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AUSTRALIAN Pork®

National Animal Health and Disease Extension and Adoption Strategy

Final Report
APL Project 2021/0036

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1. Background to Research

The project, 'Enhancing supply chain profitability through reporting and utilisation of peri-mortem information' (Health4Wealth) aims to develop a standardised approach to data collection on disease-related carcass and offal condemnations and develop a nationally agreed, consistent feedback framework to beef, pork and sheepmeat producers. It is envisaged the new system will allow producers to monitor disease prevalence in their livestock and make informed decisions to maximise yield outcomes.

The project received funding from the Commonwealth Government's Rural Research and Development for Profit Program, and it is a partnership between Australian Pork Limited (APL), Meat & Livestock Australia (MLA), Australian Meat Processor Corporation (AMPC), Agriculture Victoria (AgVic) and the South Australian Research and Development Institute (SARDI).

The project has a number of objectives and research has already been completed on the following:

- A business case for a peri-mortem data capture and reporting system that meets the needs of stakeholders across the beef, pork and sheepmeat supply chains
- Standards and software that can be used to collect and consistently report disease-related carcase and offal condemnations (total and partial) during ante- and post-mortem inspection
- Validation (pilot) studies to identify challenges or barriers to implementation and recommend solutions prior to rollout of the national system (Hamilton & Jolley, 2021; Suttor, 2021)
- Benefit:cost analysis, with results demonstrating there is likely to be a strong value proposition for both producers and processors (Frontier Economics, 2021).

Frontier Economics (2021) summarised the key findings from Health4Wealth (H4W) case studies as follows:

<u>Processor perspective:</u> Processors experience losses from the slaughter of diseased/defective animals in several ways:

- The direct loss of saleable meat and offal (condemnation and trim)
- The cost of extra processing
- The need to process extra animals to meet consignment specifications
- The costs of (extra) disposal of condemned material.

<u>Producer perspective:</u> The situation for producers is more complex:

- On one hand they clearly get higher returns from reducing disease/defects in animals sent for processing
- On the other hand, many conditions that result in carcase downgrades or trim are endemic and cannot be eradicated.

This results in a trade-off between additional expenditure to reduce disease/defects and the incremental financial gain. Additional peri-mortem data can help producers reduce disease/defects in animals, but education and support are needed to ensure that both producers and processers know how to best utilise the data.

This draft animal health and disease extension and adoption strategy has drawn on the above components with emphasis on identifying the pathways, channels and partners best placed to work with producers to understand and action their animal disease feedback. The reporting and utilisation of peri-mortem information will be referred to as "abattoir surveillance" throughout this strategy. The concept of abattoir surveillance is depicted in the proposed Australian Pork Industry Model shown in Figure 1 below (Hamilton & Jolley, 2021).

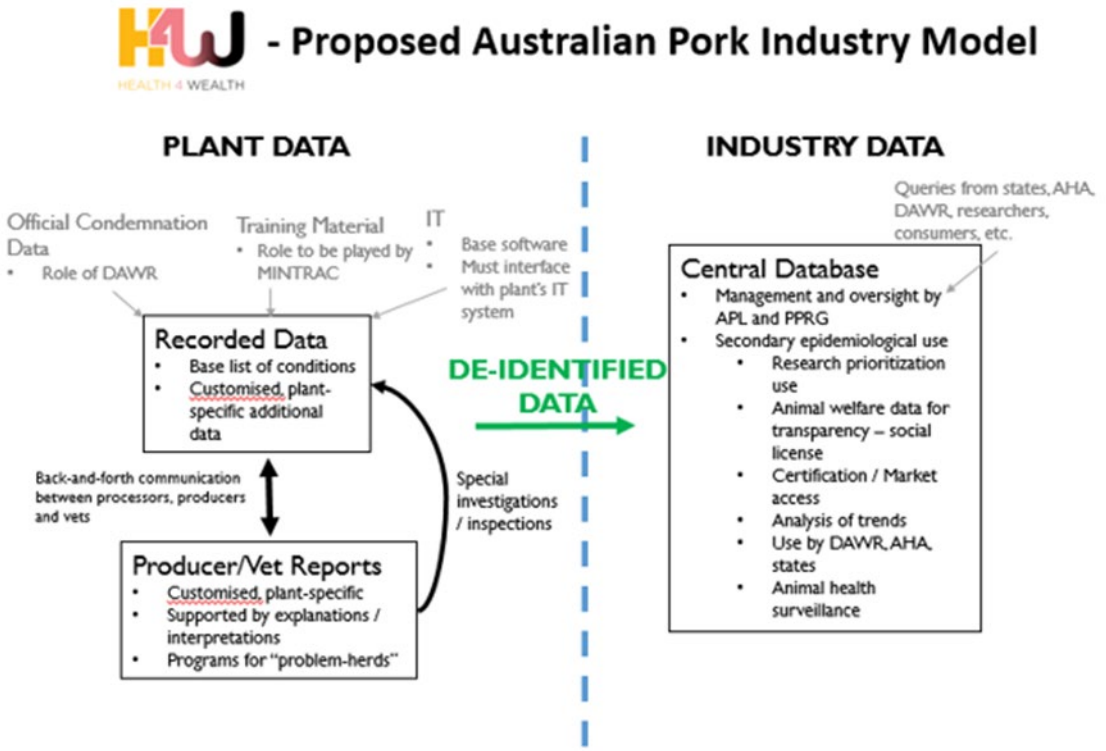

Figure 1: Proposed Australian Pork Industry Model

2. Extension and adoption process and tools

This document sets out the extension and adoption strategy for the pork, cattle and sheepmeat industries to deliver a nationally agreed, consistent feedback system for abattoir surveillance, with a 10-year timeline for the implementation of the strategy.

For the purpose of the strategy, agricultural extension is defined as including the public and private sector activities both on and off-farm relating to technology transfer, education, attitude change, human resource development and the dissemination and collection of information (Marsh & Pannell, 2000). Effective extension leads to the adoption of activities that bring about change to enable profitable primary industry value chains (SELN, 2006).

The theory of extension is complex and beyond the scope of this document, however the success of an extension and adoption program includes an understanding and consideration of a number of key elements, including (Fulton *et al*., 2003):

- Institutional and organisational structures supporting learning and change
- Professional development of farm advisers including their structural arrangement and careers
- The facilitation of enhanced learning/change processes on farm
- Better understanding of the barriers to participation in learning opportunities.

In addition, there has been a trend towards privatisation for 'private good' (productivity and profitability) extension with a decline in inputs by state governments (Hunt and Coutts, 2009). As a result, Hunt and Coutts consider the need to foster the following objectives for an extension program:

- Adopt branding of information sources that is seen as reliable, independent, and informs the industry of new technologies
- Develop a productive learning environment and culture with industry and service providers
- Develop client knowledge and understanding of production system profit drivers
- Maximise the adoption of practices and new technologies that target profit drivers.

The above elements of a modern extension paradigm need to be embedded into the extension "tools" designed for an extension and adoption strategy, with the tools described in MLA's Producer Adoption Outcomes Report (MLA 2021) as follows:

- Awareness activities: for example, field days, forums, webinars, newsletters, articles, podcasts
- Short Term Training Programs and Workshops: building producers' knowledge and skills by participating in training activities like workshops or electronic learning modules
- Long Term Practice Change and capability building: more intensive programs perhaps using small groups, producers learning from other producers, and application of new knowledge supported over the longer term. Mix of theory and hands on implementation
- Enablers: for example, tools and calculators
- Assessment of human resource capacity within the industry: for example, are there enough suitable service providers in industry to deliver what is needed and if not, recommend how this be addressed.

In formatting this strategy, GHD has drawn on the lessons identified by the above authors, and also on two recently published extension and adoption strategies, namely for the wine industry (Wine Australia, 2020) and the export fodder industry (Agrifutures, 2021).

2.1 Summary methodology

GHD completed the following steps in preparing this draft strategy:

1. Review of a range of reports from completed Health4Wealth projects to date
2. Gap analysis of extension and adoption tools and resources that will likely influence potential learning pathways for producers, including:
    a. Construction of three extension and adoption gap analyses frameworks (one each for pigs, cattle and sheep) with inputs from relevant technical experts
    b. Consultation with key informants from the industries familiar with abattoir surveillance
    c. Final gap analysis (APL 2022) and framework (Appendix 1)
3. This extension and adoption strategy with due consideration of the identified gaps.

2.2 About this strategy document

This strategy is structured as follows:

- Section 3 provides an overview of the extension and adoption strategy, including its goal, objectives and principles
- Section 4 sets out the strategy, including the implementation/actions, responsibility and timeframe for the actions
- Section 5 identifies the extension and adoption pathways, including the various extension and adoption process tools, value propositions, tactics and target audiences, and
- Appendix 1 includes a summary of the gap analysis (APL, 2022).

3. Goal, objectives and principles

This extension and adoption strategy is based on the following key components.

3.1 Goal and objectives

The proposed goal and objectives of the strategy are derived in the first place from the individual strategies of the relevant industries involved. These include the following:

Australian Pork Limited (APL) Strategic Plan 2020-2025: Timely relevant through-the-chain information (data utilisation), focusing on improving the timeliness, flexibility and availability of information to support individual decision making.

Meat & Livestock Australia (MLA) Strategic Plan 2025: More producers with access to data and feedback on animal performance to inform production decisions, and industry has a data culture, with supply chain decisions based on data capture and analysis.

Australian Meat Processors Corporation (AMPC) Strategic Plan 2018-2022 and Beyond: Ensure the sustainability of each stage of the value chain across the industry, with an in-depth understanding of the red meat value chain and establishment of a red meat information database.

GHD proposes the following goal and objectives for this strategy (noting these are drafts to be considered by the industries):

Goal

Processors, producers and service providers with access to timely and trusted data on disease-related carcase and offal information in a format that allows effective decision making to improve profitability and sustainability (the value proposition for each sector), with data made available (under industry agreed governance rules) to support surveillance activities and market access.

Objectives

1. Equip processing plants with technology that allows efficient capture and database storage of disease-related carcase and offal information for priority diseases and conditions
2. Train meat inspectors to accurately and consistently identify priority disease-related carcase and offal conditions and record the information using suitable technology
3. Establish a secure database(s) that enables authorised individuals and agencies to analyse data for effective decision making, with access limited by agreed governance and privacy rules
4. Develop objective, branded extension and adoption information (including tools and calculators) and activities designed appropriately to promote awareness and adoption of abattoir surveillance by all sectors of the industries, with accessibility enhanced via the use of a variety of suitable but coordinated dissemination platforms
5. Coordinate the resourcing of extension activities, including capacity building of practitioners, based on collaboration between processors, producers and service providers
6. Monitor and evaluate the progress of extension and adoption within all sectors of the industries based on the initial establishment of key performance indicators (KPIs).

Note that while a single strategy is presented in this document for the three industries, it is possible that separate strategies for each industry could be developed because of current differences in the maturity of abattoir surveillance. The pig industry in particular is more advanced in the use of abattoir surveillance technology compared to the cattle and sheep industries.

Also, it is uncertain at this stage whether a single national database for the three industries is feasible and/or desirable, with an alternative being a separate database for each industry. This issue is discussed in later sections of this report.

3.2 Principles

The theory of agricultural extension has evolved over time and will continue to change with technological innovation and the structure of the industries concerned, with the recent changes in approaches to extension and adoption outlined in section 2 above.

In developing this strategy, prior to examining the implementation activities required to achieve the six objectives outlined above, GHD has adopted six key principles that underpin all steps of the extension process. These principles have been adapted from Wine Australia (2020) and include the following:

1. **Foundational elements are agreed and in place.** Collection of information by processors, uploading data to database(s) with governance and access rules, and long-term, "beneficiary pays" funding arrangements.
2. **Focus on outcomes.** The benefits of every extension and adoption activity – a 'promise' – must be clearly articulated and delivered to prospective participants with a focus on actionable change and value for them (for both processors and producers). In its simplest form, this means the benefit:cost equation of any proposed treatment or change in management must be thoroughly understood.
3. **Offer consistent messaging.** Consistent, cut-through messaging is important to assist adopters navigate information overload and assist in providing clear evidence that supports informed decision-making.
4. **Design activities in conjunction with users.** All sectors of the respective industries (processors, producers, and service providers) should be directly involved in the design and input to extension and adoption activities, at national and regional levels.
5. **Support multiple providers and a range of access points.** Activities will involve a range of providers and formats to ensure accessibility to stakeholders both geographically and at a time that suits them, in a format that meets their learning needs with differing circumstances and learning styles.
6. **Measure impacts.** Monitoring, evaluation and adjustment is critical, both to ensure extension and adoption activities continuously improve but also to demonstrate accountability to stakeholders; with a focus on value and impact (outcomes), not products (outputs).

The role of these principles in the development of the strategy are described in Table 1 below.

Table 1: The role of the principles in the development of the strategy

Focus area	Description	Strategy implications (see Table 2 below)
Principle 1: Foundational elements are agreed and in place		
Processing plants have suitable equipment (hardware and software), staff and databases for collecting and sharing information.	H4W pilot trials have demonstrated the practicality of collecting and disseminating data at selected plants, but there are issues with software integration, funding and training of meat inspectors for all plants. Audio and video technology is being developed to facilitate the identification and recording of carcase and viscera conditions. Central databases are operating (SARDI for pigs, MLA Livestock Data Link – LDL - for cattle and sheep (currently being restructured), Animal Health Australia operates the National Sheep Health Monitoring Program (NSHMP) database and reporting). However, database funding and governance rules are not resolved.	Finalise the *Australian National Standard for the Development, Collection and Reporting of Animal Health, Disease and Defect Data through the Supply Chain* for all industries with endorsement by the Australian Meat Industry Language and Standards Committee, with priority diseases agreed for the three species based on impact reflecting differences between regions. This includes software to integrate data collection and consolidation between plants, and continued research and adoption of new audio and video technology for condition identification and data collection. Agree on the extent of the system being "national" (i.e. offered by all processors and being available to all producers), and then determine the operation and governance of the database(s), and resolve sources of funding (mix of individual plant, individual producer, industry levy funds, government and other contributions), with the funding mix to be based on the principle of "beneficiary pays". The pig industry may have stronger support for a national system compared to the cattle and sheep industries because of its structure (a more intensive industry with fewer, larger operators with similar management), although the sheep industry's NSHMP and its Endemic Disease Information System (EDIS) have been operational for many years.

Focus area	Description	Strategy implications (see Table 2 below)
Principle 2. Focus on outcomes		
The benefit:cost equation of any proposed treatment or change in management must be thoroughly understood by processors and producers.	The cost benefit analysis of Health4Wealth (Frontier Economics 2021) demonstrates there is likely to be a strong value proposition for both processors and producers, with strong evidence that participants across the supply chain can derive significant value from a national rollout. In practice the benefit to individual processors and producers will vary depending on their specific circumstances. The analysis finds producers have a higher benefit-cost ratio than processors because the up-front and ongoing costs of capturing and feeding back the peri-mortem data are incurred by processors rather than producers.	The value proposition (benefit:cost equation) is likely to be asymmetrical between species (pigs vs cattle vs sheep) and between participants (individual processors and individual producers). The abattoir surveillance reports and all extension materials and extension processes should be transparent so that individual participants (with their advisors) can easily understand the implications of the information to their enterprises and make appropriate decisions.
Principle 3. Offer consistent messaging		
Maintaining the knowledge base	Adoption is facilitated when information is readily accessible and searchable, consistent in its messaging and provided by a trustworthy source, e.g. a "branded" knowledge hub.	Recognise the importance of multiple delivery partners and access points to knowledge, as well as reaching a geographically dispersed audience. This favours the development of a knowledge hub that centralises learning resources on technical aspects of abattoir surveillance and related disciplines. There is a multitude of best-practice management guides/fact sheets, decision-making tools, videos and other media formats, but this is dispersed and not necessarily in a consistent format.

Focus area	Description	Strategy implications (see Table 2 below)
Principle 4. Design activities in conjunction with users		
Advisory structure	The Health4Wealth project is guided by a Project Management Committee comprising of representatives of AMPC, APL and MLA.	Establishing a broader National Project Management Committee with representation from all sectors (processors, producers and/or their representative organisations, advisors, animal health companies, and government extension agencies).
Principle 5. Support multiple providers and a range of access points		
Extension and adoption delivery partners	A range of providers are required to achieve the objectives outlined in the strategy; but this also requires enhanced transparency and co-ordination practices between the key partners.	Extension activities for abattoir surveillance are coordinated and delivered by a range of providers (see Table 3 below).
Principle 6. Measure impacts		
Monitoring, evaluation and reporting	Monitoring, evaluation and reporting is needed to determine, and showcase, the success of the strategy and identify areas for improvement.	A simple but robust monitoring, evaluation and reporting arrangement needs to be established to capture all elements of the extension and adoptions process, its outputs and outcomes.

4. National Animal Health and Disease extension and adoption strategy

Table 2 outlines a proposed strategy based on the goal, objectives and principles described above. It includes an implementation schedule with target audiences, responsibilities and a suggested timeframe. The timeframe is based on the "Rollout and Ramp Up Timeline" included in the benefit cost analysis (Frontier Economics, 2021, p. 42) that assumes a 10-year rollout period.

Note that the Table 2 strategy is generic for all species (pigs, cattle and sheep). The proposed National Project Management Committee may need to tailor actions and timeframes for each of the species based on current circumstances. For example, the maturity of abattoir surveillance, national reporting and database developments is more advanced in the pig industry compared to the cattle and sheep industries.

The extension and adoption pathways to achieve implementation of the strategy actions is further outlined in Table 3.

Table 2: Extension and adoption strategy

Objective	Implementation/actions	Responsibility	Timeframe
1. Equip processing plants with technology that allows efficient capture and database storage of disease-related carcase and offal information for priority diseases and conditions.	Establish a National Project Management Committee with representation across all industries, animal health companies, private practitioners and government agencies to guide policy, funding and implementation. The composition of the Committee to be determined by APL, MLA and AMPC with a mix of research and extension representatives. Finalise the *Australian National Standard for the Development, Collection and Reporting of Animal Health, Disease and Defect Data through the Supply Chain* for all industries with endorsement by the Australian Meat Industry Language and Standards Committee, with priority diseases agreed for the three species. The Standard also defines software to integrate data collection and consolidation between plants to enable a national database. (Note that Frontier Economics (2021) identified 7 pig conditions, 3 cattle conditions and 6 sheep conditions which pose the most significant costs for producers and processors for valuation – the Standard could allow flexibility in the number of conditions adopted by companies over time).	APL, MLA and AMPC lead the establishment of the National Project Management Committee. Animal Disease Technical Working Group finalises the *National Standard*, Australian Meat Industry Language and Standards Committee endorses the *Standard*. Where external funding is sought by processors, the level of funding and funding mix to be agreed by relevant industries (e.g. levy funds via APL, MLA, AMPC) and government bodies,	National Project Management Committee establishment – year 1 National Standard – year 1 Export abattoirs equipped – year 1 Domestic abattoirs equipped – year 4 Priority diseases/conditions agreed – year 1 Research – year 1

Objective	Implementation/actions	Responsibility	Timeframe
	Install data capture equipment in processing plants at three inspection points (carcase, viscera and retain rail) enabling nationally consistent recording of priority diseases and conditions for pigs, cattle and sheep. Install software in processing plants for data to be uploaded to a database(s) in a consistent format that enables the timely analysis of results with sufficient context for decision making. Research potential of automated audio and video capture technology to lessen burden on meat inspectors, and improve accuracy and consistency between plants. This is consistent with the draft National Standard which states that it is independent of technology or recording method, which therefore ensures that as technology evolves and becomes readily available the standards will still be applicable and compatible.	based on "beneficiary pays" principle. Relevant industries agree on priority diseases/conditions. Research priorities recommended by National Committee.	
2. Train meat inspectors to accurately and consistently identify priority disease-related carcase and offal conditions and record the information using suitable technology, with ongoing review of inspector accuracy, including statistical evaluation of performance for each disposition.	Training, monitoring and 3rd party auditing of inspectors is implemented in participating plants with requirements meeting the National Standard. The process will need to be discussed and agreed by relevant Registered Training Organisations (RTOs).	Training by Registered Training Organisations (RTO). Audits by an independent body against a recognised standard (i.e., ISO 9001).	Export abattoirs – year 1 Domestic abattoirs – year 4 Audit timing as required by the ISO standard
3. Establish a secure database(s) that enables authorised individuals and agencies to analyse data for	Database(s) capable of storing data in accordance with National Standard, noting that data for each industry could be separated and sit with a body or organisation that already has the infrastructure in place.	Each industry to determine database management and establishment of a national database, overseen by the	Export abattoir databases – year 1

Objective	Implementation/actions	Responsibility	Timeframe
effective decision making, with access limited by agreed governance and privacy rules	Provide capability to analyse priority diseases and conditions in a timely manner and with sufficient context to make decisions on livestock treatment and management. (Individual processors could maintain a company database and also upload data to a national centralised database). Determine if the national centralised database(s) accommodates pig, cattle and sheep information or there are separate databases for each. Determine funding arrangements for national database(s), based on "beneficiary pays" principle. Governance and privacy rules to be agreed for accessing both company and centralised databases, including ownership of data.	National Project Management Committee	Domestic abattoir databases – year 4 National database(s) – from year 1 depending on industry decisions.
4. Develop objective extension and adoption information (including tools and calculators)	Establish a "branded" knowledge hub as a 'source of truth' for information from all sources (e.g. "Paraboss" for parasite management for sheep, goats and cattle). This site would be a repository and information source for: Awareness activities: fact sheets, field days, forums, webinars, newsletters, articles, podcasts Short Term Training Programs and Workshops: building processors' and producers' knowledge and skills by participating in training activities like workshops or electronic learning modules Long Term Practice Change and capability building: more intensive programs perhaps using small groups, producers learning from other producers, and application of new knowledge supported over the longer term. Mix of theory and hands on implementation Enablers: for example, tools and calculators Assessment of human resource capacity within the industry to determine the sufficiency of suitable service providers for implementation.	National Project Management Committee for all actions.	Year 1

Objective	Implementation/actions		Responsibility	Timeframe
	Note that the above awareness and capacity building information and processes are "necessary but not sufficient" to achieve practice change by producers. Practice change will require more in-depth understanding of the relevant disease/condition and impacts on productivity/profitability within a whole farm context.			
5. Coordinate the resourcing of extension activities, including capacity building of practitioners, based on collaboration between processors, producers and service providers	Prepare operating plans for the delivery of extension activities – see Table 3 for a detailed list of activities, target audiences, value propositions and tactics, including identifying the pathways, channels and partners best placed to work with producers to understand and action their animal disease feedback.		National Project Management Committee	Year 1
6. Monitoring and evaluation	**Measure**	**Mode of measurement**[1]	National Project Management Committee Mid-term review by external reviewer selected by the National Committee.	Commence data collection - year 1 Mid-term review – year 5
	Inputs	Processing plants equipped and information uploaded to database(s) Reports of animal diseases conditions available at multiple levels (consignment, plant, species, region, state, national) Funding agreements in place (if required) Design and production of extension material, incl. stakeholder engagement in design, via a knowledge hub		

[1] Note that some monitoring and evaluation measurements require surveys of participants which require care in design and implementation to avoid survey 'fatigue'. Unless implemented correctly the survey process itself may be a barrier to adoption.

Objective	Implementation/actions		Responsibility	Timeframe
	Outputs	Number and types of activities (e.g. workshops, webinars, seminars, training programs, demonstrations, case studies etc.) Number and types of attendees Locations and geographical spread Knowledge hub metrics (number of data searches etc.) Number of producers receiving/accessing reports		
	Outcomes – changes in knowledge and skills	Simple surveys undertaken by delivery partners after each activity to capture: Quality of the content and delivery of the training programs Awareness, investigation and intention to adopt (percentage measure), and Practice change six-months following (depending on activity, percentage measure)		
	Adoption – practice change	Annual extension and adoption survey of stakeholders (for those that attend events and those that don't)		
	Benefits	Case studies Benefit–cost analyses of specific activities		
	Reporting	Curate the results from monitoring and evaluation activities, surveys and case studies into an annual impact report		

5. Extension and adoption pathways

The strategy described in Table 2 above will be implemented via a range of extension tools that need to be designed appropriately to ensure the optimum adoption outcomes. The types of extension tools to be employed were listed in section 4. Table 3 considers the different types of extension tools and the target audiences, value propositions and tactics (i.e. pathways, channels and partners) best placed to work with producers to understand and action their animal disease feedback).

Table 3 also cross references the relevant principles (Table 1) underpinning the implementation and actions required for each objective.

Table 3: Extension and adoption implementation pathways

Extension and adoption process tools	Value propositions, tactics and target audiences	Pathways/channels and partners
Awareness Fact sheets, newsletters, articles, podcasts, videos etc. Material is plentiful with examples being: 17 pig diseases fact sheets, branded with H4W logo; 5 cattle diseases fact sheets, branded with H4W logo; 12 sheep diseases fact sheets, co-branded in "Feedback Focus" publication by AHA, Zoetis, MINTRAC and ISC (MLA); 16 sheep diseases fact sheets, SA Enhanced Abattoir Surveillance program; State Departments of Agriculture/Primary Industries webpages with much information on a range of pig, cattle and sheep diseases, branded with state government insignia; AHA information and video on the NSHMP, including Joan Lloyd podcast on arthritis in lambs. One excellent tool is the *Sheep health conditions – carcass impacts tool, a*n interactive 3D web tool	Value proposition: The current available awareness information is plentiful but would be more effective if better coordinated and consistent in its presentation. Innovative tools such as the SA 3D web tool will increase awareness compared to standard fact sheet information. Tactic: Creation of a coordinated web portal (e.g. Paraboss) with links to all fact sheets and other resource material. The portal could be promoted by individual partners, with consideration given to H4W branding (or co-branding) to achieve recognition over time and increase engagement with processors and producers. Requires regular updates so that latest information is available. (Note that the industries will need to determine the benefits of creating a single new portal versus individual industry platforms that can then be updated and managed internally. Alternatively, housing the information on Animal Health Australia's (AHA) website may be appropriate). Target audiences: All stakeholders Principles: 3, 4, 5	Pathways/channels: Create a single web portal with branded or co-branded information and links to other relevant sites Partners: State Departments of Agriculture, Primary Industries (incl. Local Land Services in NSW). Note that the states have various extension platforms, e.g. South Australia's "Livestock Tech Talks podcast and video series". Research and Development Corporations (APL, MLA, AWI, AMPC, AHA). AWI includes producer networks: Sheep Connect in NSW, SA and Tasmania, BESTWOOL/BESTLAMB Victoria, The Sheep's Back in WA, Leading Sheep in Queensland. Representative organisations (AMIC, NFF, Cattle Council, WoolProducers, Sheep

Extension and adoption process tools	Value propositions, tactics and target audiences	Pathways/channels and partners
that shows the effects common health conditions can have on the quality of a sheep carcass.		Producers, State Farming Organisations, Animal Medicines Australia, Australian Veterinary Association). Animal health companies (e.g. Zoetis, Virbac, Coopers, MSD, Boehringer Ingelheim, Elanco, Jurox, Phibro, Troy Laboratories).
Building knowledge and skills Workshops, training sessions, E-learning modules For processors: Training of meat inspectors under the National Standard is being facilitated by Certificate 3 and Certificate 4 training modules being developed by MINTRAC. For producers: Individual processors have conducted workshops and webinars with selected producers.	Value proposition: Workshop and other training materials developed in a consistent format in conjunction with users, and with a focus on outcomes will engender trust and promote increased adoption. Tactic: (For producers) Develop co-branded materials (incl. PowerPoint presentations, E-learning modules) that can then be presented collaboratively by multiple service providers (e.g. processors, AHA, MLA, APL, animal health companies and veterinary consultants). Tactic: (For meat inspectors) Develop co-branded training materials (incl. E-learning modules) for Certificate 3 and Certificate 4 training, including ongoing auditing and training required to retain certificate status. Target audiences: Producers and meat inspectors respectively Principles: 2, 3, 4, 5	Pathways/channels (producers): Workshop and other training materials are available on the knowledge hub. Pathways/channels (meat inspectors): Training materials, incl. E-learning modules, available via MINTRAC to Registered Training Organisations. Partners: As above for awareness activities.
Long term practice change, capability building	Value proposition: Real world examples of implementation by peers promotes adoption within other cohorts.	Pathways/channels: Demonstration sites to showcase the benefits/costs of practice change,

Extension and adoption process tools	Value propositions, tactics and target audiences	Pathways/channels and partners
Demonstration sites, processor/producer champions	Tactics: Processor and producer champions of abattoir surveillance identified, and demonstration sites established to showcase the benefits of abattoir surveillance, including detailed information on the benefits/costs of practice change. An example is MLA's Producer Demonstration Sites (PDS) program supporting livestock producers working in peer-to-peer groups to pursue new skills, knowledge and management practices applicable to their own commercial livestock production systems. To ensure on-farm biosecurity, virtual demonstration sites could be considered. Target audiences: Processors and producers respectively. Principles: 2, 3, 5, 6	with selected processors/producers promoted and supported by their relevant industry representatives. Partners: Selected processor and producer champions assisted by industry representatives
Enablers – tools and calculators Tools and calculators These tools enable processors and producers to assess the likely impact of practice change on their businesses and determine if a more detailed assessment is warranted. A producer example is "Sheep DisCo", a web-based tool that takes basic information from a producer's flock production and income, summary disease statistics and control activities to estimate the residual losses due to disease that remains in their flock. The cost of control and the	Value proposition: Properly constructed and trusted calculators provide "bespoke" benefit/cost outcomes and, if positive, are an incentive to take further action on practice change. Tactic: Design and implementation of trusted, simple to use calculators as an additional tool with the aim of seeking further information from advisers to adopt practice change. (Caution: such tools are a useful aid to extension and increasing adoption, but care is required in interpreting the outputs and such tools should be used as an aid only, with any practice change decision being confirmed by expert advisors). Tools to be developed according to needs of the three industries. Target audiences: Processors and producers	Pathways/channels: Agreed tools to be developed and proven by relevant research bodies and promoted via the knowledge hub, with ongoing upgrades and maintenance included in budgets. Partners: Research and Development Corporations (APL, MLA, AMPC).

Extension and adoption process tools	Value propositions, tactics and target audiences	Pathways/channels and partners
residual disease losses can be compared to other producers, to performance in previous years and to explore the effects of proposed changes to disease control. This informs and empowers producers to best manage endemic disease to maximise profit.	Principles: 4, 5	
Capacity building The relevant industry sectors with sufficient, trained personnel to assist processors and producers in their decision making. Examples include MLA's Livestock Advisor Essentials and Livestock Advisor Updates which are regionally relevant, one-day technical workshops providing professional development opportunities, including learning the fundamentals of livestock businesses, developing knowledge, skills and confidence; and connecting with other livestock advisors.	Value proposition: Adoption of the technology will be enhanced if processors/producers have access to trusted and knowledgeable advisers. Tactic: Provide suitable information and training opportunities for livestock advisers Target audiences: industry advisers and extension officers, including development officers employed by processors. Principles: 3, 4, 5	Pathways/channels: Training opportunities for practitioners to be collaboratively developed and presented by industry providers. Partners: APL, MLA, AMPC, animal health companies.

A salutary lesson - the South Australian Enhanced Abattoir Surveillance (EAS) Program. Program changes in 2022 with Livestock SA currently facilitating discussions with relevant stakeholders to transition the South Australian sheep industry funded Enhanced Abattoir Surveillance (EAS) program to national data reporting systems. From 1 January 2022, PIRSA will no longer be managing the abattoir surveillance program in South Australia and producers will no longer be receiving carcass condition results via emails or printed letters from PIRSA, although there is a proposal for a South Australian abattoir to take on the reporting function (https://www.pir.sa.gov.au/biosecurity/animal_health/sheep/health/enhanced_abattoir_surveillance_program).

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7. Appendix

Appendix 1: Extension and adoption gap analysis

Extension/adoption element	Issues of importance	Lessons from H4W projects and consultation	Gap analysis
A. Foundational elements (processors) – data collection and sharing			
Diseases/conditions that can be directly assessed by inspectors (i.e. do not require additional laboratory assessment).	➢ Standardised language: agreement needed across all sectors of the industry – see report: *Australian National Standard for the Development, Collection and Reporting of Animal Health, Disease and Defect Data through the Supply Chain by Management for Technology Pty Ltd and Food and Veterinary Services Pty Ltd (no date).* ➢ Priority diseases: agreed list of diseases and conditions, with impact and/or consequence data. ➢ Additional diseases: responsibility of individual establishments. ➢ Export and domestic abattoirs involvement: choice of individual establishment but need to consider critical mass. ➢ Individual plant or central database: needed to collect and allow reporting and analysis of de-	• H4W pilot trials have demonstrated the practicality of collecting and disseminating data. • COVID 19 has limited involvement of some establishments. • Domestic abattoirs are not excluded, but they represent small % of total kill. • Central database: for pigs, operated by SARDI, with conversations underway with APL as to its future continued operation and the development of appropriate governance rules. • Central database: for cattle, access via MLA Livestock Data Link (LDL) – currently being restructured. • Central database: for sheep, via the National Sheep Health Monitoring Program (NSHMP) with AHA managing the Endemic Diseases Information System (EDIS) which can provide de-identified data to State DPIs to direct	1. Australian National Standard for the Development, Collection and Reporting of Animal Health, Disease and Defect Data through the Supply Chain needs to be finalised for all industries. Potential endorsement by the Australian Meat Industry Language and Standards Committee in May 2022. a. Participating plants use different systems for gathering data (electronic or paper), but all must be able to demonstrate compliance with National Standard metrics and terminology. Software vendors play a role in this. b. Funding of data collection equipment needs to be resolved (mix of individual plant, levy funds, government contributions) over time. Can the cost of implementation and adoption be offset by tapping into common industry funds/levies? 2. Agree on priority diseases (pigs have agreement - 17; cattle 5; sheep – 19 NSHMP conditions could potentially be reduced to 10 based on prevalence/significance for animal welfare and the cost impact on the processor: arthritis, CLA, grass seeds, sheep measles, dog bites, hydatids, pleurisy/pneumonia, bruising, liver fluke, vaccination lesions.

Extension/adoption element	Issues of importance	Lessons from H4W projects and consultation	Gap analysis
	identified data (sufficient for contextualisation).	their extension work and for DAWE to support market access efforts. NSHMP data is also stored on the (LDL). Also National Animal Health Information Program.	3. Whole of industry, national system a. pigs – supported b. cattle/sheep – uncertain if there is agreement for a national system or individual company systems. 4. Central database (PIC data available to PIC owner, with additional deidentified, aggregated data sets available for comparison) a. pigs – SARDI to host but need to finalise funding and governance, privacy rules and role of APL. b. cattle and sheep - uncertain. Potentially depends on critical mass of plants/throughput to be cost-effective. If agreed (e.g. EDIS, LDL replacement), will need to determine funding and governance, privacy rules.
Diseases/conditions accurately identified by inspectors/QA staff (noting % of false positives is damaging)	➢ Australian Meat Processing Training Package "*AMPA3120 - Perform ante and post-mortem inspection - Ovine and Caprine*" is delivered as part of the Certificate III and IV in Meat Safety (Meat Inspection). Competency is assessed at line speed by a Registered Training Organisation, with the RTO's assessment required for an award (Certificate III or IV in Meat Safety).	• NSHMP in conjunction with Charles Sturt University confirmed the accuracy of experienced meat inspector in disease/condition reporting. • The accuracy of animal health data is a function of meat inspectors' competency to recognise diseases and conditions at chain speed. • The NSHMP annually assesses inspector competency as part of the NSHMP's	1. Training: Inspectors have the basic training in disease/condition recognition, but need extra training in data entry. a. on-line e-training to be developed. 2. Monitoring/auditing by third party required – who will complete this task? 3. Video/camera technology could be developed to automate disease/condition identification and recording.

Extension/adoption element	Issues of importance	Lessons from H4W projects and consultation	Gap analysis
	➢ In an export establishment a new inspector is initially evaluated/assessed by the On Plant Veterinary Officer (OPV), a DAWE officer. If assessed as competent the inspector is then subject to ongoing evaluation by the OPV and FSMA, and can be deregistered as an Australian Authorised Officer if they do not demonstrate ongoing competency. ➢ Domestic abattoirs - depends on individual states. Inspectors may be subject to an initial evaluation before registration of plants. Meat inspection is audited as part of the routine plant registration audits in most states.	quality control (these learnings likely to be similar for pigs and cattle). • Assessment role falls to the Commonwealth (FSO) or third party AAO. • Competency will be assessed by the department and on plant verification should be performed by the OPV/department if the inspector is employed by the plant or a third party. • Persons will need to be competent to Cert 4 in meat processing (meat safety) for export and Cert 3 for domestic.	
Processor generated reports are contextualised – comparisons with own past lines, peers, regions, seasonal and other nuances. No judgement reporting	➢ Is there sufficient contextualisation in processor reports to ensure valid comparisons? ➢ What changes to reports are required by processors to improve contextualisation?	• It is necessary that processors and producers can benchmark themselves nationally/regionally/seasonally against others. • Without context, reports can be misleading and lead to incorrect intervention.	1. Pigs. Report format generated by a 3rd party (SARDI) to be agreed by the industry. 2. Cattle and sheep: comparisons of lots over days, weeks, months or specific Local Government Areas (LGAs) is difficult given stock are seldom of uniform quality. Recently revised reports need to be assessed for appropriateness.

Extension/adoption element	Issues of importance	Lessons from H4W projects and consultation	Gap analysis
		• Trend towards smaller lot sizes adds to need for care in interpretation and contextualisation.	3. Consistency will be brought about by implementing the voluntary standard.
Reports available based on individual animal ID or by line	➢ Does not having individual animal RFIDs cause issues with data collection and feedback?	• Individual animal ID allows better data analysis, e.g. the relationship between pathology/disease and carcase weight at slaughter (incl. for research purposes).	1. Pigs: lot level is likely to be sufficient, but confirm that individual animal ID is required to provide better analysis and interpretation, including for research. 2. Cattle, sheep: confirm that it is unlikely that information other than lot level is required.
Report – timely, whether by LDL or direct. Is there any contact with producer if "critical" disease/condition identified or other escalation?	➢ Immediacy/timeliness of feedback is important as delays can cause harm/loss. ➢ A meat processing enterprise manual is being prepared through AUSVETPLAN that will open up additional reporting avenues and improve preparedness for processors.	• Note that the On Plant Vet (OPV) is responsible for EADs and notifiable diseases direct to relevant authorities – these aspects are out of scope for this project. • Timeliness is critical with data going "stale" very quickly. For processors, the power of the data will help inform purchasing decisions. For producers, data allows animal health treatments to improve profitability.	1. Database access: can processors and producers directly access via password, and then complete comparative analyses, noting that processors technically own the data and pay to collect it, and recognising privacy issues associated with data. 2. Is it possible to link processor report with payment advice? 3. Can individual processors use abattoir surveillance as a marketing tool to attract producer clients in addition to national system (a hybrid model)? 4. Value based pricing would promote uptake.
B. Producer/advisor sector activities			
Awareness activities targeted (field days, forums, webinars,	➢ Apart from the fact sheets described above, is there a library of extension material, who is	• There is a range of fact sheets and other animal health information hosted by the State DPIs, APL, MLA, Australian Wool Innovation (AWI) and pharmaceutical	1. Potentially an overarching abattoir surveillance 'portal' subscribed to by all relevant agencies (e.g. Paraboss - Australia's premier resource for parasite management information for sheep, goats and cattle). A library of

Extension/adoption element	Issues of importance	Lessons from H4W projects and consultation	Gap analysis
newsletters, articles, podcasts)	responsible for maintaining the collections? ➢ Is there any evaluation of activities to demonstrate what producers find most useful? ➢ It is likely that awareness activities are necessary but not sufficient to achieve practice change/adoption by producers.	companies, however there is no overarching abattoir surveillance theme that cuts across all agencies/companies. • There has been little evaluation of the suitability or impact of extension materials for producers. • The greatest impact on producers will be when a report highlights a financial incentive from practice change.	extension materials and dates for industry events (e.g. field days). 2. Consider if some diseases/conditions information could be localised and thus more relevant to specific regions (problem is universal, solution local). 3. Trust in information is important, with co-branding seen as more impartial (see MLA's "Solutions to Feedback" library with linkage of carcase performance outcomes to a library of solutions).
Short Term Training Programs and Workshops, incl. electronic learning modules.	➢ What training programs & workshops for producers have been completed and who organised/delivered? ➢ Are any electronic learning modules available (e.g. Sheep Connect webinar by Joan Lloyd on arthritis).	• Pigs: Over 30 presentations to producers, vets and processors, both face-to-face and on-line have been done by the H4W research team. • Cattle, Sheep: A number have been completed but relatively ad hoc. Workshop materials example is *Feedback Focus – identify, evaluate, manage.* A collaborative and coordinated approach recognising that diseases impacting the processor also impact production and profitability for producers by AHA, Integrity Systems Company (ISC, part of MLA), National Meat Industry Training Advisory Council (MINTRAC), Zoetis, and run by individual processors such as	1. Develop standardised training/workshop packages for each species that can be used as core materials for training events hosted by extension agencies, processors etc.

Extension/adoption element	Issues of importance	Lessons from H4W projects and consultation	Gap analysis
		JBS, Gundagai Meat Processors, TFI and Fletcher International. • Face to face is best for large groups. Targeted on-line can work on a one-to-one basis.	
Long Term Practice Change and capability building, incl. producers learning from other producers/hands on implementation.	➢ The percentage of producers who have adopted abattoir surveillance, and if adoption is less than ideal, what is required to achieve better outcomes? ➢ Potential for producers to be nominated as champions. ➢ Recognise species differences: intensive industries (e.g. pigs, feedlots) are higher input systems that can apply treatments with higher chance of economic return. ➢ Extensive industries (grazing cattle, sheep) are generally lower input systems with higher risk of achieving economic returns from additional treatments.	Most producers are interested in abattoir feedback, but uncertain of accuracy of data, including independence. Credibility of the data integrity and transparency of the collection and monitoring process is required. Confidence in data confidentiality is also very important.	1. Demonstrate real world applications of the process as well as costs and benefits using real-life examples (producer demonstration sites or champions, branded product supply chains etc.).
Enablers: e.g. tools and calculators.	➢ Any evidence of the effectiveness of the tools? Will the development of tools/calculators promote adoption?	• MINTRAC has developed software for small to medium processors who wish	1. Calculators to be developed as awareness tools. The complexities of treatment interventions within a whole

Extension/adoption element	Issues of importance	Lessons from H4W projects and consultation	Gap analysis
		to collect data and provide feedback to their producers. • Sheep: a draft calculator has been developed by MLA.	farm context most likely requires expert advice before practice change adoption. . 2. Interactive dashboards preferred to static PDF reports.
Human resource capacity, service providers	➢ Have all agencies/service providers been approached? If not, why not? Are they not seen to be relevant? ➢ How supportive are they? ➢ What has been the feedback from agencies/service providers? ➢ What is their capacity to support extension and adoption, incl. number of staff with appropriate training, funding etc?	• Pigs: The system is strongly supported by processors, producers and pig veterinarians. Plants currently bear the cost of data collection and reporting. • Understanding human resource capacity gaps may be premature as trials are still in the logistic testing stage. • Covid 19 restrictions delayed previously scheduled awareness and training events – some loss of momentum. • Human resource capacity will develop over time as trials progress.	1. Recognise that, despite success of H4W trials, the system is still in a testing phase and not suited to full scale extension. 2. Traditional government extension agencies are unlikely to have resources other than for awareness activities, so private sector agents (e.g. vet consultants, animal health company technicians, processor liaison staff) are more likely to be the future, front line providers. 3. Co-funded digital supply officers employed by processors (MDC funding).