The future of animal health

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TIME FOR

TECH

MSD
Animal Health

Contents

Foreword

Helene Lanz, Managing Director, MSD Animal Health UK Ltd

The fabric of our existence has been shaped by a seismic digital shift, as the Fourth Industrial Revolution continues apace.

In an era of rapid agri-tech acceleration, it is crucial these profound developments are embraced throughout the UK's livestock supply chain to deliver the greatest advantage. The publication of 'Time for Tech' outlines the opportunities that lie ahead, advocating for a unified, technology-driven approach that promotes animal welfare, sustainability, and reduced antimicrobial use in line with the One Health approach.

Precision livestock farming (PLF) technologies offer solutions that deliver positive outcomes across key global issues. Real-time monitoring systems provide behavioural data that can be used to help detect health issues. They can also help to combat antimicrobial resistance (AMR) by assisting with quicker intervention that can minimise infection spread and reduce antibiotic reliance.

Economically, PLF enhances feed efficiency, growth rates, and breeding outcomes, contributing to the sustainability of livestock businesses. Furthermore, these technologies help to ensure a reliable food supply and empower staff by automating routine tasks, as well as providing insight to trusted on-farm advisors to make faster, more informed decisions.

While R&D innovation continues, uptake of technologies remains inconsistent. Frequently, advocacy for technological advancement in livestock farming can be met with a degree of scepticism. Some see technology as a threat to job security, or prohibitively complex and expensive, especially for smaller enterprises.

Navigating a transition where emerging technologies become integral on farm is key to reducing resource use and lowering the livestock sector's environmental impact.

At MSD Animal Health, we believe technology is a key component of 21st century farming. In recent years, our business' biopharma portfolio has been complemented by the acquisition and investment in agri-tech solutions. Preventative vaccination and treatment in tandem with real time data insights are key to delivering higher welfare, and improved production efficiencies through informed farm management decisions, and enabling greater traceability and transparency in the supply chain.

To gain widespread traction, PLF technologies require greater collaboration, integration and understanding. Only then can we change behaviours and achieve better outcomes. We hope this report helps to stimulate wider discussions.

Technology can promote positive change. Not by making decisions, but through the analysis of data and predicting trends. It is people who remain the essential connectors, though. Their stockmanship skills and compassion continue to be an essential component in the transition to widespread adoption. Ultimately, dedication and care cannot be substituted.

When farmers trust, engage, and interpret the data effectively, we will all benefit from them harnessing technology's ever-increasing capabilities. The time for tech is now and MSD Animal Health is leading the change.

> ***"Real-time data monitoring and analysis bring actionable insights that inspires behavioural change."***

Executive Summary

Introduction

Contributing £14.7bn to the economy in 2020 (Innovate UK, 2020), the UK's livestock sector stands at the threshold of a technological transformation. The publication of 'Time for Tech' highlights the benefits of the widespread integration of advanced technologies that promote animal welfare, reduced antimicrobial use and a sustainable future for the industry.

Exploring the opportunities and barriers currently facing livestock farmers, this white paper advocates for a unified, technology-driven approach. An approach that helps mitigate climate change while feeding a rapidly growing global population through accelerated innovation and enhanced production efficiencies, and aligns with the World Health Organization's One Health initiative.

Technological opportunities

Real-time behaviour monitoring systems provide data that can assist with early detection of potential health issues and optimise environmental conditions for livestock, leading to improved health and welfare outcomes. Precision livestock farming (PLF) technologies could contribute to reducing greenhouse gas emissions, enhance land use efficiency, and lead to significant environmental improvements.

Additionally, continuous behaviour monitoring enables immediate health interventions, minimising infection spread and reducing reliance on antibiotics. A crucial step towards fulfilling the UK's antimicrobial resistance (AMR) targets.

> ***"PLF enhances feed efficiency, growth rates, and breeding outcomes, promoting the long-term sustainability of livestock businesses."***

Improved health management and disease control also lead to more consistent production, securing a reliable food supply. Meanwhile, the automation of routine tasks empowers staff to focus on skilled activities to optimise the use of valuable resources.

Technological barriers

British farmers face increasing pressure to produce more from less. Any incremental improvements in livestock management can have a profound influence on delivering efficiency improvements and more. However, the initial investment required for advanced technologies can be prohibitive, especially for small and medium-sized enterprises.

Culturally, some traditional livestock farms are resistant to new technologies, incorrectly seeing adoption as overly complex, which poses a significant barrier to wider uptake.

As agri-food systems come under increasing scrutiny, societal pressures also play a role. With the green agenda continuing to gain traction in public, corporate and policy debate, there are increasing demands on farmers and the supply chain to mitigate their environmental impacts. Yet, there is a lack of supply chain and policy co-ordination that could better support farmers to drive these important improvements through PLF.

Change is underway

In recent decades, ongoing advancements have revolutionised animal husbandry, leading to improved efficiencies, better animal welfare, and enhanced management practices. As highlighted by Professor Jude Capper on pages 8 – 11 in this paper, modern livestock systems have the potential to lower environmental impact while maintaining food affordability through reduced resource use and greenhouse gas emissions per unit of food produced.

Featuring five farmer case studies across each of the livestock sectors, the white paper outlines the first-hand benefits gained by applying advanced techniques that automatically monitor and manage animal production. Each example highlights the common focus on improving health, welfare, and efficiency.

These advances have the potential to complement existing human-animal interactions through real-time, data-driven decisions, that enhance traceability and overall livestock management.

Taking decisive action for the sector's future

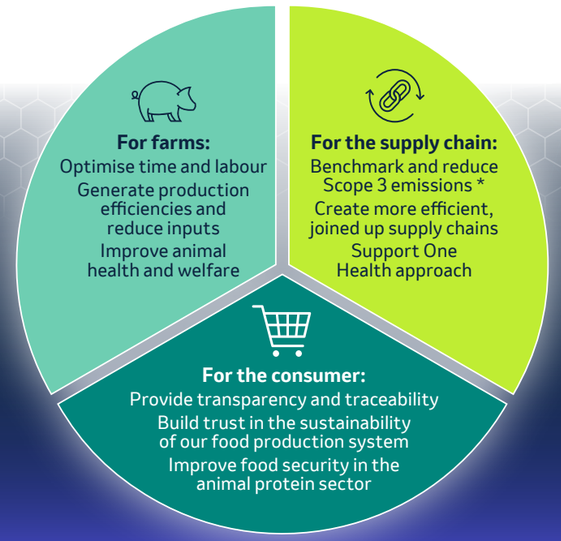
To fully harness the potential of PLF technologies, MSD Animal Health recommends targeted regulation and policies that encourage technology adoption at farm level. Offering financial incentives for precision-farmed livestock and ensuring data transparency across the supply chain are crucial steps.

By establishing a connected industry framework that commits to technology integration throughout the supply chain, it will become possible to drive widespread adoption and realise the subsequent benefits across the board.

The time for tech is now

This white paper envisions a future where technology and human expertise converge to create a sustainable, efficient, and health-focused livestock sector. Through a proactive 'big picture' approach, farmers can initiate timely interventions and productivity enhancements that promote the health of people, animals, and ecosystems.

By embracing advanced technologies and fostering collaboration among industry stakeholders, we can achieve significant improvements in animal welfare, environmental sustainability, and economic viability. The time for tech is now, and MSD Animal Health is at the forefront of this transformative journey.



The impact of technology

Integrating leading animal health and welfare solutions and data driven science and technology, can not only meet current environmental and health standards but set new benchmarks for the future.

* All indirect emissions that occur in the upstream or downstream activities of an organisation.

Innovations in technology and monitoring

Opportunities for the livestock sector

- **Higher health and welfare:** Real time monitoring provides data on behaviours that can assist with detection of potential health issues.
- **Environmental improvements:** PLF could potentially help manage waste, reduce GHG emissions, and improve land use efficiency
- **Antimicrobial resistance (AMR):** Continuous health monitoring allows for immediate intervention, minimising spread of infection and reducing reliance on broad spectrum antibiotics
- **Economic efficiencies:** PLF can reduce costs and increase profitability by enhancing feed efficiency, growth rates, and breeding outcomes which all directly contribute to the economic sustainability of livestock businesses
- **Food security:** Improved health management and disease control leads to more consistent production, ensuring a reliable food supply.
- **Labour empowerment and resource management:** The automation of routine tasks allows staff to focus on more skilled activities and optimises work allocation to improve operational efficiencies

Barriers to technology adoption

- **Initial investment:** Cost required for advanced technologies and infrastructure in PLF can be prohibitive for small and medium-sized enterprises
- **Complexity and lack of understanding:** The complexity of PLF systems can be a significant barrier, requiring specialised knowledge and training for installation, operation, and maintenance
- **Cultural resistance:** Traditional farms may be resistant to adopting new technologies due to preferences for conventional or generational farming methods
- **Cascading information:** Systems and capabilities are constantly evolving, so not all adopters are using full functionality of technology

50 years of technological advances

The evolution of technology across various livestock sectors and providers has progressed rapidly. A series of innovations continue to transform animal husbandry, improving efficiencies, animal welfare, and management practices.

> *"We need to have farmers on board because when changes are needed it will be up to them to implement them with MSD Animal Health providing support every step of the way."*
>
> Monica Miravalle, Customer Success Specialist, MSD Animal Health

KEY: SHEEP, BEEF, DAIRY, PIGS, POULTRY

1980s

Ultrasound scanning
Assesses body condition and reproductive status improving breeding efficiencies.

Genetic selection tools
Enhances herd traits such as milk yield, disease resistance and longevity.

Pedometer heat detection
Automated technology improves reproduction rates.

Genetic improvement programs
Help enhance traits such as growth rates, feed efficiency, and robustness.efficiencies.

Environmental control systems
Improves ventilation, temperature, and humidity control, critical for bird health and productivity.

1990s

Electronic identification (EID) tags
Improves record-keeping and traceability, manages breeding programs and health records.

Electronic identification (EID)
Improves record-keeping to enhance traceability in the push for better herd management practices.

Automated milking systems (AMS)
Flexible milking times reduce stress, increasing milk yield and quality.

Electronic sow feeding systems (ESF)
Individualised feeding in group housing, improve welfare by reducing aggression.

Automatic feeding systems
Supports improved feed efficiency and reduced labour costs.

2000s

Automated drafting gates
Efficient sorting reduces labour and stress on the animals.

Genetic testing and marker-assisted selection
Identifies traits like disease resistance, meat quality, and yield to improve quality and consistency.

Precision dairy farming
Wearable collars track individual cow health metrics, leading to earlier intervention and improved welfare.

Automated sorting technologies
Manages pigs based on weight and body condition, optimising market readiness and health.

Precision feeding and weighing systems
Optimises feed intake and growth rates, directly impacting health and productivity.

2010s

GPS collars
Manages pasture usage, enhancing land use and animal health.

Automated weighing and monitoring system
Real-time data on herd performance maximises growth rates.

Precision feeding systems
Nutritional intake based on individual animal minimises waste while maximising growth and health.

Health monitoring wearables
Detects disease, improving welfare and reducing economic impact of disease outbreaks.

Advanced robotic feeders
Individualised feeding enhance efficiencies and health.

Sensor technology
Ear tags automatically detect heats and monitor for early signs of illness, leading to prompt care.

Real-time ultrasound for body condition scoring
Assesses body condition and reproductive status, aiding breeding programmes.

Remote monitoring and management software
Tracks flock performance, health, and environmental conditions in real time.

2020s

Drones and aerial imaging
Monitors pasture conditions, herd location and health status to overcome labour shortages.

AI and machine Learning
Predicts outcomes and suggesting management changes, supporting decision-making support in large-scale operations.

Automated welfare monitoring systems
Continuous monitoring of health parameters, ensure adherence to welfare standards.

Blockchain traceability
Ensures the integrity of data on milk origin, processing and quality, directly benefiting consumer trust and animal welfare

Smart barn technologies
Delivers continuous health monitoring, environmental control, and automated feeding strategies.

Smart barn technologies
Delivers continuous health monitoring, environmental control, and automated feeding strategies.

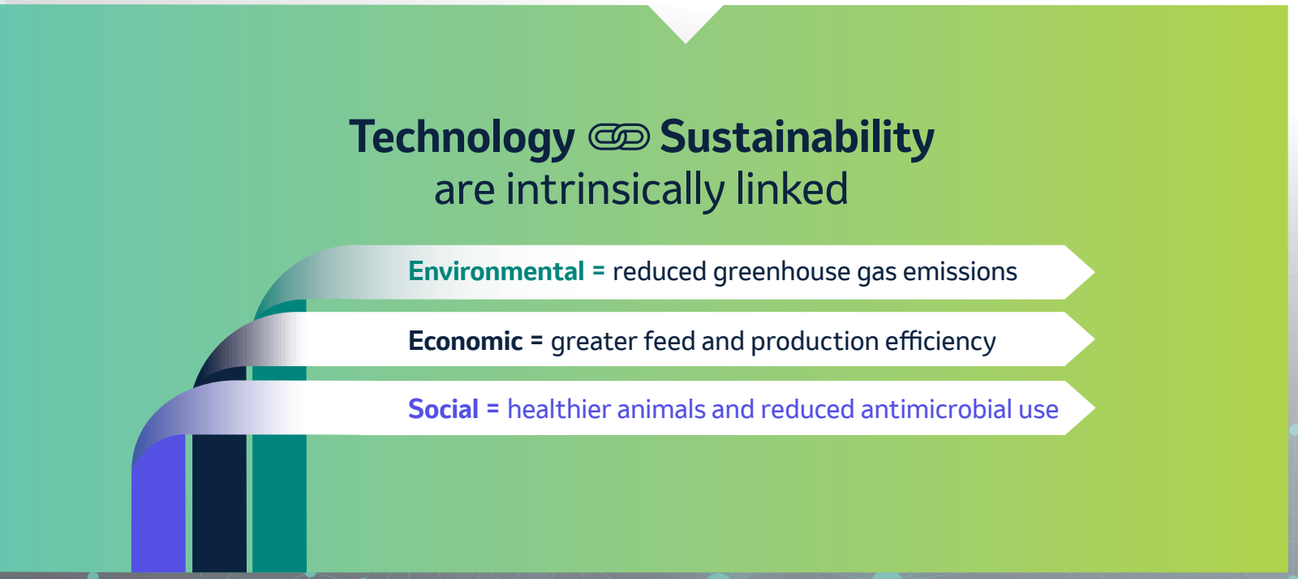
AI and machine learning
Monitors and predicts disease outbreaks, enhancing biosecurity and overall flock management.

Professor Jude L. Capper
ABP chair and Professor of sustainable beef and sheep systems at Harper Adams University

The impact of technology on the sustainability of the livestock sector

Improving livestock productivity can benefit all facets of sustainability – **environmental, economic and social.** Across the globe, the increased milk, meat and egg yields conferred by advances in nutrition, genetics, husbandry and technology over time have reduced both resource use and greenhouse gas emissions per unit of food produced. This means that modern livestock systems can have a lower environmental impact, while keeping foods affordable to consumers.

Fundamental to a sustainable and secure food system is excellent livestock health and welfare. Animals that are sick, stressed or in sub-optimal conditions cannot perform as well as their healthy counterparts. Diseases that reduce yields, growth rates or reproductive performance mean that increased resources are required to produce the same quantity of product with a commensurate increase in greenhouse gas emissions and, potentially, antimicrobial use.



Complementing human-animal interaction to secure better health outcomes

Precision livestock farming applies techniques and technologies to automatically monitor and manage animal production; enhancing the detection and management of animal disease through improved data collection and analysis.

Precision technology allows the farmer to be alerted to subtle behavioural changes that might not be obvious to the human observer; and to manage animals at the individual level, regardless of herd or flock size.

This is important because changes in normal livestock behaviours are often associated with a less-than-ideal health or welfare status. For example, reduced rumination can be an early indicator of mastitis in dairy cattle, a disease that is responsible for a significant number of cows being culled each year and annual economic losses of over £168 thousand in the UK alone (Capper, 2023).

These technologies can also provide the animal with greater autonomy and therefore improved welfare. For example, robotic milking technologies allow dairy cows to choose when to be milked compared to traditional systems, enhancing both welfare and performance measures, as well as reducing greenhouse gas emissions (Kamila Ewelina Mazur, Barwicki and Vitalii Tseiko, 2024).

In this instance, technology plays a key role in early disease detection and prompt intervention, leading to better animal health and welfare outcomes. This is intended to complement (not replace) the human-animal interaction while enhancing evidence-based decision making.

Evidence-based management decisions for health and welfare

On-farm technologies range from simple external pressure monitors that can be used to detect oestrus, to internal or external (wearable) sensors that monitor activity, body temperature and pH. Integration with mobile phone apps allows farmers to receive real-time alerts, so that prompt action can be undertaken, for example, a ewe that requires assistance while lambing, or a sow that requires veterinary treatment.

The same devices allow farmers to prioritise resources to improve cow and new-born calf health. As many dairy cow diseases occur in the six weeks around calving, this is a critical period for cow welfare, when safeguarding the survival of the dam is key to reducing calf mortality rates.

Closely monitoring cows' behaviour can help to ensure that they are healthy prior to calving, meaning they are less likely to suffer from metabolic diseases such as subclinical ketosis. However, if disease subsequently occurs there is a greater chance of it being cured when detected early (Cascone G., Licitra F., Stamilla A. et al., 2022) through data records.

Technology can also aid management decisions in situations where livestock may not be easily observed or located. In extensive pasture-based systems, there are significant opportunities for PLF to improve productivity, health and welfare, for example with GPS tracking.

Similarly, the implementation of electronic identification tags in a Scottish hill sheep system allowed individual animal weights to be monitored over a three-year period. As an indicator of parasitic infestation the recording of poor weight gain during this study helped reduce total anthelmintic use and labour by 46% and 36%, respectively, and improve economic metrics by 12.5% (Morgan-Davies C., Lambe N., Wishart H. et al., 2018).

Effective parasite control in grazing lambs reduces both age at slaughter and greenhouse gas emissions per kg of weight gain (Kenyon, Dick, Smith et al., 2013), yet many sheep producers do not currently have the infrastructure to handle or weigh stock on a regular basis.

Lower anthelmintic use could also confer valuable ecosystem benefits given the importance of reducing anthelmintic resistance for One Health, and potential negative impacts of anthelmintics on invertebrates and microorganisms essential for soil health.

A focus on lameness

Lameness is a major welfare issue widely recognised by the public, and an example of where technology can enhance livestock wellbeing, as well as providing reassurance to the consumer. Camera-based technologies offer the opportunity for animal locomotion to be assessed automatically and potential lameness identified at an early stage.

This is particularly useful for broiler chickens, which can develop foot and leg problems as they reach maturity, as these technologies do not require birds to be handled, thereby reducing potential stress (Aydin, 2017).

In one dairy study, assessing the different positions that cattle adopt while being milked through a specialised weighing platform allowed researchers to identify lameness issues with a 96% success rate (Pastell and Kujala, 2007).

Camera-based technologies could also confer significant sustainability gains in dairy cattle given that lameness affects up to 30% of cows (Randall, Thomas, Remnant, et al., 2019) and increases milk greenhouse gas emissions by 1.5%-7.8% (Mostert, van Middelaar, de Boer, et al., 2018) (Chen, White and Holden, 2016).

External sensors that monitor resting, feeding and walking behaviours can also help to determine lameness with a high degree of accuracy (Van Hertem, Maltz, Antler, et al., 2013). Wearable sensors applied to sheep have also shown promise for lameness identification, with one study correctly classifying sheep lameness in over 80% of cases (Kaler, Mitsch, Vázquez-Diosdado, et al., 2020).

Linking health and food security

Utilising technologies that provide data or information that helps diseases to be detected and identified more quickly can therefore have significant food security benefits as well as improving sustainability.

One example of improving food availability through the supply chain is the control of porcine reproductive and respiratory syndrome. Vaccinating sows against this disease could cut greenhouse gas emissions between 4.5% (low disease prevalence) and 34.9% (high prevalence) while producing up to 14.0% more pork to supply consumer demand (Capper, 2023).

Similarly, the recent outbreak of African Swine Fever resulted in losses of over 150 million pigs worldwide. If this disease risk could have been anticipated and controlled, the consequent increase in pork prices of up to 38% would have been avoided and pork could have been supplied to an extra 538 million people (Capper, 2023) (Mason-D'Croz, Bogard, Herrero, et al., 2020).

Productivity losses span all livestock species. In the dairy sector losses attributed to mastitis in the average dairy herd lead to a 6% increase in greenhouse gas emissions per kg of milk, which increases to 11% in the 10% of herds most affected (Statham, Scott, Statham, et al., 2020). Considerable improvements have been seen over time - the current median incidence of mastitis in the UK is 22 cases per 100 cows per year, compared to 36 cases per 100 cows per year in 2016 (Hanks, Taylor and Kossaibati, 2024), yet this could be improved further if it were diagnosed and treated at the earliest opportunity.

Technology's impact on emissions

Within dairy systems, technology that detects cows in oestrus helps improve the chance of cows being served at the correct time and therefore conceiving. Fertility affects both the productivity and efficiency of dairy operations. Reducing replacement rates, having shorter calving intervals and increasing lactation efficiency can all positively influence the emissions intensity of milk production.

Research indicates that improving dairy cow fertility could reduce greenhouse gas emissions by up to 7% in the average herd, and 16% in the 10% of herds with the lowest results (Statham, Scott, Statham, et al., 2020), therefore this has considerable potential as a tool to improve dairy sustainability.

Compared to a healthy cow, the carbon footprint of a cow with subclinical ketosis increases by 2.3% (Cascone, Licitra, Stamilla, et al., 2022) through reduced feed efficiency, which is a relatively small increment, but can have significant implications at the herd level. In a 500-cow herd, the increase in annual greenhouse gas emissions caused by subclinical ketosis would be equal to 23 tonnes of CO_2e – the annual emissions of 12.8 cars.

Cows with subclinical ketosis are also at increased risk of other health disorders in early lactation, including clinical ketosis, metritis and displaced abomasum, which reduce productivity and increase greenhouse gas emissions still further and may require antimicrobial treatment. Early alert to potential cases of subclinical ketosis via sensors therefore offers the opportunity to cut emissions, improve health and welfare, and reduce antimicrobial use.

Integrated technology

Technologies need not be used in isolation – combinations of cameras, pedometers and GPS systems allow beef cattle behaviour to be documented, with data that can assist with early detection of respiratory disease. In the case of infectious bovine rhinotracheitis, this could reduce greenhouse gas emissions from beef production by up to 20% (ADAS, 2015) and reduce the need for antimicrobial treatment of secondary infections.

Genomic testing offers additional opportunities for early disease detection, with integration of rapid genome sequencing kits and mobile apps potentially being able to aid in the understanding of diseases that can have considerable impacts on livestock sustainability.

The impacts of being able to use genomic technologies to identify and implement early control evidence-based measures for Johne's Disease, which confers increases in greenhouse gas emissions of up to 24% (dairy cattle) or 40% (beef cattle) would have considerable sustainability benefits for livestock producers (ADAS, 2015).

Summary

Technology has a key role to play in the early detection of animal disease.

From a health and welfare perspective, animals that receive prompt treatment are more likely to recover quickly, with fewer negative impacts on welfare. Early detection and treatment can also decrease disease severity and the risk of secondary infections, thereby reducing reliance on antimicrobials and lessening the risk of antimicrobial resistance.

Together, these benefits reduce the negative effects of disease on productivity, thereby helping to mitigate greenhouse gas emissions and resource use.

The challenge is to widen the adoption of technologies across farming systems, both intensive and extensive, such that the sustainability benefits of technology can be realised across all livestock sectors.

The dairy landscape

Labour challenges and extreme market volatility in the dairy sector have placed huge pressure on producers. Research indicates that 58% of farm businesses are finding it harder to source workers than in 2019, despite pay increasing by almost a quarter during the past four years (Farmers Weekly, 2023). At the end of October 2023, poor farmgate returns saw a 4.5% decline in the number of UK dairy farmers (McCullough, 2024).

Faced with increasingly unpredictable circumstances, many farmers are seeking to make improvements to production strategies by adopting a more dynamic approach to maximise efficiencies (AHDB, 2024).

> ***The SenseHub system gives the cow a voice and is a really useful way of assessing treatment efficacy. It also helps to confirm what we might think is happening and enables vets to determine whether or not an animal needs treating.***
>
> *Mark Glover (vet)*

MSD Animal Health Demonstration Farms Initiative showcases joined up approach to health and welfare

Through the Demonstration Farms Initiative, MSD Animal Health is working with five dairy farms and their vets over a three-year period to optimise the health of their herds, through a joined up approach to vaccination and precision livestock technology on farm.

The findings of this initiative will then be shared with the wider industry to showcase how this approach can build more resilient and productive farm businesses.

Technology's role in future proofing the dairy sector

Technology is moving quickly, providing dairy farmers with a lifeline to reduce external impacts and ensure their businesses thrive.

Access to intelligent monitoring systems and continuous on-farm data can help unlock the full potential of the UK's national dairy herd. By providing a clearer insight into the daily realities of livestock management, farmers are empowered to make informed decisions that enhance wellbeing, productivity and sustainability.

Case study: **Willow Tree Farm,** Yorkshire

Howard and Tom Pattison run an AHDB strategic dairy farm near Northallerton with an operational focus on improving sustainability through enhanced production efficiencies.

Since installing SenseHub® Dairy in March 2022, they have made significant improvements to the performance of their 280 pedigree Holstein herd with 130 followers.

Calving and housed all year round, the closed herd currently sits in the top few percent of UK dairy herds in terms of lifetime yield, with a current figure of 23.4kg of milk per day of life.

The Pattison's approach to data analysis is helping ensure heifers enter the milking herd at an optimal age, contributing to long-term sustainability and profitability of their family farm business. By monitoring reproductive cycles and optimising insemination timing, Tom is minimising resources and maximising operational efficiencies.

" Data records are helping us achieve better conception rates," says Tom. "Getting the heifers into the herd as quickly as possible has been a real push for us. The system has helped us do that by taking the guesswork out of heat detection."

Continuous monitoring also facilitates proactive health management. Tom can swiftly identify deviations from normal behaviour, such as reduced activity or decreased rumination, indicating potential health issues like metritis.

" The health benefits of monitoring every cow 24/7 are paramount. The system sends a distress alert if there is either insufficient rumination or eating time for an extended period. It means you can respond immediately," says Tom.

Beyond reproductive and health management, monitoring technology is providing a comprehensive overview into various aspects of herd management. From transition periods to milking cow phases, the system generates actionable data that informs decision-making at every stage.

Improvements at a glance

- 8% improvement in conception rates to 36%
- 34% reduction in the use of fertility treatments
- Reduced the average age at first calving by 22 days
- Age at which heifers are first served reduced by 10 days
- Maiden heifer conception rate improved by 15%

The poultry landscape

Growing at an annual rate of 2-3% in the UK, the poultry industry is the most rapidly increasing protein sector globally, with chicken making up more than half of all meat consumed in Britain (Hook, 2025). As the poultry industry continues to expand, it will require greater operational efficiencies, especially as retailers align with customer demand for higher welfare chicken (Farming Online, 2023). Some major retailers have pledged to reduce stocking densities (Farming UK, 2024 and Southwest Farmer, 2024) through the Better Chicken Commitment (The Better Chicken Commitment, 2024).

Typically housed in barns holding 25,000 – 50,000 birds, UK broilers are commonly reared on six-week rotations (Welfare of meat chickens, 2022). If something goes wrong with a flock, the liabilities are considerable, as seen with the 5.5 million birds lost to Avian Influenza between October 2021 and November 2022 (www.kingston.ac.uk, 2022).

Since announcing its influential Chicken Antibiotics Policy in 2017, McDonald's has set the standard for industry compliance. In the UK, there has been a 98.7% reduction in use of Critically Important Antibiotics since 2012 (Maxwell, 2023).

Hot on the heels of welfare comes questions around sustainability, particularly around feed and soya production (The Ranger, 2021).

In growing a chicken up to two thirds of the cost is feed (www.thepoultrysite.com, n.d.). Technology that supports feed reductions means that not only is the farmer achieving better performance, but there is also a positive environmental outcome.

Technology's role in future proofing the poultry sector

Operating such intensive systems can create sizeable challenges for producers. By constantly measuring temperature, humidity, light, feed and water intakes, PLF systems can automatically create alerts based on any changes to set parameters.

As a result, operations are more efficient, and welfare is higher. PLF barns may use less energy, with birds consuming less feed and requiring fewer antibiotics – factors which contribute to improved sustainability, helping reduce the risk of AMR, as well as conforming to the 'Five Freedoms' framework developed by the Farm Animal Welfare Committee (FAWC).

Case study:
Hay Farms, Herefordshire

Headquartered in Ross-on-Wye, Herefordshire, Hay Farms produces 25 million broiler birds annually across 18 farms from South Wales to North Yorkshire. As the business expanded, co-directors Ben and Jonty Hay recognised the need for a comprehensive, real-time view of their operations to maintain high bird health and welfare standards.

"Poultry farming is about attention to detail," explains Ben. "Monitoring the environment from minus three days during shed preparation to five-day-old chicks is critical, with a focus on temperature, humidity, and CO2 levels. Ensuring shed conditions are adjusted to different growth stages is essential for maintaining welfare and performance."

Motivated by the need for a '360-degree' view, Ben integrated SenseHub® Poultry for its wireless sensor capabilities and extensive data points.

" With SenseHub®, we're getting over 40 data points per shed, compared to five or six with our previous system, monitoring temperature, humidity and CO2 in real-time," he explains. The technology's ease of setup, requiring no extensive cabling, made it a practical choice.

The benefits quickly became apparent, helping to identify cold spots and inconsistencies in shed conditions. "Previously, we'd relied on assumptions, but now we can turn to heat maps. It's like an additional pair of eyes scrutinising each farm," says Ben.

Another advantage is the system's ability to monitor CO2, particularly during catch times when higher levels distress birds.

Beyond operational improvements, the technology has transformed farm management and staff accountability, moving evaluations from subjective feedback to evidence-based metrics. "There's much to be said for using your eyes and ears but having data and quantifiable evidence is crucial; it's focused the mind, allowing us to confirm hunches and intuitions," Ben explains.

The technology has enabled Hay Farms to incentivise staff performance, a key driver of profitability. "Good stockmanship is key but, like many industries, accessing the appropriate skills is becoming challenging. This system helps bridge that gap by providing clear bird performance metrics, ensuring staff are rewarded for achieving KPIs," he adds.

Looking ahead, Ben is optimistic about SenseHub® Poultry's potential to improve bird quality at the processing level. "Improving overall bird health could lead to better meat yields and fewer rejects at the factory," Ben says, acknowledging these benefits are still being measured.

> ***"As the industry evolves, having data-driven insights will be essential for meeting regulatory demands and consumer expectations. I see this technology becoming a key tool for audits and maintaining compliance with industry standards."***

The pig landscape

In the UK, producers are only recently recovering from one of the biggest crises of the past 25 years, during which labour shortages, rising input costs and volatile market prices culminated in mass culling and unprecedented economic losses.

Yet, in order to meet growing global demand for food, the sector must become more sustainable - driving efficiencies and ultimately producing more from less. Pig health and welfare is central to this, as healthier animals require less inputs, and produce more sustainable food. This is where technology can play a critical role.

Technology's role in future proofing the pig sector

Precision pig farming can enhance on-farm decision making, leading to improved animal health and welfare, increased labour efficiency, and better resource-use efficiency (Akinyemi et al., 2023). Yet, on-farm infrastructure and existing management practices, which can be laborious and time consuming, are barriers to adoption. A lack of long-term policy certainty and funding also impact the uptake of technology (Social Market Foundation, 2022).

Technology also presents a benefit to retailers who are attuned to a growing consumer demand for transparency and information on food provenance (Food Standards Agency, 2024).

Widescale adoption of tracking and monitoring technology could offer enhanced traceability and accountability, as well as replacing the current traditional method of livestock ID, slap marking. Yet, there is currently no legislation in place which supports the adoption of new technology or the unlocking of data in the pork supply chain.

Case study: **Joe Wilson,** North Yorkshire

Joe Wilson is a third-generation pig farmer, managing a 750-sow breeding unit taking pigs to 50 kilos, on a weekly production system of 34 farrowings per week.

He is the first farmer in the UK to trial LeeO, a piglet and sow ear tagging system which allows farmers to register, monitor and track each individual pig from birth to slaughter. Installing the equipment in March 2024, Joe is using LeeO to record information across the breadth of the farm's KPIs from conception rates, birth weights and days to slaughter, through to piglet movements and any interventions they may have required.

Data is collected from the moment a piglet is tagged, allowing Joe to make real-time and science-backed management decisions on breeding, health and welfare, to improve the long-term financial, environmental and social sustainability of the herd.

> ***"Precision pig farming is revolutionising how we think about our production systems."***

" By tagging every individual pig, room and barn, I can get to the nitty gritty of efficiencies, which is key to adding value to the pig. I can influence growth and the time it takes us to get to slaughter, making instant decisions over the best sows for breeding stock, to go with the best sires.

It also gives me traceability over diseases such as congenital tremors and over time, it will show me a sow's progeny and genetic robustness. Breeding decisions will be made to reduce incidents of scour, or lameness or breed genetic diseases out completely.

It also saves physical time on the farm for our small team. Handwritten notes back at the office are now digital entries into an app at our fingertips. It's made us all more efficient."

Joe explains that with full adoption at abattoir level, he would also have visibility of meat yield of the carcase, which could be used to enhance and refine his nutrition strategy, saving money and wastage.

" LeeO takes the guesswork out of herd management and allows me to create the fastest growing, and healthiest pigs. The supply chain must see the value and offer a higher price per kilo for a tagged pig, which comes with a whole host of data. It has to stack up financially for the farmer."

The sheep landscape

As the largest lamb producer in Europe, the UK operates a unique stratified sheep system which plays to the strengths of different breeds and habitats (NSA, n.d.). With animals predominantly grazed on otherwise commercially unviable land, many sheep farmers generally experience lower productivity and profit margins compared to other livestock sectors (Kaler and Ruston, 2019).

Technology's role in future proofing the sheep sector

The integration of technology has potential to enhance welfare, reduce antibiotic usage and improve sustainability in the sheep sector. Yet a widespread change in mindset is required to achieve these goals.

Multiple studies show that although many sheep farmers acknowledged the potential of precision technology to improve their farm businesses, they also regard it as a threat, as well as costly and difficult to use (Lima et al., 2018).

Initiatives aimed at improving farmer's understanding of precision technology have the potential to bridge the 'digital divide' (Warren, 2002) between sheep farmers and larger-scale arable and dairy farms. Industry focus should be on enabling farmers to assume greater control in optimising health and welfare through the adoption of tech.

As evidenced in MSD Animal Health's Flock Health Checklist Survey (January 2024), a significant percentage of sheep farmers are neither digitally or manually recording their gains or losses:

- 22% of farmers do not scan pregnant ewes
- 33% do not investigate abortions
- 58% do not record lamb losses between scanning, birth and weaning
- 7% routinely use preventative antibiotics at birth
- 27% do not record lambs' Daily Liveweight Gain (DLWG)
- 23% do not record links between ewes and their lamb's performance
- 23% do not review medicine and lambing records to identify issues.

Case study:

Sezincote Farms,

Gloucestershire

The 2,000 acre organic, mixed farm enterprise near Stow-on-the-Wold consists of a beef herd and arable crops. In 2019 a flock of 600 sheep were introduced.

Sam McPherson single-handedly manages the flock relying on his sheepdog, mobile handling race, an EID stick reader and a flock management smartphone app. All the flock's breeding, movements, weight and medicine records are saved to the app and automatically backed-up to the cloud.

Managing high levels of lameness was a significant issue initially, with 15% of sheep affected. Lameness has serious welfare implications and costs to the UK industry £28 million per year (www.nadis.org.uk, n.d.). In addition, two thirds of antibiotic use in sheep is thought to be used in treating lameness (www.nadis.org.uk, n.d.).

To meet his ambitions of expanding the flock, Sam knew lameness levels needed to be reduced.

" To make keeping accurate lameness and treatment records easier, I replaced my original paper-based system with EID tags, a digital stick reader and smartphone app to record each and every animal movement, treatment and handling event," says Sam.

Lambs are weighed fortnightly, to determine when they're ready to leave the farm as well as checking for any underlying health, nutrition, or welfare issues. The weight is automatically saved, and data is presented in simple graphs and charts which track individual animal's progress and has helped improve grazing efficiencies.

" Digitally capturing data has been a real game-changer. It makes record-keeping much less time consuming and more accurate compared to a paper-based system. It also makes farm audits much less onerous as all the flock's records are kept in one place," he ad

Improvements at a glance

- Lameness reduced from 15% to 2%
- Flock size increased by 17%
- Reduced antibiotic use by 80%.

The beef landscape

Beef accounts for 12% of the UK's agricultural production in terms of total value (Defra, 2022). With beef cattle fed a diet of 70% grass, a forage-based approach accounts for 87% of UK beef production (Defra, 2019). This accounts for GHG emissions from the sector being around half the global average (Land use: Policies for a Net Zero UK Committee on Climate Change, 2020).

In 2022 the production value of UK beef reached an all-time high, doubling in comparison to prices in the mid-2000s (Statista, 2023). Yet low profitability in the sector is a major barrier to tech-adoption for many small-scale producers.

The beef sector consistently experiences significant losses that could be addressed through tech-adoption. An estimated 18% of suckler cows fail to produce a calf annually (AHDB, 2019), placing a high burden on farmers. Similarly, only 35% of suckler herds calve their heifers at the recommended 24-months (AHDB, 2019).

The future of British beef enterprises relies on the ability to improve sustainability in terms of ecological impacts and increasing profitability.

Technology's role in future proofing beef farming

Technology can play a valuable role in reducing calving age to two years and bringing down development costs while increasing lifetime productivity; advancing reproduction strategies and improving the herd's overall genetic merit through accurate heat detection to optimise artificial insemination (AI) efficiency.

Technology can help producers understand exactly what is happening with individual animals with greater clarity than visual observation alone. By enabling farmers to deliver tangible benefits, precision livestock farming (PLF) is becoming a driving force for positive change within the industry.

Technical and scientific innovations can support the future of the beef supply system and respond to increasing consumer awareness around environmental impacts. The challenge is using the available resources to their full potential. Data on the uptake of technology in the beef sector is limited but anecdotally it lags behind dairy, pigs, and poultry.

Opportunities to enhance animal health and improve sustainability through technology adoption promises to deliver sector wide benefits.

Case study:

Acton Hill Farm,
Staffordshire

As well as managing his own Charolais, Limousin and Parthenais cattle, Dan Ingham of Rickerscote Livestock also shares a farming partnership with AG Parrott, where he manages a herd of 230 beef cattle including a nucleus of 120 pedigree Stabiliser sucklers.

In 2021, the pedigree herd's calving window had become staggered, with some of the suckler cows and following heifers calving a month later than planned.

By joining forces, the Parrotts were able to concentrate on their cropping commitments while Dan focussed on managing the cattle more efficiently.

Moving to AI to optimise their breeding strategy, for the new system to work effectively, Dan needed to spot as many heats as possible.

" We used a government productivity grant to subsidise the purchase of 60 SenseHub® CowCalf Monitoring Ear Tags to monitor reproduction, with a focus on realigning 27 cows and heifers that had slipped out of their assigned calving window."

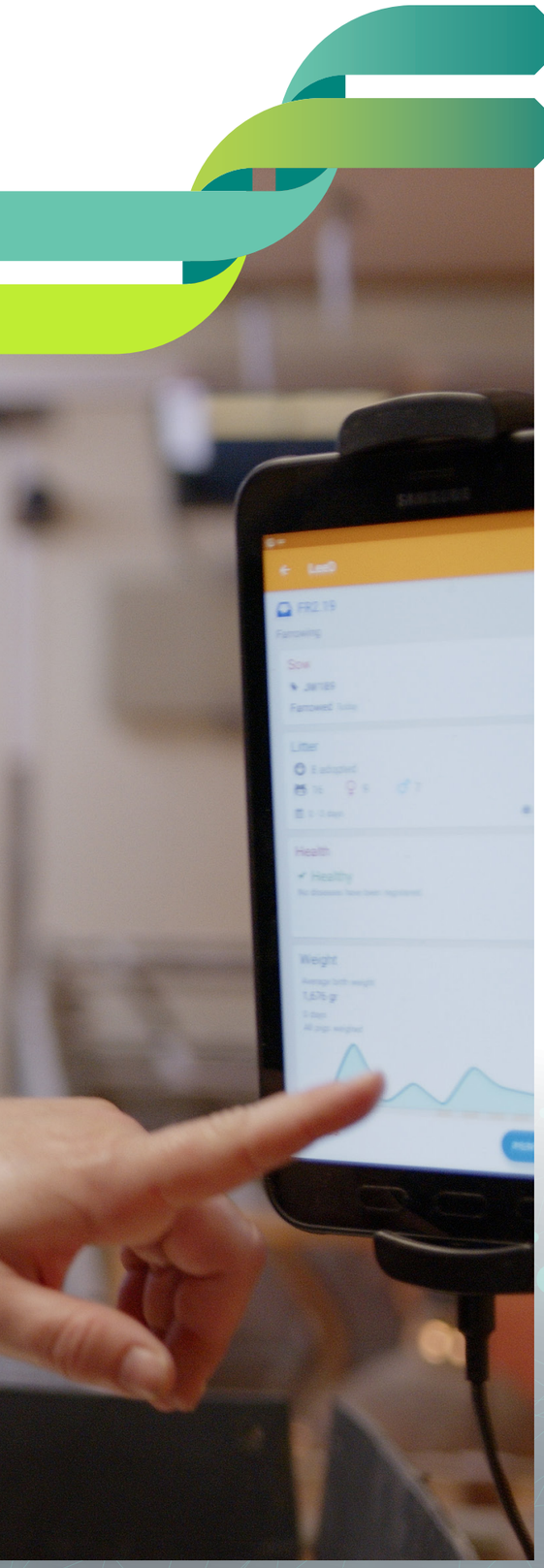
The data collected enabled Dan to spot heats in all the animals in 2022, with five of the eight cows (62.5%) holding to their first service at 30 days and the remaining three all conceiving at the second attempt. By 2023 the conception rate in heifers at first service had increased to 80%.

" The Monitoring Ear Tags have enabled me to keep an eye on all the animals without having to spend hours watching them," says Dan. "Since installing the system, I've been able to pull some time back in our breeding programme and we've recently had a phenomenal run with conception rates.

" The level of accuracy makes it viable to use AI to breed our replacements which means that we're constantly improving the overall genetic merit of the herd. It works for me in this particular system as I can respond quickly to every heat alert. It's been a terrific help."

Improvements at a glance

- Herd growth – from 90 to 120 cows in two years
- Calving window reduced to 10 weeks, a 60% improvement
- Conception rates at first service for heifers 80%, a 30% improvement



Recommendations

An entire supply chain solution

To enhance animal welfare, minimise the risks of antimicrobial resistance and reach net zero, it is essential we drive uptake of technologies that are proven to help deliver on critical sustainability challenges.

Despite widescale evidence on the beneficial impact technology can have in the livestock sector, uptake remains slow. An industry mindset change is needed at all levels to minimise barriers to adoption and accelerate engagement throughout the sector.

Collaborate, motivate and integrate

The demand for technology at farm level has been evidenced (Rushworth, 2022), but the responsibility does not stop there. To realise the true potential of technology in the sector, we need full adoption, recognition and incentivisation throughout the supply chain.

This means a fully connected industry framework, based on three basic principles:

1. Targeted regulation and policies that encourage technology adoption at farm level
2. Market premiums to drive technology uptake and the flow of performance data across all value chains
3. A joined-up industry-wide technology strategy that the whole supply chain commits to

Our asks

1. **Create policy mechanisms that make it easy for farmers to invest in technology and digitise**

   Current technology grants are frequently governed by application windows which create artificial peaks and troughs in demand and typically relate only to capital investments for systems or equipment. This can discourage farmers from investing in new technologies, as they cannot plan for the long-term with inconsistent support.

   As farming continues to consolidate and average farm business size increases, with it comes a greater demand for modern, subscription-based technology contracts. In the dairy sector alone, this equates to about 70% of MSD Animal Health's technology business in 2024.

   Farmers need legislation and funding options that allow them to capitalise the cost of subscription-based technology services, that are available year-round.

2. **Secure a financial premium for precision farmed and connected livestock that come with a lifetime of data**

   To support farmers in their decision making, and aid long-term farm business planning, processors must reward farmers for investment in technology, in return for being able to access data across their entire value chain. Offering a premium for providing performance data from day one will improve supply chain efficiency and traceability.

   Similarly, Government must incentivise farmers to uptake technology and should do so by including commitments within the Farming Innovation Programme to provide year-round grant funding for systems that facilitate precision livestock farming, and by improving efficiencies within the Sustainable Farming Incentive.

3. **Advocate for a connected livestock industry, with precision monitoring delivering joined-up data available from farm to fork**

   We aspire to have digital systems that tracks livestock performance and movements across the entirety of the supply chain.

   We need processors and retailers to establish partnerships with technology providers and adopt the use of technology within their value chains.

   We also must collaboratively advocate for policies that support technology adoption, and work with industry bodies to develop and promote standards for the use of technology in livestock farming, ensuring consistency and reliability across the sector.

Commit to change.

Take the pledge. The time for tech is now.

We invite all stakeholders to pledge their support for technology-driven transformation in the livestock sector. Together, we can achieve a sustainable, efficient, and health-oriented future.

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