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Ag-tech: The next green revolution?

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Contents:

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Introduction:

Feeding 8 billion

In 2022, the UK Government released its "Food Strategy". The strategy, which formed a core part of the government's Levelling Up Agenda, aims to transform the way that home grown food is produced, how land is used, and overall, gear the agricultural sector towards greater productivity and efficiency. The strategy comes at a time of increased need. Growing food is getting harder. Climate change threatens to lower yields and productivity, render some crops unviable through changes to heat and rainfall, and destroy agricultural assets during extreme weather events.

The challenge is of global scale. Biodiversity loss and land degradation, caused by decades of unsustainable agricultural practices, are ecological constraints crippling productivity. Nearly half of global farmland is moderately or slightly degraded, and agriculture is the primary cause of deforestation in the search of new soils[1]. Unsustainable agriculture is also a major source of greenhouse gas emissions, in particular methane from livestock and manure and nitrous oxide released from agricultural soil, requiring new approaches. After decades of progress in tackling hunger, the number of people without access to sufficient food rose to 828 million in 2021, indicating that, on current trends, the world will not reach the Sustainable Development Goal of zero hunger by 2030[2]. By that time, there will be a billion more mouths to feed, a 70% increase in caloric demand[3].

But advances in core science and technologies have produced an opportunity for the agricultural sector to reinvent itself and meet some of its most pressing challenges. The food system has to both increase production and decouple growth from the ecological boundaries already breached. Breakthroughs in science and technology, loosely termed ag-tech, are essential to improve crop yield and productivity, phase out harmful synthetic inputs, and support the commercial viability of producers[4]. This paper will explore the most recent trends as well as the future trajectory of the ag-tech sector.

[1] https://www.oliverwyman.com/content/dam/oliver-wyman/v2/publications/2021/apr/agriculture-4-0-the-future-of-farming-technology.pdf
[2] https://www.fao.org/newsroom/detail/un-report-global-hunger-SOFI-2022-FAO/en
[3] https://www.mckinsey.com/~/media/mckinsey/industries/agriculture/our%20insights/agricultures%20connected%20future%20how%20technology%20can%20yield%20new%20growth/agricultures-connected-future-how-technology-can-yield-new-growth-f.pdf?shouldIndex=fals
[4] https://www.fao.org/science-technology-and-innovation/en

Ag-Tech at a glance:

From farm to fork to waste disposal, ag-tech solutions improve the efficiency of existing agriculture, such as precision tools that disperse inputs with pinpoint accuracy, and offer new, scalable approaches to creating food, like vertical and hydroponic agriculture, cellular agriculture, and alternative proteins. Software and data innovations can also improve market coordination, transparency, and farm finance management[5].

The global ag-tech market value is projected to reach US$22.57 billion in 2025, led by North America and Europe[6], Innovations range from across the spectrum, from start-ups and academic institutions in areas like synthetic biology and alternative protein to major agri-corporations like John Deere's investments in electrified tractors[7] and chemical giant Syngenta's multi-billion dollar investment plan to back innovation at the intersection of climate change and agriculture[8].

	2023	2024	2025
North America	9,248	11,461.6	14,310.1
Latin America	52.5	58.8	67.2
Europe	3,924.6	4,808.7	5,945.5
Far East & China	807.5	932.7	1,097.5
Rest of the World	837.2	979.1	1,153.6
Global Value	14,869.8	18,240.9	22,573.9

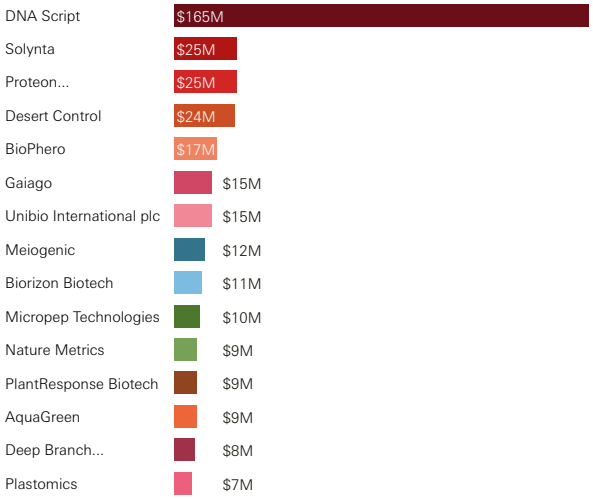
Source: Statista[9]

Figure 1: Global ag-tech value (in million US dollars)

Figure 2: Ag-tech investment trends, Europe

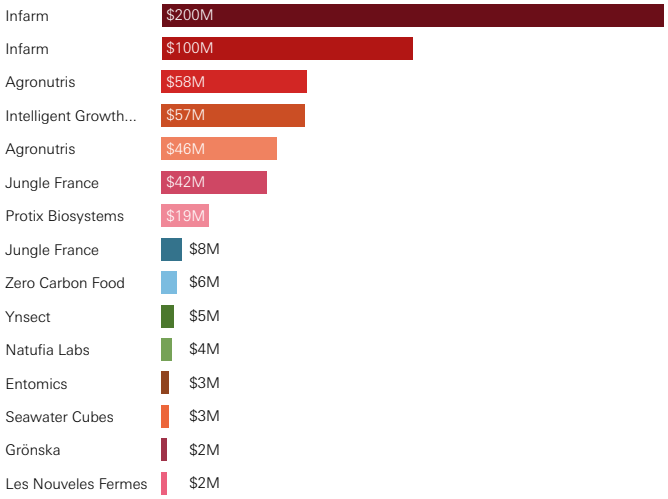
Top Ag Biotech Deals

The size of Europe's top ag biotech deals shows the relative nascency of the sector. Only France's DNA Script made it into the top global list. Netherlands-based Solynta inked its $25m Series C round 15 years after the company was founded. Of the 54 European ag biotech deals in 2021, eight were Series B or later.



Top Novel Farming Systems Deals

Investors shied away from what was their top investment category in 2020: investment in novel farming technologies fell 23% from 2020. Where they did invest: hyper-local vertical farming. German vertical farming company Infarm claimed 58% of all 2021 European investment capital in the novel farming category.



Source: AgFunder European Investment Report 2022[10]

[5] https://techcrunch.com/2022/10/05/7-investors-discuss-how-agtech-can-solve-agricultures-biggest-problems/?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAANL7IK_wEgcAY67CB6HGrcaCERJ_OZSs3fNVAPA6RIetfXrzW4HHbjXFDiDlhQRtw-Rd0jO3Om9wuFPEtEp__8775Ym6NF56ZEtQzRDzTS1SIrPWeGizlKeOnj7ScbuIMDK94Hd1XnIyoJOlQVyTKN8zEOZNBwQgr_inPbu6v9cf

[6] https://www.statista.com/statistics/1222535/worldwide-agricultural-technology-market-value-by-region/

[7] https://www.deere.co.uk/en/agriculture/future-of-farming/

[8] https://www.syngenta.com/en/innovation-agriculture/accelerating-innovation-changing-world

[9] https://www.statista.com/statistics/1222535/worldwide-agricultural-technology-market-value-by-region/

[10] https://research.agfunder.com/europe-2022-agrifoodtech-report-investnl.pdf

Just right: Precision farming and robotics

Precision agriculture is a suite of technologies that help farmers optimise and fine-tune their use of inputs like fertilisers and pesticides, benefiting the bottom line and lowering environmental impact. In the UK, for example, this data is collected through satellite technologies and plane scans. These precision tools harness Global Positioning Systems (GPS) and Geographic Information Systems (GIS), drones, sensors, and Internet of Things (IOT) to allow farmers to spot and respond to in-field crop variability and target inputs with minimal waste.

From scanning large tracts of land for signs of disease or damage, to targeting crop needs to deliver the exact quantity of inputs, precision agriculture lowers costs and lightens the use of harmful and costly synthetic inputs. Unmanned aerial vehicles are reducing the manpower and time involved in farm management and AI-powered software can ensure optimal growth conditions. This is especially useful given the sector's labour shortages, and the war in Ukraine has prompted some farmers to invest more heavily in drones to rationalise and reduce their use of costly fertiliser[11]. Over £500,000 worth of produce from Riviera Produce Limited was left rotten on the fields, and Boxford Suffolk Farms Limited reported that around 44 tonnes of fruit was wasted, due to the lack of workers in 2022[12].

In the face of workforce shortages, agricultural robotics are supporting productivity and improving precision delivery. Computer vision and AI-powered bots have been shown to reduce the volume of chemicals and herbicides by 80 to 90% respectively[13]. Bots can harvest, seed, pick, pack, palletise and monitor crops and livestock. A recent report by the Western Growers Association and Roland Berger found 50% of growers have employees dedicated to the integration of automation technology[14]. 'Swarm robotics' - the coordinated activity of a large number of robotic devices - promises to lower farmers' reliance on energy-guzzling and inefficient tractors as well as allowing them to overcome labour shortages[15]. Automation technologies, however, are not evenly applied across all fruit categories. Whilst some fruits and vegetable types can be harvested through automated machineries, others still have to be manually harvested as technology based solutions are ineffective.

Despite its promise, precision agriculture does face constraints of cost and connectivity. In the US, only one-quarter of farms use connected equipment or devices to access data, and the technology often runs on 2G or 3G networks or low band IOT that support a limited number of devices and offer low performance for data transfer[16]. In the European Union, high cost and low levels of digital connectivity in rural areas, are limiting adoption[17]. Worldwide, 90% of farmers are small scale and cannot access tools like robotics[18]. Other challenges to precision technology rollout include lack of standardisation of technology and ensuring data quality is sufficient for collaboration and interoperability[19 & 20].

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[11] https://www.wsj.com/articles/fertilizer-price-surge-drives-brazil-to-high-tech-alternatives-11654701075

[12] https://committees.parliament.uk/publications/9580/documents/162177/default/

[13] https://www.wipro.com/holmes/towards-future-farming-how-artificial-intelligence-is-transforming-the-agriculture-industry/#:~:text=AI%20systems%20are%20helping%20to,and%20poor%20nutrition%20of%20farms.

[14] https://www.rolandberger.com/en/Insights/Publications/Precision-farming.html

[15] https://www.sciencedirect.com/science/article/abs/pii/S0168169921006256

[16] https://www.mckinsey.com/~/media/mckinsey/industries/agriculture/our%20insights/agricultures%20connected%20future%20how%20technology%20can%20yield%20new%20growth/agricultures-connected-future-how-technology-can-yield-new-growth-f.pdf?shouldIndex=false

[17] https://www.euractiv.com/section/agriculture-food/news/commission-precision-agriculture-key-to-farming-double-challenge/

[18] https://www.investmentmonitor.ai/sectors/agribusiness/agribusiness-trends-2022/

[19] https://dataloop.ai/blog/precision-agriculture-challenges/

[20] https://www.agritechtomorrow.com/story/2020/09/5-challenges-for-precision-agriculture-to-face-/12399/

Smart farming in the UK

Data City, which covers over 5 million companies, estimates the UK ag-tech sector has £11.8 billion turnover, £1.2 billion total investment funding, and over 36,000 employees[21]. Aggregate annual private equity investment in UK ag-tech grew sharply since 2017, from £208 million across 116 deals to £745 million across 127 deals in 2021[22].

UK startups are world leaders in areas including agricultural robotics. The Small Robot Company, led by a team of experts from the likes of DeepMind, Dyson, IBM and Virgin Galactic and Formula 1, has raised an estimated £8 million and built a product that uses high voltage electricity and AI to eliminate weeds, offering an alternative to polluting herbicides[23-24].

The UK farming community is broadly open to technology adoption and achieving tangible results; 59% of farmers who have prioritised productivity believe technology investment will be crucial to addressing the challenge, and a third have made technology investments to improve resource efficiency, with a further 40% planning to do so by 2023[25].

Figure 3: Number of ag-tech companies in the UK

Type of Ag-tech	No. of Companies
AgSciences	432
Automation	152
Drone Technology	87
Management Platforms	173
Precision Farming	71
Remote Sensing	382
Vertical Farming	109

Source: Data City[26]

[21] https://thedatacity.com/rtics/agritech-rtic0003/?utm_term=agritech&utm_campaign=AgriTech+RTIC+Landing+Page&utm_source=adwords&utm_medium=ppc&hsa_acc=6512765314&hsa_cam=19580389613&hsa_grp=148289956554&hsa_ad=645172777143&hsa_src=g&hsa_tgt=kwd-66334401&hsa_kw=agritech&hsa_mt=b&hsa_net=adwords&hsa_ver=3&gclid=Cj0KCQiA8t2eBhDeARIsAAVEga1AiPz092RGVIZW-jg2ctVb47AXoOzE1toUJOnLMX0DqNy5lEPFCkwwaAgIWEALw_wcB

[22] https://www.pricebailey.co.uk/reports/current-trends-technologies-uk-agricultural-technology-industry/

[23] https://www.crunchbase.com/organization/the-small-robot-company

[24] https://www.pricebailey.co.uk/reports/current-trends-technologies-uk-agricultural-technology-industry/

[25] https://www.barclays.co.uk/content/dam/documents/business/business-insight/Insights_AI_in_Agriculture.pdf

[26] https://thedatacity.com/rtics/agritech-rtic0003/?utm_term=agritech&utm_campaign=AgriTech+RTIC+Landing+Page&utm_source=adwords&utm_medium=ppc&hsa_acc=6512765314&hsa_cam=19580389613&hsa_grp=148289956554&hsa_ad=645172777143&hsa_src=g&hsa_tgt=kwd-66334401&hsa_kw=agritech&hsa_mt=b&hsa_net=adwords&hsa_ver=3&gclid=Cj0KCQiA8t2eBhDeARIsAAVEga1AiPz092RGVIZW-jg2ctVb47AXoOzE1toUJOnLMX0DqNy5lEPFCkwwaAgIWEALw_wcB

Nature 2.0: Biologicals

Biological farming is a chemical-free approach to improving agricultural productivity and resilience by harnessing biological mechanisms, in contrast to chemical farming that uses inputs including synthetic fertilisers, herbicides and pesticides.

Organic farming, on the other hand, makes use mainly of natural stimulants and inputs, avoiding pesticides or synthetic fertilisers. Unlike organic agriculture, biologicals harness natural dynamics of living microbes like bacteria or fungi that help plants grow. Biological farming espouses a holistic approach to agriculture fostering a balanced and calibrated ecosystem, focusing on soil health and biological diversity. Biological alternatives like biopesticides attracted $2.6 billion in funding in 2021, more than a 30% increase from the previous year[27].

When it comes to finding the right approaches - choosing organic versus biological - there is a trade-off with crop-protection, with a) chemical molecules covering targets broadly or b) a narrow targeting. A benefit of biological approaches, Dr Giebel explains, is their specific impact, whereas in traditional crop protection technologies, the relationship between chemical molecules and targets is broader which in turn leads to wider damage. “A biological relationship is one-to-one,” says Dr Giebel. “When we discover a product that controls, for example, a fungal disease, it's controlling it in such a specific way that it likely only controls that one pathogen rather than other organisms that might be evolutionarily similar, but not exactly the same.”

Another startup, California-based Pivot Bio, is using biologicals to replace nitrogen fertiliser. Nitrogen is an essential fuel for agricultural growth, required to build DNA and proteins that turn grain into harvest, but its application via fertiliser comes at an environmental cost. Agricultural soil, laden with synthetic nitrogen fertiliser, is the principal cause of nitrous oxide, which is 300 times as potent as carbon dioxide in terms of heating the atmosphere[28].

Moreover, the delivery of nitrogen through chemical fertiliser puts farmers at the mercy of significant price swings in this commodity, especially since the crisis in Ukraine. “The war in Ukraine has disrupted fertiliser production and supply chains around the world, it has had a massive impact on farmers,” says Dr Karsten Temme, CEO and Co-Founder at Pivot Bio. Since the beginning of 2022, prices of raw materials for fertilisers, including ammonia, nitrogen, nitrates, phosphates, potash and sulphates, have increased 30%[29] and the price of fertiliser was almost three times higher after the war between Ukraine and Russia[30].

Pivot Bio aims to solve this challenge. They develop re-engineering microbes that produce the right levels of nitrogen in any weather and throughout the growing season. A special enzyme developed by the company is able to operate in all soils and the root systems of plants. This way it is able to directly deliver nitrogen in different conditions and grounds. Their approach “eliminates all the side effects associated with using fertiliser to deliver nitrogen,” says Dr Temme.

[27] https://agfundernews.com/innovation-in-agriculture-and-food-and-its-vital-role-in-fighting-climate-change

[28] https://www.nature.com/articles/s41586-020-2780-0

[29] https://www.cnbc.com/2022/03/22/fertilizer-prices-are-at-record-highs-heres-what-that-means.html

[30] https://www.npr.org/2022/09/28/1125525861/how-the-war-in-ukraine-is-affecting-the-worlds-supply-of-fertilizer

A recent trial found their product lowered nitrogen rates by one quarter without lowering corn yield. In addition, by turning microbes into mini fertiliser factories, Pivot Bio is helping re-draw the supply chain, by enabling nitrogen to be produced close to the end user and minimising its loss in the environment by producing it in the plant root and transporting it into the plant. This reduces costs, inefficiency and pollution. There are benefits downstream in having more consistently produced harvest, including the prevention of air and water pollution and the improvement in soil health. "There's an opportunity to tackle a 6 to 7% slice of global greenhouse gas emissions, that's never had a remediation or a prevention tool before," he says.

Dr Temme's vision is for science to boost farmers' economic vitality, a precondition for any shift to more sustainable agriculture. "Our ultimate goal is to serve farmers so that they have a more predictable and consistent bottom line, and there's a better chance that the farms get passed to the next generation. As a ripple effect, we will have cleaner air, water and healthier soils, and be better stewards of the land". In a recent trial, a Pivot Bio product increased revenue by $12.50 per acre, "a substantial amount in the corn industry," says Dr Temme. "If you dig into the numbers that can make the difference between a corn producer being profitable or going underwater."

Food anywhere:
Controlled environment agriculture

Controlled environment agriculture (CEA), also known as vertical farming or indoor farming, is a radical approach to growing food more efficiently and closer to consumers, optimising the inputs needed for growth, such as water, temperature, humidity, ventilation, light and CO2[31]. One estimate predicts the CEA market to reach $171 billion by 2026[32].

"Controlled environment agriculture is about resilience, protecting the crop, whether from hail storms or extremes in temperature or droughts," says Mr Charlie Guy, CEO and Co-Founder at LettUs Grow. "It's about being able to control those factors that influence the crop price. Vertical farmers use the highest precision approach to control that and get the best out of it."

Two approaches to CEA are hydroponics, which grows plants using a water-based nutrient solution rather than soil, with an aggregate substrate like coconut coir[33], and aeroponics, which grows plants without soil, instead suspending roots in the air from where they are irrigated with a nutrient-dense mist[34]. This, advocates argue, gives roots access to more oxygen, resulting in healthier plants, faster growth and improved yield[35].

LettUs grow say their aeroponic technology allows plants to grow twice as fast, using less water and fertiliser and no pesticides[36]. "The range of crops is going to expand," says Mr Guy. "In phase one it is anything you put in a salad bag and delicate herbs. These crops are often imported, and by growing them locally you can improve their quality, shelf life and sustainability". Carbon emissions can this way be cut from reducing air miles to transport produce, reduced packaging and processing through more modern local machineries.

[31] https://www.danthermgroup.com/en-gb/calorex/why-controlled-environment-agriculture-cea-is-the-future-of-farming

[32] https://www.accenture.com/us-en/blogs/chemicals-and-natural-resources-blog/vertical-farming

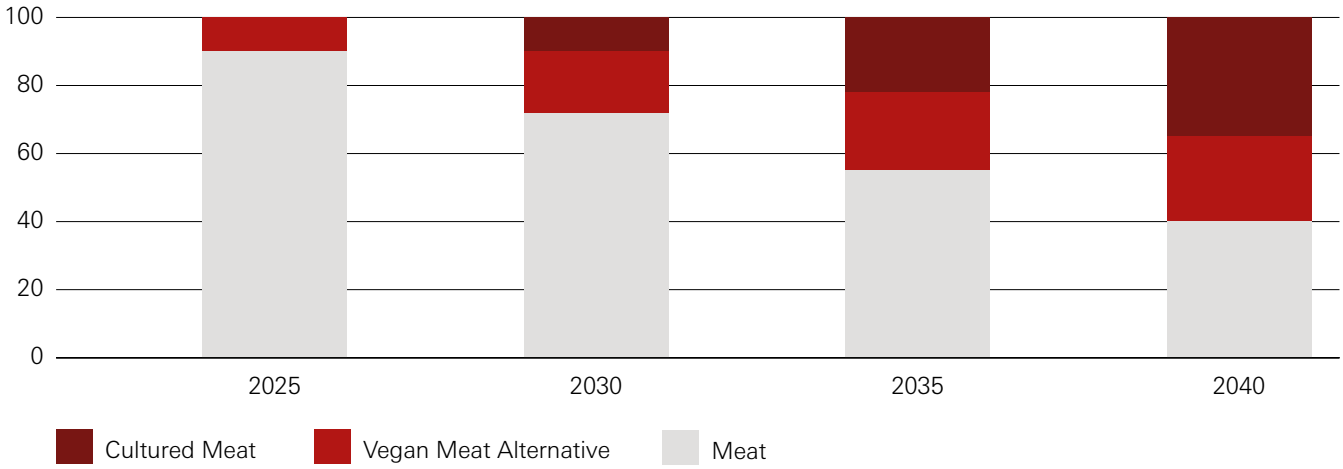
[33] https://www.nal.usda.gov/farms-and-agricultural-production-systems/hydroponics

[34] https://www.lettusgrow.com/aeroponic-technology#:~:text=What%20is%20aeroponics%3F,solution%20of%20water%20and%20nutrients

[35] ibid.

[36] https://www.lettusgrow.com

Figure 4: Market share of cultured meat, vegan meat alternative and meat (2025-2040)



Source: Statista[37]

In the future, CEA could make inroads into alternative proteins, such as plant-based meats without the emissions and environmental damage caused by the livestock industry. However, plant-based agriculture has its own environmental toll in the form of pesticide use, water and deforestation[38]. LettUs Grow sees potential in aeroponics to support propagation of commonly used proteins like soy, pea, amaranth, chickpea, rapeseed, water lentil and lupin.

Yet it should be mentioned that this sector has been buffeted by the energy crisis. Vertical farms consume on average, seven times as much energy as ordinary greenhouses[39] which leaves companies exposed to fluctuations in electricity prices, and as a capital-intensive sector, some are struggling to raise financing as investors tighten their belts in the current downturn[40]. One way to address this issue, is through investments in on-site renewables. These could include for example solar panels on roofs or spread across the container farm[41].

To date, the vertical agriculture sector has relied heavily on equity financing, according to Mr Guy at LettUs Grow, and it needs to transition to debt finance or more sustainable models. For Mr Guy, it is imperative that companies in this space are utilising renewable power.

[37] https://www.statista.com/statistics/1255950/meat-and-meat-alternatives-market-breakdown/

[38] https://www.lettusgrow.com/blog/vertical-farming-alternative-protein

[39] ibid.

[40] https://www.wired.co.uk/article/vertical-farms-energy-crisis

[41] https://avisomo.com/the-potential-for-renewable-energy-in-vertical-farming/

UK government:
Backing food

The UK government has supported innovation in the domestic food sector and ag-tech, following a 2013-published strategy to position the country as a world-leader in agricultural technology, innovation and sustainability[42].

On the regulatory front, the UK government is transitioning its rules as part of its departure from the European Union, prioritising regulatory simplification and future-focused agriculture[43]. As part of Brexit, the UK departed from the Common Agricultural Policy (CAP), which provides subsidies to the sector. The UK Agriculture Act 2020 provides a legal framework to develop alternative approaches. Furthermore in February 2023, the UK published a policy paper[44] on its Environmental Land Management (ELM) scheme, in which it laid out its approaches for its transition. The Government will phase out CAP-style direct payments and introduce payment programmes for farmers to provide public goods such as environmental and animal welfare improvements. These include:

1. **A sustainable farming incentive (SFI),** paying farmers to adopt sustainable farming practices
2. **Countryside Stewardship,** providing targeted funding in specific geographies of the country
3. **Landscape Recovery,** focusing on longer-term large scale projects to recover the natural environment

These changes are taking place during a seven-year 'Agricultural Transition' period running from 2021[45]. It remains to be seen how these reforms will impact the sector. Unions have expressed concern at the impact of Brexit on the financial resilience of farmers which may deter investments in capital, technology and alternative approaches to food production[46]. The government is seeking to address the intensification of agriculture under CAP and its toll on wildlife and the environment and views modern technology as a means to boost food production while lowering its geophysical toll[47]. It will focus its efforts on industry-led research and development syndicates to work over medium term (up to 4 year) initiatives, combined with smaller agile projects to test the feasibility of new technologies[48].

[42] https://www.sqw.co.uk/application/files/4116/1960/6611/Agri-Tech_Industrial_Strategy_-_Evaluation_and_Baseline.pdf

[43] https://defrafarming.blog.gov.uk/2022/03/02/understanding-and-improving-farming-regulation/

[44] https://www.gov.uk/government/publications/environmental-land-management-update-how-government-will-pay-for-land-based-environment-and-climate-goods-and-services/environmental-land-management-elm-update-how-government-will-pay-for-land-based-environment-and-climate-goods-and-services

[45] https://commonslibrary.parliament.uk/research-briefings/cbp-9431/#:~:text=Since%20Brexit%2C%20the%20Agriculture%20Act,this%20Parliament%2C%20ending%20by%202024.

[46] https://www.theguardian.com/politics/2022/dec/29/uk-farmers-impact-brexit-trade-deal-losing-common-agricultural-policy

[47] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/954283/agricultural-transition-plan.pdf

[48] ibid.

Scaling sustainability

While ag-tech innovations are thriving in the field and farm, whether from startups, academic institutions or large corporations, there are challenges. Scaling from environmentally sound pilot projects to large-scale production is one bottleneck. Innovators in plant-based meats, for instance, have seen falling stock prices of late as they face high costs and tapering demand[49]. The reasons for this are manifold, from a reduced hype and consumer interest to concerns of high consumption on people's health. Following an early hype cycle, plant-based meat companies must now turn to more technological investment and improved consumer messaging to build mass market demand[50]. Positively, consumer sentiment is shifting towards vegan alternatives and governments are stepping up support for the sector; in September 2022, the Biden administration passed an executive order to support American biotech, including in the food sector[51].

Figure 5: Likeliness of customers choosing vegan alternative products

Curiosity for vegan alternatives is becoming common

Percentage of curious consumers who are likely to choose the following vegan alternative products	Extremely likely	Somewhat likely
Fish and seafood	13	18
Pork	13	20
Cream	13	22
White meat/poultry e.g. chicken, duck	13	22
Red meat e.g. beef, lamb, etc.	14	21
Cheese	15	22
Egg	15	16
Yogurt	16	24
Milk	18	23

Source: Investment Monitor, GlobalData[52]

Financing also needs to be as long-term and sustainable as the agriculture sector seeks to grow. Positively, ag-tech startup financing has proven resilient despite the economic crisis of 2021-2022, outperforming overall venture capital activity (see figure 6), buoyed by shifting investment trends as food and sustainability become high-priority areas for ESG-conscious investors[53].

[49] https://www.wsj.com/articles/beyond-meat-ethan-brown-stock-layoffs-sausages-11668963839

[50] https://www.wsj.com/articles/impossible-foods-hires-a-marketing-chief-as-it-seeks-to-win-over-meat-eaters-11667869820

[51] https://www.whitehouse.gov/briefing-room/presidential-actions/2022/09/12/executive-order-on-advancing-biotechnology-and-biomanufacturing-innovation-for-a-sustainable-safe-and-secure-american-bioeconomy/

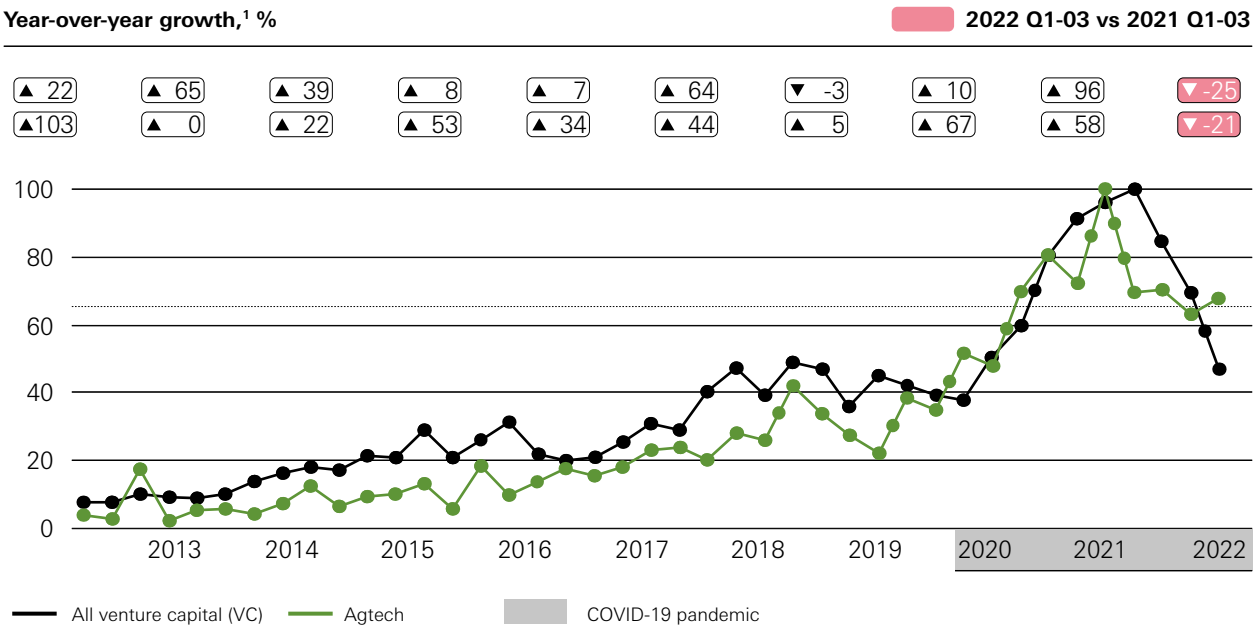
[52] https://www.investmentmonitor.ai/sectors/agribusiness/agribusiness-trends-2022/

[53] https://www.mckinsey.com/industries/agriculture/our-insights/how-agtech-startups-can-survive-a-capital-drought

Figure 6: Quarterly investment activity

Macroeconomic uncertainty has led to a meaningful decline in overall venture capital and ag-tech investment activity in 2022.

Quarterly investment activity normalized (%) to maximum quarterly value observed



Note: Quarterly investment activity normalized (%) to maximum quarterly value observed. Total VC investment normalized against 04 2021, whereas agtech normalized against 03 2021.

[1]Year-over-year growth calculated using sum of all quarters in the year. For 2022, year-over-year metric calculated versus Q1-Q3 2021.

Source: PitchBook (as of October 14, 2022); McKinsey analysis[54]

But startups face challenges as they progress, according to Dr Olga Dubey, CEO and Co-Founder at AgroSustain, a Switzerland-based startup that has developed natural fungicides and plant coatings from food waste. "At the very start of your journey, you are usually going for business angels and it is ok [to raise funding]. When you are close to but not yet commercial, you need to find investors that understand your segment but it is still high risk. This is where it can be harder to find support." In the current environment, late-stage ag-tech startups may struggle with exits and returns on investment[55]. Another challenge for ag-tech startups is restricted government policies, which only help for a limited time[56]. Governments need to implement startup-friendly policies and create an encouraging environment for the sector to thrive[57]. There could be scope for public-private partnerships in the sector, bringing together startups and universities with farm producer organisations and NGOs.

Ag-tech is often a capital-intensive sector, and providers need to be able to produce at scale to make a meaningful dent on the supply chain, which makes strong and reliable financing streams and long-term support essential to growth. Controlled environment agriculture, for instance, has in the past faced limits on its ability to provide food at the scale needed by major retailers[58], requiring them to ramp up capital-intensive facilities. The UK has positive growth stories, like the Jones Food Company, a UK leader in vertical farming, backed by Ocado, which is investing heavily in expanding production and aims to supply 70% of UK fresh produce within a decade.

[54] https://www.mckinsey.com/industries/agriculture/our-insights/how-agtech-startups-can-survive-a-capital-drought

[55] https://techcrunch.com/2022/10/05/7-investors-discuss-how-agtech-can-solve-agricultures-biggest-problems/?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAANL7IK_wEgcAY67CB6HGrcaCERJ_OZSs3fNVAPA6RIetfXrzW4HHbjXFDiDIhQRtw-Rd0jO3Om9wuFPEtEp__8775Ym6NF56ZEtQzRDzTS1SIrPWeGizlKeOnj7ScbuIMDK94Hd1XnIyoJOlQVyTKN8zEOZNBwQgr_inPbu6v9cf

[56] https://www.computer.org/publications/tech-news/trends/agritech-startups-challenges-solutions

[57] ibid.

[58] https://content.sifted.eu/wp-content/uploads/2022/09/27191637/Agritech.pdf

Government funded programmes

The UK Government is heavily investing in grants and programmes driving innovation in agriculture. The most notable is the £270 million Farming Innovation Programme, delivered through the Department of Environment, Food and Rural Affairs (Defra) and UK Research and Innovation[59], which targets cutting-edge agriculture and horticulture to boost productivity and lower labour demands, in recognition of workforce shortages which have deepened since Brexit. Projects include Farmsense's use of sensor technology and AI to optimise pigs' welfare; Blue Planet II which is developing autonomous technology to increase crop yield and quality of fruits; and Muddy Machines's agri-robot concept that speeds up vegetable harvesting[60]. Automation is key for the UK agriculture sector. According to the National Farmers Union, up to £60 million of UK crops were left to rot due to labour shortages, with £22 million of fruit and vegetables wasted in 2022, and growers expect a further fall in production of 4.4% in 2023[61].

"There has been a good amount of innovation funding from the UK government and research councils," says Mr Guy at LettUs Grow. But he notes that more support may be needed to improve the rollout of high tech greenhouses, including measures that help de-risk investments. Mr Guy argues that public procurement could be a powerful lever for supporting ag-tech innovation and sustainable agriculture through, for instance, government procurement of foods for public sector institutions like schools, hospitals and public services.

[59] https://www.gov.uk/government/news/boost-for-farming-innovation

[60] ibid.

[61] https://www.pricebailey.co.uk/reports/current-trends-technologies-uk-agricultural-technology-industry/

Conclusion

Feeding a growing global population, without exacerbating the already deleterious impact of agriculture on land and climate, is one of the most essential questions for achieving the Sustainable Development Goals. With the right public policies and financing, and innovative business models, ag-tech could help foster a new green revolution. In this transformation, the UK agricultural sector provides a strong opportunity for supporting the transition towards a greener economy and reducing carbon emissions.

To make this happen, however, this report presented a series of measures and suggestions to be considered. The future of farming is custom-made. New technologies, such as precision farming and robotics can provide a more bespoke and targeted way of crop farming, saving resources and harvesting soil more sustainably. Combined with biological crop-protection technologies which target pathogens directly, new farming approaches can help scale operations whilst tackling specific challenges in the process.

The role of policy and regulators in this process, however, cannot be understated. Particularly when it comes to genetic research and creating scientific breakthroughs, industry and academic researchers will require sufficient funding for exploring uncharted territory in agricultural innovation. What is clear is that with a rising global population and changing climatic conditions, the sector will need to find a way to innovate its processes and supply chain - from farm to fork.