# Remote Vet Inspection

Remote Animal Health & Welfare Inspection for Australian Red Meat Processing Industry.

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# 1.0  Executive Summary



Inspection of livestock health and welfare is a significant and necessary activity across the red meat supply chain. Historically, animal health management and inspection by veterinarians and related workers, whether by government or third-party organisations, has relied on paper-based checklists (though digital checklists are emerging), email and phone communications, as well on-site visits to inspect an establishment feedlot in person. This labour-intensive approach has changed little in decades and has significant limitations and inherent weaknesses which impose considerable costs on the red meat processing industry. One of the emerging threats to the delivery of health and welfare assessment services into the red meat supply chain is the increasing shortage of veterinarians who are both livestock specialists and who are prepared to work in regional, rural or remote Australia.

Recent animal disease outbreaks such as Foot-and-Mount disease (FMD), Lumpy Skin disease (LSD) in large parts of the world have also highlighted the importance of more significant investments in prioritising animal health systems and efficient biosecurity surveillance strategies. Recent data from the Department of Agriculture, Forestry and Fisheries (DAFF) showed that FMD animal disease outbreaks could cost Australia approximately $80 billion over ten years.

Advanced, innovative technologies are suggested to provide an opportunity for improving national biosecurity surveillance strategies, reliability, and cost-effectiveness. New digital communications technologies present the opportunity to scale animal health and welfare assessments. Industries such as manufacturing, logistics, and the military are now actively adopting the use of smart glasses across their business to drive efficiencies. Such technologies also enable the delivery of expertise at a distance, this enabling a greater range of workers across supply chains to be involved in delivery of expert services.

Following our previous investigation of the use of remote audit technologies in the red meat processing sector (AMPC 2021-1113), it was clear an opportunity presented itself to further explore the potential for remote inspection technologies for delivery of remote animal health and welfare inspections. The research reported here aimed to provide the red meat processing sector with a better understanding of the opportunities for provision of livestock health and

welfare inspections in those instances where a specialist, e.g. veterinarian, may not be available in-person to make a determination.

The research reports on:

A review of existing animal health and welfare assessment technologies that could enable remote service delivery.

A better understanding of the opportunity for remote animal health and welfare technologies to be deployed across the red meat processing sector, including on-farm and in -feedlot.

An investigation of the necessary standards that will need to be adopted for remote animal health and welfare inspection

A number of product features required for remote inspections and a comparison of existing technologies

Presentation of several scenarios where one remote inspection technology (Elixar) was trialled.

# 2.0 Introduction

The Australian red meat processing industry is the largest in the agriculture sector ($A28.5B in 2018-2019), is Australia's largest Agricultural export industry ($A17.2B in 2018-2019) and is the largest regional employer and the most prominent Australian manufacturing sector. In 2018-2019 the total sale of goods and services in the red meat and livestock sector was $72.5B (https://link.bondilabs.com/MLA-Sol).

The importance of meat export to the Australian economy was recognised in the 2020/2021 Budget announcement of $328M for Busting Congestion for Agricultural Exporters, including $10.9M allocated for Building a More Competitive Meat Industry. A key component of modernising meat processing will be identifying opportunities to improve regulatory activities using technology. Examples of these technologies might be to digitise paper-based forms, using 'smart' computer vision for autonomous surveillance and fault detection.

A critical determinant of the ongoing vitality of the Australian red meat industry, such that Australian processors can sustain productivity, maintain market access and remain competitive, is the overall health and welfare of livestock[1]. National and international community expectations, and associated regulatory controls, regarding the suitability of red meat for human consumption is driving greater need for the red meat sector to deliver products that are sourced from animals that are disease free and which have been raised, transported and processed with the highest levels of animal health and welfare controls. This project has been conducted to better consider how technology can be used to address a key factor involved in the maintenance of animal health and welfare, namely veterinary inspection. In particular we address a significant challenge facing the delivery of veterinary services across the livestock supply chain, the increasing shortage of veterinarians who work in regional, rural and remote communities within which red meat processors are typically situated.

One critical area where technology can play a role is in the monitoring of animal health and welfare. Recent animal disease outbreaks such as Foot-and-Mount disease (FMD), Lumpy Skin disease (LSD) in large parts of the world have

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[1] https://www.mla.com.au/research-and-development/reports/2010/review-the-national-animal-welfare-standards-at-livestock-processing-establishments/

highlighted the importance of more significant investments in prioritising animal health systems and efficient biosecurity surveillance strategies. Advanced innovative technologies provide an opportunity to improve the reliability and cost-effectiveness of these strategies. Recent statistics from the Department of Agriculture, Forestry and Fisheries (DAFF) showed that FMD animal disease outbreaks could cost Australia approximately $80 billion over ten years[2].

Historically, animal health management and inspections by veterinarians in the meat production supply chain, whether by government or third-party organizations, has relied on paper-based checklists (though digital checklists are emerging), email/phone communications, as well on-site visits to inspect an established feedlot in person. This labour-intensive approach has changed little in decades and has significant limitations and inherent weaknesses which impose considerable costs on the red meat processing industry. One of the emerging threats to the delivery of veterinary services into the red meat supply chain is the increasing shortage of veterinarians who are both livestock specialists and prepared to work in regional, rural or remote Australia. In their pre-budget submission, the Australian Veterinary Association (AVA) brought this threat into sharp focus and the immediate challenge:

> "underinvestment in the profession has resulted in the current veterinary workforce shortage…Left unchecked, this has the potential to lead to the collapse of the sector, which poses significant risks to the community at large"[3]

Following our previous investigation of the use of remote audit technologies in the red meat processing sector (AMPC 2021-1113), it was clear an opportunity presented itself to further explore the potential for remote inspection technologies for delivery of remote animal health and welfare inspections.

Remote veterinary inspection is proposed as an adjunct/alternative to address the limitations of existing veterinary inspection procedures. Veterinarian inspections create economic benefits and result in earlier application of new scientific information and guidance along with improved disease control and management. These benefits can be significantly increased through remote veterinarian inspections, where the veterinarians have significant opportunity to make a fast-paced efficient contribution whilst saving crucial resources. Especially, the Covid pandemic has revealed the seriousness of these labour-intensive limitations and their consequential effects on animal welfare and the livestock processing supply chain. The major loss due to the cascade of closures, resultant lockdowns, decreased labour force, restricted movements of animals, and change in legislation of markets has resulted in risk of biosecurity of animal health and welfare with damage to entire meat processing chain. This crisis has significantly compromised veterinary capacities and disrupted the veterinary services, their activities and resources on the on-farm stays of stock and to protect animals from triggering incidence of transmissible diseases and thus resulted in limited animal product productions. Our research showed that compared to culled cattle and feeder cattle, the feedlot cattle economy has suffered the most significant hit with 16% decline in price compared to a 9% decline in the former. Adapting to new methods of incorporating remote veterinary inspection methods into animal health compliance and inspection procedures can significantly help in the overall alteration of these limitations.

This project therefore was design to better understand the potential use of remote inspection technologies for animal health and welfare inspections along the red meat supply chain, in particular for the red meat processing sector.

# 3.0  Project Objectives

Since the initiation of this project, the following objectives have been modified, in consultation with AMPC and their agreement, to increase the focus on remote inspection of animal health and welfare: These objectives include

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[2] https://www.agriculture.gov.au/abares/research-topics/biosecurity/biosecurity-economics/fmd-update-of-2013-estimate
[3] https://www.ava.com.au/siteassets/advocacy/2022-23-federal-budget-submission_approved_final_20220124.pdf. Quote from p3

1. Significantly increase the number of Australian feedlots and meat processors who are trained and ready for remote inspection and auditing.
2. Increase the number of Australian veterinary professionals, para-veterinary workers, and auditors, whether government, third party, Halal or other, performing remote veterinary inspections.
3. Develop a range of new Remote Inspection product features to significantly increase the benefits of remote auditing and veterinary inspection over traditional inspection.
4. Contribute towards the development of international standards that take advantage of Australia's early lead in developing remote auditing and veterinary inspection.

## 1) Significantly increase the number of Australian feed lots and meat processors who are trained and ready to be remotely audited or access a remote veterinary inspection.

In research reported in AMPC 2021-1113, the research team delivered a remote auditing solution to over seventeen separate organisations and trained over fifty individuals in remote auditing technology. The revised project aims to further scale the rollout of remote inspection technologies to those workers involved in the assessment of animal health and welfare across the red meat supply chain, particularly focussing on veterinary services that are delivered across the red meat supply chain, particularly in feedlots. Our experience to date is that successful uptake of remote auditing and inspection requires both the ongoing support of a champion at each processor site (typically a QA manager) as well as providing quality training in the use of the technologies. We, therefore, need to build relationships with managers of feedlot facilities as well as providers of veterinary services in those facilities.

The Australian cattle feedlot industry has grown over the past 20 years, escalating the equity of animal health care, with distance and time being critical factors for most veterinarians and individuals employed in cattle feedlots. Early adoption of standardised remote veterinary inspections is an essential forward technique in the advancement of industry in these highly competitive markets.

## 2) Increase the number of Australian veterinary professionals, para-veterinary workers, auditors, whether government, third party, Halal or other, performing remote veterinary inspections.

The Australian feedlot industry presents an expanded opportunity to adopt emerging inspection technologies that support several veterinary professionals to sustain efficient biosecurity levels. In addition to increasing the proportion of Australian feedlots who are "audit-ready", this project focuses on a rollout to and support an increased number of veterinarians, para-veterinary workers, and veterinary organizations/associations. The success of remote veterinary inspection relies on many actors along the supply chain, from feedlots, veterinarians, auditors through to customers of audit reports, to be adequately trained and experienced in the use of remote veterinary inspection tools. The key aims of this objective will focus on aiding the capability and capacity of veterinarians and the associated workforce to be well-trained to conduct more remote inspections. This extension approach is vital for the veterinarians and related workforce to comprehend the significance of the obscured value of adopting remote inspections, to create significant income for themselves and the industry. In addition, this approach increases the number of remote inspections, which adds credibility to the whole endeavour, attracting more animal welfare organizational services and livestock industries, which many have been "sitting on the fence' to see how this goes.

## 3) Develop a range of new Remote Auditing and Inspection product features to significantly increase the benefits of remote veterinary inspection over traditional inspection.

Following industry consultation throughout our initial exploration of remote auditing technologies, the research team has identified the need to develop an extended set of capabilities in the technology to significantly increase the benefits of Remote Auditing and inspection over traditional in-person inspections such as:

a)      The ability to record and review every remote audit/inspection for efficient review of compliance evidence leading to improving product integrity and competitiveness

b)      Ensuring the security and privacy of video and another remote audit/inspection data streams

c)      Technology features enable simultaneous audits to reduce audit duplication, which is a major cost to the industry.

This direction is to be validated via qualitative research methods in collaboration with industry participants. This report showcases some of this investigation work. This objective has come about via prior research in understanding the needs of meat processors, auditors, and audit report customers. If this objective is not pursued, remote inspections will not rise to become better or more efficient than the current practice i.e., onsite inspection.

### 4) Contribute towards development of international standards that take advantage of Australia's early lead in developing remote animal health and veterinary inspection.

To take advantage of Australia's early lead in developing remote auditing smart glasses technology and start the process of developing the world's first Remote Auditing Standards with a vision for these eventually becoming ISO Standards that inform and complement the CODEX Guidelines on Remote Auditing which is being led by DAFF.

There is still hesitation by domestic and international governments to adopt and legislate the use of remote inspection technologies. This hesitation is in part due to limited industry evidence of the efficacy and practicality of the technology. Other roadblocks in the adoption of this technology stem from fears over cyber security when broadcasting footage and as always that natural hesitancy to do something new or different. This objective will involve planning, facilitating, and engaging with multiple regulatory parties to ensure any new CODEX standards best support the remote inspection needs of the industry. Getting in early is vital to ensuring the meat processing industry can have a significant voice in the conversation.

## 4.0  Methodology

### 4.1 Video Calls and Site Tours

Numerous video conference calls were conducted with all participants who initially responded to the Expression of Interest or who were participant organisations from the prior project. In some cases, separate calls were organized with relevant people in the organization who had specific expertise, e.g., Separate calls with Veterinary staff and QA teams. These discussions via phone call or video chat were designed to:

- Understand their business challenges, focusing on food safety, inspection and compliance.
- Communicate how to enhance on the job decision making via remote inspection technologies.
- Communicate how to continue to pilot the remote inspection technologies in a business.
- Begin to understand the technology readiness of their business to support remote inspection  technologies.
- Deeply understand the remote inspection challenges within the industry.
- Gain feedback if remote inspection technology is continuing to be used.
- Trial new concepts and ideas

Site tours were also conducted during this time. The purpose of these site tours was to continue investigative work, visually see areas where remote inspections occur, and observe individuals performing QA or inspection tasks.

**Key Organisation/Plant Site:**

The following processors have provided access to staff and facilities to ease our understanding of livestock health and welfare inspections:

- Fletchers- NSW and WA
- JBS- Sth (Brooklyn)
- Casino Food Coop
- Wagstaff

Note, we pursued renewed engagement with several other meat processing partners however various reasons (staffing shortages, increased requests for onsite audits and inspections, increased operational pressures) were all cited as reasons why processors were unable to engage in further research.

While we planned for visits to feedlots, within the timing constraints of the project, challenge of network connectivity at many feedlots and the distances involved in sending our personnel out to feedlots, we were unable to establish times and dates to do. We continue to explore opportunities for trialling remote inspection technologies in feedlot.

In addition to the industry sites visited we expanded our research to cover as much of the industry as possible to fully understand the entire supply chain and how it might be impacted by current vet practice shortages and potentially enhanced with the opportunity of remote animal health and welfare offerings. These included:

- Direct to livestock producers:
    o Dayboro cattle farm
    o Oakey sheep, cattle and cotton farm
    o NSW North Coast cattle farm
- Direct to training and education faculties:
    o University of Queensland (UQ) department of Veterinary Sciences and Training
    o TAFE Queensland Agriculture and Livestock faculty

## 4.2 Technology Readiness (IT and Wi-Fi checks):

Due to the restricted nature of the project in picking key processors to work closely with, there was a need to quickly identify those who might be able to adopt remote inspection technologies now vs those who may need networking upgrades to their facility. Bondi Labs has previously been working with the participating project organisations and has this IT information readily available.

## 4.3 Needs Analysis:

Needs analysis work is constantly reviewed and updated based on new site tours and pilots. From this, User Personas and customer journey maps are generated, which paint an indicative picture of the types of people that will come to use this technology, i.e., 3rd party auditors, government auditors, and organisation QA managers. A user journey was also used to describe a narrative of how the different roles will come to interact with the technology in a case example. Interview comments were coded and grouped into themes. These themes consisted of Software

Needs, Procedure Needs, Future Ideas, Existing Experiences, Benefits, and Challenges. Each of these themes directly helps with the future design phases of this project.

## 4.4 Research questions

### 1: What is needed to significantly increase the number of Australian feed lots and meat processors who are trained and ready to be remotely audited?

Part 1: RQ1: How can remote inspection be adopted broadly by any livestock handing (feedlot) service, even by those who have small-scale operations or limited connectivity?

- Interview, Site Visits, Pilot observations

Part 1: RQ2: Can livestock handing staff become confident and ready to conduct a remote inspection at a moment's notice

- Interview, Site Visits, Survey

Part 1: RQ3: What new animal health inspection tasks can be performed using remote inspection technologies?

- Interview, Site Visits, Pilot observations

2: What is needed to increase the number of Australian veterinary professional, para-veterinary workers, auditors performing remote audits?

Part 2: RQ1: How can remote inspection be adopted by any veterinary agency, even those that have small-scale operations?

- Interview, Site Visits

Part 2: RQ2: Can vets become confident and ready to conduct a remote inspection at a moment's notice?

- Interview, Site Visits, Pilot observations

Part 2: RQ3: Has remote animal/health inspection been explored in other parts of the world or industries?

- Literature Review, Interview

### 3: How to increase the benefits of Remote Inspection?

Part 3: RQ1: What are the challenges faced when conducting remote inspections?

- Interview, Site Visits, Pilot observations

Part 3: RQ2: Can an audit be fully recorded and stored in the cloud?

- Experiments, Pilot observations

Part 3: RQ3: What is state of the art for remote inspection tools?

- Literature Research

Part 3: RQ4: What additional tools may be required to support remote animal health inspections?

- Needs analysis, interview, pilot observations

**4: What are the standards needed for Remote Inspection to be accepted both domestically and internationally?**

Part 4: RQ1: What are the standards needed for animal health remote inspection to become accepted by Australian and foreign government agencies?

- Literature Review, Interview

# 5.0  Project Outcomes

## 5.1 Review of Remote Vet Technologies

Veterinary inspection is a significant part of the entire process of animal health and welfare. Historically, animal health management and inspection by veterinarians, whether by government or third-party organisations, has relied on paper-based checklists (though digital checklists are emerging), email/phone communications, as well on-site visits to inspect an establishment feedlot in person. This labour-intensive approach has changed little in decades and has significant limitations and inherent weaknesses which impose considerable costs on the red meat processing industry.
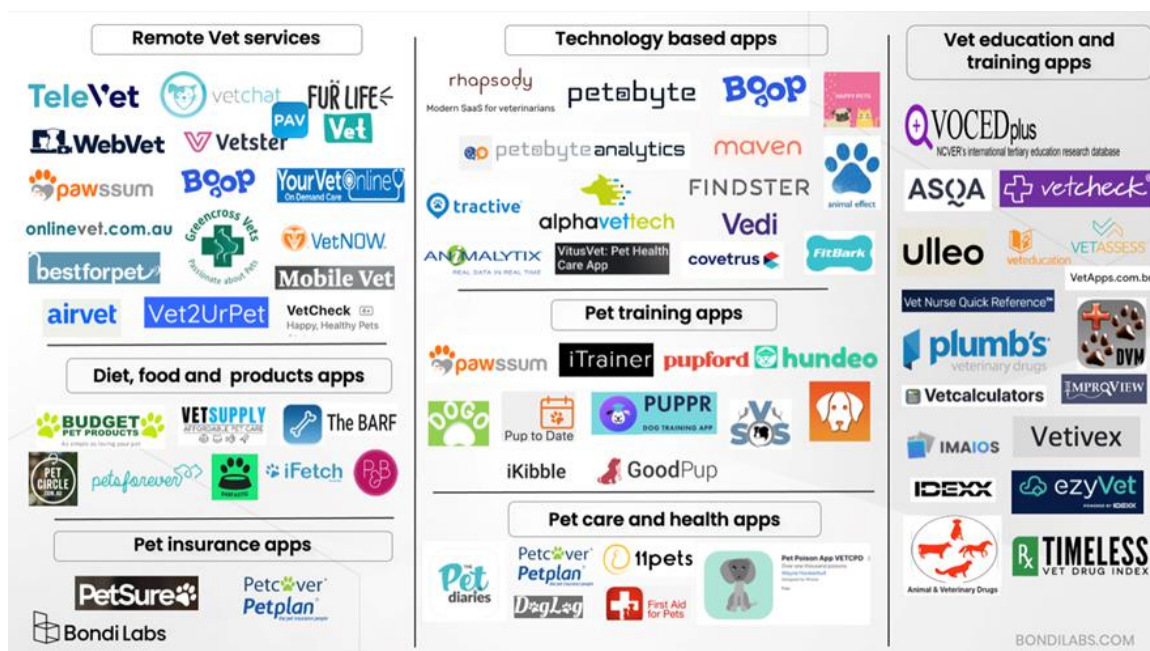


*Figure 1: Market map of apps and technologies we have identified for pet healthcare market*

In order to better understand how remote inspection technologies might be applied within the context of feedlots, we first started with a high-level review of the use of technology for health and wellness tracking in animals (see Figure 1). Very quickly, we identified that the most significant use of technology for monitoring and managing the health of

animals occurs in the petcare sector. The global telehealth/teleconsultation market growth in animal welfare soared with the covid-19 pandemic and especially the global veterinary telehealth market size was valued at USD 119.6 million in 2021 and is expected to expand at a compound annual growth rate (CAGR) of 17.6% from 2022 to 2030[4]. Many business models have evolved with the increasing availability of technologies for veterinary service provision and increasing consumer demand. Globally there are numerous companies providing remote or "tele"- pet health and welfare services. Figure 1 provides an overview of the current apps and remote veterinary services available in the Australian market, several of which are specifically targeting the delivery of remote veterinary consultation services.

For example, in discussion with veterinarians we frequently encountered the perspective that the industry would welcome some form of mobile-based app televet service. During an interview with the creator of one such app, they revealed the impetus to develop a tele-veterinary consultation solution stemmed from their own experience as a practicing vet that producers might hold off on contacting a vet if they perceive an in-person consultation to be too expensive or greater than the price of the animal. Other comments made from this vet was

> "*I was spending a lot of time giving free advice and at all hours via the phone, and while many livestock producers were willing to pay for my time, there was no means of doing that.*"

> "*Sometimes farmers will just want to speak to a vet to get some advice, rather than go to the expense of either getting a vet out to their property, or to take an animal into a vet practice*"

Using apps like Phone-a-Vet[5], pet/livestock owners can register their pets/animals and then book a consultation with a vet who specializes in their breed of animal. Booking a consultation also provides the opportunity for the owner to upload any photos for review by the consulting veterinarian. For remote-based vets, a technological solution has attractive benefits in enabling them greater flexibility in providing consultation services. During a consultation for the pet of one of our researchers, when asked about her experience of delivering services through the app, the consulting vet remarked:

> "*I have a couple of young kids so this allows me to make better use of my time*"

## 5.2 Hybrid Auditing Models

As discussed in relation to the previous exploration of remote auditing technologies in the red meat processing sector, Covid has led to several regulatory authorities reviewing their approach to the use of remote inspection technologies. For example, the United States Food and Drug Administration (FDA) has established a hybrid auditing model[6] encouraging the use of remote inspection technologies. Furthermore, during Covid, the FDA lifted a restriction on the in-person requirements for delivery of veterinary services, enabling the uptake and use of tele-veterinary consultation services. Normally, the federal veterinarian-client-patient relationship (VCPR) definition requires that veterinarians must physically examine animal patients and/or make medically appropriate and timely visits to the location where the animal(s) are kept. In relaxing the VCPR requirements, the FDA enabled veterinarians to remotely deliver services, including to:

> "*to prescribe drugs in an extra label manner or authorize the use of VFD drugs without direct examination of or making visits to their patients*"[7].

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[4] https://www.grandviewresearch.com/industry-analysis/veterinary-telehealth-market
[5] https://www.vetpracticemag.com.au/telemedicine-for-vets/
[6] https://www.fda.gov/media/144883/download
[7] https://www.fda.gov/news-events/press-announcements/coronavirus-covid-19-update-fda-helps-facilitate-veterinary-telemedicine-during-pandemic

## Discussion of Remote Inspection around the World

Recently the World Trade Organization Committee on Sanitary and Phytosanitary Measures (SPS) has also assessed the use of remote/virtual audit and verification in response to challenges introduced by covid with respect to international regulatory frameworks[8]. This review followed a recommendation by the Australian Delegation to the Committee's meeting on 15-16 July 2021 to build a greater understanding of 'Use of remote audit and verification in regulatory frameworks'. The proposal from Australia noted that:

> *"The COVID-19 pandemic has accelerated the development and utilisation of alternative assessment measures, such as remote audit, in regulatory practice relating to the food supply chain. These measures will become increasingly relevant to regulators and food businesses in the post-pandemic world."[9]*

The SPS review of remote audit technologies received input from several Government and industry representatives of the agri-food sectors who presented case-studies on the use of remote/virtual inspection across their respective countries[10]. For example, the Red Tractor organisation in the UK reported on 28,000 remote audits across a range of agrifoods between April 2020 and March 2021 and concluded that:

Remote assessments enable conformity checks when physical checks are impossible but have also brought additional benefits:

- Improved focus on document assessment

- Assessors to get 'eyes on the business' quickly in crisis or emergency scenarios

- The ability to audit during disease outbreaks (Avian Influenza)

- Better rotation of assessors

- The ability to focus appropriately at different seasons / production cycles

- Easier to witness assessors to ensure capability & consistency

Reference to the capability of technology to enable remote inspections during disease outbreaks, or by extension in cases where in-person inspections are difficult, has relevance for remote animal health and welfare inspection. During an interview with a NSW Local Land Services vet, it was revealed that in some cases, legislation enforces the in-person assessment by a veterinary officer. For example, in the case of a livestock transport accident in NSW, only a veterinarian can make decisions regarding euthanasia for injured and dying animals. While it may be technically feasible for a remote assessment of animal welfare to be made through video streaming or photographic evidence, legislation currently prevents ongoing distress to livestock in accident scenarios.

Some jurisdictions however are taking a more enlightened approach. For example, in Alberta, Canada, the Video Ante Mortem Inspection (VAMI) program[11] permits the inspection of animals unfit for transport such that they can be slaughtered on site, for example, in the case of transport accidents such that injured animals can be humanely assessed for euthanasia by people attending the accident in the absence of a veterinary officer (Figure 2).

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[8] https://www.wto.org/english/tratop_e/sps_e/thematic_session_21jun22_e.htm

[9] https://docs.wto.org/dol2fe/Pages/SS/directdoc.aspx?filename=q:/G/SPS/GEN1949R1.pdf&Open=True
[10] https://www.wto.org/english/tratop_e/sps_e/thematic_session_21jun22_e.htm
[11] https://www.alberta.ca/video-ante-mortem-inspection.aspx

# Injured livestock slaughter now allowed in Alta.

By **Alex McCuaig**

Published: January 27, 2022
**Livestock**

Reading Time: 2 minutes

Under the Video Ante-Mortem Inspection program, as of Jan. 1, livestock injured in traffic accidents during transportation or in the field can now be slaughtered onsite and processed for human consumption by a provincially licensed facility. | Ontario Provincial Police photo

*Figure 2: Ontario has introduced a Video Ante Mortem Inspection service (VAMI) which can be used in the case of livestock transport roll over to facilitate decisions about euthanasia. From https://www.producer.com/livestock/injured-livestock-slaughter-now-allowed-in-alta/ Viewed 10 August 2022*

A review of the literature has also revealed other shifts in legislation which could facilitate the uptake of remote veterinary inspections. In many jurisdictions, controls are in place to ensure the health and safety of meat products from livestock. For example, the Australian Export Meat Inspection System (AEMIS) is an integrated set of controls specified and verified by the government that ensure the safety, suitability and integrity of Australian meat and meat products. Underpinning AEMIS are objective hygiene and performance standards that are continually monitored. For export establishments, Government On-Plant Vets conduct pre-slaughter AM inspections to ensure livestock are fit for slaughter while Food Safety meat Assessors (FSMA) or Australian Government Authorised Officers (AAO) conduct Post-Mortem (PM) inspection on meat products. Such inspections involve checks for any signs of gross pathological lesions or other issues related to food safety, contagious disease or animal welfare. In 2014, the EU introduced a

legislative change that enabled purely visual post-mortem inspection of the carcasses of pigs rather than the usual palpation and incision-based approach.

Recently, a Swedish PhD student[12] has explored whether this shift in legislation could support remote post-mortem inspection of pig carcasses. Using video streaming software, the students; research aimed to compare PM inspections to current on-site PM inspections (see Figure 3). The study was part of a project at the Swedish Food Agency to streamline and modernize public control at slaughterhouses and game-handling facilities through innovative and digital solutions. The research[13] concluded that

> *"Remote inspection appears to constitute a viable alternative for post-mortem meat inspection in pigs, given a sufficiently standardized method of inspection and sufficient inspection times."*
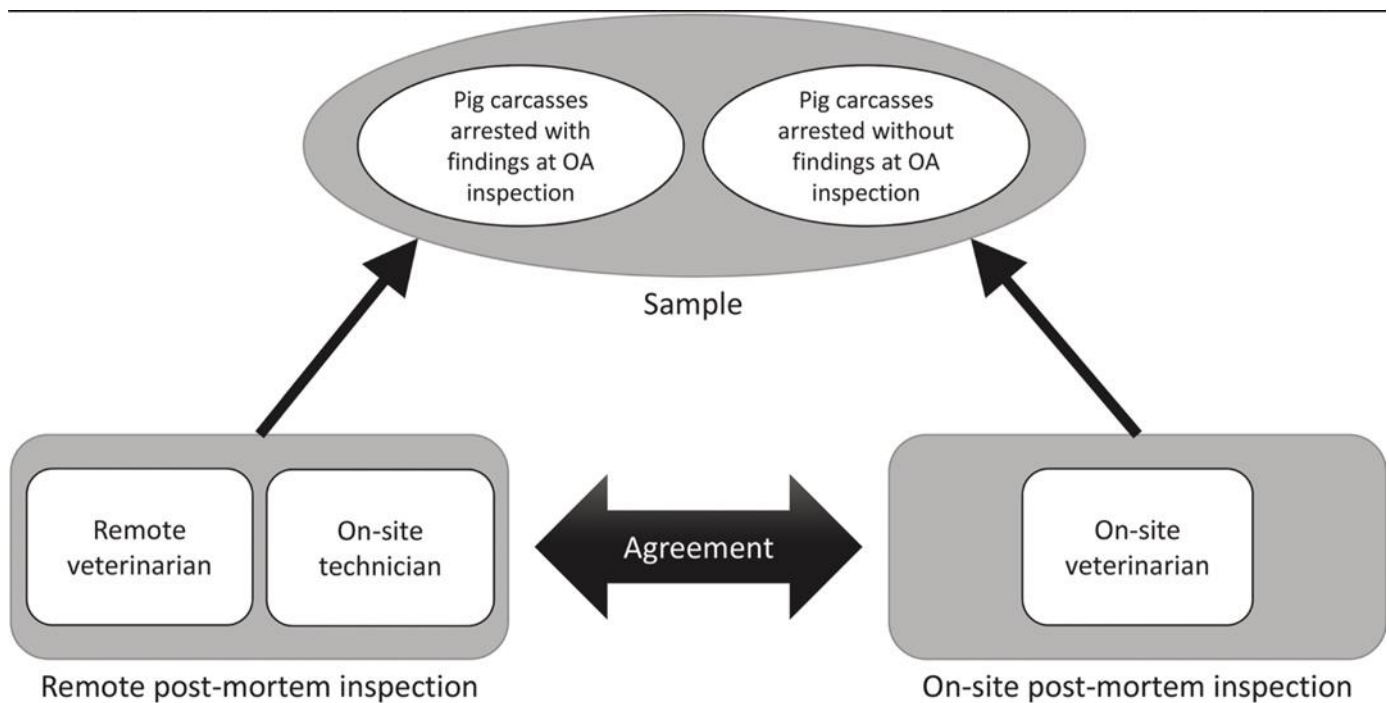


*Figure 3: Remote inspection process diagram*

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[12] https://pub.epsilon.slu.se/25860/1/almqvist_v_211018.pdf
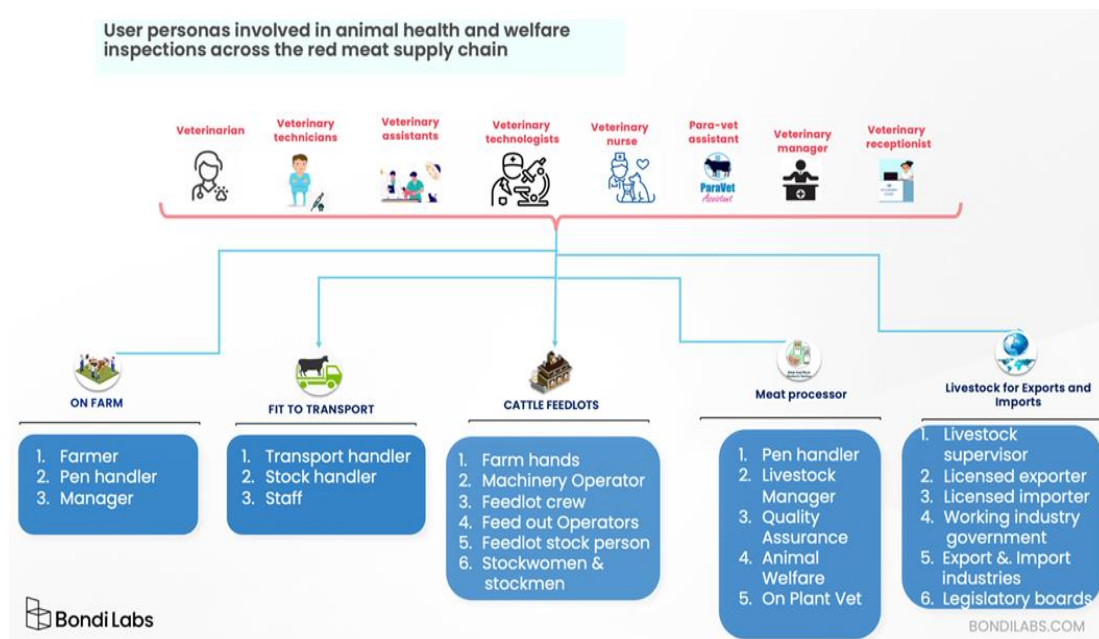[13] https://www.sciencedirect.com/science/article/pii/S0956713521000785

*Figure 4: User Roles within the livestock sector*

Virtual/remote animal health and welfare tools in the pet space are slowly becoming more common. However, the acknowledgment of their value by veterinary services in livestock is still in its infancy. One of the steps to increase the number of Australian veterinarians and feedlot industries is to build awareness of the opportunities. These opportunities include making it more apparent that the vet practice can become more financially sustainable and efficient. Additionally, advocating for actions on legislation and educating veterinary health care teams to use remote technology tools.

To better understand the potential use of remote veterinary inspection technologies for the production of livestock, the research team thought it necessary to refine our understanding of the types of workers across the red meat supply chain (see Figure 4). These worker roles define who could be involved in delivering remote animal health and welfare inspections.

From the perspective of veterinary service delivery, several workers are involved, including:

- Qualified vets
- Veterinary nurses
- Veterinary technicians
- Other vet assistants (para-vet assistant)
- Practice managers, receptionists

Given the well-known shortage of qualified veterinarians[14], especially in regional and rural areas, the research team has increasingly considered whether veterinary paraprofessionals (nurses, technicians, assistants) will be an important workforce. These additional roles may help to alleviate these shortages and facilitate the scaling of remote veterinary services. In more than one conversation with vets, the research team has learned that vet nurses, technicians and others trained in animal management can perform a great deal of standard veterinary services. When asked about the potential role of para-veterinarian professionals, one vet responded:

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[14] https://treasury.gov.au/sites/default/files/2022-03/258735_australian_veterinary_association.pdf

> *"if the assistant has sufficient experience, they can do pretty much everything that we do. In NSW we are dumb at using paravets better. Train your nurses better who can do pretty much everything we do."*

According to a collaborative review exploring the training of veterinary paraprofessionals[15], these workers are individuals who

> *".. for the purposes of the Terrestrial Code, is authorized by the veterinary statutory body to carry out certain designated tasks (dependent upon the category of veterinary paraprofessional) in a territory, and delegated to them under the responsibility and direction of a veterinarian".*

The paramedical profession perhaps best illustrates the concept of paraprofessionals undertaking increasing roles and responsibilities. Paramedics have increasingly become responsible for the delivery of emergency medical services in the pre-hospital setting. Paraprofessionals, like paramedics, can perform tasks requiring significant knowledge in their field and may even function independently of direct professional supervision. It is generally understood that paraprofessionals are the next most qualified professionals after the master professional in their field.

As such, we can consider the delivery of animal health and welfare inspections along a continuum from most qualified (vets) to vet nurses and technicians, through to animal welfare officers and others along the livestock supply chain, such as livestock handlers, transport workers, feedlots workers and producers (farmers).

We believe there is a significant opportunity to understand a veterinarian's tasks during animal health and welfare inspections in a feedlot. This understanding helps to map skills required across the broader para-veterinary continuum. One vet we interviewed shared that, in her opinion:

> *"Animals are suffering because we don't have enough vets. Better off to have a para vet than no-one at all."*

## What does a feedlot veterinarian do?

Based on interviews we conducted with several veterinarians who have had experience working with feedlots, the research team has provided in (**Error! Reference source not found.**) below a profile of a typical feedlot vet. In the table, the research team has tried to capture as many of the day-to-day tasks shared with us by these vets. It is important to note that most of the vet's jobs at feedlots involve using the sensory end organs (eyes, ears, nose) to gather the most information. For example:

**Ears:** "if you hear dogs you'll be wondering how are they using the dogs"

**Eyes**: "you might look around and see grain on the ground and that might indicate the presence of rodents. Rodents carry disease like Eosinophilic Myositis which is a major thing seen in grain fed cattle. While you might not see it very often, when you do it has potential to condemn whole carcass, it's primarily spread through vermin getting into feed.

**Nose**: *"If you are on a feedlot and you smell decaying carcass, that is a biosecurity thing .. so you then wonder how are they dealing with dead animals. You might then go and have a look at the dead pit or hunt around for wherever the dead animals are"*

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[15]Cobbold RN et al An International Collaborative Approach to Developing Training Guidelines for Veterinary Paraprofessionals, Journal of Veterinary Medical Education, 47(5), 546-554. https://jvme.utpjournals.press/doi/10.3138/jvme-2019-0086 Accessed 15 Sept 2022

Other activities, e.g., NFAS animal welfare audits are largely administrative and, following visual or document inspection, require determination on items such as:

- Are feedlot pens and associated yards and loading facilities are constructed and maintained in a manner to minimise bruising and injury?
- Has the feedlot ensured that livestock husbandry and management practices minimise the risk of bruising, hide and skin damage with consideration to husbandry practices such as horn length and vaccination?
- Has livestock been prepared adequately for transport and have they been selected as fit for the intended journey in accordance with MLA Document 'Is it Fit to Load (as amended)?
- Are there appropriate procedures implemented to address animal welfare at the feedlot in accordance with the Model Code of Practice for the Welfare of Animals - Cattle (as amended)?

Occasionally a veterinarian may be required to undertake the clinical examination of sick or injured animals and/or perform some form of surgical intervention, e.g., assist in calving, although note:

> *"If animal starts calving but if it doesn't progress they (feedlot operators) might just shoot the animal depending in market conditions. If it is more expensive to get the vet out than the value of the animal they may just euthanise the animal"*

Much of what the vets revealed to us in an interview about the tasks they undertake in feedlots, as well as the kinds of tasks other livestock vets undertake, has suggested to us that only in the very special circumstances of surgical intervention or where the immediate diagnosis is required, or where their activities are proscribed by legislation, is a fully qualified vet required to attend in-person.

In one case, a vet shared that they had recently employed an animal health officer, and while

> *"she probably couldn't diagnose, if she was just taking blood samples, conducting field surveys or even PMs (post mortems) she could do that already. As she gets more experienced, she could even do diagnosis"*

In most instances, the information used by vets during inspections of feedlots is mainly visual in nature, for which smart glass remote inspection technologies are ideally suited.

One concern, however raised by vets regarding remote inspections was that if they were to rely on feedlot staff to be their "eyes and ears" on the ground, it could be relatively easy for those feedlot workers to bias the information provided to a remote inspector.

> *"two things in response": first, if we do remote inspection, you depend on someone on the ground with at least some training. Second, if doing inspection on something that is potentially commercially damaging, then things might be hidden from you by the person on the ground"*

## 5.4 Remote Inspection Comparison Table

As noted above, during the Covid pandemic, organisations throughout the globe found themselves in an unprecedented situation where they were unable to travel or otherwise conduct business in person. Whereas many businesses pre-covid were starting to explore video-based meeting solutions like Zoom, Skype and Microsoft Teams, during covid the need for such technologies exponentially increased. For example, in December 2019, Zoom

had 10 million daily meeting participants. By April 2020, that number had risen to over 300 million[16] . The increasing availability of video communication tools was experienced in areas as diverse as pharmaceutical industry audits through to remote machinery maintenance and delivery of human telehealth services[17]. Many video communication products launched onto the market were designed specifically to facilitate meetings in an office scenario using standard, off-the-shelf video camera and audio technology available in PCs and laptops.

In a previous AMPC project (AMPC 2021-1113), we reported on evaluation of a remote inspection tool (we developed Elixar) for delivery of remote food safety audits (Figure 5). In addition to the standard video conferencing capabilities of commercial-off-the-shelf solutions like Microsoft teams or Zoom, Elixar was built around a smart glass platform (Realwear Navigator) which enables hands-free interaction on the part of the smart glass wearer.



A                                        B

*Fig5. (A) Onsite QA officer wearing Realwear smart glasses inspecting a cut of meat while connected to, and receiving instruction from, a remote food safety auditor in an Elixar session (B). Remote auditor gets an I-see-what-you-see image from the QA smart glasses*

In Table 1 we provide a comparison between the top 7 commercially available video conferencing solutions and the Elixar remote audit and inspection tool. When considering remote audit or inspection tools, many organisations may choose to adopt one of these off the shelf solutions. The comparison table was constructed to enable organisations to make decisions about which video conferencing tool they may wish to adopt. The table describes several key features of video conferencing tools including:

> Collaboration capabilities: related to user experience e.g. video resolution

> Security: regarding inbuilt features to ensure privacy and trust in any data shared by the solution

> Guest access and integrations: regarding the ease with which the solution works with other tools

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[16] https://accelerationeconomy.com/cloud/the-zoom-revolution-10-eye-popping-stats-from-techs-new-superstar.
[17] https://www.frontiersin.org/articles/10.3389/fpubh.2021.648009/full

| | BlueJeans by Verizon | elixar | Google Meet | GoToMeeting | Skype | Teams | webex by Cisco | zoom |
|---|---|---|---|---|---|---|---|---|
| **Collaboration** | | | | | | | | |
| **Web video streaming** | 1080p, 650 kbps | Flexible to customer's camera and network quality. (Up to 4K quality per user) | 360 p or 730p video meetings | 1080p, 650 kbps | 1080p, 650 kbps | 1080p, 650 kbps | 1080p, 650 kbps | 1080p, 650 kbps |
| **Integrated audio** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **Video recording** | Yes, but **not** customisable | Yes & customisable | Yes, but **not** customisable | Yes, but **not** customisable | Yes, but **not** customisable | Yes & customisable | Yes & only customizable via premium account | Yes & customisable with consent |
| **Screen sharing** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **Document management** | Sharing files via integrations | Built-in | Sharing via Google workspace | Via chat or meetings needs integration | Microsoft SharePoint | Microsoft SharePoint | Management via integration | Sharing files via integration |
| **Annotations** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **Chat messaging** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **File sharing** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **Security** | | | | | | | | |
| **Secure data sharing** | Based in USA | Based in Australia | Worldwide | Based in USA | Worldwide | Worldwide | Worldwide | Worldwide |
| **Multifactor SSO** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **Join via QR code** | Yes | Yes | Yes | -- | Yes | Yes | Yes | Yes |
| **Support for representative customer settings** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **Support for organization to run own accounts & teams** | customer support via ticket creation | customer support via email | customer support via email | No flexible customer support. | customer support via chat | customer support via documentation | customer support via email | customer support via email |
| **Customer settings and limits** | Flexible | Flexible | Flexible | -- | Flexible to MS terms and conditions | Flexible to Team Viewer terms and conditions only | -- | -- |
| **Session duration** | 30 hours | 12 hours | External users can't' join before 15 minutes | 40 minutes one attendee forever. | 24 hours | 45 minutes, doesn't show session duration | 24 hours | 40 minutes |
| **User & group provision controls** | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| **Guest access** | | | | | | | | |
| **Chat with users in other organizations** | Allowed access to guests | Allowed access to guests | Allowed access to guests | Allowed access to guests | Allowed access to guests | Allowed access to guests | Allowed access to guests | Allowed access to guests |
| **Limitations and permissions to guest** | Latency issues, Recorded content quality, lack of file sharing | The shared document and images can't be viewed, participants can't create a session. | Google external contact can' access the link before 15 min | Limited chat, costs. to access premium features, lot of bandwidth requirement | Must be enables at admin level. | Guest only access to chats, Admin discretions channels and meetings | Internet connection quality is effect on using software, Cloud storage and security issues, No data integration | Web-version used to be a bit limited, only 5 people can use it once, cloud storage and security is managed by third party. |

*Table 1. Comparison of Collaboration, Security and Guest access features for each of the major video communication tools used by various agencies during Covid*

## 5.5 Identification of software features and appropriate software for remote veterinary inspection

In addition to the commercially available video conferencing tools described above, several more bespoke remote expertise/support software tools have become available. The research team looked across the landscape of available remote inspection software platforms and found many share common functionality and features described in Tables 1 but which also include smart glass capabilities which are represented in Table 2

The following additional features were discovered to be valuable to the remote vet scenario. These being

- Ability to use a mobile phone to conduct a remote inspection in the field.
- Ability to be guided without a vet on hand and record the inspection for later review
- Ability to schedule sessions with a vet
- Ability to record sessions
- The vet/auditor needs to see the high quality in almost real-time e.g., within 5-10 seconds of capture to believe freshness and authenticity of the mage.
- Stakeholders need to trust that their data is secure and they have control.
- Vet needs focused view of something in detail and thus the need to be able to zoom in on the specific detail.

Vet needs control over the data captured and to review after a session.

1. Accessible for all potential users- mobile access with potential for offline mode and uploading of information when device can be connected.
2. Simple to use and simple to navigate with potential to "plug and play" i.e. pick up and use immediately with little complication.
3. Cybersafe, secure data transfer- privacy and confidentiality guaranteed.
4. A system that manages data and reports without adding workload, potentially reducing paperwork and enabling professionals to cover more appointments with a high-level delivery of quality information, communication and outcomes.

The research team has also identified several tools that may be of benefit. These include:

- Camera technologies that utilise alternative image spectrums e.g., thermal, hyperspectral, depth sensing.
- Scheduling and access to a vet at a moment's notice.
- Collecting and having access to animal prior heath information.
- Enhanced telecommunications e.g., satellite or 5G
- Online forms to collect data and submit reports.
- Offline recording of inspections guided by workflows or instructions.
- Supporting additional camera angles to show greater perspective

|  | ATHEER | Elixar | Kiber | LIBRESTREAM | Remote Assist | TeamViewer | vsight | vuforia chalk |
|---|---|---|---|---|---|---|---|---|
| **Collaboration** | | | | | | | | |
| Web video streaming | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Integrated audio | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Video recording | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Image and document sharing | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Screen sharing | Built-in | Built-in | Yes | -- | Yes | Yes | Yes | Yes |
| Annotations | Yes | Yes | Yes | -- | Yes | Yes | Yes | Yes |
| Chat messaging | Allowed | Allowed | Built-in | -- | Built-in | -- | Built-in | -- |
| File sharing | Allowed | Allowed | Allowed | -- | Allowed | Allowed | Allowed | Allowed |
| Best in class smart glass integration | Capable | Capable | Capable | -- | Capable | Not capable(yet) | Capable | Capable |
| Document management | Yes | Yes | -- | -- | Yes | -- | Yes | -- |
| **Security** | | | | | | | | |
| Secure data sharing | Based in USA | Based in Australia | Based in Italy | Based in Canada | Worldwide | Worldwide | Frankfurt, Istanbul | Worldwide |
| Multifactor SSO | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Join via QR code | Enabled | Enabled | Not Enabled | Enabled | Enabled | Enabled | -- | -- |
| Support for representative customer settings | None | Yes | None | Yes (Realwear navigator) | Yes | Yes | Yes | Yes |
| Support for organization to run their own accounts & teams | No 24/7 customer support | Customer support | No 24/7 customer support | Support request form | Microsoft account only | -- | -- | 24/7 customer support |
| Customer settings and limits | Flexible | Flexible | Flexible | -- | Flexible to MS terms and conditions | Flexible to Team Viewer terms and conditions only | -- | -- |
| Infrastructure scaling | Remote assist, self-assist, work assist, global, security, Integrations, | Remote assist, self-assist, work assist, national, security, Integrations | Remote assist, training, Integrations | Remote assistance, Digital work instructions, Knowledge Base, Specialized accessories | Remote assist, Hololens | Remote AR assist, training | Remote AR assist, training | Remote AR assist, training |
| Attendance & communications records for each session saved for post review | Stored | Stored | Stored | Stored | Stored | Stored | Stored in mobiles | Stored |
| **Guest access, interoperability** | | | | | | | | |
| Chat with users in other organizations | Yes | Yes | -- | -- | Yes, but only with MS tools | Only Via Team Viewer | -- | |
| Limitations and permissions to guest | No premium consulting/ infrastructure services | The shared document and images can't be viewed, participants can't create a session. | Difficulty in integrations, headset need more power requirements, battery life, complex GUI | Restriction of only having 2 people on a call when initiated from a mobile device (phone/tablet), Additional costs for online storage capabilities. Some of our end users operate with MacBook and there is no software available for this. Invitees must download the application to operate, issue maintaining connection the quality of the video transmission is insufficient, which is related to the low prioritization of video data in the bus system file format is only readable by Onsight Data cannot be reused outside the application. | HoloLens hardware limitations, remote assist is a close ecosystem with Microsoft product suite, requires a Microsoft Dynamic 365 licenses as well as Microsoft Office license for Teams, Not solely built for remote audits so less flexible. | Restriction to use applications outside TeamViewer, no feasibility to connect to smart glasses, less flexible to remote audits, less adaptive | Internet connection quality is effect on using software, Cloud storage and security issues, No data integration | Web-version used to b a bit limited, only 5 people can use it once cloud storage and security is managed by third party. |

| | ATHEER | elixar | (Kiber) | LIBRESTREAM | Remote Assist | TeamViewer | vsight | vuforia chalk |
|---|---|---|---|---|---|---|---|---|
| **Smart Glass features** | | | | | | | | |
| Smart glass technology integrations | AiR Glasses headsets. | Realwear Navigator | Kiber 3 Kit | Vuzix M400 Smart Glasses | HoloLens | Team viewer's Binocular and Monocular Smart Glasses | RealWear, Vuzix, Epson | Hololens 2, Realwear - NAVIGATOR 500, HMT-1Z1, Magic Leap 1. |
| Device comfort | -- | Comfortable to wear with PPE | The AR smart glasses are built-in with PPE helmet | OnSight Connect wearables | Hololens, not compatible for any PPE | Not compatible without any smart glass integrations | Capable to updated smart glasses | Capable to updated smart glasses |
| Device safe to use/worn with PPE/hygienic/Easy to clean | Yes | Yes | Yes | Yes | -- | -- | Yes | Yes |
| Full shift battery life | 8 hours | 12 hours | 6-8 H Long Life Battery | 8-hour battery life | 2–3 hours of active use | -- | 8 hours | 8 hours depending on the Realwear |
| Hands-free | Yes | Yes | Yes | Yes (not all the scenarios) | Yes | Mobile usage for AR assist | Yes | Yes |
| Shared Smart-glass device | Yes | Yes | Yes | Thermal imaging only | Yes | -- | Epson, Realwear, Rokid, Vuzix | Realwear, AR |
| Allow narrow and wide-angle view | 720p (1280 x 720) 60fps, 50-degree field-of-view | 20° field-of-view, | 160 degrees field view with binocular vision, 110° for vision on field environment, fully integrated headset, handcam and thermal camera | Real Wear Navigator™ 500 combined with Onsight solution IT | Accelerometer, gyroscope, magnetometer, Display optimization for 3D eye position, 8-MP stills, 1080p30 video | Depends on the camera of the mobile phone being used | Depends on the smart glasses used | Depends on the AR in their app and Realwear used |
| Video zoom feature | Built-in | Built-in | Yes | -- | Yes | Mobile video zoom feature | -- | Realwear |
| Flashlight features | No | SG Flashlight | -- | -- | -- | Mobile phone flashlight | -- | . |
| Voice input | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Image stabilizations | -- | Yes | Yes | -- | Yes | Depends on the mobile being used | Yes | -- |
| Voice control operated in noisy environment | -- | Yes | Yes | -- | Yes | -- | -- | -- |
| Operated in low/no WIFI | Low bandwidth. Support from Atheer remote assist | -- | -- | Low bandwidth operability | Yes | -- | -- | -- |
| Image capture | dual RGB cameras capture | Yes | Enabled | 48 MP Camera Sensor | Enabled | Depends on the mobile phone sued | Yes | Yes |
| Data sharing | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Video recording | Built-in | Built-in | Built-in | Built-in | Built-in | Via Assist AR app in mobile | Yes | Yes |
| Local storage | Allowed | 64 Gb local data storage | 4GB local data storage | 64GB internal storage | 64-GB UFS 2.1 | -- | -- | -- |
| Smart glasses Pricing | Table2scre | USD $2500 | -- | - | AU$5,599.00. | -- | AU$5,599.00. | AU$5,599.00. |

*Table 2. Comparison of features for several software tools which have been purpose built for remote inspection scenarios. Where no data is available ("-")*

## Hardware Device Comparison

The research team had adopted the Real Wear HMT-1 and newer Navigator 500 device for trials in the project. This device was chosen based on meeting the high-quality standards outlined below. There are many other hardware choices on the market, with new devices coming out every few months. Therefore, when choosing a hardware device to utilise during a remote audit, the research team recommends considering the following things.

**Affordability:**

Affordability refers to the price per unit. Smart glasses are an early-stage technology that is still gaining widespread use, manufacturing costs are a lot higher than standard consumer products. Compare this to regular smart phone device, and you can see how manufacturing costs could be reduced if the devices became mainstream. It is often best to think about the costs saved by using this device over a year of continual use versus the cost savings received in removing the need to travel and minimising the chance of risk.

**Battery Life:**

Battery life refers to the ability to continuously function and perform real-time vision streaming. Audits can take 60-180 mins of continual livestreaming. Factor in devise that may not be fully charged or re-used quickly after an audit. The research team recommends looking for a device that provides at least enough battery life for one long (180min) audit without becoming completely flat. Another option to extend the battery capacity is to have on hand hot swappable batteries or additional power bank devices.

**High Fidelity Images:**

High fidelity footage is the ability of the device to capture high resolution photos or video footage. The maximum quality of video footage needed is often between 720p-1080p High Definition (HD) for video streaming, and image capture greater than 10 megapixels. Another feature to look for is inbuilt video stabilisation either on a software or hardware level. Constant movement of the device can result in remote users becoming motion sick.

**Stream High Fidelity Footage:**

Streaming high fidelity footage requires a CPU processor capable of encoding/decoding video streams in real-time. Lower end CPU's will noticeably struggle to provide a smooth, high quality video feed, and will produce a lot of heat. Additionally, older generations of CPU will drain battery life faster as they are working harder. It is best to try out different devices to see how it can affect the battery life and ability to stream video footage and switch application tasks. Low performing devices will severely impact on the user experience and can lead to un-intended consequences like eye strain, fatigue and motion sickness.

**Ease of Use:**

Ease of use refers to the ability to interact with the device menu and operate the system simply and easily. The main feature that enables this are voice commands to navigate the menus. Most devices offer voice recognition; however, not all devices have high quality noise cancelling which allow for work in noisy environments. It is best to try out a few devices to determine which works best for the working environment.

**Suitability and Safety:**

Suitability refers to the devices ability to safely be used in high-risk environments with relevant PPE (i.e., comfortably worn and securely attached to a hard hat, safety glasses or the devices are safety glass rated). Another aspect of suitability is the devices ability to function is different environments. Is the device dust / waterproof to a rating that satisfies your needs. Can you read the contents of the screen when using the device outside in bright environments?

Is the device usable in moist/wet environments? In addition, can the device be worn safely and not obstruct the users peripheral vision or become distracting. It is recommended when choosing a device to consult your health and safety team to assess if the device needs to have a Workplace Health and Safety assessment before using onsite.

## 5.6  What are the standards needed for Remote Inspection to be accepted both domestically and internationally?

Generally, the technology utilised complies with localised standards for example safety. However as remote inspection is still an "emerging" assistive technology in the realm of animal welfare and food safety there are limited legislative requirements developed. In saying this we have been working with DAFF and a specific Halal food audit body to identify what may be required internationally in terms of ISO and other standards of operation. As progress is made in this space, the research team will always endeavour to stay informed and shape the remote offering to meet all applicable requirements.

RQ1: *What are the standards needed for animal health remote inspection to become accepted by Australian and foreign government agencies?*

Across different verticals each has been forced to respond to the challenges facing in-person inspection because of travel restrictions associated with Covid. For example, the Food and Drug Administration in the United States provided guidance for industry for the remote evaluations of drug manufacturing and bioresearch monitoring facilities during the Covid-19 pandemic[18] Similarly, the American Bureau of Shipping recently published guidance[19] on the use of remote inspection technologies that refers to several International Association of Classification Societies (IACS) Recommendations and Requirements:

● IACS Recommendations No. 42, Guidelines for Use of Remote Inspection Techniques for Surveys

● IACS UR Z7, Hull Classification Surveys 1.6 Remote Inspection Techniques

● IACS UR Z17, Procedural Requirements for Service Suppliers

In late 2021 the Standards and Trade Development Facility (STDF) , a global partnership to facilitate safe trade, contributing to sustainable economic growth, poverty reduction and food security, announced a project preparation grant (PPG) to "identify current practices applied by regulators regarding the conduct of remote inspection practices of food business operators in their jurisdiction" the output of which aimed to establish "International best practices identified for remote inspection in food safety". This project will deliver details on how competent authorities might apply remote and/or blended inspection in official control through technology and help establish what procedures, **standards** and regulations these practices will adhere to. We await the publication of the outcomes from this project at its completion, 30 November 2022.  At which point we hope to have further details on the standards needed for remote inspection[20].

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[18] https://www.fda.gov/media/147582/download
[19] https://ww2.eagle.org/content/dam/eagle/rules-and-guides/current/other/242-gn-remote-inspection-tech-2022/rit-gn-may22.pdf
[20] https://standardsfacility.org/sites/default/files/STDF_PPG_782_Application_Form.pdf

## Understanding development of remote auditing standards

The research team has conducted desk-based research to start to understand the complexity involved in establishing standards for remote audit and inspections. This has included a review of documentation from our local Standards Development Office (SDO), Standards Australia and the International Standards Organisation (ISO).

A summary of the organisations involved in the development and maintenance of standards is provided in the summary below.

There is a wide range of international standards development organisations ranging from those with a specific narrow focus, for example, the International Commission on Illumination (CIE) or the International Wool Textile Organization (IWTO), through to those with a wide-ranging scope such as the International Telecommunications Union (ITU) and the Codex Alimentarius Commission (food standards).

Two organisations of relevance to most SDOs are the:

- International Organization for Standardization (ISO) and the
- International Electrotechnical Commission (IEC)

These two organisations are also represented by a third hybrid organisation, the Joint Technical Committee (JCT1)

*International Organization for Standardization (ISO)*

ISO is a network of National Standards Bodies (NSBs) of 157 countries (based on one member per country) with a Central Secretariat in Geneva, Switzerland, that co-ordinates the system.

ISO Standards are drafted by Technical Committees (TCs); subcommittees (SCs) and working groups (WGs) comprised of experts appointed by the NSBs of ISO. The topics covered by these groups are varied, including topics from cork and cement to tourism and personal financial planning. ISO publishes Directives on Technical Committee work and Guidance for delegates and experts. Copies of these documents are available from: http://www .iso.org/iso/standards_development/processes_and_procedures/iso_iec_directives_and_i so_supplement.htm

More information about ISO can be found at http://www.iso.org

The standards needed for Remote Inspection to be accepted both domestically and internationally are stated below.

1.  19011:2011 Guidelines for auditing management systems by ISO.
2.  ISO/IEC 17020:2012. Conformity assessment – Requirements for the operation of various types of bodies performing inspection
3.  ISO 9001: Auditing practice group.
4.  IAF:ID 12:2015: Principles of Remote Assessment
5.  IAF MD4:2022: Mandatory document to use the Information and Communication Technology.

*International Electrotechnical Commission (IEC)*

The International Electrotechnical Commission (IEC) is the leading global organisation that prepares and publishes international standards for all electrical, electronic and related technologies. These standards serve as a basis for national standardisation and as references when drafting international tenders and contracts. IEC currently has 51 full members. Membership of IEC in each country is nominally via a National committee of IEC, which represents all aspects of the electrotechnology industry. The secretariat of the Australian National committee is maintained by Standards Australia.

Over 170 technical committees (TCs) and subcommittees (SCs), and about 700 project teams carry out the standards work of IEC. These working groups are composed of people from all around the world who are experts in electrotechnology. The great majority of contributors come from industry, while others from commerce, government, test laboratories, research laboratories, academia and consumer groups also contribute to the work.

More information about IEC can be found at http://www.iec.ch

### *Joint Technical Committee (JTC1)*

ISO and IEC have established a Joint Technical Committee (JTC1) for Information Technology Standards. It operates on the same principles as other Standards Committees, but on a much broader scale. Subcommittees (SCs) of JTC1 are effectively Standards Committees, given the breadth of the information technology field. Standards from JTC1 are joint ISO/IEC publications.

More information about JTC1 can be found at http://www.jtc1.org.

### *Standards Australia*

Standards Australia is the National Member Body, and Australia's representative, at the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). This role is recognised in the Memorandum of Understanding between the Commonwealth Government and Standards Australia.

Standards Australia is responsible for co-ordinating Australia's participation in ISO and IEC standardisation activities.

### Developing Standards

The following document from Standards Australia provides a comprehensive overview developing standards:

https://www.standards.org.au/getmedia/8067250b-e8c3-4db5-a661-e1df043e6b3d/SG-001-Preparing-Standards.pdf.aspx

We have simplified this in Figure 6.
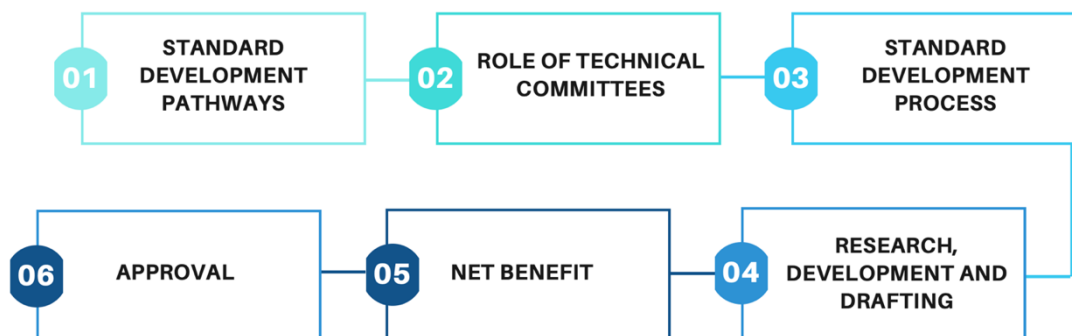
## The Stages of Preparing standards

*Figure 6: Stages involved in preparation of Standards*

It is important to note that development of a standard, or addition to an existing standard, must be able to demonstrate Net Benefit over and above existing processes. Therefore, for the development of standards for remote auditing, we need to first understand existing standards for audits and inspections such that we can demonstrate how including of remote technologies provides a net benefit to the current audit process.

Net benefit is considered from multiple perspectives including taking into account the costs and benefits related to the following criteria:

- Public health and safety
- Social and community impact.
- Environmental impact;
- Competition; and
- Economic impact.

The standards needed for animal health remote inspection to become accepted by Australian and foreign government agencies vary depending on the specific animals, practices and regulations in each jurisdiction. However, some general principles can be applied in order to ensure that remote inspection is accepted by government agencies. These principles include:

1. Security
    a. Use of a secure, reliable communication system that can transmit data in real-time.
    b. Access to secure data storage
2. Onsite Compliance
    a. Ensuring that the remote inspection process meets the same standards as an on-premises inspection.
    b. Ensuring that the technology used is appropriate for the remote inspection process.
    c. Strict adherence to biosecurity protocols
    d. Compatibility with existing standards and protocols
3. Animal Inspection
    a. Appropriate physical examination of the animal, including observation for any signs of distress or illness.
    b. Appropriate testing for the specific pathogen or condition being inspected.
    c. Thermographic imaging equipment to detect changes in body temperature.
    d. Quality control measures to ensure accuracy and reliability of the data collected.
4. Training
    a. Trained personnel to operate the necessary equipment and interpret the results.
    b. Adequate technical support and maintenance of the equipment.
    c. Adequate training and certification of remote inspectors
5. Recording and Reporting
    a. Accurate recording and reporting of data
    b. Appropriate use of video and other technologies
6. Communication
    a. Effective communication between the remote inspector and other stakeholders
7. Traceability

       a.   Traceability of animal movements

       b.   Effective traceability and monitoring of animal health status

8.   Monitoring

       a.   Regular monitoring of the remote inspection process to ensure accuracy and compliance with regulations

## 5.7 Industry Trials – Remote Quality Assurance and Animal Inspection

### 5.7.1 In Facility - Casino Food Co-op, QLD

In what may be a world first, Bondi Labs had partnered with BAI Communications and the Casino Food Co-op to live stream a real meat box quality inspection between Melbourne and the Casino Food Co-op in NSW to the AMPC Innovation Conference event audience. To our knowledge, streaming over a private 5G connection directly linked into the Smart Glasses headset to a remote 5G connected user has not been achieved before in such a public setting.



*Figure 7: 5G live stream of processing facility to AMPC audience.*

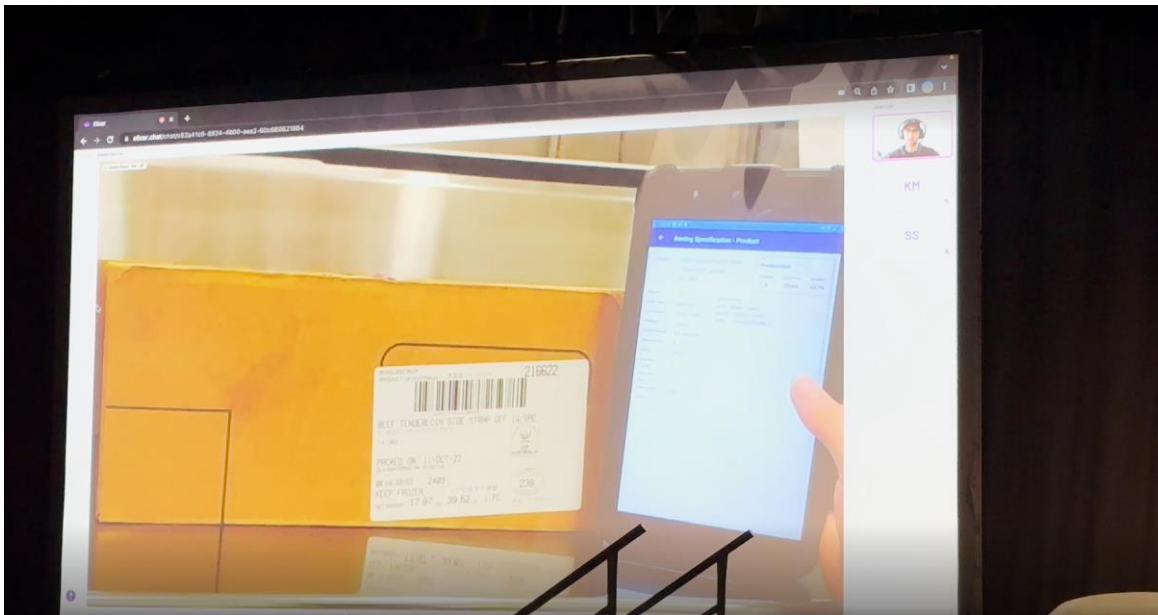*Figure 8: Remote Carton Inspection Livestream to from Melbourne to NSW*

### 5.7.2 On-Farm - Dayboro, QLD

Trialled

- Telstra 5G Sim connectivity on Farm
- Use of Elixar Recording
- Use of Elixar photo capture
- Use of Smart Glasses by livestock handler / farm owner
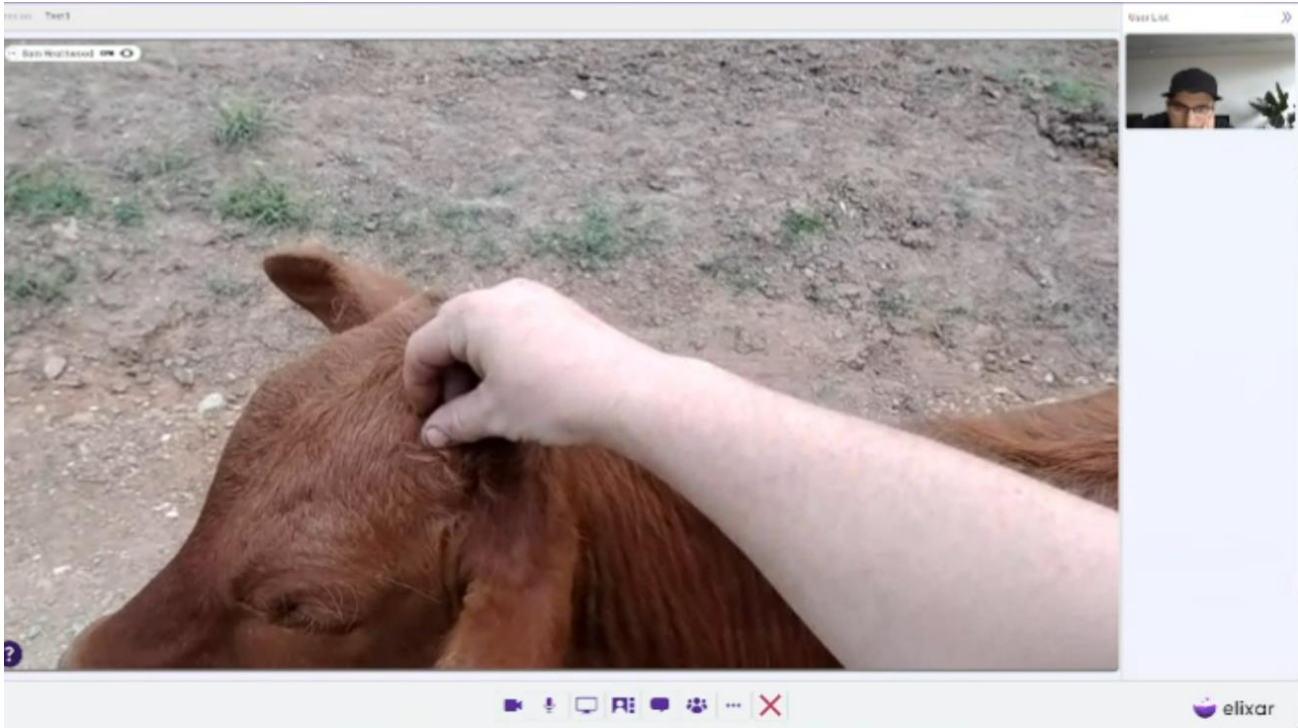
*Figure 9: Remote on Farm Inspection of live cattle*
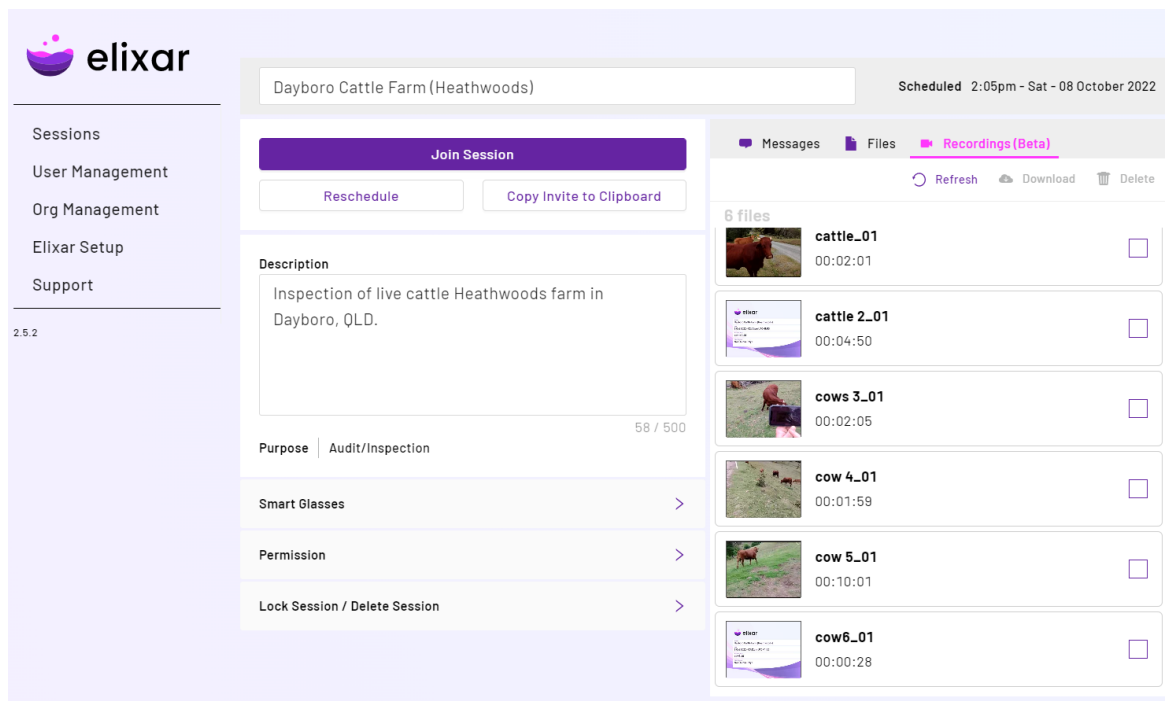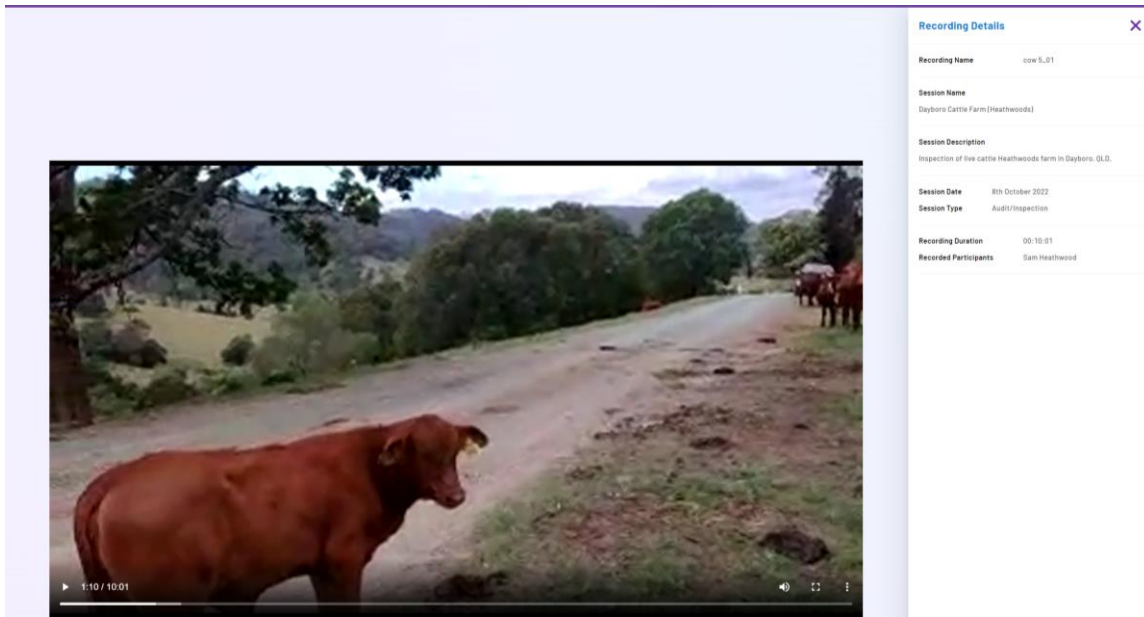


*Figure 10: Selection of Recordings to choose from*

*Figure 11: Recording of On Farm inspection*

### 5.7.3 Trial of Remote Animal Inspection: Meat Processor A 30 August 22

Performed a remote yard session, based on a remote ante-mortem or animal health and welfare inspection. Connectivity was far superior to inside plant, no dropouts and minimal latency issues. Hot spotted to personal mobile phone of process worker.

- Tour conducted with experienced stock handler.
- Sheep pens inspected
- Viewed quality and mobility outside pens
- Images captured of animals, conditions and ear tags (kept locally)
- Full walkthrough of pens from delivery yards to knocking areas

"Walkthrough proceeded smoothly- one area was quite dark, as a cloudy day, but the device held up well and visuals were good, tried the flashlight, zoom functions and all working well"

"Focus was a little off today on the device, not exactly sure what the issue was- voice prompts were good, it just seemed like the device was struggling to focus while in zoom- preparing to take an image- still able to take and upload images on request of the third-party assessor"

"All up it was a great session, follow up from this session is for processor staff to attempt to get a transport operator details for potential interview and reach out again to his vet contact (former site OPV) for the same"



*Figure 12: Live animal inspection footage captured from Elixar*

*Figure 13: Live animal heard inspection at holding pen at processor*

### 5.7.4 Remote Veterinary inspection: Cattle producer, Northern NSW, 22ⁿᵈ Nov 22

Queensland-based remote veterinarian (RV, identifying information withheld) agreed to participate in a remote inspection of cattle on a property in Northern NSW associated with one of our research team. Research team member (SS) donned the RealWear smart glasses tethered to his 4G mobile phone and joined the Elixar session. Bondi Labs team members (JH and GB) joined from their own offices (Melbourne, Brisbane respectively).

First RV asked to inspect animals in a pen from a distance to get a sense of their general demeanour and to observe whether there was any evidence of external issues on the hide (Figure 14A). Using the voice control available in the Elixar app, SS was able to issue a "take photo" and "upload photo" command set for a high-resolution image of cattle (Figure 14B) to be uploaded into the session record (Figure 15)



A                                                                 B
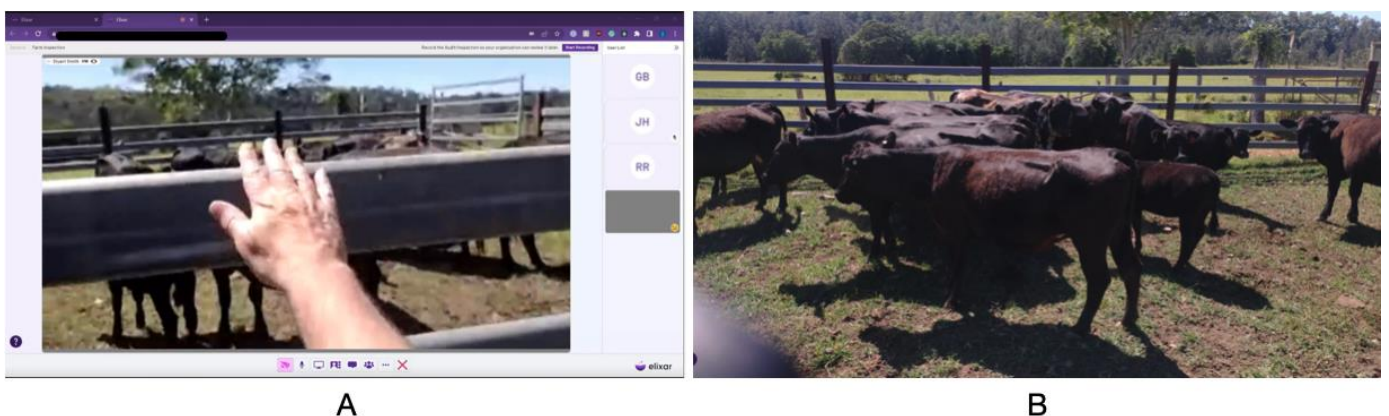
*Fig 14. (A) screen capture from Elixar remote inspection session showing view from smart glass camera worn by SS (main image) as he mounts enclosure fence. Bondi labs team members (GB, JH) and remote vet (RV) present in session. (B) High resolution photo captured by SS and made available for session participants to view*

*Fig 15. Elixar session management record for the cattle inspection on 22nd Nov showing thumbnails for high resolution images captured during the session*

With the assistance of the owner of the cattle, one animal was selected for closer inspection and moved into a crush. RV instructed SS to move to the head of the animal and begin an inspection of eyes, mouth and nose. SS was instructed to prise open the eye lids of the animal such that RV could check the colour of the sclera as well as open the mouth to inspect gums, tongue and teeth (Figure 16).
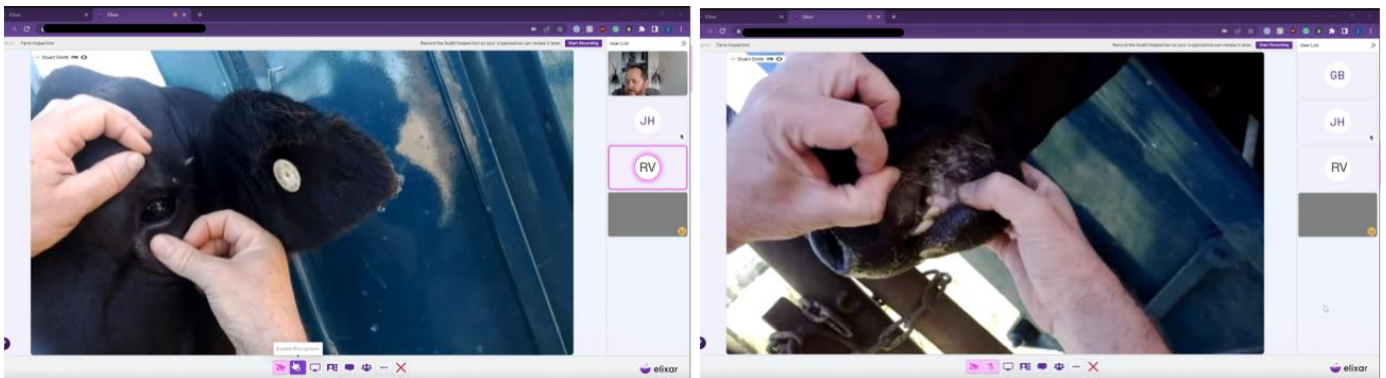


*Fig 16. Screenshot of Elixar session showing details of inspection of eyes (left) and mouth (right). Note in the left screenshot there is a pink square and circle around RV's icon. This means that at the time RV was speaking to SS and providing instruction*

At this point discussion between RV and SS focussed on the potential integration of digital stethoscope, thermometers and other devices that may be required for a veterinary inspection.

RV then instructed SS to move to the side of the animal and feel for a pulse in the artery underneath the hind leg (Figure 17). Without specific training SS was unable to accurately report heart rate. RV was also at this stage concerned for SS's welfare in case the animal kicked.
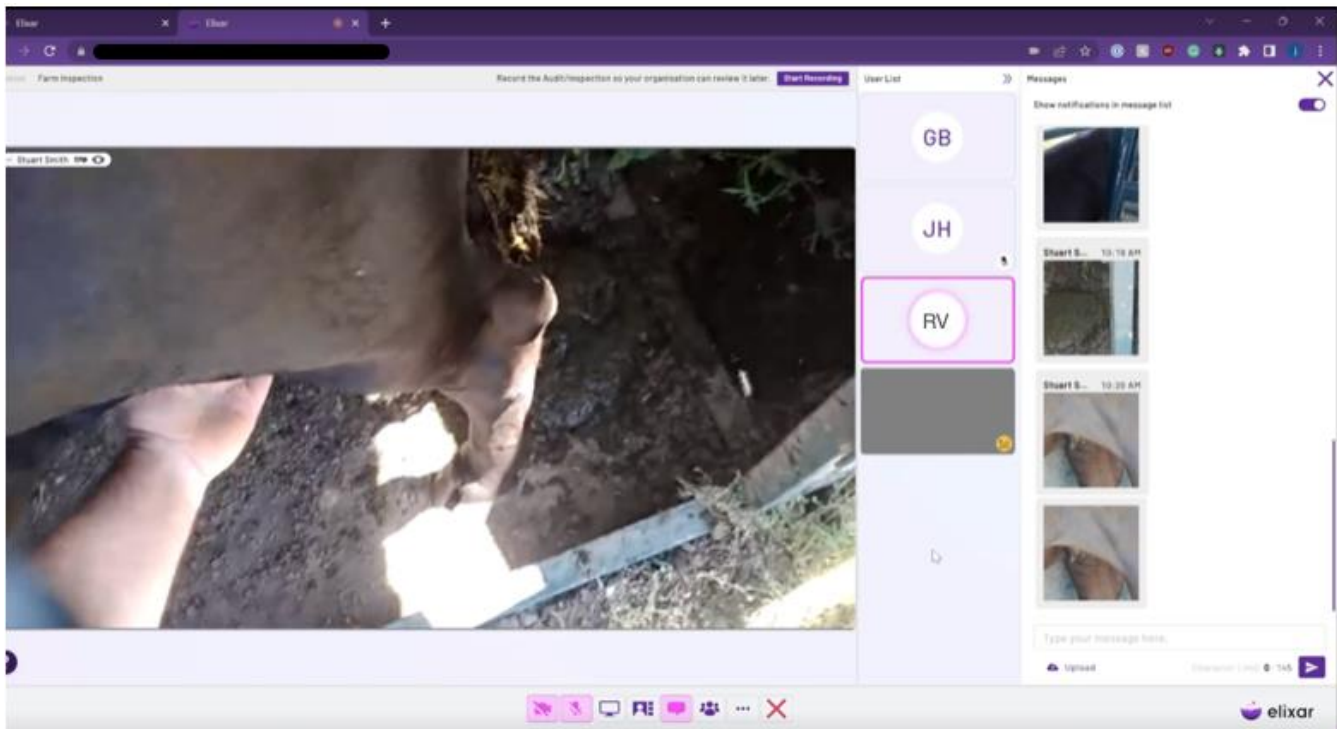


*Fig 17. SS instructed by RV to try and feel for a pulse from artery underneath rear leg*

Overall, RV reported that they were able to get a good idea of the state of health of the animal (no issues) and was confident the system could provide sufficient data for a visual inspection of livestock if they were not able to attend a site in person.

Points raised:

- Challenge in making a thorough visual inspection of the hide of animals in open pen. Dark colour of the livestock meant that RV was unable to make sufficient observations in shadowed areas of hide
- Needed to get a better observation of faeces on ground to establish presence of any parasite, smart glass camera digital zoom provided only a lower resolution image
- RV reported that they would need to know that the smart glass operator was skilled in animal handling and had some level of knowledge about animal anatomy for RV to direct them appropriately.
- Discussion around possible integration of digital stethoscope to provide a more complete assessment of the animal.
- Visual images captured by the smart glass wearer were useful even if the video stream was pixelated or delayed by network connectivity issues.

### 5.7.5 Remote Veterinary inspection: Meat processor B, Victoria, 29th Nov 22

Queensland-based remote veterinarian (RV, identifying information withheld) agreed to participate in an evaluation of remote inspection of animals in lairage at a mixed livestock processing facility. The veterinarian delivers consulting services into feedlots, meat processors and onto farms. This veterinarian was the same who had previously experienced an Elixar session on farm.

Processor stockhandler (SH) donned the smart glasses and joined the Elixar session established by Bondi Labs team member GB (with additional observers RH and SS in the session). At the start of the session RV asked to have a look at the kill sheet for the day which was then uploaded into the Elixar session by SH (Figure 18). RV then asked SH to navigate their way to pre-slaughter cattle pens for an inspection. Asked general questions about the processing plant and experience of the SH. RV wanted to establish level of experience of SH
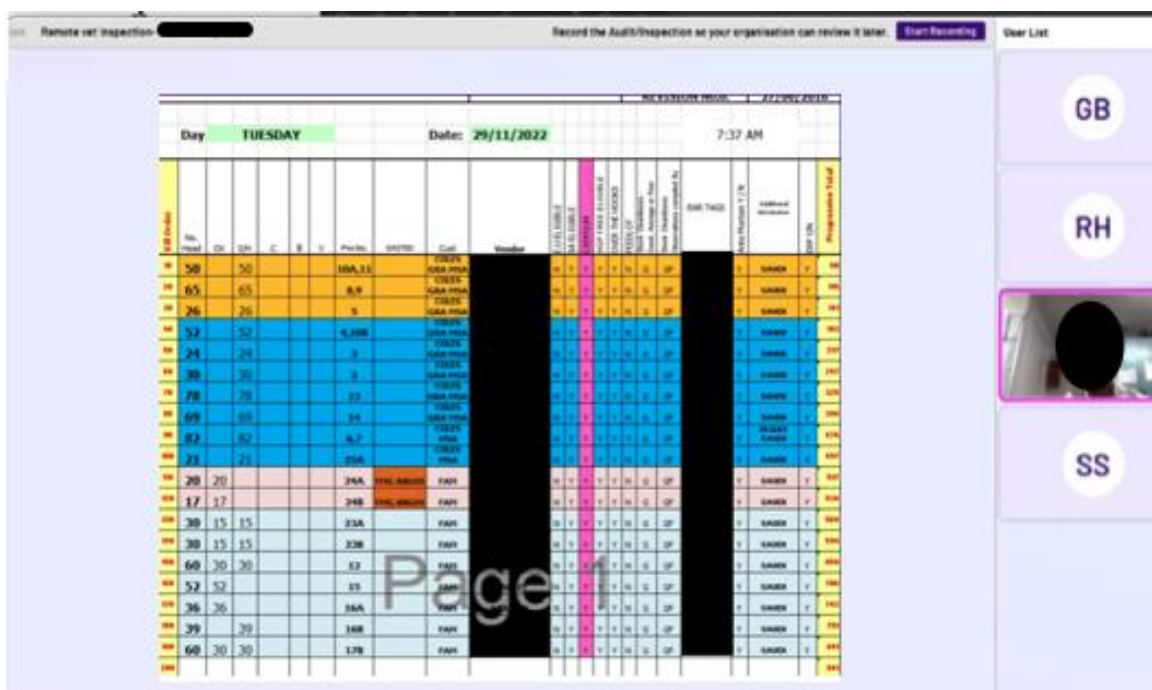


*Fig 18. Screen share of kit sheet for the day. Redacted to maintain anonymity*

Once in position RV asked SH to direct camera feed towards isolated animals where possible such that they could observe animals in a more freely moving aspect. RV was also able to perceive, and remarked up, the general state of flooring and water in troughs and observe animals in several different locations and poses (Fig 19). RV remarked that lighting and resolution of camera feed was sufficient for them to get a good sense of the overall health and welfare of the animals.
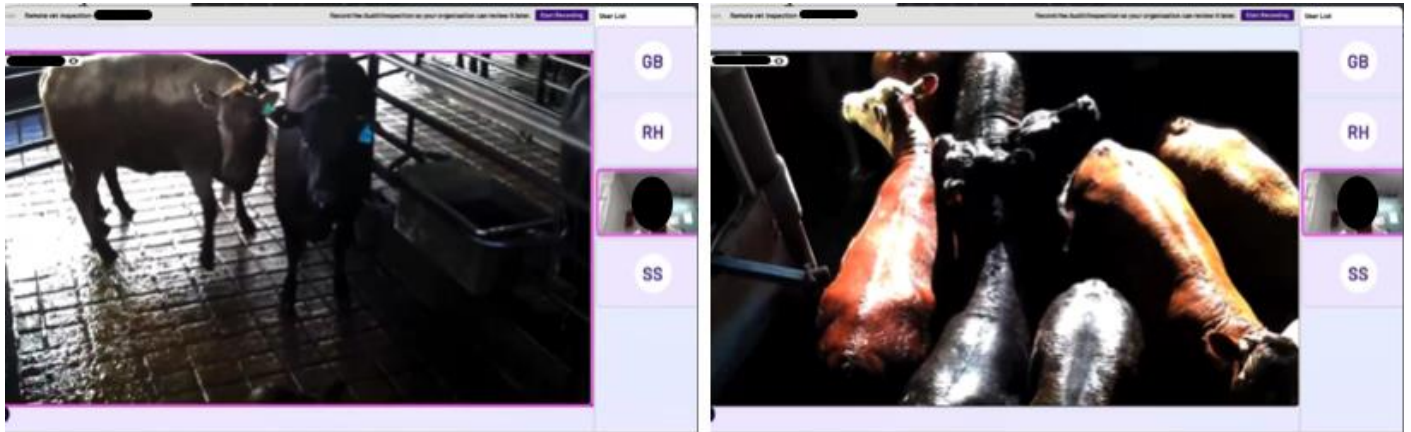
Fig 19. Screenshots from Elixar session at various points of cattle inspection

Once satisfied that they had seen everything they needed to get a sense of cattle inspection in a relatively massed and enclosed environment, as they might if the cattle were in a feedlot, the RV then asked to observe small stock (Fig20A). In particular, RV asked SH to move through pens of sheep to get a better sense of how animals moved (Fig 20B).
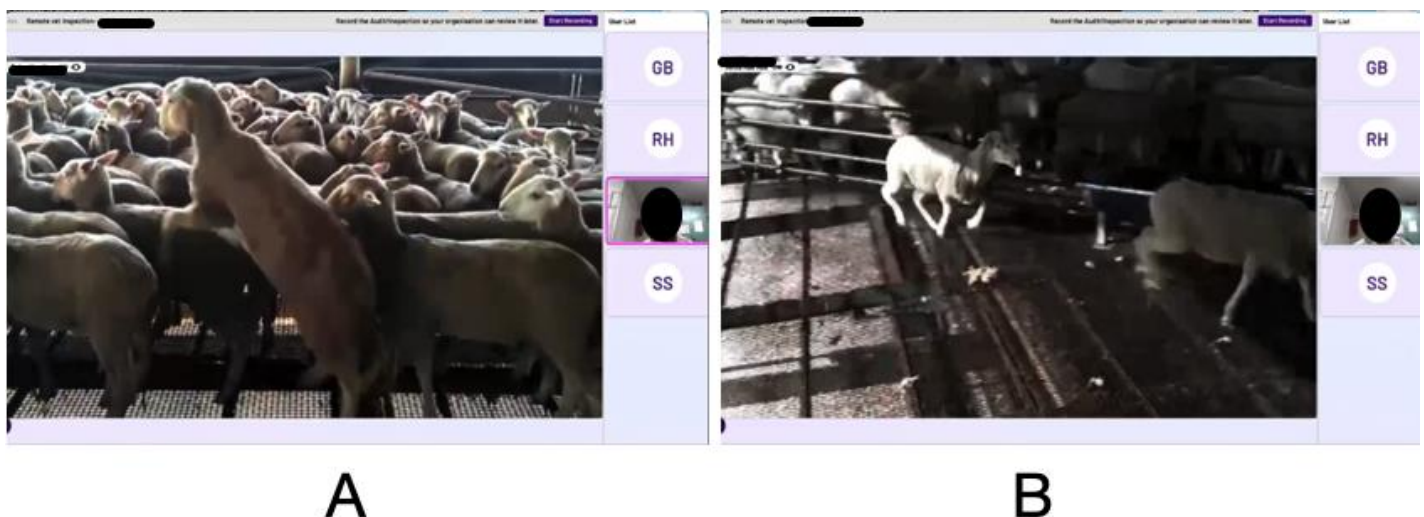


Fig 20. Screenshots from observation of small stock. RV gave SH instructions to move through the pen of animals to observe how they moved (A). In particular, to try and isolate one or two animals for closer inspection (B)

General observations from RV were that they were able to inspect animals in a manner based on the video feed that would help them make determination about animal health and welfare. RV mentioned that they would want to trust the stock handler wearing the smart glasses to know how to position themselves and the camera to provide best possible viewpoint.

RV also mentioned that by the end of the session they were feeling nauseous. This was likely caused by the relatively fast and frequent head movements made by SH during inspection. RV mentioned that they thought smart glass operators need to be trained to provide steady video feed.

# 6.0 Discussion

A range of activities were conducted during the project such as:

**Video calls and site Tours to gain a more in-depth understanding of the context and the people involved.**

Site tours and interviews give researchers the chance to observe the environment first-hand and ask participants questions in a natural setting. This type of data collection can provide more detailed and accurate information than surveys or focus groups. Additionally, interviews and site tours provide the additional benefit of building relationships with participants, which can help ensure cooperation and reliability in the research process. The research team engaged a number of different organisations such as Teys, JBS, Casino Food Coop, Wagstaff to understand the problem space.

**Literature to review remote vet technologies.**

This helped create an understanding of hybrid auditing models and international standards, discuss remote inspection approaches in different countries and better understand the job of Vets and livestock handlers. This helped to identify the current state of the field, current trends and challenges, and best practices for the use of this technology. It also provides insight into how remote vet technologies are being used in different contexts and how they are being received by veterinarians and animal owners. Additionally, studying the literature can help to identify areas where further research is needed.

**Current remote inspection technologies on the market.**

This analysis helps to craft advice for businesses to make informed decisions about the software that best fits their needs. By comparing different options, businesses can be sure that they are selecting the software that offers the best features and capabilities at the best price. Additionally, comparisons can help businesses identify potential vendors that offer additional services and support, such as customer support and training, that can make the remote inspection process more efficient and effective. Finally, comparisons can help businesses identify potential vendors that have extensive experience and expertise in remote inspections.

**How to implement remote animal health and welfare inspection**

The research team also investigated several solutions to the challenge of how to deliver remote animal health and welfare inspections and found there is no one-size-fits-all answer to this question, as the adoption of remote inspection will vary depending on the size and connectivity of the livestock handling service.

During the research project the team conducted several trials of remote inspection technologies including:

- Fit for Slaughter observation
- Holding pen animal health and welfare checks
- On farm vet inspection
- Remote assessment of potential yield of an animal

Remote inspections that were not trialled but mentioned by project participants as viable were:

- Loading and transportation assessment and monitoring
- Live animal transportation over road and sea
- In feedlot inspections

Results of these trials indicated that while remote inspection technology are not as good as in-person inspections, they offer a potential "stop gap" solution when animal health and welfare inspections by a qualified person would not otherwise be possible.

The project also identified several determinants that will influence future exploration and implementation of remote animal health and welfare inspections including:

**Security and privacy of data.**

Through the course of this project, the research team has sought feedback relative to the needs of the specialists involved with remote inspection. With the feedback attained we have been able to better identify opportunities within a system like Elixar to provide for software that is safe, secure and appropriately suits the needs of the specialists and industry. Through the research conducted and the conversations documented it is very clear that the technology and software support chosen must be reliable, cybersecure, simple to use and collate appropriate data. Additionally, it must not add a layer of complexity to a persons' workload.

**Network connectivity as a barrier.**

A significant barrier to the uptake of remote inspection technology for animal health and welfare assessments is the availability of fast, reliable internet connectivity. New technologies (for example low Earth orbit communication networks such as Starlink) alleviate some of the complexity here but would require appropriate return on investment analysis. As with implementation of any new technology into business, a case must be made for any ways in which the technology can add value. Remote inspection is unlikely to be adapted if it costs more for the veterinarian to deliver a remote inspection than they can recover from their client. We also need to ensure that we can provide confidence to veterinarians that remote inspections can provide them with at least a core set of observations they need to make an informed decision about the state of health or welfare of animal.

Additional determinants are reported in Appendix 3.

In summary, while our results indicate that some video streaming technologies are sufficiently advanced to support a remote livestock health and welfare inspection, more research is required to define the range of inspection activities for which such technology is appropriate. Additional challenges, from the difficulty of establishing connectivity in areas with limited or no mobile device coverage, to the high turnover and competition in the industry resulting in difficulty training and retaining staff, through to legislative changes that enable deployment of remote animal health and welfare inspections, are all yet to be adequately addressed

# 7.0 Conclusions / Recommendations

The project identified that technologies such as live stream video communication using voice activated smart glasses are a potentially viable approach for delivery of remote health and welfare inspections of livestock across the red meat supply chain, especially in meat processing.

To increase the likelihood of uptake and adoption of such technologies, the following are recommended:

- Making the remote inspection software easy to use and accessible from any device or computer
- Offering training and support for users so that they can make the most of the software
- Creating clear and concise documentation on how to use the software and how to audit the livestock handling process
- Developing a system for tracking and reporting on the results of remote inspections, so that improvements can be made where necessary
- Exploring the use of a low connectivity mode and better feedback on low connectivity situations
- Rely on offline recordings guided by checklists and workflows
- Improved training on photo capture method to ensure high quality images are at least recorded if video quality is not sufficient.
- Exploration into satellite connectivity options for processors who do not have access to NBN
- Exploration and trailing of newer, high bandwidth, low latency network systems such as WiFI 802.11 a/g/n/ac, WIFI-6 or private 5G options

Additionally, the following should be considered when adopting remote health and welfare inspection services:

- The size of the business and its connectivity

- The type of livestock being handled

- The complexity of the livestock handling process

- The number of staff using the software

- The training and support required for users

Other findings from this research found the following areas could help to increase the number of Australian veterinary professional, para-veterinary workers, auditors performing remote livestock health and welfare inspections such as:

**Increased access to veterinary education and training:** Investing in more veterinary courses and providing more scholarships and bursaries could help to increase the number of veterinary professionals and para-veterinary workers in the Australian livestock industry.

**Improved support and incentives for remote auditors:** Government and industry bodies should provide more support and incentives for remote auditors, such as financial assistance and resources, to encourage more professionals to take up auditing roles in the industry.

**Improved technology and infrastructure:** The Australian livestock industry should invest in improved technology and infrastructure, such as teleconferencing and remote auditing systems, to facilitate remote audits and improve the remote auditing experience for professionals.

**Improved communication and collaboration between industry and government:** Establishing better communication and collaboration between industry and government could help to ensure that remote auditors have access to the most up-to-date guidelines and legislation, as well as providing support and advice when needed.

# 8.0  Bibliography

# 9.0 Appendices

## 9.1 Appendix 1 – Remote Live Animal Inspection Plan

The following is a template inspection sheet to be used in preparation and during a live animal inspection.

# Remote Live Animal Inspection (trial) NAME DATE

**Purpose**

The purpose of this work instruction is to provide a remote health assessment of animals before slaughter, in the absence of an On Plant Veterinary Office (OPVO) or commercial vet partner.

This inspection will ideally be conducted by an operator (Inspector) who is competent in ante-mortem inspection. In this case it has been performed by NAME (ROLE) and lead remotely by the ROLE and an independent 3rd party- NAME from COMPANY.
*NOTE* reword the document for target session*

**Method for this inspection:**

- Inspector contacted the Quality Assurance Manager to acquire the headset and prepare an Elixar session with a remote 3rd party.
- Inspector is to liaise with other stock handlers to identify which mobs/pens require animal health inspection.
- Inspector (Stock handler) attends the lairage and prepares the remote attendees for inspection.

Inspector passed through cattle herds first and provided a firsthand livestream (un-interrupted) of the following attributes and features:

- Cattle ambulating through the runs and entering the lairage areas (pens)
- Cattle in the pens awaiting processing
- Image capture on request and close contact with several beasts to listen for signs of stress or to visualise any possible blisters or lesions, wounds or discharges (none detected)
- Allowing the cattle to move in front of the device so the third-party team could visualise any signs of fatigue, posturing, lameness or any other physical concerns (none detected)
- Cleanliness of the herd and of the watering facilities in the pens- noting that due to the massive amounts of rain some of the beasts were muddier than usual but the herd were all fit for slaughter

Inspector passed through sheep mobs next, taking care not to cause undue stress to the animals and trying to visually check each animal within the mob. 3rd party provided direction to the Inspector, targeting any animals that show indications of animal health issues. Communication between the inspector and 3rd party were facilitated through the headset directly- connection was very clear in video feed and audio- no concerns (connected to a 4g mobile phone).

- Mob in the pens awaiting processing (none in the runs leading to pens)
- Image capture on request and close contact with several beasts to listen for signs of stress or to visualise any possible blisters or lesions, wounds or discharges (none detected)
- Open mouth checks of selected animals, checking for discolouration or signs of rot or disease (no images captured here as no concerns)
- Allowing the sheep to move in front of the device so the third-party team could visualise any signs of fatigue, posturing, lameness or any other physical concerns (none detected)
- Cleanliness of the herd and of the watering facilities in the pens- noting that due to the massive amounts of rain some of the mob were muddier than usual (only low numbers) but the herd were all fit for slaughter

While passing through the mob the inspector with guidance and support from the remote 3rd party and remote QA team conducted checks for any of the following:

**Ante-Mortem symptoms**

- Blisters and/or lesions on lips, muzzle, tongue, teats, above hooves and between claws of the hoof
  - o Nil identified
- Excessive ropey salivation, mucus or nasal discharge
  - o Nil identified
- Lameness, stiffness

- o        Nil identified
- Staggering, trembling, loss of coordination
  - o        Nil identified
- Abnormal posture i.e., arched back, head low
  - o        Nil identified
- Abnormal hair loss, skin lumps
  - o        Nil identified
- Maggot infested wounds
  - o        Nil identified
- Abnormal vocalisation
  - o        Nil identified
- Discharge or blood from eyes, nose and/or anus
  - o        Nil identified
- Diarrhoea especially with blood
  - o        Nil identified
- swelling of lymph glands, lips and/or tongue
  - o        Nil identified
- Sudden death
  - o        Nil identified

## Behavioural indicators

- Depression i.e., head down, loss of appetite, isolated from herd
- Disorientated, nervous, aggressive
- Hypersensitive to sound, touch and/or light
- Reluctant to move
- Sensory changes i.e., head tossing, teeth grinding, tongue licking, licking feet, muscle tremors

Example:
*Nil identified- good stock, animal health and welfare maintained at a high level. Ready for production.*

## Corrective actions

Example:
*It was not necessary for any animals to be designated as 'suspect' by the remote 3rd party. No animals were required to be segregated from others and held in the 'suspect' pen.*
*There were no technical issues with the headset or Elixar session, one minor freeze for approximately 2 x seconds however came but up almost immediately and did not damage the livestream integrity. It was not required to contact Quality Assurance Manager or other technical support for this session.*

## Suggestions or recommendations for future sessions?

Example:
- *No Wi-Fi connectivity in lairage at all as we were using a personal 4g mobile phone, this will potentially cause complications if an untrained user was trying to connect immediately for an emergency remote inspection so as not to delay production- two suggestions:*
  - o *Assess the costing for the plant to upgrade the lairage with plant Wi-Fi connectivity so device will automatically connect when in use*
  - o *Ensure a process flow or "cheat sheet" is prepared in layman's terms so in a worst-case scenario a new user may be able to connect to a new Wi-Fi device if required*
- *Focus a little on the training of the team users or champions on site- voice controls and image uploads were exceptional on this session however there may be concerns with adjustment for lighting conditions. Flashlight worked well but at this time of day (8am Melb) there was both a lot of incoming light and shadow inside the lairage- device handled it well however there may be an opportunity here to conduct a little in-depth training to be observant of conditions.*
- *The HMT device was great but comparing to the newer device it is highly recommended to switch, when possible, to the new Navigator 500's for increased image quality and livestream.*

- *A full process flow document may be required to cover several aspects of the plant:*
  - *Safety guidelines and policies*
  - *Privacy and image sharing policies*
  - *How to use the device and Elixar*
  - *Expectations and desired outcomes of a remote session.*

**Notes or comments?**

Example:

*Session went very well; observations were very clear.*

- *Great connectivity as noted only one freeze for about 2 x seconds*
- *Nice images, may need a newer device and a little more training to be a higher quality but the real value was in the steady and consistent live stream for the 3rd party observers*
- *If I were a remote vet or para-vet professional I was offered a secure livestream of animals being prepared for slaughter- with the level of quality and control of the device, I was able to make a determination of what I saw through their eyes. Animal health and welfare was sound and, in an emergency scenario like this one I would have been happy to make a call and sign off that the animals were fit for slaughter- at least the pens I was able to assess and at least to get production going until a site vet may have become available.*
- *Next steps- live assessment with a remote vet.*

## 9.2   Appendix 2-Interviews with technology users

The following provide an overview of interviews we have conducted with a range of individuals who are involved in the management and observation of livestock and who have been introduced to remote inspection technology.

# District vet

**Role**: Livestock Vet

**Age**: 53

**Shift Length:** on call 12 hours a day

**Education**: Vet Degree / med science (4-5 years) maybe more

**Location**: Ballarat

**Bio:** Graduated with Vet Science Degree. Worked in regional community practice (Wagga) livestock vet. Now working from another regional vet practice but does on farm visits. Started working with feedlots exclusively in last 5 years. Owner of the practice.

**Accessibility Needs:**

- On the road a lot. Could be using laptop in the car
- Working onsite, not a lot of shade so out in the sun.
- could be working early or late at night so poor lighting if on site.
- the skill and ability of the sg or mobile user transmitting clear footage.

**Tasks and Responsibilities:**

- Mentoring younger vets

- Outwards facing vet for the practice i.e. first name people think of when they need help with their animals. B

- Responding to emergency calls

- Turn up to scheduled calls / appointments

- Helping triage sick animals

- Check the skin, check the poo
- asking lots of questions, what's the feed like, change in diet or eating.
- Viewing colour and shape of things
- Identify ownership of the animal before action is performed. e.g. recommending medication or death
- Talking to the livestock manager
- Perform routine inspection of the entire cattle yard as a part of the global best practice guidelines. 2-3 days a month routine feedlot inspection.

- View the animal history and record the diagnosis as the inspection occurs.

- If its a notifiable disease found, need to start the required procedures e.g. FMD

**Core Needs for a remote inspection technology**

- High quality vision and audio if needing a live stream

- receive high quality still images

- be able to an instant text chat with the other user

- needs a simple system to use

- needs to have access to the practice software at the same time to pull up records and record data

- Needs to be able to search their notes or Google/for vets

- Need the other remote user to have their hands free whilst they show footage

- Needs more than vision or audio e.g. temp reading from device in the animal

**Pain Points:**

- knowledge of using new technology

- connectivity of the user on the other end.

- visual observation of the animal is difficult
- Colour of the video sometimes is not correct
- Audio may not be clear
- Missing the smell

- If instructions are not followed its hard to see the angle or have the right photo taken.

- if footage is laggy, hard to see walk pattern

- Availability and distribution of smart glasses is hard.

- animals vocalise around the SG or mobile user making it hard to hear.

# Government vet

**Role**: Field vet for NSW Local Land Services.

**Age**: 44

**Shift Length:** 7.6 hours but can be much longer depending in travel

**Education**: Vet Degree

**Location**: Northern Rivers

**Bio:** Been working in this role for 3 years.

**Accessibility Needs:**

Works both in office and out in the field.

Working out in the field may need to travel and be on the road for extended period.

Works outdoors with live animals

**Responsibilities:**

- Local Land Services (LLS) is a regional-focused NSW Government agency delivering quality customer services to farmers, landholders and the wider community.
- LLS helps people make better decisions about the land they manage and assist rural and regional communities to be profitable and sustainable into the future.
- We do herd health and biosecurity work, extension small component of complicate.
- I've been involved in delivering the EAD information roadshows around the district and I'll also go out to farms and review their EAD response plans

**Motivation**

- Always had interest in herd health work, only options are at big cattle only practice or going out open own as consultant. So a way to have good conditions and pay. Conditions are a big factor
- flexible working with this job works as we have a farm.
- Dairy and beef operation keeps her busy, full-time job itself
- Huge issues at the moment with cattle dying of starvation following the significant rain event over the year. Even if you can get good quality feed cannot get it to the animals
- Workforce issues around every kind of vet

**Core Needs**

- Lots of travel, I have a large area to cover, A lot of the work is remote. We're not working in a collegial environment, you are mostly working alone and out of mobile signal.
- If you have a lot of dead and dying animals you can't really call a friend which can be challenging. In most vet clinics, most large animal you work by yourself, in my role high number of mortalities, trick roll lovers etc or emergency events (fires and floods) we are on the spot which is why they hire experienced vet
- Legally with something like a truck roll over a vet has to be there in person to make euthanasia decisions. Potentially some triaging could be done remotely but there are some things where a vet is required to be there
- Laws restricting what you can do with remote inspections.

- Not sure where the legislation is at with phone a vet type activities
- With a lot of the things we do there is a world of difference between what we do and what private vets do, in a lot of instances recipients of our services don't want us to be there. We probably couldn't trust them to provide us with the details we need. And there is a lot that we would need to see eg in a herd health investigation it is more than just an individual animal or herd inspection you are also looking at the operator and the environment
- the 360 degree inspection and all of the things they don't tell you eg smell, depending on the place there are certain diseases with a smell as well as dead animals.

## The Task:

- Do history from owner, what kind of operation are they running what are their animals like, old, young in calf etc how long issue has been going in
- Do clinical exam on animal, look at others in the cohort, depending in case you'd look around the property
- Take samples and get tests.
- have kit with them. Samples sent to State Vet Lab in Sydney,. some things can be done locally eg worm egg counts can be done at home Path results might take a few days
- Takes around 30 mins for an animal inspection if herd issue could be two hours. Multiple animals, paddocks

## Time Taken: Post Mortem

- post mortem takes about an hour
- need an assistant, normally have at least one buddy,.
- equipment: therm, steno, my hands, urine test strips, ph and nitrate strips m eyes, nose for sampling blood tubes, needles, poo sampling, PM have butchering equipment, formalin etc.

## Opportunities for Efficiency:

- Having a dedicated nurse or admin person can help, vet does notes while driving around. Good animal handler. If you have a good nurse or someone good at working cattle makes it easier. If you know that the farmer is hopeless you'll take someone with you.
- paravet: if sufficient experience, they can do everything that we do. Ion NSW we are dumb at using paravets better. Train your nurses better who can do pretty much everything we do,
- We have an animal health bio officer, already trained, she couldn't diagnose but if just taking blood sample, feral surveys or even PMs she could do that already. As she gets more experienced she could even do diagnosis
- We absolutely should because at the moment we don't have enough vets. Particularly in large animal because t is not very profitable, so we just don't have enough people to go out.
- Anyone can do the mundane drudgery.
- Animals are suffering because we don't have enough vets. Better off to have a para vet than no-one at all.
- Much quicker to train para vets than a 6 year trained vet.
- Guys working for agents, out on farms all the time they could be used. Everything is measurable.
- Not rocket science being a vet
- Animals are unpredictable and they respond to you. An Ai would be able to respond to the animal
- NLIS tags and a halo around the feedback is being used in feedlots to detect if animals aren't eating which might be a sign of sickness.
- Have had very little uptake on biosecurity management plans from the NSW LLS exotic disease workshops.
- an area that needs work If FMD does get in we are well under resourced nationally in vet workforce.

# Livestock producer

**Role**: General Manager - Sole Trader Farmer

**Age**: 35

**Shift Length:** 10 hours x 5 days per week + 4 hours per day weekends

**Education**: High School + technical college (TAFE)

**Location**: Dayboro, QLD

**Bio:** Grew up on the farm and continuing the family business. Manage a cotton plantation, 1,000 head of sheep and about 150 head of cattle.

**Accessibility Needs:**

- Works outdoors and with live animals.
- Often solo or isolated when working.
- Uses a lot of mechanical equipment and fuel

**Responsibilities:**

- Staff management
- Administration
- Planning the daily or annual activities
- Accessing weather and markets.
- Look after the farm, boundaries, agistment, house, shed and all the machinery on farm.
- Primary income earner for a family.

**Motivations:**

- Personally rewarding, like working with only a few people and looking after animals

**Work Culture:**

- Like them to have a life with a good balance but work is hard. Aim to make the work enjoyable so they enjoy the work and become really good at it.

**Core Needs**

- The support (technological or otherwise) to be able to do the job better and in better time
- Access to facilities, businesses and support when I need it- when it suits me and my farm

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**Pain Points:**

Are there any special job demands? (extended hours, time pressure etc.)

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- Typical farmer gripes for example: In summer the days are too long, too much rain, too little rain, weather people seem to usually get it wrong. Can be long hours at times.

**The Task:**

How long does it take to perform the task (animal inspection)?

- High mortality days it takes a lot of time to check for dead animals, especially as I agist my flock in the neighbouring farm- which is a solar farm.
- Day can revolve around a poor return investment (in sheep management). It certainly can be very time consuming- especially if a number of animals are unwell.

How many animals in an hour do you inspect?

- Up to about 500 per hour if in a drive by scenario to do animal welfare checks on the motorbike, can take about 2 x hours for the entire flock to be checked.

Does this task require assistance or collaboration with others?

- Usually these types of daily tasks are done by myself- vets when required or available. I also liaise with stock buyers and the occasional auditor. To note I have already had an onsite LPA with an Ausmeat inspector.

How does your experience influence your ability to do tasks?

- Well, you need good skills and experience to do this job well and keep on the ball.

What are the ramifications for not completing this task correctly?

- Wouldn't be viable- slowly lose the farm and my living (not to mention a family legacy)- sometimes you never know if you are making the right decision but as long as you make some of them right everything will be OK.

What skills are required to be competent at the job?

- People management, admin, general management skills, understanding, compassion and technical know-how- for example I studied agricultural science, chemistry at University. I also have a lot of other learned skills and of course some financial management skills

Are there any tools, information or feedback you wish you could have with you out in the field?

- Drones to manage a live flock on other properties, virtual fencing would be great, access to data could be valuable, I can see the value of the smart glasses too- especially with remote vet work. I would really be interested in more data around my livestock- especially something that could visualize their health quickly, how much they weigh, fat ratios and the like. It would be great if it were something similar to the Monsanto platform I use for the cotton.

**Extra:**

What could help save costs to do your job?

- Look at electricity, fertilizer, cost of technology from Monsanto for their platform on managing the cotton. Water costs, reduce the loss of water.

If given one super-power to do your job more effectively, what would it be?

- Weather man, predicting events- keep ahead of patterns and systems to map out production on farm.

Do you think you could do this job remotely if supplied with effective equipment?

- Definitely some aspects like drone support and remote inspections

What are your thoughts about recording inspections?

- No problems if of benefit.

Industry Perspective:

What are the main costs/expenses do you think should be addressed as an industry for animal health inspection?

- Main concern is to me as a farmer- the vet expenses to actually get someone to site are pretty high- at the moment I am actually thinking of getting out of sheep production as it doesn't make sense to me to continue with the return per sheep being so low- then you may have to involve a vet as they are more at risk than my cattle. The animal welfare perspective is impacted here, even though I am a compassionate farmer that has a respect for all of my animals- I will have to put down animals sometimes simply because I either cannot get a vet to attend or the cost far outweighs the outcomes.

What are the biggest risks/challenges not being addressed at an adequate level right now?

- Can be a little unreasonable to expect the same standards across the board in production of animals- I am just a small agency but a larger one would definitely struggle in terms of the cost. It is hard enough for a small operator to employ a vet; I can only imagine how the bigger operators go with this problem. I currently sell my animals to Mort and co. (Note: JBS Beef City is about 10 minutes' drive from this site.)

What are the main blockers in addressing these challenges?

- Large scale blockers would be the manpower required for the number of animals- simple economics. As I mentioned before we are really pushing towards getting out of sheep production as the cost doesn't make sense. I might get $200 per head at market but if I ever need support from a vet it is usually $350-$400 and this is only because I live "so close" to a built-up area like Toowoomba (45 minutes).

Are there underserved areas within animal health e.g. regional areas that are struggling to get vets?

- I have concerns here in my area- I always have to weigh up the need against the financial outputs- I lost a lot of sheep really recently and a stud ram worth a lot of money, one that I went out and paid for to increase the yield of the flock. As I did not know the cause of these deaths and in particular the passing of the stud ram I really needed a postmortem but no-one was available, in fact the first few vet companies I contacted about this said they would not touch sheep as the only livestock they support were horses. In the end- I still had to get the postmortem so I put it into the back of the ute and drove Took down to Gatton- basically losing a half a day there and back, time I really cannot afford to lose when it is just me and a few stockhands working the farm. Postmortem with the device you brought along today to show me (Navigator 500) would be great considering the access we do not have to on site support. Every time I have paid a vet to assist on site I ended up losing the animal, $200 animal and $300+ vet bill- I am a compassionate bloke but sometimes it makes more sense to put them down. Given the value in cattle though- I would arrange a vet visit for a cow- even if it was just one. With the device I would be comfortable doing a remote postmortem

with an experienced offsite vet, right down to being advised on how to actually do this- including opening up the carcass. I genuinely need to know what has happened to my livestock- especially if it has something to do with a disease. In saying this I would have confidence with sheep but cattle would be a different story.

What has your experience been with adopting technology to help you do your job in the past?

- Weight consoles and other mechanisms for the flock- accessible via computer for comparisons, I have heard of a few different innovations that would be really helpful for me though- especially the "virtual fences" for the sheep as I have an arrangement with the solar farm next paddock for agistment of the sheep however as it is riddled with solar panels part of the arrangement is that I check the sheep every single day to ensure there are no dead ones under the panels… 1,000 head of sheep in a very large space and this can take up to 2 x hours on the motorbike every day. I am not really sure how the virtual fences work but I would like to know. The other bit of kit I am interested in are high quality drones so I could check the flock quicker.

What has worked/not worked with the adoption of new tools or technology?

- I use Monsanto software to manage my cotton crop and it is very useful with a lot of gathered data informing me of many different aspects of the farm. This platform is really the biggest cost outlay I have, second being the fertilizer for the cotton farm. It is a great system but not cheap to manage.

# Livestock Supervisor

**Role**: Livestock Supervisor

**Age**: 35

**Shift Length:** 7.6 hours per day on contract x 5 days per week (uncommon not to take additional shifts every week though.)

**Education**: High School and Home Farm based experience

**Location**: Ballarat

**Bio:** 2 years on the current job. Started out as a livestock drover for a year. Before that grew up on a cattle farm.

**Accessibility Needs:**

- Works outdoors
- Works with live animals
- Limited access to technology due to manual handling

**Responsibilities:**

- Carry out normal stock handling duties
- Livestock admin tasks
- Livestock traceability tasks
- Team building, support and management

**Motivations:**

- Lifestyle working out in the country with animals.
- Take pride in knowing I am looking after these animals in the best way I can.

**Workplace culture:**

- There is a difference between those who are new and those who have been around for a while.
- Some have been in the industry for over 40 years and are unionised.
- There are politics at play. And often people approach this as livestock handling for a farm which is different to livestock handling for meat processing.

**Core Needs**

- Request a call with a vet
- Need a resolution to the sick animal
- agile and aware of what is going on around them
- Need to remain safe, and keep distance
- Need peripheral vision
- Taking instruction from the remote vet.
- Showing remove vision to the remote vet using the SG device
- Need to be able to use phone as a connection device to the session as I am in the livestock pen.
- Register I need a consultation with a vet
- take a photo of the animal to help identify and register
- Enter in basic info about the animal needing inspection
- notified when the vet is available to call
- Need to be Able to connect to a vet at any time
- Need to remain flexible to do other jobs rather than wait around for the vet to call back

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**Pain Points:**

- Hard to give voice commands if cows keep speaking cow
- hard to hear the remote vet
- Often doing 12 to 15 hours of overtime a week.
- Have to turn up sometimes at 3am so its like being a doctor on call.

**The Task:**

Time taken:

- An experienced vet would likely have the whole thing done in about 30 minutes.
- Someone who is less experienced, fresh off their Aquis training, you'd see them definitely taking a lot longer to complete the process as they are trying to make an impression and show their capabilities.
- If we were walking around with the QA's as well, they have a number of different criteria they're looking for. Like overall yard cleanliness and they wouldn't necessarily get down to the fundamentals of animal welfare. They'll be looking at other things so it varies greatly I'd say. 30 minutes is normal but I've been out there for an hour and a half.

How many animals in an hour do you move or inspect?

- Up to 7000 lambs per day so up to 1000 per hour.

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Does this task require assistance or collaboration with others?

- QA team, FMA's, Vets, Transport operators, Stack Handlers, Management and maintenance teams.

What items are required to perform that task?

- Biggest problem is getting things fixed, keeping things to code or up to standard, even things that go beyond our standards or seem just plain and simple or relate to company policy.
- It's really hard to keep the yards maintained, some basic things like our phone wasn't working for a week and then actually trying to get someone from IT down to fix it. They sent three people down before it was fixed.

What techniques/rule of thumb do you use during this task?

- Fix it ourselves where we can. Saves time and hassles.

What would happen in the business if you and your team did not perform your roles correctly?

- Disciplinary action and we could be more than likely, at my level you'd be taken in front of someone like the QA manager or Southern QA manager who manages everything on the southern front. It's just one of those things, you never know how it's going to go and unfortunately there's a little bit of a culture in our business about replaceability. I think there are still some people who are really good and they recognise the skills involved. And then there are definitely some people who are just like "everyone's replaceable", but I can tell you right now if the livestock team walked off site- complete chaos, compliance chaos. Without us and our admin, our admin girl sits there and manually enters the RFID's of every single head of cattle that goes through to check that they can sign and correlate with the property where they allege to have come from. If that's not being done or worse you know bodies get mixed that doesn't get picked out you get farmers being paid for the wrong animals and absolute worst case scenario you have a disease outbreak and you can't say where it came from.

Is there any specific training or a course you need to complete to maintain your role?

- Informal, I was asked by my predecessor- a bloke with 28 years on site here at site if I wanted to train for the role and I was lucky enough to shadow him for 6 weeks before he decided to leave but all the training is informal, I didn't really need certificates to do this role but I do have a lot of livestock experience. This has been more like a traineeship in a sense for me.

Now that you understand some of the technology that we use in our day-to-day operations, do you think this may be able to assist you and your team?

- Yeah, absolutely. I mean there's got to be a better way. And I when I look at some of the software that we've got here, some of our biggest issues aren't necessarily the hardware, for example an RFID scanners is an RFID scanner.
- But the way that the data is stored and processed.
- Compatibility between different platforms that need to be integrated instead of sitting there copying and pasting things from spreadsheets into other spreadsheets. And of course Excel's versatile and we can do things with that to put it into other applications but you look at the licensing on, for instance, the software that runs out the kill floor scales and records all that information is licensed as 2004.
- A lot has happened since 2004 and I think the last time it had an update was 2008 and now that company no longer produces this. They've either gone bust, rebranded or they just simply don't do that kind of stuff anymore.

What could help save costs to do your job?

- The other week we (our expense of course) flew a Meat Inspector from the U.S to do their audit. I think we could do this better to save some cost. Do we still need to do this? I don't think so.

What could help to improve time efficiency to do your job?

- Technology and more support- this is not mum and dads business, it is a really big business with lots of smaller businesses to manage within it.

If given one super-power to do your job more effectively, what would it be?

- Eyes everywhere! I guess the management team already have this super power- basically hundreds of eyes everywhere for them via the CCTV system!

**Extra:**

Digital documentation:

- Something I find really perplexing is that they brought in a system for digital documentation for livestock transportation and this was meant to be a national system as well. We have documentation that comes with our livestock. They brought in the system to make that all digital but we receive only half of our declarations with digital certifications. Half comes through the digital portal and the other half will come in a paper form- ripped out of a book. Now they were meant to make this a digital (fully) 100% a number of years ago. But the issue you've got here is I think it's the heavy vehicle regulatory body the MVHR or NVRH forget what they are called but they will not come to the table because one of their requirements that surround the actual driver of the vehicle- they insist the driver be carrying a physical copy. Why can't they download copies before they leave and make it available offline. How hard is it to implement a system like this? We are putting away two pallets of archive boxes full of paper every single year.

What are your thoughts about recording animal movements?

- No problems there. I think at the moment we're trialling some artificial intelligence counting software. It's terrible. I mean really bad! Across three sites, the Feedlots. My personal experience with it, which is about three weeks' worth seeing how it works, we're keeping records of what our count and what our drivers counts are then what their AI counts is, and the count on the paperwork as well as what is then physically there which I guess is the 100%, confirmation physically what goes over the hooks, through the kill floor. And the AI is bad. Like we're talking at times, you're going to have a count of 300 lambs off a truck, but the AI counts 196. Our plant manager, he came and asked me, how's it all going? And I said well, look, over the past two weeks the closest we'd come to an accurate account was within four, I think it was. It had missed four. It had missed four lambs. There was 120 in that lot. Relatively small lot. Wow, you know I've sat and worked it out with the IT team previously. My accounting accuracy, my personal manual visual counting accuracy is about 98%. So if we're not at least matching that Yeah, exactly. There's no point in putting it on. Yeah, physical. Like tick, tick style counters that well… older systems like the trigger system- they run past and trigger a button or lever are renowned for being unreliable because lambs go back, the dog runs past it, you bump it with your knee. I think the idea of a camera-based AI visual system is probably the way to go, but the software needs dramatic improvement. It needs a lot finer tuning to be effective so they're still working on it but I'm not confident. The first system was put in at border town. I've not heard anything good. I've heard it's completely hit or miss. It doesn't understand and from my point of view this is not as good as the human eye from my perspective. For a start if I configured the AI I'd be counting them side on. Currently it risks miscounting something based on that you have smaller lambs that running past? You just miss it where these cameras are mounted overhead looking directly down where the animals physically cannot

- come out of that area more than three wide. I understand they're relatively new (the company running these AI projects). Not as University though- I believe it is a Startup that approached Border town initially.

- Maybe by 2050 we'll be looking at putting in automated, completely automated stockyards where, I have actually heard stories of saleyards using what they call a walking gate. So someone opens the gate and they press the button, and then this big giant solid gate comes up behind the animals and just sort of very slowly crawls behind them.

**Industry Perspective:**

Are there any major risks/challenges in your role?

- Hard to say, particular risks I suppose, there is always a manual handling risk if for example a vet were to ask us to flip a lamb over or get a closer look at the underside of cattle but I would not say there was a huge risk. We do whatever they ask really- we are pretty obliging for the vets. Hoof checks, mouth checks, lifting the lip and that sort of thing.

Does your organisation ever struggle to get a vet to attend site- for example in an emergency or immediate scenario?

- I mean, look in, in my experience, no. There have been a couple of occasions where maybe there's been a communication error and there's been a misunderstanding about the time in which we're starting. So it's been, you know, there's been close calls, but I wouldn't say there's a lot. They've got their own systems in place, so for continuity, to make sure that there's always someone there to meet those obligations.

Do you use a lot of technology to help you do your job?

- Virtually none. We have our computers but its just basically for data collection. We don't even use dogs at our site- it is pretty primitive.

If you had the opportunity to use more technology- what sort of tools would be useful to you or a vet team member on site?

- Well, look, I mean as it's already been being floated- the headset is definitely something that I feel there would be an application for. It's just trying to find where that would fit in and in what scenarios. I mean I don't know if it's been conveyed to you that in the event that vets are not available, especially during the COVID pandemic- they created a bit of a loophole to allow an on-site meat inspector (FMA) to do the government meat inspectors antemortem inspection. So I guess that that leaves a fairly big opportunity as if that wasn't an option, I think the need for something like this would be (remote inspection).

# Vet Trainer

**Role**: Vet Trainer

**Age**: 49

**Shift Length:** 7.6 hours

**Education**: Vet Degree

**Location**: Samford, QLD

**Bio:** At TAFE since 2017 but worked on stations prior to this in Katherine NT for over 11 years

**Accessibility Needs:**

- options for technology and streamlining of employer processes
- More opportunities to visit or virtually visit trainees in the field (non-invasive)

**Responsibilities:**

- I have an educational role, so I do teaching of vocational units
- Management role where I look after teams of educators in horticulture, civil construction, animal studies and rural agriculture

**Motivations:**

• Teaching is always fun. Excellent, that's the easy part. That's the fun bit going out and teaching, I love interacting with students. It's good fun!

**Work Culture:**

In a few words, explain the work culture in your environment.

- In TAFE Queensland it's an intense environment but it's not actually all driven by revenue. I do travel a bit too: up to four hours away from Toowoomba. But now I get to travel mainly during the holidays. Seeing trainees.

**Core Needs**

What could help save costs to do your job?

- Certainly, being able to remote in when something's going on. We are doing it to a point- using video for example. But it's not the default. It is important to note that a face-to-face visit also makes a huge amount of difference to people out there- makes sense to shake a hand of "the man on the land" so to speak.

What could help to improve time efficiency to do your job?

- Evidence collation- I have used an iPad application for safety and culture in the past which was very beneficial and saved time and money.
- Assessments as you go- with an iPad you also have the opportunity to do all this offline and have people live sign documents. Upload when you can or have appropriate access.

What could help improve accuracy or certainty in inspection/diagnosis in your job?

- NA (as above)

If given one super-power to do your job more effectively, what would it be?

- X-Ray vision or something I can really see the future with really- Crystal Ball.

Do you think you could do this job remotely if supplied with effective equipment?

- Certain aspects of it. Yes, for some of their more remote students who do live away- certainly if there is good connectivity.

Are you aware of any remote inspection technologies?

- May have, I will have a look as recently some were mentioned in the field of VR training.

What are your thoughts about recording inspections?

- No problems here- providing important evidence.

Are there any factors that may impact your ability to (learn/do) activities based on (topic here)

- No

Is there anything you think i may have missed or is important to know about your job?

- 

**The Task:**

What are the three most important tasks you perform in your job?

- Farm visits to assess and assist trainees
- Communication
- Looking at new technology that can assist industry

Given your knowledge and skills of the industry and as an educator, how do you try to pass that along your skills and experience and make sure that your trainees are equipped with the skills and knowledge to do the job?

- We are changing and we used to be able to access 8 training sites where we could get trainees to really get dirt under their fingernails but that's all gone now, so we're all trying to work out how to provide that level of education and experience because the expectations are a lot higher. People come out of education, or an RTO with a high level of expectation for training and it is a lot harder to actually deliver that, because you don't necessarily have that same accessibility anymore.

Now that you understand some of the technology that we use in our day-to-day operations, do you think this may be able to assist you and your trainees?

- Yeah, I mean, that's where we're sort of thinking of, you know, because we sort of. We're just lacking this bit of middle area where we can provide different scenarios, different things- live situations cannot be simulated over and over without upsetting the animals, in a virtual setting you could potentially create many different scenarios. We could simulate an animal charging someone in a virtual scenario as this could happen in the real world. It could really help people to gain experience in a safe situation.

Are there any tools, information or feedback you wish you could have with you out in the field?

- Cannot think of anything we have not spoken about.

**Pain Points:**

Are there any special job demands? (extended hours, time pressure etc.)

- I do travel a bit too: up to four hours away from Toowoomba. But now I get to travel mainly during the holidays. Seeing trainees.

**Extra:**

What are the main costs/expenses do you think should be addressed as an industry for animal health inspection?

- Just the just the distance factor. You know you could have a lot more vets in airplanes if they are willing, but it's also that little bit of we've never had used vets either. So, there is that mindset as well we've never had to use a vet. You know you find a dead animal here, or it's not well. Well, you must keep it in, look at it for a while and it doesn't look like it's getting better will you euthanize it? There's a little bit of a cost imperative of where it's going to cost me. It might cost $1200 to come out and fix a $400 calf.

What are the biggest risks/challenges not being addressed at an adequate level right now?

- Animal welfare risks. We are certainly getting better at this- for example I know a lot of places are using pain relief in processes now during branding, marking and dehorning. Becoming pretty much a standard now.
- We have worked with a site that is toxic- has anthrax on the property, generally if an animal gets sick around there- even after precautions are well managed- by the time a vet attends the animal is dead. Time, availability and travel factors, also the factor of not being able to identify 100% what the animal died of, potentially this could be assisted by remote technologies in identifying the concern while the animal is still alive?

What are the main blockers in addressing these challenges?

- Attitude about change, concerns about cost and no idea of what technology could do to reduce costs, make things more effective and save some stress. A lot of angst is based on people's emotions.
- Travel costs
- Scared of technology.
- Privacy and data management perceptions plus security.

Are there underserved areas within animal health e.g. regional areas that are struggling to get vets?

- In general, rural and remote areas are underserved with vets so spread out and covering massive regions- we work with St George basin vets and they cover 100's of thousands of square klms. A lot of vets have pilot licenses to try to cover more territory.
- Vets are easy to tap into in built up areas- especially on the East Coast- the further inland you go- the harder they are to find.

What has your experience been with adopting technology to help you do your job in the past?

- Not too bad. Also, we use a lot of it. I think we look for well how's the application work and then OK we can see the benefit. The application I mean.
- Depending on the mindset of the user, some want to stick to the old school ways of paper and pen, others in the team are more than happy to have everything supported on computer.

What has worked/not worked with the adoption of new tools or technology?

- Sometimes the new system is not easy to use which causes complications.
- Not having the patience to teach new users or new technologies. Not willing to try different approaches and possibly think outside the box for the different types of learners.

- Understanding people's digital literacy, for example they are bloody hopeless on a computer, but it is simple to place a video on TikTok or YouTube. Almost anyone can drive a mobile phone now.

What standards need to be met or considered when looking to introduce any technology into the animal health inspection process?

- Unsure apart from regular (privacy, data etc. TAFE perceptions).

## 9.3 Appendix 3. Determinants for future successful rollout of remote animal health and welfare inspection services

Financial incentives from the government to encourage investment in the sector.

- Tax credits to businesses that invest in remote inspection technologies.
- Grants to cover the cost of implementing remote inspection technologies.
- Subsidies to offset any additional costs associated with remote inspection technologies.
- Financial assistance to cover training costs related to the implementation of remote inspection technologies.
- Special financing packages to help businesses purchase or lease remote inspection technologies.
- Subsidized technical support for businesses using remote inspection technologies.
- Investment incentives in the form of low-interest loans or grants to encourage the adoption of remote inspection technologies.

Investment in the infrastructure needed for remote auditing, such as secure IT systems and secure auditing portals. Key requirements for this are:
- A secure network infrastructure with appropriate firewalls and network security protocols in place to protect against cyberattacks.
- A virtual private network (VPN) to ensure secure data transmission between the auditing team and the meat processing facility.
- An online collaboration platform to facilitate communication between the auditing team and the facility personnel.
- Video conferencing equipment and software to allow for virtual meetings and inspections.
- Secure, cloud-based document storage to enable the secure sharing of audit documents.
- A system for tracking and monitoring audit results in real-time.

Clear regulations and guidelines for feed lots and meat processors to ensure compliance with remote auditing requirements.
- Have a written process in place for any changes to the product or production process.
- Establish a system of record keeping to document all processes and procedures.
- Establish a system for verifying the accuracy of all records.
- Ensure that the facility is equipped with necessary equipment for the remote auditing process.
- Develop a communication protocol for communicating with auditors during the remote audit.
- Establish a system for providing access to the facility for remote audits.
- Establish procedures for reporting any changes to the facility or its operations.
- Develop a system for testing and verifying the accuracy of the data collected during the remote audit.
- Establish a system for responding to any findings from the remote audit.

Training and certification programs for feed lot and meat processing staff, to ensure they are able to understand and utilize remote auditing technology. Key deliverables in this training would be:
- Overview of remote auditing technology and its advantages.

- Instructions on how to use the technology, including setting up and using the necessary hardware, software and tools.
- Best practices for conducting remote audits.
- Overview of relevant regulations and standards, and how they apply to the use of remote auditing technology.
- Hands-on practice with the remote auditing technology to ensure staff are comfortable with the technology.
- Explanation of audit results and how to interpret them.
- Discussion of ethical considerations in the use of remote auditing technology.
- Review of the responsibilities of feedlot and meat processing staff in relation to remote auditing technology.

Access to an online platform for feed lot and meat processor owners to conduct remote inspections. This software platform should contain features such as:
- Secure authentication and authorization system for users to safely access the platform.
- Document management system for uploading, annotating and sharing inspection reports.
- Video conferencing and audio calling for communication between inspectors and feedlot and meat processor owners.
- AI-enabled image recognition and processing capability to quickly analyse feedlot and meat processing conditions.
- Real-time data visualization capabilities to allow inspectors and feedlot and meat processor owners to view the results of inspections.
- Automated notification system to alert stakeholders of relevant alerts and changes in inspection conditions.
- Automated data collection tools to allow inspectors to collect and store relevant data during inspections.
- An integrated reporting system to quickly generate reports on conditions found during remote inspections.

Increased public awareness of the importance of remote auditing and the benefits it can provide to both the industry and consumers. Some ideas to achieve this are:
- Create a digital campaign to spread awareness. Use social media, blogs, and other online platforms to explain the importance of remote auditing in the meat processing industry.
- Develop partnerships with industry organizations to host webinars and seminars highlighting the benefits of remote auditing. Invite speakers who are knowledgeable about the topic and can provide evidence-based research to support your message.
- Reach out to local media outlets and ask them to cover stories related to the importance of remote auditing in the meat processing industry.
- Write articles for trade publications and submit them to industry-related websites and blogs.
- Offer incentives to meat processing industry workers who complete remote auditing training.
- Provide educational materials about remote auditing for meat processing industry workers, such as fact sheets and infographics.
- Connect with stakeholders in the meat processing industry, such as government agencies, suppliers, and customers, to explain the importance of remote auditing.
- Develop a comprehensive digital resource center with resources on remote auditing in the meat processing industry.
- Sponsor events and conferences related to remote auditing in the meat processing industry.