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● Smart Farming in the UK

BSI report



By Royal Charter



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● What is smart farming?



Smart farming is commonly understood to centre on using information technology to transform agricultural systems. It has the potential to advance traditional farming techniques by delivering higher, more profitable growth and improved food quality, while limiting risks and environmental damage.

Agricultural technology can have a real impact on the farming sector in ensuring food security.

Professor James Lowenberg-DeBoer, from Harper Adams University, predicts smart farming will have as much impact on the way agriculture is done as motorised mechanisms did in the early 20th century.

You may also have heard the phenomenon of smart farming referred to as “Farming 4.0”, “digital farming” or “precision agriculture and farming”.



Primarily, the main use of technology in agriculture is for data harvesting and making farming more efficient, productive and predictable. Technologies currently employed here include the use of the Internet of Things (IoT) and edge computing, sensors, machine learning, robotics, drones, 5G, blockchain, and artificial intelligence (AI), with reports suggesting that between 10% to 15% of farmers have some form of Internet of Things (IoT) technology on their farms¹.

The global smart farming market is predicted to more than double in five years, going from £10.5 billion in 2021 to nearly £17 billion in 2026². Global spend is also projected to reach £12.4 billion by 2025³.

North America has embraced the smart farming revolution, in part as a result of government-backed initiatives and subsidies, focusing on precision agriculture to meet a growing population and rising food demands. The region now has a global market share of 45%⁴. The UK is making progress with the adoption of smart farming practices driven in part by a series of funded research and development programmes tailored to the smart farming sector, as well as strict environmental targets.

In this report, we explore why smart farming is needed and how it aims to improve the agriculture market, as well as examine the key technologies and innovations within the industry that have been responsible for propelling it forward.



● How smart farming improves agriculture

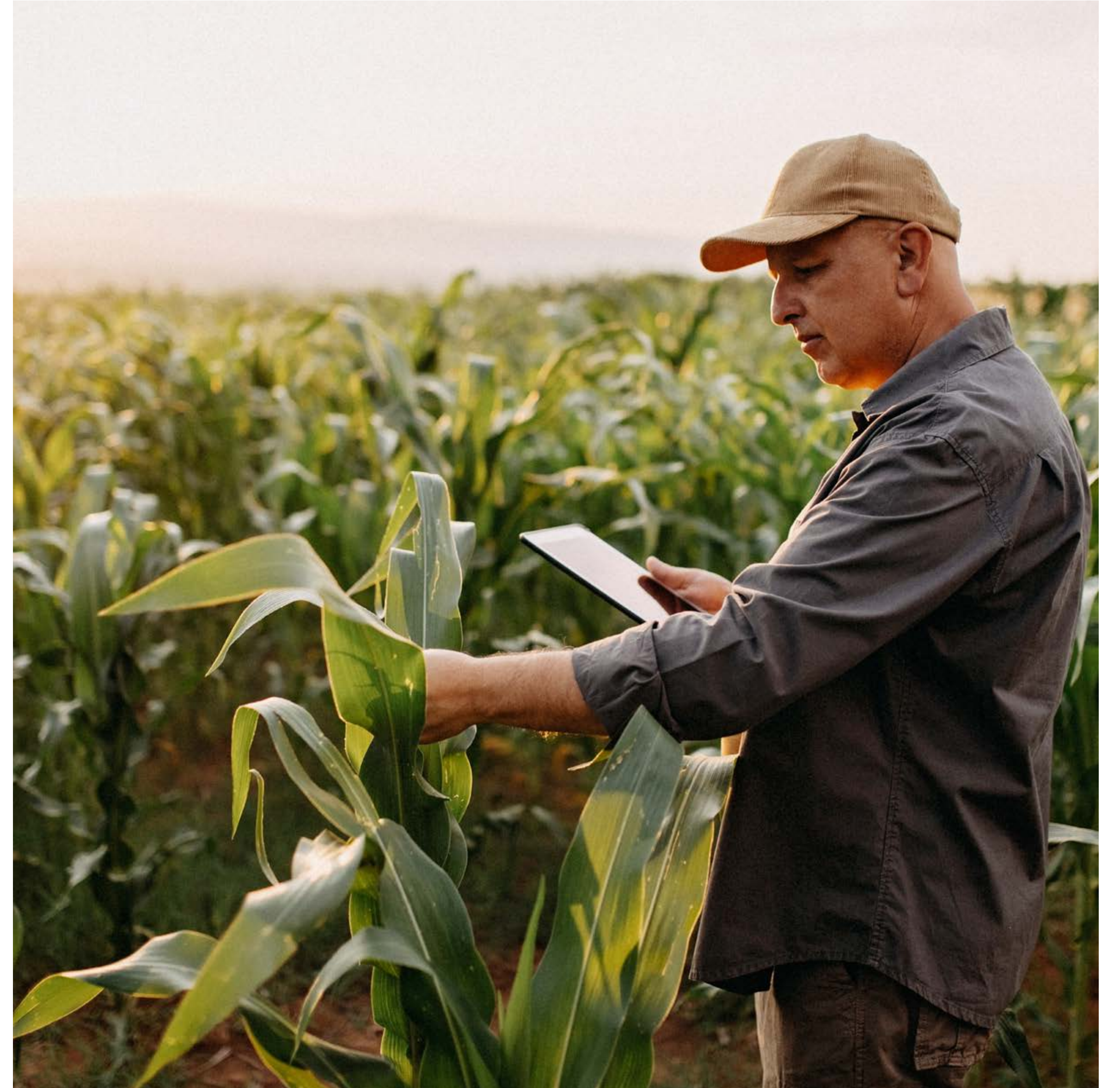


Statistics show that food production must increase by 70% to meet a growing global population⁵, which is predicted to reach 9.7 billion in 2050⁶.

The farming sector is also suffering from vast labour shortages, with events such as leaving the EU and issues around visa processing reportedly contributing to these shortages with seasonal workers reduced by up to 75% in 2022⁷. The solution for many farmers could well be smart farming. Becoming more autonomous, with the use of robotics replacing previously manually intensive jobs, helps remove some concerns about labour shortages, as farmers can redirect skilled labour and reduce some immediate operational costs.

Internet of Things technology empowers farmers to capture data to improve their overall production process, make efficiencies and prepare for the unexpected. With this data, farmers can also discover which processes could be automated, freeing up manual intensity, and improving productivity, with focus switched to the areas that most need it. This could also help minimize costs.

Data analytics give farmers detailed information about their operations in real-time too. Research indicates that farms could generate more than 500,000 data points every day⁸ via the use of data analytics solutions, such as sensing the moisture level of soil at different locations within a field. Whereas previously farmers may have simply used their experience to predict the weather, new data technologies will measure rainfall over a set period, temperature changes, wind speed and direction, air pressure and humidity. This enables them to increase crop precision and accuracy, and to monitor quality control so they can take steps to adjust processes to maximize yields, and impact profitability. This type of technology also makes the reporting process much more streamlined and greater insight means farmers can reduce their risks, making forecasting easier, as well as predicting future income.



There is also a link between smart farming and sustainability, with technology able to recognize inefficiencies in processes, reduce food wastage by identifying poor soil health, and enable the use of automated tractors and other machines for more precise sowing and irrigation.

Traditional farming can reduce the levels of nutrients and fertility in their soil, eventually resulting in a decline in yields, so it becomes an unsustainable method of farming with fields effectively becoming redundant until the nutrients are added back into the ground via fertilizers or manures.

Traditional farming methods can also contribute to greenhouse gas emissions via the use of fertilizers in crop production. However, technology, such as soil sensors, will mean farmers can use fewer fertilisers and pesticides, and those they do can be used more effectively. A host of new technologies are being developed and the hope must be that they will make changes that will help move farming towards its net zero targets.

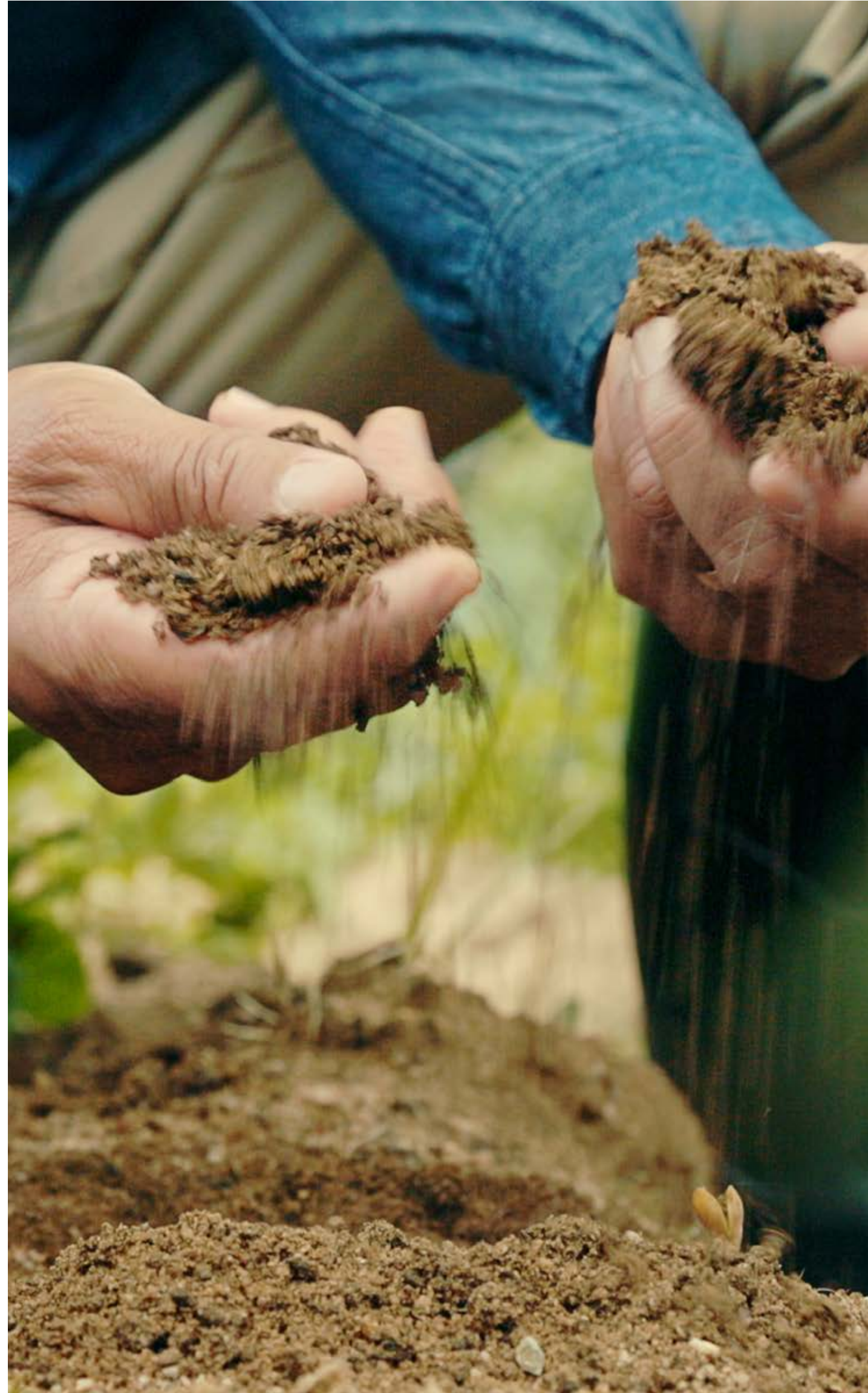
Improved productivity and profitability via automation, risks considered, easy reporting that does the job for itself, and yields maximized via insight and precision could

mean farmers get to enjoy a greater quality of life. It also means food can be produced via a more effective and sustainable method.



● The 10 key benefits of smart farming





01 Improves productivity

02 Increases profitability

03 Helps farmers to prepare for the unexpected

04 Increases crop precision and accuracy

05 Maximizes yields

06 Enables redeployment of skilled labour towards more technically proficient work

07 Helps farmers enjoy a greater quality of life

08 Improves fuel efficiencies

09 Promotes streamlined reporting

10 Aids easier forecasting

● Innovation in the industry



The smart farming industry is quite literally planting the seeds of innovation, with the use of technologies such as the Internet of Things and Software as a Service (SaaS) to shape the future of agriculture.

In the UK, thanks to the £90 million **Transforming Food Production Challenge**, which was announced by its government in 2018, more than £22.4 million⁹ has gone towards smart farming projects via its **Farming Innovation Programme**.

As part of a partnership between **DEFRA** and **UK Research & Innovation**, the Farming Innovation Programme aims to increase innovation in farming with funding committed to companies that are seeking to enhance environmental sustainability. The hope is that these projects will support farmers and governments in their ambitions of becoming net zero, whilst also creating a more efficient and productive farming sector.

● Sensors

It's predicted that around 12 million agricultural sensors will be in use over the globe by 2023¹⁰. Sensors enable farmers to monitor crops, livestock and equipment, with the ability to capture and analyse this data to inform decisions, make forecasting easier and be prepared for the unexpected.

Desamis is one company that is leading the field with smart farming technology focused on using sensors to monitor livestock and analyse data in real-time.

The monitoring of livestock is a time-consuming and costly farming activity but an important one. Desamis' U-Monitor allows farmers to keep track of the movement of each individual cow or bull, from how much they're eating and drinking, to how much they're moving, standing or lying down. Not only that, but the sensors can also be used for heat detection, to help improve insemination, and assist with early diagnosis of diseases.

Tuberscan was one of the companies which received funding from the Transforming Food Production Challenge. It used its £391,000 funding to support the development of a ground-penetrating radar, which farmers can use to monitor potato crops. As well as its sensor

technology, the firm also uses data and machine learning to enable farmers to know when their potato crops are ready to harvest. The tech firm claims its smart farming technologies could result in a 5-10% increase in usable crops.



● Software

Specializing in livestock health and welfare, **RAFT Solutions Ltd** has worked with partners in the dairy industry, including the **Centre for Innovation Excellence in Livestock (CIEL)**, **Quality Milk Management Services (QMMS)**, **Fera Science** and **OptiSense** in the development of new smart farming technology. With a £530,000 grant from the Transforming Food Production Challenge, 'RapiPath' is a diagnostic hardware and software test which allows farmers to test their dairy cattle for mastitis. The tool is being used to inform treatment decisions and reduce the dairy industry's reliance on antimicrobial medicines.



● Robotics

Robotics can be used to replace jobs that are typically manually intensive, freeing up valuable time, skills and resources, as well as making harvesting crops and other areas of farming more efficient and profitable.



Robotics can be used for seeding, weeding, watering and harvesting crops. **Abundant**, prototyped technology that combined computer vision with a vacuum end-effector to select and pick ripe fruit, which was then transferred into a bin. Similar organizations include Israel-based **Tevel Aerobotics Technologies** which uses drones and AI to autonomously pick ripe fruit from trees.

The **Hands Free Farm**, which is based in Shropshire, is another company that received funding from the UK Farming Innovation Programme. With an aim of becoming completely autonomous, the farm used its £1.5 million investment to develop robotic skills, smart machines and new evaluation technologies.

Professor James Lowenberg-DeBoer, Economist at The Hands Free Farm, commented:

"The Hands Free Farm is a great place to study the economics of crop robotics, which is presently a very sparsely researched area. As far as I can tell, this is the one place on earth - certainly within the public sector - where you can get information about a whole cropping cycle using autonomous equipment."

Artificial Intelligence (AI)

Artificial Intelligence (AI) technology brings numerous benefits, with farmers able to identify inefficiencies in their processes, gather data (which can be used to manage risks), and monitor the progress of crops, including assessing soil health, pests and diseases.

Following a Smart Grant from [Innovate UK](#), [Antler Bio](#), a biotechnology company that specializes in combining epigenetic testing of livestock with AI-driven data analysis, launched 'EPIHERD'. This platform, coined as a precision herd screening tool, provides farmers with insight into prominent genes that are influenced by specific environmental factors around them. This means they can alter factors that are within their control to improve productivity and sustainability.

Meanwhile, [aiScope](#) is an AI data platform focused on helping farmers tackle Blackgrass, a common cereal weed that is becoming increasingly resistant to herbicides. It received £1 million in investment which is going towards a forecasting tool, which uses AI and analytics, with the firm claiming its tech could save farmers up to £580 million each year¹¹.

Internet of Things (IoT)

Internet of Things technology can be a combination of other technology, allowing farmers to gather insights and analytics and to encourage machine learning, as well as enabling them to remotely control and autonomously manage aspects of their agricultural production system. [John Deere](#), a British tractor and farm equipment manufacturer, is developing Internet of Things (IoT) technology to complement its existing range of solutions, including technology that allows farmers to identify the pressure and spacing of planted seeds.



Standards for smart farming

The typical standards for agriculture can also be applied to smart farming and some of these are listed below. It should also be noted that work is underway on a new Standard: “Use of autonomous mobile machinery in agriculture and horticulture – Code of practice”.

ISO 17989 provides guidelines to help designers and manufacturers of tractors and machinery that are used for agriculture and forestry to integrate sustainability principles, practices and considerations about their organizations and processes¹².

ISO 6720 covers agricultural machinery, such as equipment that’s used for sowing, planting, distributing fertilizers and spraying. It also covers recommended working widths.

ISO 22763 refers to equipment that’s used for crop protection, such as sprayers, and provides a demonstration track for field crop sprayers.

ISO 22000 sets out the guidelines for a food safety management system that will help a business to improve its food handling and safety.

ISO 14001 provides the criteria of an environmental management system to enhance a business’ environmental performance.

ISO 15959 refers to fertilizers and pesticides, and the method for determining phosphorus in fertilizer extracts. This includes phosphorus soluble in mineral acids, water soluble phosphorus, phosphorus soluble in solutions of ammonium citrate, phosphorus soluble in 2% citric acid and phosphorus soluble in 2% formic acid.

ISO 765 is a list of pesticide chemicals that have reasonably short and distinctive chemical names or trivial names already known, to which it is deemed unnecessary to assign recommended common names at present.

ISO 8210 specifies a test procedure for the measurement and testing of all types of combine harvesters, which includes both functional and capacity tests, to assess grain loss and capacity characteristics, as well as ease of operation, adjustment, and rate of work.

ISO 8945 identifies equipment used for working the soil, such as rotary cultivator blades, and fixing dimensions.

● Conclusion



The traditional farming market simply has too many challenges to navigate. A growing population and the increased food production that will be required, alongside the impacts of leaving the EU, ongoing labour shortages and vital environmental targets, means it currently seems hard for farmers to forecast the future using their traditional farming methods. This does make smart farming attractive, however.

The sheer amount of innovation already in the industry speaks for itself. Prior to the UK's Transforming Food Production Challenge, many businesses were already exploring the potential of the smart farming market, but since the Farming Innovation Programme, this has only accelerated innovation and technology further.

With its ability to meet some of the world's biggest challenges, including addressing the food demands of a growing population and becoming more sustainable, now is the time for the UK government to increase its policy focus and introduce new funding initiatives. There's no doubt the uptake of agriculture technology among farmers is set to soar, making the market far more attractive for tech start-ups to enter the space with new smart farming solutions, but a policy focus within this area will help to drive further growth of the market.



The farms of the future, on the surface, may not look much different to the farms of today, but methods used, outputs, efficiencies and worker wellbeing could well change this for the better.

Smart farming makes great business sense. And with the need to accelerate the transition to Net Zero in this as much as in other sectors, new approaches and technology aimed at improving outcomes, will be welcomed and prioritised. While some farmers may initially start with one type of smart farming technology, it surely won't be long until the majority are embracing available technology, opting for a combination of Internet of Things (IoT), sensors, robotics, drones, and artificial intelligence to maximise the full benefits.

As highlighted throughout our report, it certainly seems like now is the time for farmers to embrace the smart farming revolution that's already underway.

Did you know the BSI offers a [standards subscription service](#)? Get updates as soon as they happen, plus the ability to set your package, whether you want to create your own custom collection, choose the most relevant modules for your business, or simply access the full library of 100,000 internationally recognized standards.



Footnotes

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- **UK Research & Innovation** - <https://www.ukri.org/>
- **Desamis** - <http://desamis.co.jp/en>
- **Tuberscan** - <https://www.b-hiveinnovations.co.uk/projects/tuberscan>
- **RAFT Solutions Ltd** - <https://raftsolutions.co.uk/>
- **Centre for Innovation Excellence in Livestock (CIEL)** - <https://cielivestock.co.uk/>
- **Quality Milk Management Services (QMMS)** - <http://qmms.co.uk/>
- **Fera Science** - <https://www.fera.co.uk/>
- **OptiSense** - <http://www.optisense.com/en/home.html>
- **Abundant** - <https://waxinvest.com/projects/abundant-robots/>
- **Tevel Aerobotics Technologies** - <https://www.tevel-tech.com>
- **Hands Free Farm** - <https://www.handsfree.farm/>
- **Innovate UK** - <https://www.ukri.org/councils/innovate-uk/>
- **Antler Bio** - <https://www.antlerbio.com/>
- **aiScope** - <https://aiscope.net/>
- **John Deere** - <https://www.deere.co.uk/en/index.html>

Your next steps

- Develop a sustainable model for your business
- Consider the benefits as much as the risks
- Choose the standards that suit your needs
- Make a plan to adopt those standards

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