

Appendices

Appendix A: Bovine electronic identification technology

- A.1 Electronic Identification (EID) uses Radio Frequency Identification (RFID) technology whereby the identity of an object (e.g. an animal) is encoded onto a microchip attached via a device such as an ear tag. The object's identity can then be retrieved wirelessly using electronic reading equipment.¹ Bovine EID refers to the adaptation of this technology for cattle electronic identification.
- A.2 There are three different types of EID technologies that can be used for cattle ID: low frequency (LF) which comes in either full duplex (FDX) and half duplex (HDX) variants; and ultra-high frequency (UHF). LF is a long-established animal ID technology and is already used in sheep in the UK and many other parts of the world including the EU,² whereas the use of UHF for animal ID is comparatively new.

Low Frequency Technology

- A.3 For LF electronic identification, the use of RFID operates in the frequency range of 120-150 KHz for animal identification.³
- A.4 The distance over which LF microchips can be read varies but is generally relatively short. UK technical standards currently indicate that with a portable (handheld) LF reader, ear tags must be readable at a minimum distance of 12 cm; and with a stationary LF reader, ear tags must be readable at a minimum distance of 80 cm.⁴ These are minimum required distances under test conditions, not guaranteed working distances under all scenarios.
- A.5 There are a range of International Organisation for Standardisation (ISO) standards which specify the structure of the identification code which can be read using LF technology: these include ISO 11784, which defines how numbers are stored on an animal identification device (ie tag).⁵
- A.6 Current UK regulations stipulate that EID encoding must comply with ISO 11784 and replicate the visual ID printed on the outside of the ear tag as What-You-See-Is-What-You-Get (WYSIWYG).⁶ Existing LF visual cattle EIDs in the UK are incompatible with this ISO standard because their numerical value is too large to fit onto the allocated space on the microchip.⁷ To manage this, a 'tag bucket file' must be uploaded onto the reader first: this file provides a lookup table linking the

¹ [ScotEID Report Using UHF For Cattle Electronic Identification August 2023 - ScotEID Library](#), paragraph 6

² [DEFRA and Welsh Government Bovine Electronic Identification \(BEID\) Pilot Projects: Joint Final Report](#), p. 1

³ [ScotEID Report Using UHF For Cattle Electronic Identification August 2023 - ScotEID Library](#), see Glossary, page 32

⁴ [Bovine official electronic identification \(EID\) technical standards - GOV.UK](#)

⁵ [DEFRA and Welsh Government Bovine Electronic Identification \(BEID\) Pilot Projects: Joint Final Report](#), p. 36

⁶ [ScotEID Report Using UHF For Cattle Electronic Identification August 2023 - ScotEID Library](#) paragraph 49

⁷ [ScotEID Report Using UHF For Cattle Electronic Identification August 2023 - ScotEID Library](#) paragraph 50

tag's chip number (EID) with the animal's full herd number and individual identifier as printed on the ear tag.⁸

- A.7 To implement ISO 11784, the UK's animal numbering system will need to be updated. UK cattle currently have a 12-digit identification number, with the first six digits being the herd mark, there is then a checksum digit, followed by a five-digit individual animal number. Defra has proposed that this difficulty could be overcome by dropping the checksum digit, which was initially added so that manual transcription errors could be more easily detected,⁹ to make UK cattle IDs compliant with this ISO standard.

Ultra-High Frequency Technology

- A.8 For UHF electronic identification, the use of RFID operates in the frequency range of 860 to 960MHz for animal identification.¹⁰
- A.9 The distance over which UHF microchips can be read varies. For certain handheld UHF readers, the read range for cattle tags is up to 5 metres¹¹ or for generic handheld UHF devices at a range in excess of 5 metres.¹² For fixed/static UHF readers, the read range is likely higher, up to 6 metres and more.¹³
- A.10 UHF has 'anti-collision' properties,¹⁴ meaning that multiple tags can be read simultaneously by the same reader. Consequently, the user (e.g. farmer, abattoir, market) has the option to handle cattle either in batches or as individuals.
- A.11 ISO 6881 - published in December 2023 (ie now a ratified international standard) – defines how to encode the animal identification codes in UHF RFID transponders (ie tags). There, as of now, no comprehensive ISO standard that fully covers everything for UHF readers, advanced transponders nor conformance testing for those readers for cattle yet.¹⁵ ISO 6881 uses the same encoding structure as ISO 11784 (the current LF equivalent).¹⁶
- A.12 The implementation of ISO6881 would require the UK's use of the existing cattle identification numbering system to be updated. An alternative standard developed by the United States Department for Agriculture (USDA) has been employed in the

⁸ [DEFRA and Welsh Government Bovine Electronic Identification \(BEID\) Pilot Projects: Joint Final Report](#) pp. 2 and 26

⁹ [DEFRA and Welsh Government Bovine Electronic Identification \(BEID\) Pilot Projects: Joint Final Report](#) p. 51

¹⁰ [ScotEID Report Using UHF For Cattle Electronic Identification August 2023 - ScotEID Library](#) paragraph 24

¹¹ [Consultation on cattle identification and traceability in Scotland April 2024](#)

¹² [DEFRA and Welsh Government Bovine Electronic Identification \(BEID\) Pilot Projects: Joint Final Report](#) (Rutter et al., 2023), p. 30

¹³ [ScotEID Report UHF EID in Scotland](#), p. 3

¹⁴ [ScotEID Report Using UHF For Cattle Electronic Identification August 2023 - ScotEID Library](#) paragraph 25

¹⁵ [Implementation of Bovine Electronic Identification \(Bovine EID\) in Wales | GOV.WALES](#), response to Q1

¹⁶ [Part 2: Identification, Registration & Movement – Bovine EID - Cattle identification and traceability: consultation - gov.scot](#)

ScotEID bovine EID pilot. This interim UHF standard would not require the existing cattle identification numbers to be updated.¹⁷

¹⁷ [ScotEID Report Using UHF For Cattle Electronic Identification August 2023 - ScotEID Library](#), p.10

Appendix B: Stakeholder views on the potential business impact of regulatory differences

B.1 Our conclusions and recommendations draw on our consultation with a range of industry stakeholders, including trade associations, abattoirs, markets and farmers. Given the review's focus on whether the use of different technologies will lead to an effect on trade on the UK internal market, this Appendix is structured around two key questions:

- **Question 1: Will regulatory differences lead businesses in the bovine supply chain to change who they buy from and sell to?** There are two aspects to this question, as described in paragraph B.2 below.
- **Question 2: Will businesses incur any costs – including longer-term investments – to accommodate the regulatory differences?**

Question 1: Will regulatory differences lead businesses in the bovine supply chain to change who they buy from and sell to?

B.2 Here, we explored with participants across the bovine supply chain (ie abattoirs, markets and farmers) their views on two closely linked questions:

- (i) whether regulatory differences might change the geographic pattern of internal market trade; and
- (ii) in particular, what changes they might make to where they buy or sell their cattle when both EID technologies are in operation in the UK

Trade associations

B.3 Trade associations expressed a range of views on these related questions:

(i) whether regulatory differences might change geographic pattern of internal market trade

- (a) Generally, the trade associations that we spoke to did not think that the geographic pattern of internal market trade would change.
- (b) However, one trade association highlighted a number of concerns relating to changes in the geographic pattern of internal market trade. In their view, trade across the English/Scottish border will not happen if: (i) farmers based in Northern England do not want to absorb the costs of either re-tagging cattle or investing in dual readers; (ii) farmers do not want to absorb the costs of maintaining two different EID systems, finished (English or Welsh) cattle

would not go to Scottish abattoirs and some Scottish cattle would not go to Welsh abattoirs.

- (c) A second trade association described how English and Welsh cattle dealers and buyers may avoid sourcing from Scotland to sidestep complications (arising from regulatory differences in bovine EID) and that this would potentially disadvantage Scottish producers. They called for careful consideration of these dynamics under the Internal Market Act to avoid unintended consequences.
- (d) A third trade association told us that, if one part of the UK became more difficult for cross-border trade (relative to the others), beef processors could shift production and investment over time to the more efficient locations.

(ii) what changes their members might make on where they might buy or sell their cattle when both EID technologies are in operation in the UK

- (e) One trade association did not think it would be practical for buyers and sellers to change their purchasing/selling practices, although acknowledged that there could be additional costs to adjusting to both technologies.
- (f) A second trade association suggested that the beef processing industry is consolidating and that decisions about sourcing and processing are likely to be driven more by animal quality and retailer specifications than by EID technology.
- (g) A third trade association described how the differences in EID technology could be analogous to blue tongue restrictions, which caused disruptions to intra-UK trade (with Wales and Scotland not accepting cattle from England).

Abattoirs

B.4 The abattoirs that we spoke to generally expressed consistent views on these related questions:

(i) whether regulatory differences might change geographic pattern of internal market trade

- (a) One large abattoir indicated that having two bovine EID technologies implemented in the UK would not affect which part of the UK it would process meat. They also did not think that the trade patterns of farmers would be affected because farmers will continue to trade where they get the greatest market value for their stock.
- (b) A second large abattoir did not think that intra-UK trade patterns would be affected by the implementation of both bovine EID technologies, unless the

implementation of one or other of those technologies created challenges to exporting their products to non-UK nations.

(ii) what changes they might make on where they might buy or sell their cattle when both EID technologies are in operation in the UK

- (c) Three large abattoirs described how regulatory differences in bovine EID would not change where they would source cattle from.

Markets

B.5 Markets expressed similar concerns that farmers would buy animals with technology that they are already using, which would limit cross-border trade.

(i) whether regulatory differences might change geographic pattern of internal market trade

- (a) One market operating in the North of England, indicated that some farmers might only buy cattle that are already tagged with the particular EID technology they use on their holding and this could have some impact on the geographic pattern of internal market trade.

(ii) what changes they might make on where they might buy or sell their cattle when both EID technologies are in operation in the UK

- (b) A second English market explained that, although they did not expect to lose any customers as a result of the regulatory differences, there was nevertheless a risk that, if it becomes too complicated for Scottish buyers to buy English cattle, they would buy Scottish cattle instead.
- (c) One Scottish market suggested that their buyers have indicated that they will only buy cattle with EID tags that they have the technology to read. They considered that some farmers might add a second EID tag to cover both LF and UHF frequencies but that less technology-savvy farmers would not.
- (d) This view was supported by an English market that considered their customers would likely buy cattle tagged with an EID system they were set up to handle and this could impact cross-border trade.
- (e) Another English market thought that the regulatory difference might affect the willingness of some buyers to bid for batches of animals that have a mix of LF and UHF tags because of the cost of implementing EID reads and the infrastructure needed to support them.

Farmers

B.6 Farmers expressed consistent views on these related questions.

(i) whether regulatory differences might change geographic pattern of internal market trade

(a) Farmers expressed the common view that changes to geographic pattern/s of internal market trade, as a result of regulatory differences, will be limited.

(ii) what changes they might make on where they might buy or sell their cattle when both EID technologies are in operation in the UK

(b) The shared view was that regulatory differences will not affect farmers unless they are in border areas – e.g. some Scottish farmers on the border use some North England markets and some farmers in England use South Scotland.

Question 2: Will businesses incur any costs – including longer-term investments – to accommodate the regulatory differences?

B.7 We explored with stakeholders whether businesses would incur any costs to facilitate working with cattle with either LF or UHF tags. The responses indicated a strong expectation that investments will be made in having EID readers capable of reading either type of tags (either two separate systems or a dual frequency system). There was only limited support for the idea that animals would be routinely retagged (perhaps reflecting the current legal situation which prohibits this).

B.8 In addition, there was a near universally held view that, while EID offered significant benefits, having two technologies operating across the UK would introduce friction when trading across the English/Scottish border. However, the extent to which a business would bear costs and the scale of the costs was fact sensitive, depending on the type of business and its scale.

Trade Associations

B.9 Trade associations expressed a range of views on costs and investments:

(a) One trade association indicated that larger abattoirs who handle a lot of Scottish cattle will probably invest in both sets of bovine EID reading equipment.

(b) A second trade association said that, while the cost of implementing dual technologies is not considered prohibitive for large abattoirs, it is a significant concern for smaller businesses. This trade association anticipated that

regulatory divergence may influence strategic decisions, such as where to invest or consolidate operations. It added that smaller abattoirs are more vulnerable to the costs and complexities introduced by dual systems.

- (c) A third trade association indicated that markets that are located close to the border who are reliant on, and instrumental in, cross-border trade will probably need both sets of bovine EID systems.
- (d) A fourth trade association suggested that it is likely that electronic tags will cost £1 more than non-electronic tags and that these costs can become significant over time.
- (e) A fifth trade association held the view that (dairy) farmers would need two sets of readers to read the tag used for farm management (which might be in a collar) and the tag used for tracing (which will be an ear tag). It considered a dual tag might require a third reader.
- (f) A sixth trade association considered that the duplication of costs and the maintenance involved in running two EID systems would, by necessity, lead to the use of dual-frequency tags which they expected to be more expensive.

B.10 Many trade associations held the view that smaller businesses would not find it cost effective to invest in both technologies. For example,

- (a) One trade association told us that, in its view, smaller businesses are expected to bear the brunt of regulatory divergence, lacking the capital and infrastructure to adapt as easily as larger abattoirs and markets and thereby foregoing the benefits of EID across some of its throughput.
- (b) Another trade association described how a small abattoir would see that the cost of installing both sets of technology is likely to be prohibitive and would not be outweighed by the benefit of being able to scan a lot of animals. In their view, small abattoirs would only accept one type of EID.

Abattoirs

B.11 The abattoirs who participated in this study described how larger businesses would invest in adopting to both technologies:

- (a) One large abattoir suggested that all its UK facilities would probably invest in dual LF and UHF systems for various reasons (including in the event of a disease outbreak). It also told us that initially there would be extra costs, such as readers, and that they would probably purchase dual-frequency readers. They did not envisage that initially they would be able to reduce staffing numbers as a result of introducing EID, whereas another thought there may be efficiencies from reduced labour costs.

- (b) A third large abattoir told us that it would have to restructure the layout of its facilities for single cattle to be scanned by the LF reader or by both types of readers.

Markets

- B.12 A majority of markets indicated that they would invest in both bovine EID technologies to be able to scan them at auction, even if this meant additional costs:
- (a) One market business that operates primarily in the North of England and Southern Scotland is currently looking into investing in UHF readers and thinks that, to make its markets compatible for both systems, the cost would be 'in excess of £100,000'.¹⁸ This market also told us how markets operating in border regions will face increased compliance costs in relation to traceability because it considered that operating both EID systems at markets might create bottlenecks if the systems did not work together.
 - (b) A second market identified the cost of installing EID systems and also the additional labour cost for reading cows both manually and electronically (ie might need an extra member of staff to do this).
 - (c) A third market reported that they often sell cattle through three sale rings simultaneously, which would require any technology investment to be made in triplicate. If two technical standards had to be supported that would double the required investment.
 - (d) In contrast, a large market located in the West Midlands region of England told us that they are unlikely to invest in UHF technology unless there is a significant increase in Scottish cattle being sold through their market to justify the expense.

Farmers

- B.13 Farmers expressed a plurality of views on investments/costs. Overall, farmers with larger cattle holdings appear more likely than smaller farmers to invest in equipping their farms with both bovine EID technologies. Among the reasons given for this were that larger farmers would see the efficiencies from the technology, such as identifying and weighing cattle electronically, which were greater when applied to larger numbers of cattle. Smaller farmers could benefit from these efficiencies as well, although in some cases the costs of the equipment might outweigh the gains. More detailed views expressed by farmers included:

¹⁸ We note that this amount is a total cost, not an incremental cost from supporting two EID technologies rather than one.

- (a) One farmer, with a medium beef herd in South West Scotland, indicated that farmers in the dairy sector would be most likely to invest in bovine UHF readers, which they would set up in dairy parlours. He also suggested that farmers with large beef herds would also see advantages from using EID technology for farm management purposes.
- (b) A second farmer, with a large beef herd in Central Scotland, described how, if an LF tagged animal moved from England to Scotland, the farmer would need to put a UHF tag on it for management purposes which would involve a cost. In addition, he suggested that a farmer will need to choose between having two sets of readers or retagging any animals not on the frequency used on the farm.
- (c) A third farmer, with a large beef herd in the North of England, explained that the extent to which English farmers would invest in UHF readers (which would be able to read UHF-tagged cattle arriving from Scotland) would depend on both the farm size and what the farmer might wish to learn from data collection and record keeping – there were significant productivity benefits to be achieved. They also suggested that small farms will not invest in EID readers and instead continue to rely on visual readings – a view that was supported by a tag manufacturer.
- (d) A fourth farmer, with a small beef herd in the North of Scotland, indicated that the minimum cost for a farmer is to fit a tag – they are not required to use EID tags for submitting cattle movement data. However, if farmers wish to read EID tags (which could be either UHF or LF tags) there will be costs to acquire the reading equipment.
- (e) In contrast to the views expressed above, a fifth farmer, with a small beef herd in Central Scotland, told us that smaller farmers and crofters would probably see benefits from investing in UHF readers because they can read the tag from a distance. Another farmer, with a large dairy and beef herd in Central Scotland, explained that small farmers (e.g. 4 or 5 farmers) could share the cost of both LF and UHF readers, and that this was feasible because they only need to do readings when moving cattle.

Other types of costs: non-investment costs

- B.14 As described in paragraph 3.24 above, two technical standards for EID will also introduce trade frictions over and above additional investments. Stakeholders' views on non-investment costs are organised according to four categories: (i) increased complexity as a result of implementing two EID system; (ii) practical challenges in managing herds with mixed tag types (LF, UHF and flag tags); (iii) stakeholders' concerns about potential database compatibility; and (iv) international exports.

(i) Increased complexity as a result of implementing two EID systems

- B.15 Many stakeholders we spoke to - including trade associations representing a substantial portion of the cattle industry - highlighted concerns that having two technical standards for EID systems will complicate the day-to-day operations of cattle businesses.
- (a) One trade association described their members as being nervous about having to deal with both UHF and LF technologies, due to many complications such as manufacturers having to train up staff in two different systems. In their view, the 'real hassles' will be felt by markets and abattoirs handling large volumes of Scottish and English cattle.
 - (b) A large abattoir told us how the margins are thin enough now and that trade frictions create costs. They highlighted many unanswered questions relating to (unknown) non-investment costs, including: if a store animal is bought in Scotland with a UHF tag and moves to an English farm, what happens next? What happens with the reverse regarding an LF animal going to a Scottish farm? What are the up-to-date implications for beef and red offal for EU exports out of Scotland with the adoption of UHF?
 - (c) One market highlighted how cross-border trade in the Scottish/English border region is going to face a major complication – especially as no one has had to think about it in the past as trading had been seamless and easy to do. Now the business is going to have to think very carefully about (the scale of) English border farmers buying in Scotland.
 - (d) A second market described the complexities arising from potential divergence between LF and UHF technologies as horrendous and cited the need for additional equipment and training. This business currently charges 3.5% commission and might increase this to 4% if additional labour and equipment are needed. They also told us how the two systems would create confusion and inefficiencies, thus undermining the goal of improving traceability and management.
 - (e) A third market told us that seamless trade is hard enough now; and, in their view, the additional costs arising from increased complexity of having two systems would be detrimental to the manufacturing industry, if care is not taken.

(ii) practical challenges in managing herds with mixed tag types (LF, UHF and flag tags)

- B.16 Several stakeholders that we spoke to raised a number of challenges relating to having mixed EID technologies (ie traditional flag tagged animals and both LF and

UHF tagged animals) on site. All of these indicate an increased cost to businesses.

- (a) One trade association reported to us that most abattoirs have limited spaces and therefore it will be challenge getting the configuration of the fixed reading equipment right and not all facilities will have the space to install both LF and UHF readers.
- (b) One market described how mixed tag types would require manual checks to ensure accuracy, especially when discrepancies arise. They told us that they prioritise 100% traceability and would take extra steps to ensure all movements are correctly recorded, even if it means rescanning or manually verifying animals.
- (c) Two other markets envisage difficulties in 'batching' cattle together when carrying out both manual reads and EID reads. One of these businesses highlighted the challenges of being able to show on a TV screen in real time all the vital pieces of information customers need to bid; and, with two different types of EID technologies, the concern is that this might not be possible to do.

(iii) Stakeholders' concerns about potential database compatibility

B.17 Some of the stakeholders that we spoke to expressed concerns about database compatibility and whether information would flow seamlessly between the new national databases.

- (a) One trade association described how its most pressing concern is whether the two EID systems will be interoperable. Its members require seamless access to animal data, regardless of tag type or origin, and fear that fragmented database systems could hinder traceability and increase administrative overhead.
- (b) A second trade association said that all (UK) countries need to talk to each other and this is not in place yet. In their view, this database system for cattle identification and traceability is possible, and the markets will drive its development.
- (c) A third trade association told us that the focus should be on getting databases that will speak to each other as a matter of high priority before worrying about whether the cattle tags can cross borders. They described how there needs to be a sound and robust system that can operate across the devolved nations, with interoperability at the very least.
- (d) One abattoir raised concerns around data transfers between the different jurisdictions, mainly in relation to Scottish information not coming back to

England. They stressed the need for the two systems to be linked up for disease management.

- (e) A second abattoir told us that the two EID systems do not talk to each other and that industry should not be allowed to move to EID until the databases speak to each other.
- (f) A third abattoir raised the concern that sometimes government/s changes their mind on how data is to be collected. They are worried about whether the (devolved) governments will speak to each other and whether the database system/s will work.
- (g) An IT company suggested to us that it is a 'five-minute fix' for software to be re-designed to read data from both LF and UHF readers and input the data to a national database. They also added that it is not required for the customer to invest in EID software that can handle both technologies.

(iv) international exports

- B.18 Although we have not looked explicitly at the issue of exports to European and non-European countries, some of the stakeholders highlighted important issues to us.
- (a) One stakeholder with regulatory responsibilities described how embarrassing it is that the UK has different bovine EID regulations across the devolved nations. In their view, the choice of technology should be based on evidence; and, if one system is better, agreements should be reached without political or commercial influence. This stakeholder reported how it is challenging for them to explain in international trade discussions how the devolved administrations have different ways of reading ear tags, as this provides more opportunities for inconsistencies to be picked up or imagined. This lack of consistency across the four nations is making more work for everyone in the regulatory landscape.
 - (b) More generally, another trade association questioned the compatibility of UHF tags with EU standards, which could affect export viability.
 - (c) Two trade associations told us that Scotland may not be compliant with EU rules and that this will affect GB's trade with Europe. One of these stakeholders said that this issue is supposed to be resolved in ongoing discussions. If not resolved, this trade barrier would be absolutely devastating for Scottish abattoirs because the EU is their largest export destination.
 - (d) One large abattoir suggested that Europeans will adopt the LF system, at this point in time, and so UHF could be an export trading challenge. They wanted

to know what the up-to-date implications for beef and red offal for EU exports out of Scotland with the adoption of UHF. In their estimates, the UK exports 16-18% of its beef and 25% of its hides and offal, with much of this going to the EU. If the EU does not accept these products from Scotland (due to the products being derived from UHF EID tagged cattle), the business will have a lot more product that they would have to try to sell in England and Wales. They are concerned that this domestic market is too small because English consumers are not interested in a lot of them (e.g. offal which is more popular on the continent).

- (e) A second large abattoir described how the recent EU Deforestation Regulation (EUDR) requires information on the geolocation of all cattle that the EU imports, so that the geolocation can be checked against deforestation data. This will mean that the information captured from cattle ear tags of every UK consignment of beef sold to Europe needs to show no deforestation. This new EU regulation – highlighted by another large abattoir as well - raises the new challenge of ensuring that the UK's EID technology has a database that can share the same cattle traceability information with its EU trading partners.
- (f) A third large abattoir raised the issue of the UK government negotiating the UK-EU SPS Agreement, which might (or might not) cover bovine EID technology. They described how, when trade delegations look for comfort around traceability standards, some have expressed surprise around there being two EID systems operating in the UK. They speculated that this regulatory difference might feed through into those considerations.

Appendix C: Costs modelling methodology

- C.1 This appendix describes the methodology used to model the incremental equipment investment costs of supporting two EID standards. The analysis estimates total investment costs over five years under three alternative scenarios, reflecting different potential policy outcomes.
- C.2 The modelling estimates direct equipment costs to bovine farms, auction marts and abattoirs. Costs are divided into fixed and variable components and expressed as industry totals, sectoral breakdowns and average firm-level estimates. All calculations use average values across data sources.

Analytical Scope

- C.3 The model captures only initial equipment-related costs, which comprise:
- (a) **Fixed costs** – One-off investment in EID reader equipment (handheld stick readers and panel readers operating under LF, UHF or dual-frequency standards); and
 - (b) **Variable costs** – Annual expenditure on EID tags, calculated as the product of the average yearly calf population by nation and the average tag cost under each scenario.
- C.4 The total five-year cost combines these two elements. No allowance is made for depreciation or equipment replacement during this period.

Modelled Scenarios

- C.5 The analysis compares costs across three scenarios:
- (a) **Scenario 1: Single Technical Standard (LF or UHF).** A uniform technology is implemented across all UK nations. This represents a baseline against which the incremental equipment costs of multi-standard systems can be measured.
 - (b) **Scenario 2: Two Concurrent EID Systems.** LF tags are mandated in England, Wales and Northern Ireland, and UHF tags in Scotland. This reflects the current industry expectation.
 - (c) **Scenario 3: Dual-Frequency Tags.** Cattle are fitted with dual-frequency EID tags incorporating both LF and UHF frequencies, allowing either LF or UHF readers to be used to read the tag.

Data and Assumptions

- C.6 The model uses both firm-level and aggregated industry data, supported by stakeholder evidence and market-sourced price estimates. Key inputs include:
- (a) Firm numbers by industry, nation and size;
 - (b) National cattle and calf population data;
 - (c) Cross-border movement volumes; and
 - (d) Indicative costs for EID tags and readers obtained from public manufacturer data and stakeholder submissions.
- C.7 Adoption probabilities for different reader types were assigned to each firm-size group, based on stakeholder interviews. These reflect the expected differences in operational needs between small, medium and large businesses in each of the bovine farming, auction mart and abattoir sectors.
- C.8 Firm size categories as shown in the table below, were defined for these purposes using equipment adoption bounds identified in the limited previous EID literature concerning ovine EID equipment adoption,¹⁹ natural break points in the industry firm size data, and likely EID equipment adoption bounds based on our stakeholder interviews.

Table C.1 Size bounds by Industry (cattle numbers, holdings and annual throughputs)

<i>Industry</i>	<i>Small</i>	<i>Medium</i>	<i>Large</i>
<i>Farms</i>	1–50 cattle	51–150 cattle	>150 cattle
<i>Marts</i>	0–1,000 throughput	1,001–10,000 throughput	>10,000 throughput
<i>Abattoirs</i>	0–1,000 throughput	1,001–10,000 throughput	>10,000 throughput

Model Structure and Calculation Process

- C.9 The modelling process followed five steps:

¹⁹ [PMC Ovine EID Implementation Study](#), (10 October 2025)

- (a) Establishing firm counts: Firms were categorised by sector, nation and size class using datasets on cattle holdings and the throughput of bovine auction marts and abattoirs.
- (b) Assigning equipment configurations: Reader types and adoption probabilities were allocated to each group, distinguishing between businesses that would not invest in readers, small-scale users (typically handheld readers) and larger or high-throughput operators (typically panel readers).
- (c) Calculating fixed costs: Fixed costs are calculated as the product of the number of firms; their adoption probability; and the average equipment cost for each reader type.
- (d) Calculating variable costs: Annual variable costs are calculated by multiplying average calf numbers by the average tag cost under each scenario and then multiplied by five (years, undiscounted) to obtain total costs over an initial transitional five-year period of EID adoption.
- (e) Aggregating results: Fixed and variable costs were combined to produce an overall total. Scenario total costs exist in an array of aggregation and granularity.

Key Assumptions

C.10 The analysis rests on the following simplifying assumptions:

- (a) Equipment price data represent the mean of our stakeholder and supplier estimates and has not been discount modelled;
- (b) Adoption probabilities vary across bovine sectors and firm sizes, reflecting operational need;
- (c) Farms, auction marts and abattoirs are not modelled to incur additional costs from lost-tag replacement; and
- (d) Equipment performance is modelled to remain stable throughout the five-year period. Equipment is not modelled to reflect EID equipment upgrades, degradation, failure or replacement.

Limitations

C.11 The following limitations apply:

- (a) The costing model excludes direct costs of implementation and indirect or administrative costs such as additional staff training, additional staff costs, infrastructure modification costs or any costs associated with any impacts on

trade. These costs could be significant in comparison with the direct equipment costs we have estimated;

- (b) Adoption probabilities are based on stakeholder views rather than empirical observations of EID adoption behaviours;
- (c) Equipment price data are indicative and may change as technology markets evolve and mature;
- (d) Confidentiality restrictions of stakeholders meant that geographic location data for bovine auction marts and abattoirs was withheld and thus could not be utilised for additional modelling of border-related effects.

Modelling Outputs

- C.12 The model produces a set of cost estimates for each scenario, including scenario comparisons showing absolute and percentage differences relative to the baseline scenario.
- C.13 Sensitivity testing was conducted to assess how different investment intensities affect total costs in each EID scenario. Two alternative cases were modelled, diverging from the assumed central baseline EID equipment adoption probabilities.
 - (a) A **high-investment case**, assuming higher adoption of EID technology within firms using EID and wider deployment of EID reader technologies across the industry; and
 - (b) A **low-investment case**, assuming lower adoption of EID technology within firms using EID and narrower deployment of EID reader technologies across the industry.
- C.14 Specifically, under the high-investment case we assumed that, within each industry, small firms would match medium firms' EID adoption behaviour (under the central baseline investment case), medium firms would match large firms' EID adoption behaviour (under the central baseline investment case) and large firms would not change their EID adoption behaviour from the under the central baseline investment case.
- C.15 Under the low-investment case we assumed that, within each industry, medium firms would match small firms' EID adoption behaviour (under the central baseline investment case), large firms would match medium firms' EID adoption behaviour (under the central baseline investment case), and small firms would not change their EID adoption behaviour from the central baseline investment case.

- C.16 These cases generate upper and lower bounds for total five-year costs. They provide a way of thinking about how sensitive the model's estimates are to the adoption probabilities that have been used.

Future Modelling Expansion and Refinement

- C.17 The model provides a framework that can be developed further as new data become available. Potential areas for refinement include:
- (a) **Updated cost data** – revising equipment prices as the market for UHF and dual-frequency EID technologies mature.
 - (b) **Improved adoption modelling** – updating adoption probabilities using observed behaviour from future bovine EID implementation.
 - (c) **Dynamic equipment costs modelling** – incorporating depreciation, cost discounting, replacement cycles, maintenance costs and indirect costs of EID equipment implementation.
 - (d) **Scenario enhancement** – considering the costs over a timeframe that would include the phasing out of bovine paper passports.
- C.18 These refinements would enhance the precision and policy relevance of future cost modelling.