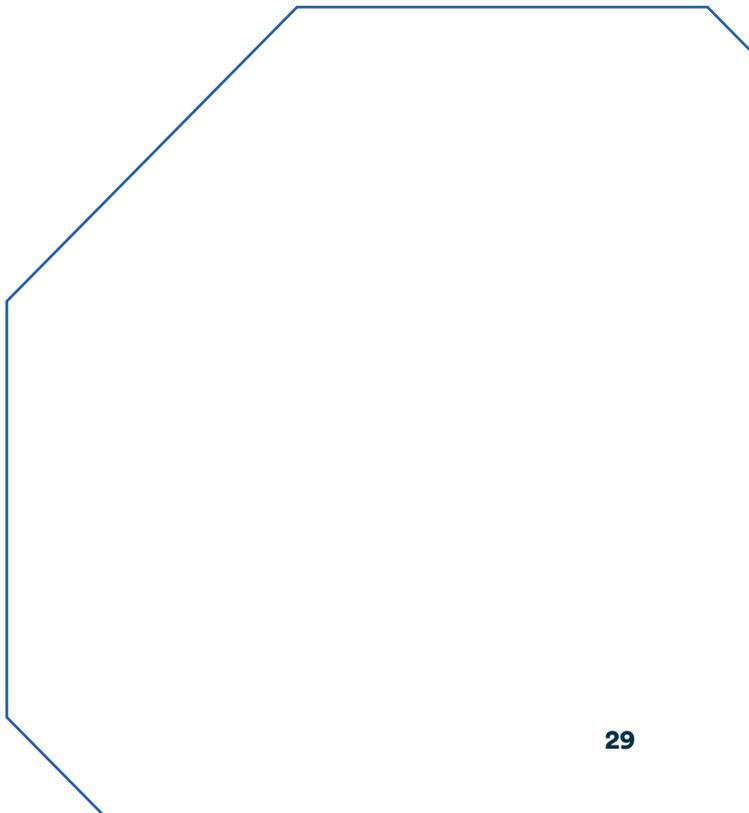


Enthusiasts say vertical farming offers a means of guaranteeing yields and reducing the industry's environmental impact, while improving the supply of safe, healthy and nutritious food and minimising the miles involved in its distribution. The use of automation and robotics to keep human intervention and labour costs to a minimum is attracting interest, while less food waste and making better use of limited land space are bonus features too.

According to Prof. Leo Marcelis of Wageningen University in the Netherlands: “VF took off after advances in LED lighting was capable of providing the type of light that different plant species need at a much better price than the previously used high-pressure sodium lamps. LED lights, which are essential for replicating natural daylight, can be used to change the way plants grow, when they flower and how they taste. It’s all about varying the spectrum used at different growth stages.

“LED lights can be positioned between plants and layers, produce hardly any heat radiation and are more energy efficient”. Asked whether vertical farming is sustainable, Prof Marcelis says that the current bottleneck is energy use. “It meets so many requirements, such as much lower water and nutrient use, but it is energy intensive. Of course, that is improving all the time, especially with lower-cost LED lighting and other technical developments.”







Policy, Trade, Tariffs and Brexit

+ The UK Agriculture Bill

The UK Agriculture Bill was presented to Parliament in February 2020. Aside from some minor adjustments such as those pertaining to soil quality standards, the Bill was much as was initially presented in September 2019. The National Farmers Union praised the new legislation as *“one of the most significant pieces of legislation for farmers in England for over 70 years”*.

The new legislation has the intent to radically transform Government support for agriculture, seeking to incentivise farmers with UK Government subsidies for the public good. Acts to be rewarded include improving air, soil and water quality, high animal welfare standards, increasing public access to the countryside and better flood curbing methods.

This Bill will replace the system of ‘EU Direct Payments’ during a 7-year ‘transition period’ beginning in 2021, which has the potential to revive and grow the farming industry. In the eyes of many active in the industry, the EU’s Common Agricultural Policy has shackled the UK farming industry with inefficient and overly bureaucratic rules, only rewarding farms based on their size, with the most significant amount of available subsidies given to so-called ‘mega-farms’, thereby suppressing the growth of smaller British and Northern Irish farms.

A key component of the Bill is the introduction of Environmental Land Management schemes (ELMs) the purpose of which is to progressively wean farm subsidy away from direct payments, so-called Pillar 1, to forms of environmental stewardship which would replace the current CAP Pillar 2 standard equivalents. Covid has, temporarily at least, interrupted the consultancy process whereby farmers and other rural stakeholders are invited to submit their responses to the outline proposals supporting the ELMs.

+ NFU view on ELMs

In order to understand a little more about how these might work, we spoke to John Pawsey, NFU Organics Forum Chairman about this and other aspects of the changes facing future farming practice.

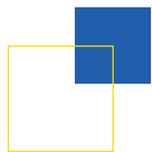
How will the Environmental Land Management scheme change land usage and farming practice, e.g. is this likely to result in a move away from intensive methods?

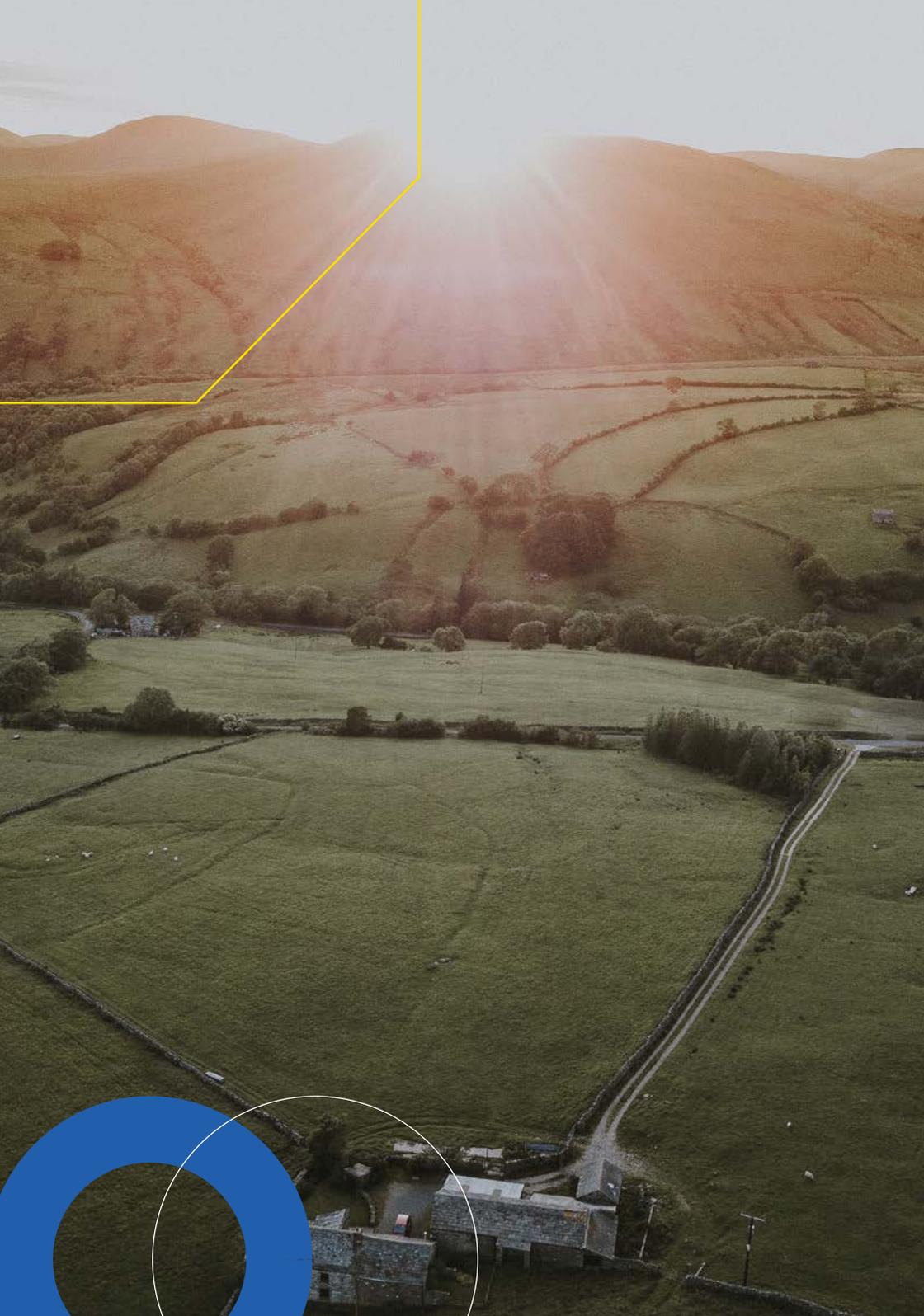
UK Agriculture will be somewhat split by location, Lincolnshire/parts of Norfolk and Cambridgeshire and the Midlands have less protected features so will pursue large scale farming; but it is much harder in other regions with many protected boundaries, hedgerows etc. ELMs in these more protected regions will need to offer their farmers more than the 'income foregone' proposal; policy needs to be creative to have a hope of hitting its 80% take up target. The UK currently is not rewarding management time so that gives them some wiggle room. Overall the mix of intensiveness will change.

Within the rural economy and agricultural sector do you have examples of the sorts of innovations which are likely to deliver the most advantageous outcomes in terms of the sustainability imperative?

One major problem is that all the data is collected on different platforms, which then needs to be layered and integrated to provide solutions. We all use the new mapping tools but could do more if these were integrated with other data sources available. It is not really being used to help the farming industry yet, it is more a marketing tool for equipment manufacturers. Historically farmers are poor at collaborating but they need to leverage their combined data to deliver the benefits. Companies like SOYL are at the cutting edge of improving yield and quality for their farmer customers through the use of precision farming techniques.







+ Brexit

We spoke to David Swales, Head of Strategic Insight at the Agricultural & Horticultural Development Board. [We asked him what the main challenges, concerns and opportunities for AHDB interests in the dairy and beef sectors in a post-Brexit world are.](#)

In our Horizon Market Intelligence [Report](#) published in April 2019 AHDB presented an impact assessment for the farming sector. The methodology applied considered 3 key variables:

1. Agricultural Policy
2. Trade Policy
3. Labour availability and cost.

In the continuing absence of certainty over the type of deal the UK will agree upon, for the Brexit context we modelled on the basis of a UK/EU Free Trade Agreement (FTA) and one based upon World Trade Organisation (WTO) tariffs as then applying.

Our key findings can be summarised as:

↘ Agriculture policy

- In general terms dairy will be less impacted than beef, given the latter sector's greater reliance upon direct (Pillar 1) payments.
- DEFRA has guaranteed (ring-fenced) funding under the new transition arrangements, and have proposed a substitution of £150m from direct payments to 'public good' type payments Pillar 2. While these Pillar 2 type payments will be more generous, farmers will have to do more in future to earn them than they do under existing CAP arrangements. Depending upon size of operation, regional location and type of land worked, there will be considerable variability for individual farmers to access these payments. Clearer understanding of the definitive application of the Environmental Land Management schemes is awaited.

↳ Trade Policy

- The key element of the post-Brexit trade arrangements will be how we engage with the EU in future. For both beef & dairy sectors the EU is our single largest market, in terms of both imports and exports.
- In a FTA scenario, trade facilitation (frictional) costs will inevitably rise as additional paperwork and customs compliance arise. We assess this at around 5% for the beef industry, and rather less so for dairy. Prices in both sectors, though, are likely to rise for UK consumption. In general, the impact on trade in a FTA Deal scenario is projected to be relatively small.
- In a WTO scenario we will see the imposition of tariffs, which creates greater exposure to global competition and additional frictional costs for the beef sector. Even with a lower tariff regime than with the EU, as there is a big differential between world and UK prices, the model expects cheaper world beef to flow to the UK, pushing down prices even with the expected trade friction costs.
- In a so-called UTL (Unilateral trade 'free-for-all) the impacts will be dramatic, especially in commodity linked products - but this scenario is thought to be unlikely in light of recent government statements on tariffs for the agricultural sector.

↳ Labour Availability and Cost

- A restrictive line from the EU could have a significant negative impact on labour availability and cost, if seasonal migrant workforce is lost.
- If examined in terms of substitution effects, i.e. comparing farm labouring wages with manufacturing, there is about a 50% premium.
- This, in relative terms, will hurt dairy sector more than beef, where there is less labour intensity. The highest performing dairy farms could see a £20,000 increase employment related costs.



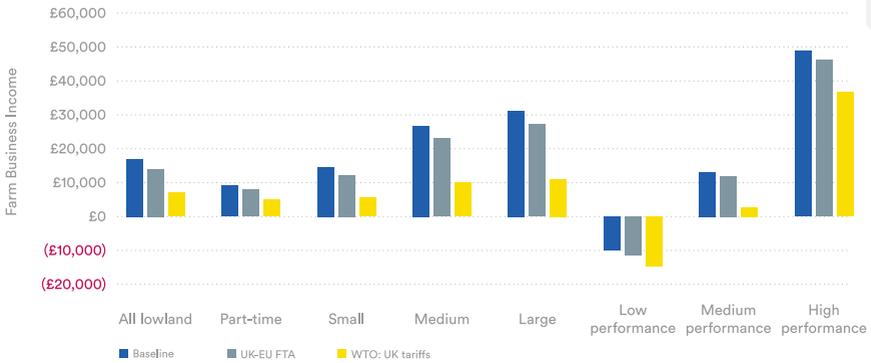
+ Trade Policy

In terms of general willingness to invest and innovate to best industry practice, dairy is more receptive than beef. Those remaining in the dairy business are in it for the long haul and are often multi-generational operators. Given beef's greater reliance upon direct payments there is generally a reluctance to invest sufficiently to adapt to changing external conditions, and a preference instead to seek to influence policy.

As an acknowledged higher quality product, UK beef and dairy have opportunities to expand into growing markets, particularly such as those in South East Asia where there is an increasing demand for higher value added product and a favourable population demographic.

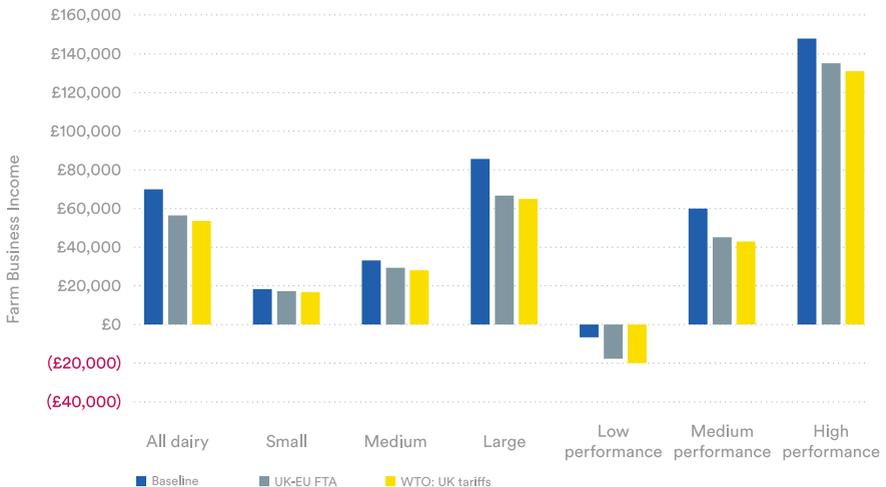


Lowland Beef and Sheep: Farm Business Income (2022)



In the 2019 Horizon report referenced earlier, the AHDB modelled outcomes in terms of impact on beef and dairy farm incomes. The two slides represent their findings in terms of possible impact on farm profitability in these scenarios.

Dairy: Farm Business Income (2022)



Dr Carmen Hubbard of the University of Newcastle Rural Economy department was the lead author of a study reviewing the possible impact on the beef sector in various trade simulations commissioned by [the Andersons Centre](#) and published in March 2019 and highlighted the relative importance of Ireland both in terms of imports and exports of beef to and from the UK, as these pictures from the AHDB confirm.

Top 5 destinations

For UK Beef Imports (2017)



→ Ireland 70%
Netherlands 8%
Poland 7%
Other EU countries 9%
Non-EU countries 6%

Top 5 destinations

For UK Dairy Imports (2017)



→ Ireland 71%
Netherlands 8%
France 4%
Belgium 3%
Germany 2%

Overall, the trade simulation results show that under a Brexit Deal-type scenario (denoted as FTA+), there is relatively little change with respect to domestic output and trade and any changes that do take place are brought about as a result of trade frictions principally created by non-tariff barriers. In general, the impact on trade in a Brexit Deal scenario is projected to be relatively small.

Table 7-2 FAPRI Modelling Outputs for Beef and Sheepmeat (% change versus Baseline)

Description	FTA+ (akin to Brexit Deal)	UTL+	WTO+
Beef			
Production	+1%	-12%	+11%
Domestic Use	0%	+16%	-3%
Exports	-1%	+1%	-100%
UK-EU	-1%	-6%	-100%
UK-Non-EU	-1%	+55%	-100%
Imports	-2%	+69%	-68%
EU-UK	-2%	-100%	-100%
Non-EU-UK	-3%	+1481%	+199%
Cattle Price	+1%	-42%	+17%
Output Value	+1%	44%	+30%

The more significant impacts on trade are associated with the ‘No Deal’ scenarios. In the WTO scenario (denoted WTO+) beef production is projected to rise by 11% as domestic UK production is protected by the EU Common External Tariff. Given this level of tariff protection and the fact that competition from EU27 imports decreases significantly, cattle prices are projected to rise by 17% and this helps to drive an output value increase of 30%. Higher domestic prices also result in reduced consumption which is estimated to be 3% lower when compared with the base line.

Under unilateral removal of import tariffs, the UTL+ scenario, UK producers are forced to compete with cheaper prices from non-EU producers and results in price declines of approximately 42% for beef – a reflection of the significant price differential that exists between the UK and cheaper markets such as Brazil for instance. The Hubbard [study](#) suggests that this in turn will lead to a 12% decline in UK production.

↳ Trade Economist Prospective

Commenting on this latter possibility, Shanker Singham, CEO of Competere and former adviser to the US Trade Representative and Department of Commerce, and to the UK Trade Secretary [noted](#): “If there is no deal, and by implication no agricultural quotas between the UK and EU, then all ag trade between the two stops. This means no Irish beef into the UK which would be catastrophic for the beef trade. Similarly it would be bad for Bavarian dairy, French beef and lamb etc. But I think the Irish would be uniquely damaged. The UK has an expensive beef market and the quotas agreed by the WTO modification process (for the US, Aus, NZ and other quota holders) would mean they could end up being permanently frozen out (UK farmers will also be looking to sell more domestically as their EU export markets will be foreclosed). It is very possible that supply chains would reorient on a permanent basis in ways that would be very damaging to Irish Ag interests”.

+ UK Farmer Prospective on Brexit

We spoke to one UK dairy farmer for his thoughts on the sector.

Within the dairy industry, what areas or sectors are likely to benefit most from these measures, and are you aware of farmers starting to make adjustments to their business preparations such as new machinery investment to prepare for the changing circumstances?

It is very difficult to answer this fully, when you ask about the Dairy Industry as a whole. This spans the country from large units to very large units that are more comparable with factory farming and from sandy soil to heavy clay so each farmer or land manager will view the Guidelines from a different perspective. That said, we cannot sit back and await the unknown, but it is likely to influence our decision over a complete new efficient dairy unit, capitalising on the benefits that it could bring to the business. We will however concentrate on assessing our business and the efficiency of the cows in fine detail, making better use of our recording data to ensure that we continue to work towards a very healthy herd which puts less strain on the environment and on our pockets.

One area that is always up for scrutiny is the handling and efficient use of the dairy slurry and possibly we can benefit from grants and new technology in this area. We firmly believe in dairy cows being grazed for

as long as the season and weather allows so providing good access to the fields is a concern. From reading the published articles it appears that there will be a large gap for our business as we believe we are good keepers of the countryside with a very mixed farm - dairy, beef, cereals, potatoes. We are constantly improving the land and the buildings and value the wildlife that we live with. We will be losing, within in the next few years, a substantial amount of basic payment, at a time when market prices will be volatile, this will have an impact on future investment.

We think we fall into the middle ground – which is always the most vulnerable - the very large farms may be able to take out hectares to return an income and the very small farms to totally make use of the ELM. I am hoping that with any new grants on offer that it does not mean that we have to have reams of paperwork and various advisors beating a path to our door. It does appear that all of the Government Schemes create unnecessary desk jobs before it gets off the ground for the farmer's benefit, so they need to be clear from the onset for everyone to understand, easy to administer and to claim.

How will the revised emphasis on Environmental Land Management schemes change land usage, and influence demand for agricultural machinery/technology?

I am not convinced that in Cheshire it will hugely change the face of the environment. We do need to protect our one natural asset - the soil - and improving agricultural machines and technology will play its part with precision work. I think the ELM will have a greater impact on the Arable Counties with their vast hectares. I wonder what impact the timing of reducing the Basic Payment which starts in 2021 may have on investment. Appreciating it will be phased but a £150k Basic Payment at the moment will be reduced by £37.5k.

What opportunities or threats can you identify for your sector post-Brexit, and how dependent are these on the basis of any future trade deal with the EU?

We can see problems going forward with finding experienced members of staff. There will be worries of cheaper imports coupled with no improving prices for our commodities. We need stable enhanced prices to be able to improve our businesses and grow.



**Feature Interview, The
Future of UK Farming –
Dr David Rose**

We spoke with Dr David Rose, Elizabeth Creak Associate Professor of Agricultural Innovation and Extension at the University of Reading, and asked him how best farmers can benefit from academic studies and technologically-led innovation to become more productive and cost efficient.



Reaping the Benefits of Farming Innovation - Interview with Prof. David Rose



How can farming be best re-configured in the post-Brexit landscape such that technology, R&D and sustainable land stewardship are optimally aligned?

I will answer that question in two ways. Firstly, I argue that the question is phrased the wrong way around. Farming should not be re-configured so that technology and R&D are aligned to it, but rather technology and R&D should be aligned to farming priorities. Technologies fail when they are not designed to solve real farming problems. Funders of technology

development in agriculture should ensure that they are engaging farming stakeholders to understand problems on the ground and then prioritise the research areas of competitions. Much could be learned from the Farmer-Led Innovation Network, Innovative Farmers, and similar exercises¹ where farmers are taking the lead in innovation. Technologies must match policy priorities, which are further outlined in the third question.

Secondly, the devolved nations are clearly moving to a system of farm subsidy which rewards the provision of public goods with public money. These public goods include clean air and water, improved biodiversity, enhanced cultural heritage, healthier soils, and better natural flood management. Technologies may enhance the delivery of these new agri-environment schemes, such as Environmental Land Management in England, and trials are underway of various technologies such as The Land App². Technology and R&D will play a key role in monitoring the effectiveness of management actions for ecosystem services and may help farmers to understand the services on their land and allow evidence-based reporting to Defra.

How can academic research be better deployed in creating the bridge between best practice and farmer behaviour/adaptation?

Research tells us that farmers are generally distrusting of academics where there has been little co-creation of knowledge³. In the words of Dwight D. Eisenhower "farming looks mighty easy when your plow is a pencil and you're a thousand miles from the corn field." Though universities in the UK might not be 'a thousand miles from the corn field', research has shown a disconnect between the type of science being produced in academic institutions and the needs of practitioners, who may face very different problems than those being investigated in the 'laboratory'. To this end, there are many examples of good academic practice where knowledge is co-created with farmers. Involving practitioners in setting research questions can ensure that the science is relevant to on-farm problems and builds trust between farmers and academics⁴. One example of this is the work being done at the Loddon Observatory⁵ by the University of Reading, which generates research questions through multi-stakeholders workshops with academics, local policy-makers, and land managers. This builds trust and support, for example, for trials on local farms and face-to-face demonstration events.

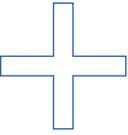
¹www.nfuonline.com/cross-sector/science-and-technology/research-and-innovation-news/help-for-farmer-led-innovation/

²www.thelandapp.com/

³www.researchgate.net/publication/341756535_Have_farmers_had_enough_of_experts

⁴www.ingentaconnect.com/content/iagrm/ijam/2018/00000006/f0020003/art00001

⁵loddonobservatory.org/



Reviews of farmer behaviour-change show that the RESET model can be used effectively to bridge the gap from best practice to implementation on-farm⁶. Academics interested in stimulating update of interventions could work on developing projects which provide:

- + Rules – determine clear rules for farmers to follow so there is no confusion.
- + Education – building knowledge and confidence of farmers about how to do a new practice. This education should be delivered with trusted advisors (e.g. agronomists, vets), face-to-face in demonstration events or at least interactive video (containing farmers like them, not scientists), rather than endless information sheets which farmers generally do not like.
- + Social norms – working to bring farmer groups together across a landscape to share knowledge and inspire each other to try new things.

Economics – prove the economic benefit of adopting a new practice or incentivising uptake by providing some things for free (e.g. free soil tests).

- + Tools – providing easy-to-use tools to help the farmer implement new practice (e.g. a lameness scoring chart to help farmers diagnose lameness).

Research shows that farmer behaviour can be influenced if all of these things are done together and if scientists are open to changing their own behaviour, rather than necessarily blaming the farmer for inaction⁷.

⁶irishvetjournal.biomedcentral.com/articles/10.1186/s13620-017-0085-x
⁷ahdb.org.uk/knowledge-library/understand-how-to-influence-farmers-decision-making-behaviour

Where is there highest demand for new technology solutions in farming within the next five years?

Technologies are sometimes adopted relatively quickly by farmers⁸, but also sometimes over very long timescales. We should be careful not to be seduced by so-called 'game-changing' technologies, which may not yet be fully developed, tested on farm, nor of proven benefit to the farmer.⁹ However, there are a number of pressing challenges in farming that technology could help solve, including:

- + Loss of labour – particularly in soft fruit (e.g. strawberries), top fruit (e.g. apples) and field veg (e.g. broccoli) sectors. Brexit and COVID-19 have led to shortfalls in migrant labour, which may never be fully replaced, leading to huge economic damage and food waste as crops aren't picked. Autonomous robots, at first to pick crops, but then to automate the planting, harvesting, and packing processes may play an important role in addressing this deficit of labour.
- + Loss of various chemicals – environmental regulations have limited the use of certain crop protection products, such as neonics. Technologies, such as gene editing, and other new products will be needed to address this loss in a safe way.
- + Zero carbon – a key policy focus for the agricultural industry to be net zero in the UK by 2040. Precision livestock technologies, as well as more energy efficient farming in the arable sector, could be part of the solution. In the livestock sector, this may include more precise nutrition of livestock to limit emissions, more accurate health diagnostics to improve efficiency, or in the arable sector smaller, energy efficient machines.

⁸ access.onlinelibrary.wiley.com/doi/full/10.2134/agronj2018.12.0779

⁹ davidchristianrose.files.wordpress.com/2019/11/speech-1.pdf

What are the major barriers to technology adoption in UK farming and are there ethical concerns?

We have identified several barriers to the adoption of new technology on-farm¹⁰:

- + Performance – the technology must be perceived by farmers as likely to have a benefit.
- + Ease of use – the technology must be easy to use for a farmer or operated through a service model.
- + Trust – the technology must be trusted by the end user.
- + Peer/adviser recommendation – other farmers or advisors must recommend technologies to encourage others to use it.
- + Cost – the technology must be affordable and make a positive difference to the bottom line.
- + Reliability – the technology must work every time, technical help must be available (e.g. by phone), and repairs must be carried out quickly.
- + Rural infrastructure – poor broadband and mobile phone signal limits the use of technology in rural areas.
- + Digital skills – there is a lack of knowledge and confidence about how to use new technologies.

Ethical concerns¹¹ should be considered too, such as:

- + Data ownership and privacy
- + Animal welfare
- + Effect on rural employment
- + Impacts on farmer physical and mental health
- + Right to repair

¹⁰ www.sciencedirect.com/science/article/pii/S0308521X16305418

¹¹ chap-solutions.co.uk/blogs/responsible-farming-futures-anticipating-the-consequences-of-new-technologies/

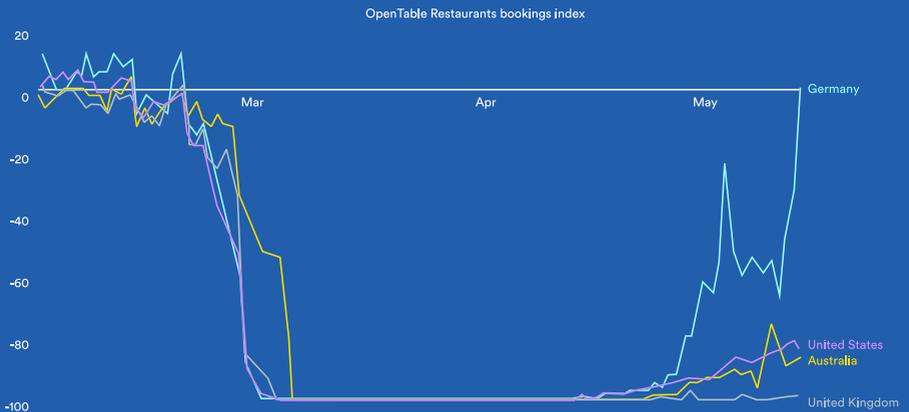


Conclusion



Prior to the Covid-19 pandemic, the UK farming sector was facing considerable uncertainty relating to the nature and terms of post-Brexit trading relationship with the EU, and indeed the rest of the world. Reform of the UK agriculture sector as part of this process will lead to structural changes in policy approach. The so-called 'public money for public goods' determination, which though phased over a 7-year transition from 2021, will no doubt result in mixed outcomes dependent upon individual circumstances.

The forced closure of hotels, restaurants and other food outlets resulted in surplus milk and dairy produce and led to a drop in pricing and the occasional story of milk 'dumping'. The beef sector was squeezed financially when restaurants closed as they demand most of the more expensive cuts. These factors have had a meaningful near-term impact on demand for agricultural equipment as noted in the collapse in demand for new tractors observed in April and May. However, if data from Germany is any guide there is hope restaurant bookings may recover quite swiftly once those restrictions are lifted.



While it is much to be hoped lockdown aversion will progressively lift, policy may remain understandably cautionary. The mix in demand for food within the beef and dairy sectors may shift as the hospitality sector learns to adapt to a new world possibly creating uncertainty for producers and possible disruption in markets and their pricing for many food stuffs.

In May the government revealed a scheme of tariffs designed to protect the beef, butter & poultry sectors in the event of a no-deal outcome with the EU, indicating some willingness to adopt a pragmatic response to concerns within the sector at a time when food security issues have emerged as a result of the pandemic. This is both a challenge and an opportunity for the industry, as the UK is currently reliant upon net imports of food across very nearly every sector, as the graph below demonstrates.

With one exception, the UK is a net importer of food and drink

UK trade in different food groups, 2018 (£bn)



Source: HMRC

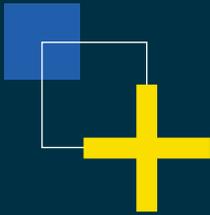


Henry Dimbleby was commissioned by the Government to conduct a major review of the country's entire food system. Commenting recently on the "extraordinarily good job the food system has done in the pandemic" in swiftly adapting food processing capacity to concentrate on most urgently demanded products, he added "We don't know what form the next crisis is going to take so having diversity within the system is a good thing: diversity of species, of suppliers, of supply chains and types of farming."

If the UK agricultural sector is to be re-gearred to deliver a greater share of our food domestically then the current system is going to need considerable additional assistance. Technology, as we have seen, will increasingly play a pivotal role in this, especially given the potential permanent disappearance of migratory workers. Both Associate Professor David Rose, in his interview commissioned for this report, and David Swales from the AHDB have noted that access to labour is a key industry risk.

Ultimately, agriculture is dependent upon consumption, however, and in this respect of perhaps greatest concern is the issue of public confidence. What has been striking to us in our research is the persistently high resistance among those polled to further release from lockdown. An Ipsos [poll](#) recently said 54% thought the Government is moving too quickly and only 13% too slowly. This is a potentially damaging matter for any immediate recovery hopes, and suggests large numbers of the public remain very cautious and potentially fearful of a return to work. This sustained polarisation of public opinion on the issue suggests expectations of a 'V' shaped recovery may be too optimistic.

[Primary Access and Research 9 June 2020](#)



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