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Evaluating the potential cost benefits of electronic data recording for UK sheep and beef farms

Written by:

Matthew Blyth NSch

September 2024

A NUFFIELD FARMING SCHOLARSHIPS REPORT

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A NUFFIELD FARMING SCHOLARSHIPS REPORT (UK)

NUFFIELD Farming Scholarships

"Leading positive change in agriculture. Inspiring passion and potential in people."

Date of report: September 2024

Title	Evaluating the potential cost benefits of electronic data recording for UK sheep and beef farms
Scholar	Matthew Blyth
Sponsor	John Oldacre
Objectives of Study Tour	To evaluate the potential cost benefits of electronic data recording for UK sheep and beef farms.
Countries Visited	New Zealand, Australia, Tasmania, Norway, Ireland, Scotland
Messages	There is an opportunity for farmers to see the cost benefits of using electronic data. At this time, there are still some hurdles to overcome for most farmers before they see the benefits. One hurdle which starts to open the door to more electronic data use is when electronic identification becomes compulsory. • We need better support and training for farmers - to understand what data is helpful for their business and how to collect it easily. • More independent projects and work looking at what data to collect and when. These projects need to be run over a period of years to see what effect one event will have on lifetime performance and identify what is the important data is to collect. • Collaboration between scientists, hardware manufacturers and software companies. To work out how farmers can use it in the field and how it can improve production and lower drug use. • Developers need to consider the work effects by involving farmers with different capabilities in the development. • If we don't measure it, we cannot manage or understand what is going on within your business and find where there is opportunity for improvement. Work with advisors that understand the results. Better sharing of data between different software packages e.g. accounting software, feed budgeting, and livestock management software, saving time on double entering data.

EXECUTIVE SUMMARY

Electronic Identification Devices (EID) can improve animal welfare, detect disease outbreaks early, and optimise diets for increased production in farming businesses.

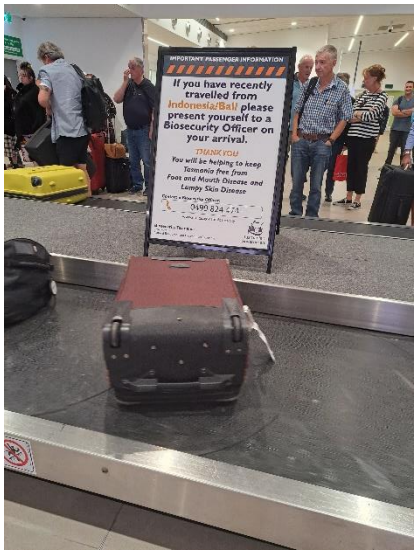

Figure 1: A bio security warning at Hobart Airport, Tasmania.

Traceability is crucial for animal welfare and food safety. EID in sheep and cattle passports helps accurately record their movements, ensuring complete traceability. This enables quick identification of potential health risks or disease outbreaks to ensure safe consumption. It also helps the UK market its livestock products worldwide as high-quality and safe. Without traceability, the UK's ability to export products would be limited and farmers' profitability reduced.

It is challenging to assess the cost-benefit of using EID for farmers at the farm level. Although mandatory for sheep in the UK, only a small percentage of UK sheep and beef farmers use EID for individual animal or flock/herd-level data recording. Even when EID is used, most farms only collect data on their animals once or twice a year. Farmers worldwide agree that when EID became mandatory, it pushed them to use it to help them understand their livestock businesses. However, better integration of data between government gateways, livestock markets, slaughterhouses, and all the different on-farm software programmes used on farms is necessary to provide an easier way to generate useable reports for farmers to understand and compare their business year on year and against industry KPIs. In trials in Australia, they have seen a cost-benefit of using EID – for every $1 invested, they saw up to a $7 return on investment. In the UK, a trial by Scotland's Rural College (SRUC) has seen a £3 per ewe benefit by using the technology.

Farmers need independent support to understand and integrate software and hardware across different platforms, as well as training and ongoing support for accurate and easy operation of their equipment and software. Currently, in the UK government capital grants support the purchase of EID hardware but not software.

Farmers are purchasing equipment with limited support to help them get the most out of the equipment. The UK government, as well as software companies, need to support farmers with ongoing training to get the most out of their investment. There seems to be a global lack of farmer training, which is what most farmers are looking for, from people going on farms to help capture important and accurate data to simple training e.g. 'How do I connect the equipment to a phone or computer to report a movement?'

To overcome integration and data management challenges and promote sustainable agriculture practices, it is essential to collaborate between farmers, industry stakeholders, and technology providers on how EID data can enhance farmers' abilities to manage their livestock effectively and efficiently. However,

collaboration and knowledge-sharing among farmers, industry stakeholders, and technology providers are essential to realise these benefits fully.

EID offers lots of opportunities. The key to using it effectively is not making it too complicated and using the technology to the level which brings a benefit and return from beyond what is required for simple identification purposes.

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DISCLAIMER

The opinions expressed in this report are my own and not necessarily those of the Nuffield Farming Scholarships Trust, or of my sponsor, or of any other sponsoring body.

All photos are the author's own, unless otherwise stated

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1. PERSONAL INTRODUCTION

Figure 2: Matthew Blyth, the author.

My journey began in southern Lincolnshire, where the bustling activity of local farming surrounded me. I grew up immersed in agriculture on a farm where my parents, who had no agricultural background, rented a house. The farm, predominantly arable, cultivated a variety of crops including cereals, potatoes, onions, sugar beets, and vegetables, while also having sheep, pedigree Charolais cattle and growing-on dairy replacements for their sister farm in Norfolk.

It was amidst these rural surroundings that my interest in livestock was sparked. However, my path wasn't without its challenges. At the age of 10, I was diagnosed with dyslexia, which led me to withdraw from mainstream schooling to focus on relearning essential literacy skills. Despite facing difficulties, I persevered and eventually pursued further education at a college in Lincolnshire, specialising in general agriculture.

My thirst for knowledge and passion for livestock management led me to Northumberland, where I delved into the intricacies of sheep and beef farming. This period of specialisation laid the foundation for my subsequent endeavours in the field. Upon returning to northern Lincolnshire, I embarked on a journey of continuous learning and professional growth. Working on a mixed farm, I was exposed to progressive farming techniques, including the utilisation of embryo transfers and artificial insemination to enhance pedigree stock quality.

My tenure at various farms across the UK provided me with invaluable experiences and insights. In Hampshire, I had the opportunity to contribute to large-scale commercial sheep farming operations leading to participation in product trials for major pharmaceutical companies. These experiences not only deepened my understanding of livestock management but also instilled in me a keen appreciation of the importance of trial ideas and making data-driven decisions.

My journey reached new heights at Didling Farms in West Sussex, where I progressed from being a shepherd to a flock manager, eventually overseeing the entire farming enterprise. Here, we embraced the cutting-edge technologies of the time, such as electronic identification and automated drafting facilities, using data to optimise flock and herd performance. Over 15 years, our concerted efforts resulted in a significant improvement in livestock performance resulting in financial improvements for the business; a testament to the power of innovation and data-driven strategies in modern agriculture.

My journey took an unexpected turn in November 2019. I was made redundant by the new owners and I set up my own advisory business specialising in helping other sheep and beef farmers collect and use data drawing on my own farming experiences.

2. BACKGROUND TO MY STUDY

My Nuffield farming scholarship explores how different countries utilise electronic data recording for decision-making in agriculture, especially regarding livestock identification and performance data, which could provide valuable insights for improving practices in the UK and beyond.

I'm intrigued by the hurdles that prevent farmers from embracing electronic livestock recording, especially in sheep and cattle farming. Despite the compulsory implementation of electronic identification for sheep in the UK in 2010, it's noteworthy that many farmers haven't maximised the potential of this technology beyond mere compliance with regulations. The scholarship offered a chance to delve into the factors contributing to the limited uptake and to pinpoint potential obstacles or difficulties that might impede the efficient utilisation of electronic data in agricultural practices. Furthermore, I explored the successes and obstacles in different countries where the use of this technology is compulsory, alongside investigating instances where farmers opt for electronic livestock data recording voluntarily in other nations, becomes crucial. It is even more pertinent when considering that we're all employing similar technologies. Analysing how these technologies are applied across different scales could offer valuable insights into their effective utilisation in the UK.

3. MY STUDY TOUR

I visited the following countries during my study tour:

Country:	**Reason:**
New Zealand	To investigate how large-scale farms utilise the Electronic Identification (EID) readers and weighing equipment designed by two local companies.
Tasmania	To explore how farmers collect and leverage sheep data to enhance wool quality, particularly during busy periods like shearing.
Australia (Victoria and New South Wales)	Australia has been interested in compulsory EID for cattle for over a decade, yet Victoria stands out as the only state where it's mandatory for sheep. I looked at how EID is utilised in the cattle and sheep sectors and how compliance in sheep farming has become a nationwide concern. Additionally, how farmers utilise the products of global ruminants' software company AgriWebb.
Ireland	Ireland, like the UK, adopted EID for sheep in 2010. However, there's a 2023 initiative to introduce EID into cattle farming. I explored the potential impact of EID for cattle in terms of costs and working practices.
Norway	There are small-scale farms with both sheep and cattle operating on a low-input system where animals graze on common land during the summer and then are housed on high-input systems for most of the winter. I looked at how they utilise technology.
UK	I investigated how UK farmers are utilising EID technology and engaged with UK-based software companies to understand the obstacles preventing farmers from embracing it. Additionally, I talked with researchers about what lies ahead.

4. INTRODUCTION TO EID

Is there a cost benefit to the farmer of collecting electronic data? The reason for this question is that in the UK we put Electronic Identification Devices (EID) in sheep. These can be put in a lamb's ear before leaving the holding of birth or before they reach nine months of age. On some farms, they might only be in the ear of the lamb for a few hours. Is the £0.75p to £1.20 worth the investment? The UK government is looking at putting EID in cattle in the next few years. There is also public money to help fund a percentage of the value of the equipment to capture data. If the tags are only in use for a few hours, is this a good use of public money?

The first thing that has come out of my travels, is revealing the reasons why EID are being used. Some farms are using them as a management tool through independent choice. But, in some parts of the world, in sheep, cattle, or both it is often due to compulsory regulation brought in for disease, movement and traceability reasons. EID was introduced for sheep in the UK after the 2001 foot and mouth outbreak when Defra realised there was limited traceability of sheep movements around the country. Europe mandated EID in sheep and goats for traceability and movement to help raise confidence in disease surveillance. If we hadn't adopted this measure, it would have potentially limited or reduced the UK agriculture's ability to export products to other countries, lowering the price the farmer gets at the farm gate and lowering their profitability.

The UK propose to introduce EID for cattle in the coming years. The main reason behind this decision is to improve the traceability of livestock, linked to a new online method of movement reporting. In time, I can see the phase-out off the current cattle passports which, in turn, lowers the costs by replacing paper documentation, saving the government money and improving real-time traceability. In the UK, we have three days to report a movement; in another part of the world, they have 48 hours, so a quicker method is sure to help disease control.

5. TECHNOLOGY

Farmers use two types of technology to identify sheep: low frequency (ULF) electronic chips that can be installed into a tag (applied to the ear) or implanted into a bolus that goes into the stomach. The most popular choice amongst farmers worldwide are tags, as they are more affordable and visible. Additionally, if not mandatory, tags can be used multiple times, making them a reusable product that saves money.

Figure 3: different types of sheep & cattle ID tags.

The chips in the UK tags can use one of two different technologies: Full Duplex (FDX) and Half Duplex (HDX) chips. Within these technologies, different sizes of chips and aerials receive information to wake-up and provide data to the EID reader. In the UK, smaller and lower-quality chips/aerials are used (the aerial size ranges between 12 and 24mm). This makes the read range change. Plus, ULF has a problem being read if there is noise/interference. This can result from metal, light not working properly, or even a motor in the next building sending out a magnetic field. Some of this can be corrected if the equipment is set up correctly otherwise this can result in farmers having trouble reading some of the tags. Another issue that is frequently observed around the world is that if the chip is incorrectly inserted into the pin of the tags, which can get damaged during the application process and degrade over time, it leads to difficulty in reading the chip.

When a tag fails to read or is lost, changing the tag and recording information in the flock book becomes frustrating for farmers. This can result in farmers not recording the information through frustration and time pressures.

The other technology that could be coming along, and Defra are looking at it for cattle, is ultra-high Frequency EID (UHF). This can be read from nine meters away to a few centimetres, and multiple tags can be read at one time. It works better in areas that have problems with noise/interference. While these points are positive, UHF does not like water. I have only come across this technology in tags used for animals that only live a few months; so, will it last 10-plus years and still be readable? Can we get a reader that can read both ULF and UHF? At this time, we can only buy readers for one or the other and we need readers which can handle both. Or, will there be an option of using UHF tag for sheep? We cannot have one industry using one type and the other a different type. We don't want farmers to

have two readers on a farm. There are trials underway in the UK looking at the advantages and disadvantages of the technology to see if there is a cost-benefit to using this technology. I have found some current trials in France and Israel, but the results are yet to be published.

6. TAG FORMAT

I feel we are lucky in the UK and the EU with the EID format for sheep. The EID numbers have a 15-digit format—a unique 6-digit flock number (preceded by a zero), followed by a 5-digit animal number (Figure 1). EID tags have to be yellow. The same letters and numbers are printed on both tags and are programmed into the chip in the EID tag (or another EID device), which is known as WYSIWYG ('what you see is what you get'). If the EID tag is scanned with a reader, it will display the number printed on the tag; 'UK' will display as '826', the internationally recognised code for the UK

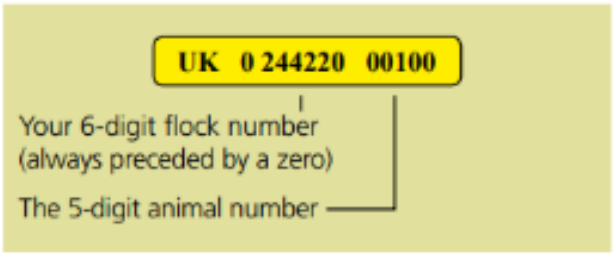
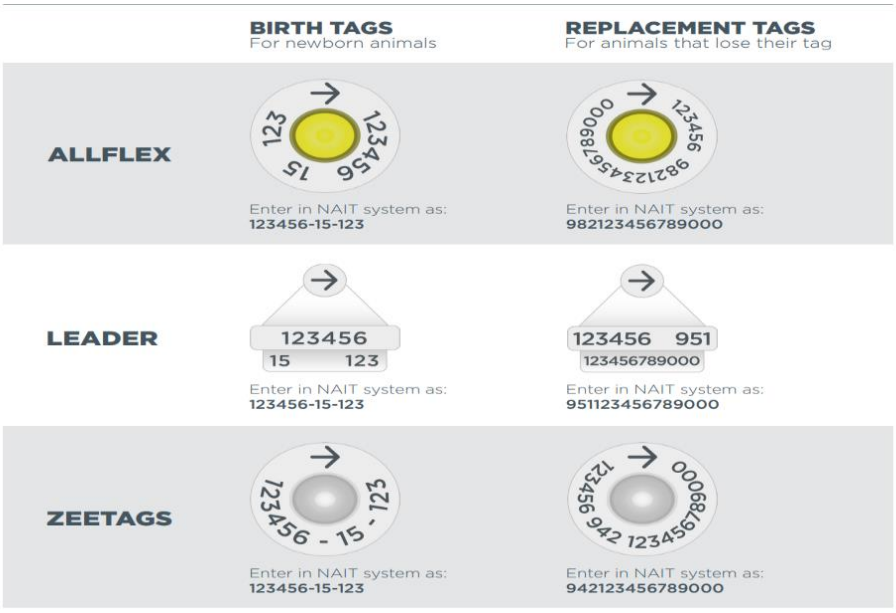


Figure 4: Image taken from an order for tags, Defra.

All sheep movements must be recorded onto the livestock information servers within three days, either online or by paper. All cattle movements must be reported to British Cattle Movement Service (BCMS) within three days online, by phone or by post.

In New Zealand cattle, National Animal Identification and Tracing (NAIT) approved birth tags often come with an RFID tag and a matching visual ID tag, which are already linked in NAIT. You can also choose to use your own type of visual tag and link it to the RFID tag in your NAIT account. EID in sheep is not compulsory in New Zealand. You need to fill in the animal status decoration when you move animals. This covers all species: cattle, deer, horses, alpacas and llamas.



In Australia, they must report all cattle movements to the National Livestock Identification System (NLIS). They must be tagged, regardless of age, and all cattle must be identified with an electronic NLIS before being leaving a holding.

Figure 5: Image from *Reading Your NAIT Tags.*

There are two types of NLIS (cattle) tags available:

- **NLIS breeder tags** are white and are used to permanently identify cattle before they leave their property of birth
- **NLIS post-breeder tags** are orange and are used to permanently identify introduced cattle, not already identified or that have lost their original tag.

Each visual number printed on a tag displays a territory code, a property identification number and a manufacturers code. I like this system as we can gather evidence of tags that fail to be read at some point and report back to the manufacturer. Additionally, there is a letter code for the year of manufacture, finished with a series of five numbers which can help accurately identify the animal. The EID number appears to be a unique identifier which is related to the visual number (see Figure 3). In the UK, both the visual number and EID number are the same for sheep, and, hopefully, this will be the case for cattle.

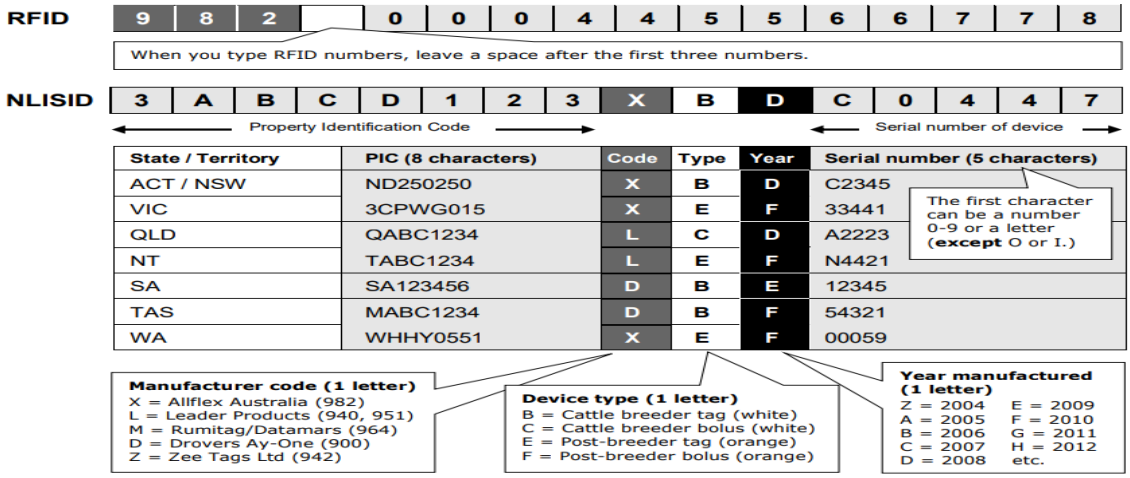


Figure 6: An example of a cattle format used in Australia. Image from *Tech Tips*, National Livestock Identification System Ltd.

7. EQUIPMENT

There are four major companies which manufacture ruminant data capture equipment: Datamars (known as Tru Test) and Gallagher, from New Zealand (both companies make weighing equipment as well as EID readers); Agrident, which is owned by MSD (a pharmaceutical company); finally, the English-based company Shearwell Data, which makes EID readers with weighing equipment and software. Throughout the world, these are the main building blocks for capturing data. The companies produce a range of equipment, from panel readers connecting to the side of a weigh- crate or race through to stick readers and handheld devices. These devices can record tag numbers, or separate EID readers which can add information to the ear tag. Each reader has its own merits, advantages, and disadvantages.

The two main companies are Gallagher and Tru Test and, as they don't make any global software (unless you want to work on weight), most, if not all, of the independent software companies connect to these two manufacturers' devices. In the UK, Tru Test probably has a larger market share. A lot of the third-party software companies connect to the Shearwell Data stick reader, but the product works better using their own software which makes the setup and configuration easier.

One of the biggest things I noticed is that people are increasingly looking for cloud-based software so that they can share information across their network, which can include vets, advisers/consultants, other members of staff, nutritionists, financial advisers, as well as owners' office staff who are not directly involved. Also, with cloud-based software, it is accessible on any PC or Mac.

Around the world people want to record information in the field to save time when they return to base and avoid having to upload information from the equipment into third-party software plus add records to the session, like a treatment or movement. But this can lead to problems as Apple operating systems update their Bluetooth encryption frequently. In the last few years, some EID readers have struggled to connect to some devices due to the age of the EID reader and phones or tablets using a more up-to-date Bluetooth connection. One company started to use a Wi-Fi connection to get around this issue.

None of the four companies mentioned make an EID reader which can read high-frequency EID, which could be a disadvantage if this technology is used in the UK to record cattle movements. Weighing equipment has the same connectivity issues; operators are advised to research the best options for their individual circumstances.

The high-end weigh head is able to record multiple pieces of information and probably 95 to 100% of what farmers need and displays the information in real-time in the field. One of the big advantages of the weigh heads and the EID readers is that they are waterproof and have a daylight screen suitable for use in

bright light or even when it rains. Seeing what's happening and tapping the right buttons on the screen to record information can be a problem. However, a good routine on an app receiving information from a weigh head (weight only) or the EID reader (number only) and adding the information like a treatment as well as the weight to the tag number in the field recording data is a great way of working, and a lot of the world's big software players seem to be working in this way to get around some of the upload problems.

Especially around cattle EID, when the EID number doesn't match the visual identification number, farmers upload a CSV file called a tag bucket list with the visual identification number in one column and the EID number in the next. Some of the tag manufacturers do not list the herd number and individual number in the same column, making this information impossible to upload.

There are similar problems with some third-party software. Getting the CSV file in the correct format to upload the drafting lists or alerts to find animals is very difficult. Some software companies now accommodate CSV file imports reasonably, but in the case of data such as body condition scores, the file information has to be broken into each individual score and uploaded as a separate CSV file. Most software does not have an export facility to populate weigh heads or stick readers.

8. SOFTWARE

In the UK, we are fortunate to have a wide range of software options available. However, selecting software that is compatible with farm equipment and user-friendly can be a daunting task. This is particularly challenging when considering the desire for real-time information imports through mobile apps. Compatibility issues with Android and IOS, as well as app and software manufacturers, can make this goal difficult to achieve. Farmers expect software to comply with UK regulations, such as recording information for movement, veterinary medicine, national inventory, retagging records (sheep only), death, and red tractor requirements. Unfortunately, some larger companies attempt to create a one-size-fits-all product for a global market, resulting in software that may not meet the minimum UK compliance standards. This is the same in other parts of the world.

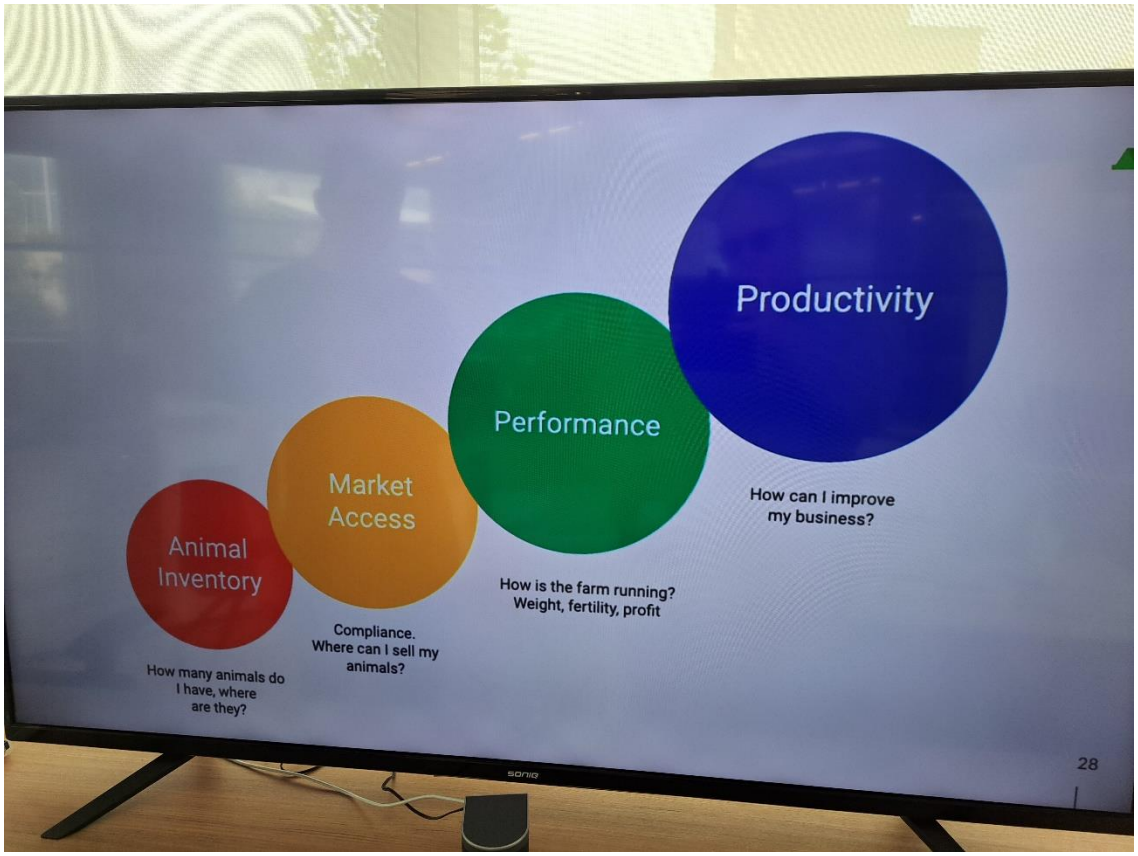


Figure 7: An example of the goals software companies are striving to achieve.

Software companies worldwide are facing challenges in translating data analysis into practical insights for farmers. This is partly due to the lack of industry-specific key performance indicators. Even when indicators such as flock performance assessment are available, the information is not always presented in a format that is easily understood by veterinarians and other professionals. As a result, it can be difficult to identify areas for improvement in the business. A few years ago, a working group was convened in the UK with participation from all the software

companies. However, there was no consensus on the standardisation to be adopted.

Question: Do commercial farmers need third-party software? All EID readers and weigh heads come with free software that allows the data to be downloaded into Microsoft Excel/CSV files, which can be accessed on a PC or app. With basic training in Excel, farmers can record veterinary and medical usage using a stick reader or a top-of-the-range weigh head in the field. These records can be downloaded into Excel for further use. The same process can be repeated for death, birth, retagging (sheep only), and sales records.

In the UK, farmers can record sheep movements through the Livestock Information Service (LIS), which can import Excel or CSV files. This makes it easy to import individual numbers and complete movements online using any device with a web browser. Unfortunately, most farmers are not aware of this capability. The software has been designed to import files based on the ear tag number of the sheep, making it very user-friendly. However, due to a lack of education, most farmers still rely heavily on paperwork for sheep movement records. It will be interesting to see how this changes when cattle have compulsory EID, as farmers currently report the movement of cattle online.

In other countries, such as New Zealand, when farmers purchase their EID reader, it is set up in-store to access government movement records. This is something which is lacking in the UK.

9. WHAT FARMERS WANT

There is a European Horizon 2020 programme-funded project looking at digital technology sheep and goat farming, which started in 2021 and finished at the end of 2023. This project, Sm@rt Small Ruminant Technology, looked at small ruminant production systems across Europe and Israel examining the tools and technology available to the industry.

Figure 8: European partners from the Sm@rt Ruminant Technology Group.

They asked farmers what equipment was currently being used on the farm and presented farmers with 20 options across different sectors (flock management, milking, feeding, breeding and health and welfare).

Out of all the farmers surveyed, the most popular tools currently on-farm were those associated with flock management: weigh crate (40%), flock/herd management software (35%), video cameras (28%) and EID-tag stick readers (27%). Of those who answered the feeding, breeding and health and welfare sections, less than 10% had any of the tools or technologies identified (Figure 6).

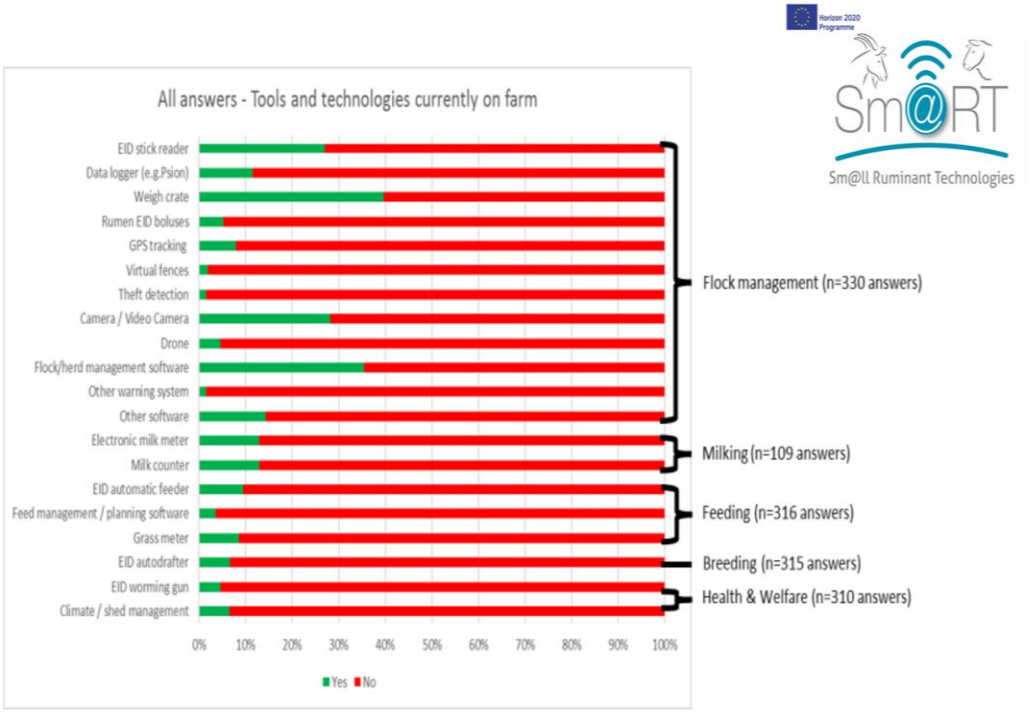


Figure 9: Data collected by the European Sm@rt Project (No: 101000471).

Even though known weight is important for accurate drug administration, and with EID across Europe and the UK, it is surprising that more data capture is not being used within the industry.

When asked for more detail, in terms of how many hours a week were spent using these tools and technologies, the farmers indicated that a large amount of time was spent using the surveillance technologies (Figure 7).

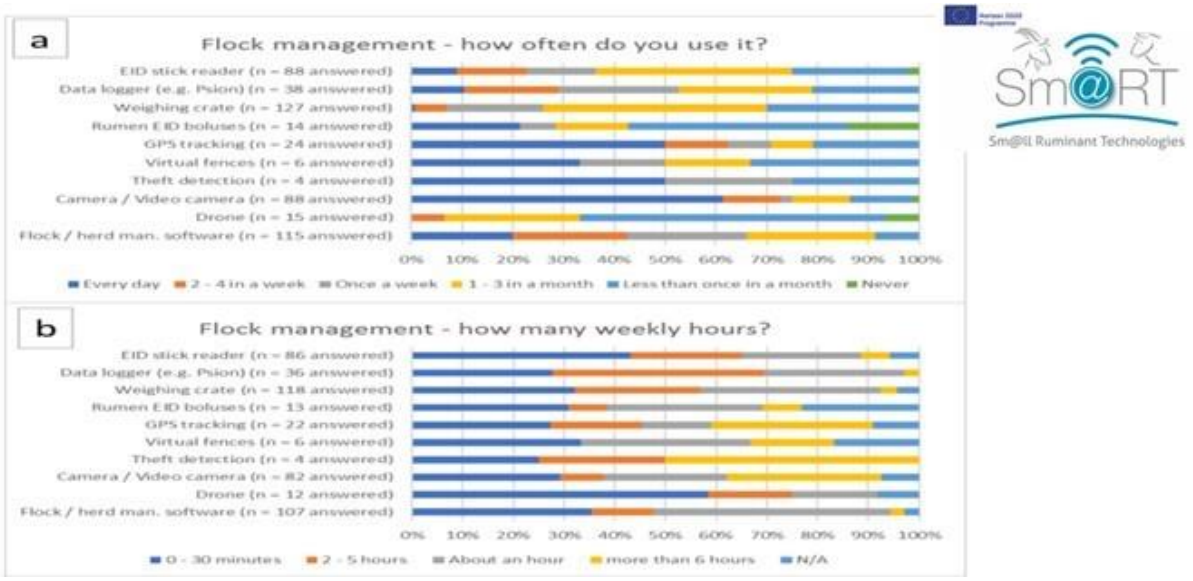


Figure 10: Details of how often farm management-related technology was used per month (2a) and per week (2b) Data collected by the European Sm@rt Project (No: 101000471). .

After using a variety of tools and technologies, participants were asked to select from a list of seven options which influenced their decision to purchase or use each tool. The most common reasons were that the tool or technology was relevant to their system and convenient to use, as shown in Figure 1. When asked about potential improvements for each tool or technology, many participants selected improving data transfer from one device to another, especially for those using weigh crates, flock management software, and EID stick readers. Other areas that were highlighted for future consideration included price and simplification of use, as shown in Figure 8. Data transfer from a device to software seems to be a massive issue with a requirement for better after-sales training.

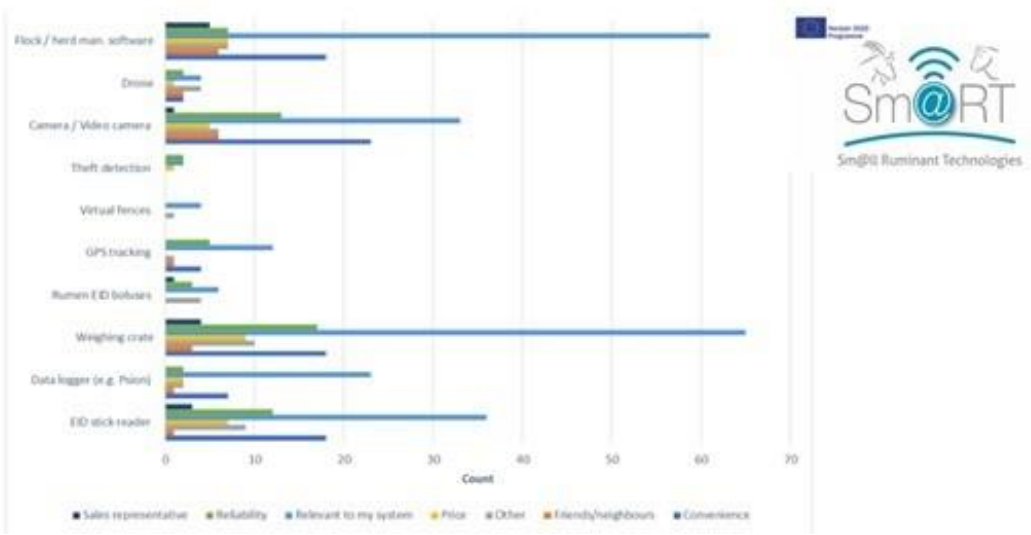


Figure 11: Details of what influenced the purchase/use of farm management tools and technologies. Data collected by the European Sm@rt Project (No: 101000471).

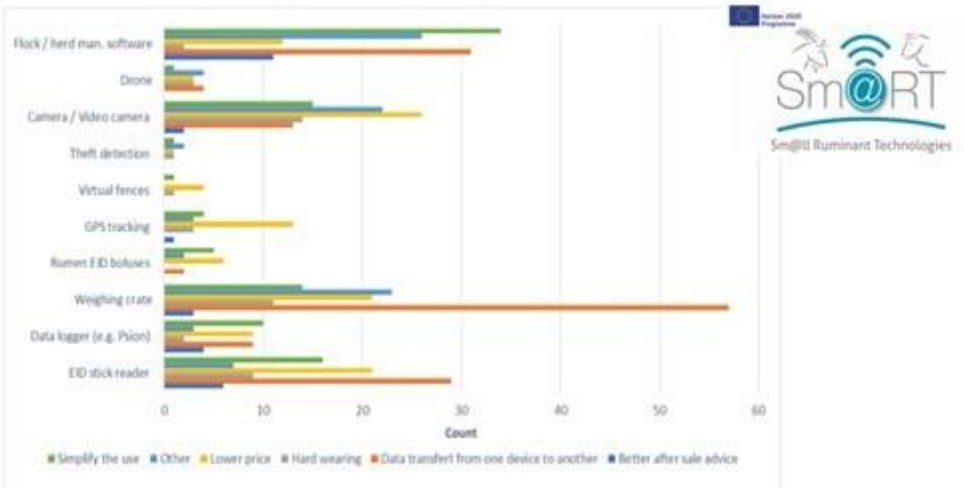


Figure 12: Details of how farm management tools and technologies could be improved. Data collected by the European Sm@rt Project (No: 101000471).

In the survey, participants were asked about the tools and technology that farmers prefer to use. After discussing the tools and technology currently available to farmers, they were asked which product they would like to use, assuming it was available.

According to the results, the tools and technologies with the highest weighted scores were those related to flock management, such as flock/herd management software and weighing crates. Out of the 201 farmers who responded about the EID stick reader, 47% gave it a score of five out of five.

To discover reasons for and against the use of tools and technologies, participants were asked to select from a choice of five options to best describe why they would like to use these tools or technologies. They were also provided with an additional five options to describe why they did not want to use these tools or technologies. Similar to the answers received when discussing tools and technologies already in use on farms, the participants highlighted the relevance to their system as the main reason why they wanted to use these technologies (Figures 10). Reliability was also an important factor as was compatibility with other devices, particularly for the EID stick reader and data loggers.

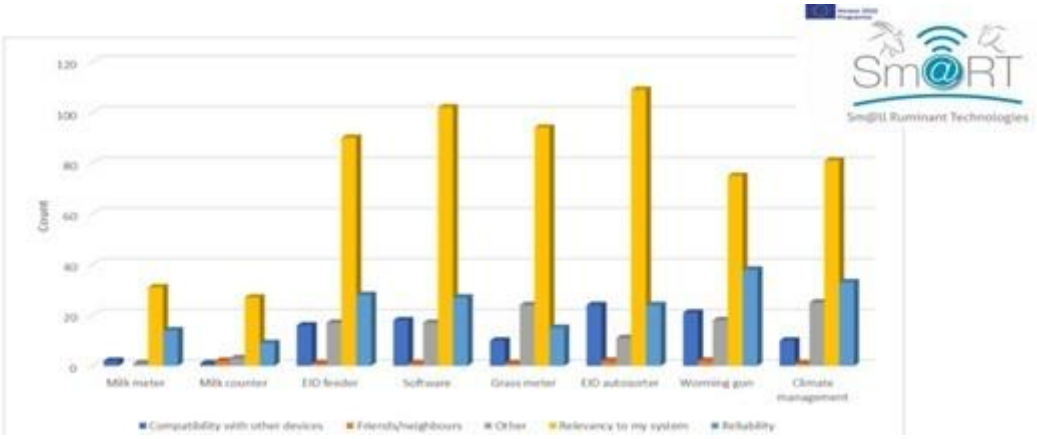


Figure 13: Details of why participants would like to use tools and technologies associated with milking, feeding, breeding and health and welfare. Data collected by the European Sm@rt Project (No: 101000471).

Answers to the question 'why participants did not use each tool or technology?' are covered in Figure 11. The most common reason given was that the participants did not feel the tools/technologies were relevant to their system. In addition to a number of participants selecting another reason (other – no detail given), many also deemed the technologies to be too complicated.

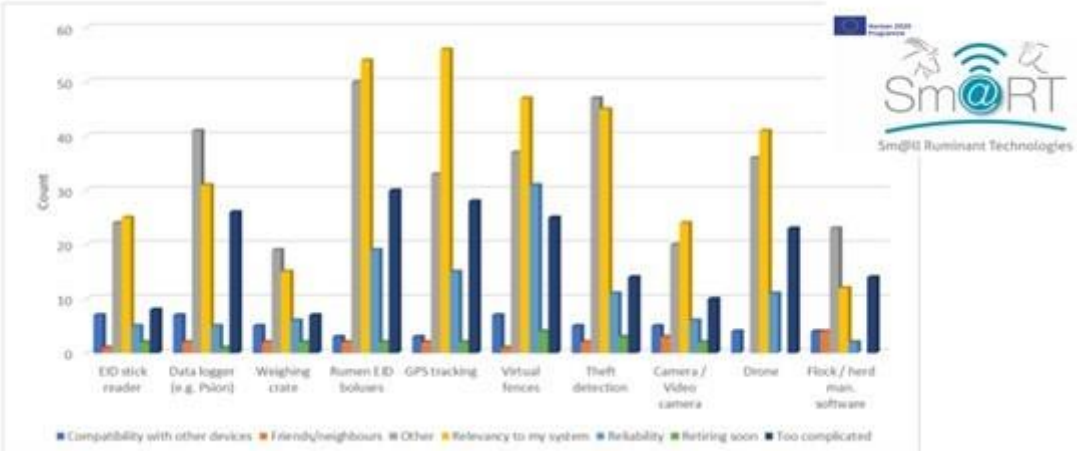


Figure 14: Details of why participants would not like to use flock management tools and technologies. Data collected by the European Sm@rt Project (No: 101000471).

Farmers in the survey were asked to identify and rank the top five tools and technologies that they deemed to be most beneficial to their system. The results from 251 participants who answered this section are given in Figure 12.

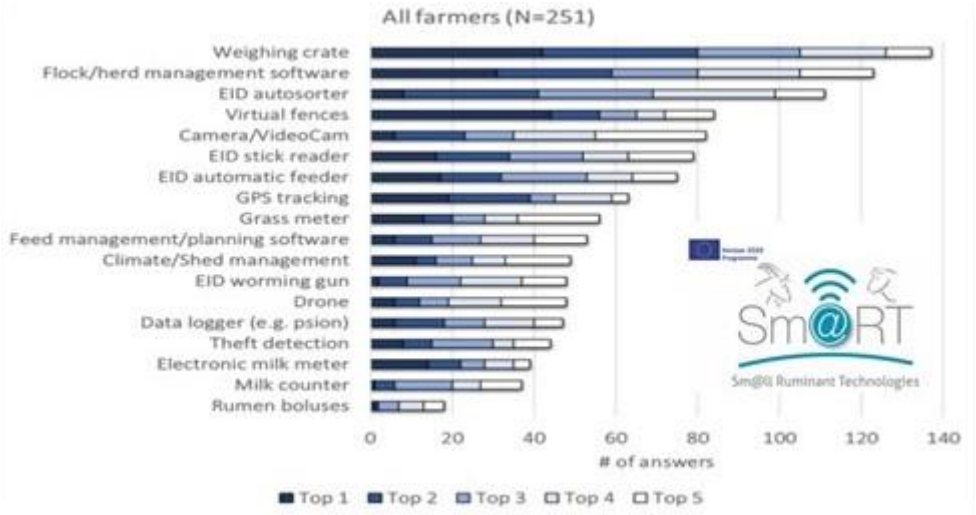


Figure 15: The results ranking the tools and technologies deemed most beneficial to each farmer. Data collected by the European Sm@rt Project (No: 101000471).

The top three tools/technologies identified were the weighing crate, flock/herd management software and an EID auto-sorter. The tool/technology ranked at number one by most farmers was the virtual fence, closely followed by a weighing crate.

10. UNDERSTANDING THE POWER OF DATA FOR SHEEP AND BEEF

The use of data can help improve efficiency, productivity and economics; this can be with low-tech and high-tech ways of collecting data and processing the information collected. From basic records, saving time in the office at the end of the day, through to precision livestock technologies to help welfare and production to help improve efficiency. The basis for collecting data is that it is just a number of pieces of information/records which results in helping the farmer to understand the business by recognising what they are seeing and what the impact may be on making a decision e.g. like the new sire they are buying or a mineral treatment administered. Data can be analysed at a whole flock or herd level down to a mob or an individual animal level which can help to monitor health and welfare or to select the best animal for breeding or sale. If we manage the average animal, there are 49 animals out of 100 that are below average and could be suffering from lameness or worms, but also the other half of the group of animals that are coping and performing. Why can they cope? We also need to get more information from the data than just the animal on the farm, staff; the goals of the business need to come into play.

11. THE POTENTIAL FLOCK AND HERD BENEFITS OF EID

Using EID-based equipment helps to reduce errors, if not eliminate them, saving both time and labour. On return to the office, the data can be captured in the yards/pens while increasing the accuracy of the information, resulting in greater efficiency.

Some of the benefits of EID monitoring of livestock include:

- Weight or body condition score and growth rates to meet market specifications or business needs.
- Pregnancy status each year.
- Selecting stock for improved current and future production:
    - Sire selection and allocation to specific groups of ewes.
    - To match ewes and lambs to calculate kilograms of lamb weaned per ewe, sire, or group of sires.
    - Tracking specific bloodlines.
    - Using carcass feedback to inform genetic and management decisions.
    - Identify which ewes produce light lambs.
- Minimise the risk of parasite outbreaks by:
    - Parasite risk management mapping.
    - Using selective drenching, better known as targets, selected treatment (TST).
- Identify poor performers in the flock before they become costly issues and make the correct business decision.
- Stocktake annually:
    - Where are the losses coming from and when and how can they be reduced?
- Keep an eye on how many animals are on the property/farm.
- Use records for treatment reasons to identify and initiate an early resolution of problems plus highlight any persistent or recurring health issues in individual animals.
    - Know which animals are within a withdrawal period.
- Which animals have been sold already?
- Feeding.

By bringing together all the information, it is possible to build a flock management plan for the year e.g. increase the fertility of ewes when target mating weights are reached. Ewes need to have a good body weight and condition for high ovulation rates at mating. It is much more efficient to hold ewe live weight and condition scores between weaning and mating as it takes a lot of extra feed to regain weight. Regular weighing helps ensure optimum breeding outcomes.

12. MAXIMISING THE VALUE OF EID TECHNOLOGY

Despite electronic identification technology being available for over a decade, commercial sheep producers worldwide have been slow to adopt it. This is mainly due to limited information on its long-term effects on flock structure profitability and management decisions, which has resulted in producers focusing more on cost rather than performance. While stud/pedigree producers have been able to see the benefits of EID through more accurate management of individual animals and data collection such as with Signet (pedigree breeding recording service in the UK), many commercial farmers remain unconvinced about the possible long-term gains. However, there is potential for commercial sheep producers to use EID to make better practical decisions regarding flock or herd management.

In 2019, a study was conducted in Australia on maximising the value of existing technology in sheep production. The study explored the implementation of EID results across different scenarios to increase wool and meat production. The study found that despite incurring additional costs, there was a significant increase in revenue. For every dollar invested, a return on investment of between $4 and $6 was achieved, However, it is worth noting that when information gathered was not utilised, there was zero return on investment (scenario eight) (see Figure 8).

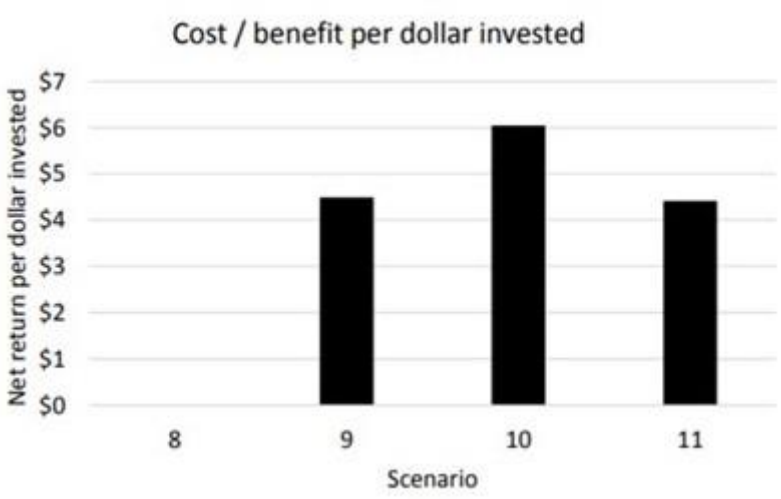


Figure 16: Cost/benefit of utilising EID for under each scenario for crossbred and composite enterprises, showing net return per dollar invested in collecting data

In 2018, a study was conducted by Scotland's Rural College and Morden Research Institute on the impact of using a precision livestock systems-targeted approach in mountain sheep flocks. The study found that using precision livestock systems resulted in an average benefit of £3 per ewe, despite the additional cost of £21 per ewe for introducing a Prattley 5-way Auto Drafter. This was due to the technology bringing in an average annual saving of £3 per ewe. As a result, the equipment

would pay for itself after seven years on a 470-ewe flock. The savings estimated for a typical traditional farm were also significant, with a reduction in labour by 36% compared to using modern traditional farming techniques.

What would the investment look like on a 800-ewe flock?

Manual weigh crate £3,500

Weigh head £2,200

EID reader £1,200

Total £6,900

If a 800-ewe flock produces/sells up to 150%, which is equal to 1,200 lambs, and sells them all the stores at £65 a head, that equals £78,000 income.

If you use the technology to understand what's happening on the farm, and you are able to lift your sales by 7% to 157%, which is equal to 1,256 lambs when sold as stores at £65 ahead. This equals £81,640, resulting in the equipment being paid for in two years.

If we add three years' worth of software, training, support, data analysis and advice to the purchase price of the equipment.

Equipment £6,900

Software for three years £1,080

Support, training, data analysis & advice £3,000

Total **<u>£10,980</u>**

Utilising technology, advice, and support, software to help understand what goings on your farm could significantly increase your sales by 7% to 157%. This can amount to 1,256 lambs sold, translating to a revenue of £12,480 if sold at £65 per head. With this revenue, the cost of the equipment and support software can be covered within just three years, with additional profits. Keep in mind that achieving a 0.07% increase in sales without a proper understanding of your business can be a difficult task.

Monitoring the body condition score and maintaining consistent condition scores throughout the year can lead to a 0.07% increase in sheep industry production, as proven by the Key Performance Indicator project run by the Agriculture and Horticulture Development Board (AHDB). This helps reduce the number of light

lambs at eight weeks post lambing and weaning, resulting in higher value or earlier sales of lambs on the farm. The project monitored a four-year production cycle on three sheep units across England. The ewes and their offspring went through to weaning, which was the first worldwide that a ewe had been followed 48-plus months. Electronic identification made this possible. The Challenge Sheep project, also run by AHDB, used this technology to monitor wastage and the amount of lamb produced over the lifetime when mating six-month-old lambs versus mating 18-month-old ewes. This project is still ongoing.

Identifying animals with early signs of internal parasites can potentially save money. The use of Targeted Strategic Treatment (TST) involves administering anthelmintics to only those animals that require it, as opposed to treating all animals. By selectively worming only those animals that need it, farmers can potentially reduce their anthelmintic use and lower their veterinary medicine.

13. PROBLEMS

- Software to hardware connections: I have noticed in the Sm@rt project and smart sheep project, as well as on my travels, that many people are in search of hardware that can communicate with software and apps, allowing them to upload as well as download drafting lists from software to hardware as well as upload target weight files in a similar way to TST-based approaches. While there are only a few companies that produce such hardware, it should not be an issue. However, during my travels to different countries, I have realised that we need better integration and connectivity between software and hardware, particularly concerning iOS products.
- With a growing number of individuals seeking cloud-based software, it has become imperative to improve internet connectivity across the country. This is crucial for the seamless download and update of records either through mobile app updates or for remote access to databases by individuals in different locations.
- Integration with other software: what we see is one company good at building ruminant software and another company good at building payment/accounting software and feed budgeting. We could do with a central hub that can bring information together or add the right pieces of information into the other software, e.g. the price of medicines into the ruminant software, to build a more accurate flock performance assessment. This could be simply a way of joining information together to add into AHDB's Farmbench software, which then produces a flock performance assessment.
- Farmers in the UK frequently purchase equipment from merchants without receiving any proper setup or training. However, is it unfair to expect manufacturers to provide training? is it their responsibility? For instance, car manufacturers like Ford do not offer training to drivers on how to operate their cars. In some other countries, the store where the equipment was purchased may provide basic training and support, such as how to input data into the government database. Unfortunately, in the UK,

on-farm training and support are lacking. Similarly, software companies often fail to provide adequate training and support to their customers.

- When working on the Smart Sheep Project (TST) with Moredun, one of the issues that arose was getting farmers to understand what a CSV file was and how to upload it into the weigh heads. This remains an ongoing problem for new users who are unfamiliar with the software and need guidance on how to get their animals into it for the first time. They also need to know how to extract information from it and upload it back into an EID reader or a weigh head to produce a drafting file. Tag bucket for cattle: this CSV file comes with the herd number in one column and individual numbers. These need to be stitched together to get visual identification numbers to go into any of the devices or software; difficulties put farmers off using EID. It is hoped that this will change when EID becomes compulsory in cattle in the next few years.
- Government capital grant investment: it is great that farmers are supported by public money for public goods but the downside is getting the right advice to farmers about the best equipment to fit their needs, not just filling the minimum level to be eligible for grant support.

14. RECOMMENDATIONS

- Looking at the information in the Sm@rt project, one of the flags for improvement was enhancing data transfer from one device to another, a commonly selected option. To improve each tool or technology, enhancements in data transfer between devices—especially for those using weigh crates, flock management software, and EID stick readers—would be beneficial.
- When the government supports capital grant investment around EID and weighing equipment, there should be some compulsory training (maybe a voucher) to approved courses on how to get the best out of the equipment, and this could link to Defra animal health pathways.
- Farmers looking at purchasing any hardware or software should get advice on what hardware and software best fits their needs. At the moment, it is what is recommended by the salesperson, which is not always compatible with what else they have got on the farm, or it is sometimes not able to record what they would like. Who provides this? Or who could?
- Independent data analysis, which can be shared between the farmer and the advisers.
- Workshops flock or herd health clubs, using key performance indicators and benchmarking to help farmers understand where there is room for improvement within the business.
- Video hubs for training in both software and hardware, which farmers can access, especially when out in the field and facing problems or in the evening when support is lacking outside business hours.
- Support farmers by creating and uploading drafting lists.
- It is important to keep ongoing projects like Challenge Sheep and the Key Performance Indicator project going to identify the data that needs to be captured and how it can be used to improve farming efficiency.
- It is important to get projects to bring scientists and companies together to integrate technology and software into disease management like the target strategic treatment (TST) work on parasites. There is an opportunity to identify other problems early and lower drug use.

15. AFTER MY STUDY TOUR

I had an inspiring experience during my travels and have returned with better ways to support UK beef and sheep farmers.

1. Business Focus: To assist UK beef and sheep farmers in leveraging Electronic Identification (EID) and weight technology to improve farm operations and decision-making processes.

2. Data Collection and Processing: Drawing inspiration from companies in Australia and New Zealand, I plan to help farmers collect and process data effectively. This involves understanding farm operations, providing training on data collection methods, helping to find the best fit third-party ruminant software for that farm and developing systems to analyse the data for actionable insights.

3. Equipment Rental Services: Recognising the need for specialised equipment for projects and veterinary work, I propose offering equipment rental services like I have seen in New Zealand. This includes items like barcode printers with EID readers and simplifying tasks such as labelling sample plots and blood tubs. Additionally, providing Excel spreadsheets with animal details streamlines data management.

4. The industry needs better training and support globally, both in terms of software and hardware. Collaboration with software companies and stakeholder organisations such as AHDB, Farmer Connect, and SAC is essential to ensure that technology meets farmers' needs and drives adoption.

5. Advocacy and Policy Influence: With the impending transition to EID in cattle, my aim is to ensure that farmers' perspectives are considered in policy decisions. This involves providing input to regulatory bodies like Defra and advocating for a seamless transition to digital traceability systems.

6. Stakeholder Collaboration: I cannot stress enough the importance of collaboration among stakeholders, including farmers, industry research organisations, and technology providers. Farmer-led projects facilitated by organisations like AHDB, Farmer Connect, and SAC can drive technology adoption and help farmers understand the benefits of data-driven decision-making.

To achieve my Nuffield goals over the next few years, I am considering the following actions:

- Develop partnerships with software companies, equipment manufacturers, and industry organisations to build a programme to support farmers with training and support.
- I have started conducting educational programs with Farming Connect and SAC to raise awareness among farmers of what technology is out there

and what technology could be. It would benefit their farming business by helping with data-driven decision-making.

- I am also investigating other sectors, such as equine, especially with anthelmintic resistance becoming a prevalent issue across all livestock. It's crucial to administer the correct dosage to animals based on their weight and individual needs, especially when it comes to parasite management. Additionally, monitoring weight gain can be used to identify potential health issues. Interestingly, all horses have an electronic chip implanted under their skin (similar to the tags used for sheep and cattle). I wonder if there's an opportunity for the sheep and beef sector to contribute to equine health by leveraging the expertise and technology developed over the past 15 years.

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Special thanks are due to Lesley Stubbing (LSSC Ltd) and Nery Wright (AHDB) for their encouragement in applying for the Nuffield scholarship, as well as for their ongoing mentorship and support. Their guidance has been instrumental not only during my time working on the farm but also in my transition into a new career path. I am grateful for their continued encouragement and support throughout my Nuffield journey and beyond.

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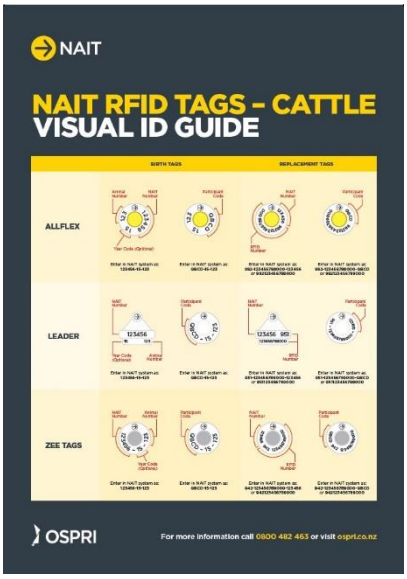

Figure 17: EID tag formats of different manufacturers in New Zealand

- Tech Care Project (This project received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No: 862050) https://techcare-project.eu/
- Sm@rt Project (This project received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No: 101000471) https://smartplatform.network/?s=
- Smart Sheep Project https://moredun.org.uk/news/foundation/funding-for-smart-sheep-project
- Agriculture and Horticulture Development Board (AHDB) https://ahdb.org.uk/using-eid-to-drive-farm-performance
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