Final report

Advanced livestock data insights for improving performance in the Australian red meat industry

Project code: V.LDL.2001

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Abstract

The integration of several industry databases in the MLA Group Data Platform provide the opportunity for enhanced feedback systems. Previous Livestock Data Link (LDL) research projects (specifically V.LDL.1902 Developing aggregated data insights for LDL) demonstrated that it is possible to aggregate data into informative dashboards of insights based on several criteria including geographic location, season, sex, production type etc. These dashboards require significant refinement with industry participants to prioritise functionality and enhance useability. Regional, state and national comparisons can improve useability for producers that do not have data within the LDL database.

In this project we developed four, fully functional web-based concept dashboards, one each for sheep producers, cattle producers, sheep processors and cattle processors. These dashboards utilised four years of sheep and cattle carcase, and health data provided by the Integrity Systems Company (ISC) to deliver 32 interfaces (eight per dashboard) that allow for shire, region, state and national comparisons. Key stakeholders of major beef and sheep processors as well as twenty-five producers extensively tested the dashboards and suggested improvements.

Dashboards were refined on feedback received during the interview/demonstration process as part of a systematic but agile methodology. Participants were informed of improvements and encouraged to provide further feedback.

Feedback was overwhelmingly positive with most participants enquiring when the enhanced dashboards will be implemented and when they can access the dashboards live. Access to these dashboards will generate the opportunity for management and genetic improvements in red meat livestock value chains.

Executive summary

Background

The aim of this project was to assess and rank which comparative carcase and health dashboards and visualisations producers and processors would use to improve management and genetic outcomes in their enterprises. In addition, it aimed to maximise the value that processors and producers can get from their aggregated data in a range of specified geographic benchmarks.

The target audience of this research is beef and sheep processors that contribute data to industry databases in the MLA Group Data Platform; as well as sheep and cattle producers irrespective of whether their data is included. Improving grid compliance and management decisions can lead to significant improvements in profitability. Carcase and health data stored in industry databases is key to enabling producers and processors to identify areas for improvement. Trialling several concept dashboards, that enable key stakeholders to compare their performance with others on a regional, state and national level will enable them to rank the useability and importance each dashboard.

Results from this research will enable Integrity Systems Company (ISC) and their software engineering team to prioritise the delivery in platforms like Livestock Data Link (LDL). These concept dashboards were engineered to use available industry data and are fully functional. The complete source code has been provided as part of this project. This will ensure that production ready dashboards can be constructed quickly and cost effectively.

Objectives

- Develop four web-based interactive dashboards that allow for the visualisation of carcase and health data by time and region, as well as trait x trait comparisons.
- Trial the concept dashboards with industry participants from a list nominated by ISC management.
- Complete a review of the likely impact the insight dashboards will have on industry participants if developed.
- Work with ISC management to create a list and logic map of key insights that can be used to enhance value extraction from the MLA Group Data Platform.

Methodology

- Four dashboards, each with eight tabs that display aggregated sheep and cattle carcase and animal health data, were developed and tested with processors and producers.
- Feedback from the processors and producers both during demonstration guided further refinement of the dashboards.
- Participants were invited to explore the dashboards in their own time and then complete an online survey to gauge their evaluation of the value of the dashboards.
- Interview and survey results contributed to the development of a logic map of key insights.

Results/key findings

There was overwhelming support for the new dashboards with most participants wanting to know when they can access these enhanced dashboards for their live data. Both processors and producers prioritised grid compliance functionality. In addition, processors prioritised carcase trends, health

incidence and health trends; whereas producers also prioritised total animal comparisons, carcase distributions and carcase trends.

Benefits to industry

Availability of these decision support tools that use real time data, would enable both producers and processors to systematically review carcase and animal health data. These tools would enable them to spot carcase and health trends earlier and act through either genetic, management or purchasing decisions. They should lead to better health outcomes, better grid compliance and more informed supply decisions.

Future research and recommendations

It is recommended that ISC prioritise the development and implementation of enhanced dashboards for grid compliance, carcase trends and health incidence to improve the engagement and utilisation of the current LDL platform.

Future projects within the LDL platform should focus on improvements that can be made iteratively based on feedback from producers and processors.

Integrating these tools into any system accessible to processors and producers should include links to standard industry information to improve the performance of carcase and animal health trends as well as information and online videos on how to maximise the benefits from using these tools.

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1 Background

The consolidation of several industry-facilitated databases that collect livestock, carcase and animal health data through the development of the MLA Group Data Platform, provides the opportunity to deliver advanced insights for lamb and beef producers and processors. Livestock Data Link was created and implemented as a reporting platform too translate data collected at slaughter and carcase grading into reports that guide producers and processors to make more informed decisions on ways to improve carcase compliance to market specifications and pricing grids.

To provide such functionality LDL needs to provide a comprehensive framework of information aggregation, analysis and utilisation within key value chains that link producers and processors. That framework must be responsive to differences in end-user expectations depending on the dynamics of the value chain including production environments, market specifications, brand options and resulting grid structures. A previous project (V.LDL.1902; Developing aggregated insights for LDL) explored a range of opportunities for visualisation and interpretation of carcase attributes by several different filters or aggregation fields that exist in LDL. However, that project was limited to static non-interactive displays of information.

In response to recommendations in the previous project V.LDL.1902, ISC and MLA commissioned the UNE team to develop advanced data insights utilising currently available data. A key part of this current project was the establishment of series of enhanced dashboards in a data platform that provided real time and dynamic access to a range of scenarios and reporting formats.

The challenge with the development of new software functionality is knowing what users would find useful. Software engineering is expensive and prioritising new development to start with the most valued functions first, ensures the most value is derived in the earliest possible timeframe and to encourage greater adoption and utilisation by the user. This approach is consistent with the design-led thinking approach that has been adopted by MLA. A design-led thinking approach is a collaborative mechanism that encourages the design team to work with the end users of the technology or system to identify requirements and outcomes sought (through user feedback) throughout all phases of the project. The main question addressed as part of this project was which of the visualisations delivering advanced insights should be prioritised for different user groups. The target audience for this project was sheep and cattle producers and processors who did and did not have data available to them via LDL but who are using a data driven approach to make management (including purchasing) and genetic selection decisions.

The results of this research will be used to prioritise the development of the visualisations delivering advanced insights in accessible platforms like LDL.

2 Objectives

This project had the following objectives:

1. The assembly of dashboard components into a coherent framework that guides users from data discovery through identification of opportunity to decision making that supports practice change and industry development. This comprised:
    a. Discovery. Produce four near industry ready insight dashboard concepts, one for each of sheepmeat and beef producers, and one each for a beef and a sheep processor. These allowed the visualisation of both trait by time and trait by trait dimensions across PIC, shire, region, state and national to provide comparative analysis of trends and performance.
    b. Opportunity. Continued development of insight dashboards for red meat livestock data including the trialling of extension elements such as percentiles (variance maps), outlier reports and heat maps of performance/compliance.
    c. Decision making. Produce relevant insight logic maps that create decision support processes that guide users through the dashboards based on a set criteria or opportunities.

    This objective was met by developing a web-based application that delivered four concept dashboards resulting in a total of 32 insights (eight per dashboard) for each of the groups. These dashboards used up to four years of industry data supplied by ISC to deliver production ready visualisations. Those dashboards were then systematically reviewed with a range of end-users to capture feedback and use patterns that were used to construct the logic map.
2. Through group videoconferences or through one-on-one interviews, the dashboards should be trialled with a defined number of industry participants from the sheep and beef industries. This was an iterative and interactive process with feedback used to refine the dashboards prior to the next stage of testing. Users were guided through the decision-making steps by the interviewer and were able to interact with the dashboard on their own after the interview. *Representatives of a major sheep and beef processor and from another major beef processor were interviewed. Twenty-five cattle and sheep producers, some with and some without data in LDL, were interviewed through group and individual video conferences.*
3. Complete a review of the likely impact of the insight dashboards on industry participants. *This objective was met through feedback obtained on the priority and rating that users gave to each of the dashboards as well as an indication of what was important in each of the dashboards which is reflected in the logic map.*
4. Technical review meetings will allow for knowledge transfer from the project team to ISC and MLA staff. *Objective met by offering ISC and MLA staff access to development team for a technical review.*
5. Work with ISC management to create a list and logic map of key insights into national information messaging and industry performance metrics that can be used to stimulate engagement with the Group Data Platform and broader industry facilitated databases. *Logic map created and shared with ISC management for input.*
6. Produce a final report that addresses all objectives.

3 Methodology

3.1 Database and web-based concept dashboard development

3.1.1 Background

A key component of this project was to develop a pre-commercial interactive or “real time” series of dashboards in a data platform that encouraged user participation and developed priorities for implementation that can assist ISC with future planning. To do this the project requested access through ISC to four years of sheep and cattle carcase and animal health data which was added to a PostgreSQL database. The data structure and naming of the original data extracts was kept intact to ensure that the code developed to integrate any functionality in production systems can be done quickly and easily. A number of tables were derived from the original data to ensure aggregation selection options. These tables were not included separately in the data extract and include animal health codes for sheep and cattle; establishment codes for suppliers; producer list linked to shires, regions and states; and a number of tables to allow users to log into the system and only see producer and processor data linked to their login. A number of functions were developed to extract data for each of the visualisations. The principle followed was that user selectable options were sent as a JSON object that are used to select data for all of the visualisations. All of the data used for the visualisations are assembled in the database layer with minimal manipulation done by the web application. As the database is really efficient in data aggregation, it allowed for extraction of data on shire, region, state and national level in a reasonable amount of time. Please see 8.2 for a description of the database structure and functions developed.

The web-based application was constructed utilising a standard JavaScript framework licensed to MLA for the purposes of this project. This standard framework makes provision for the creation of user, user login, enquiries and home page. As the focus of the project was to determine what interactive visualisations and filters should be included the team aimed to maximise the number of visualisations rather than develop ‘standard’ features like the printing of graphs, access to underlying data and external links to standard industry information. These should be included in any future production version of the dashboards.

Following on from the previous project, V.LDL.1902 ‘Developing aggregated insights for LDL’, the project team scoped a range of dashboards covering what they believed from their experience were likely to be feasible and useful to processors and producers. Within that previous project, the team extensively reviewed the current LDL system and developed insight maps for both sheep and cattle producers /processors that identified what the key requirements were from potential aggregated benchmarks and then what the likely series of dashboards would need to be (including componentry, filtering options and graphical interfaces that would stimulate engagement and utilisation within end users of the system. The cattle insight map is shown in Figure 1.

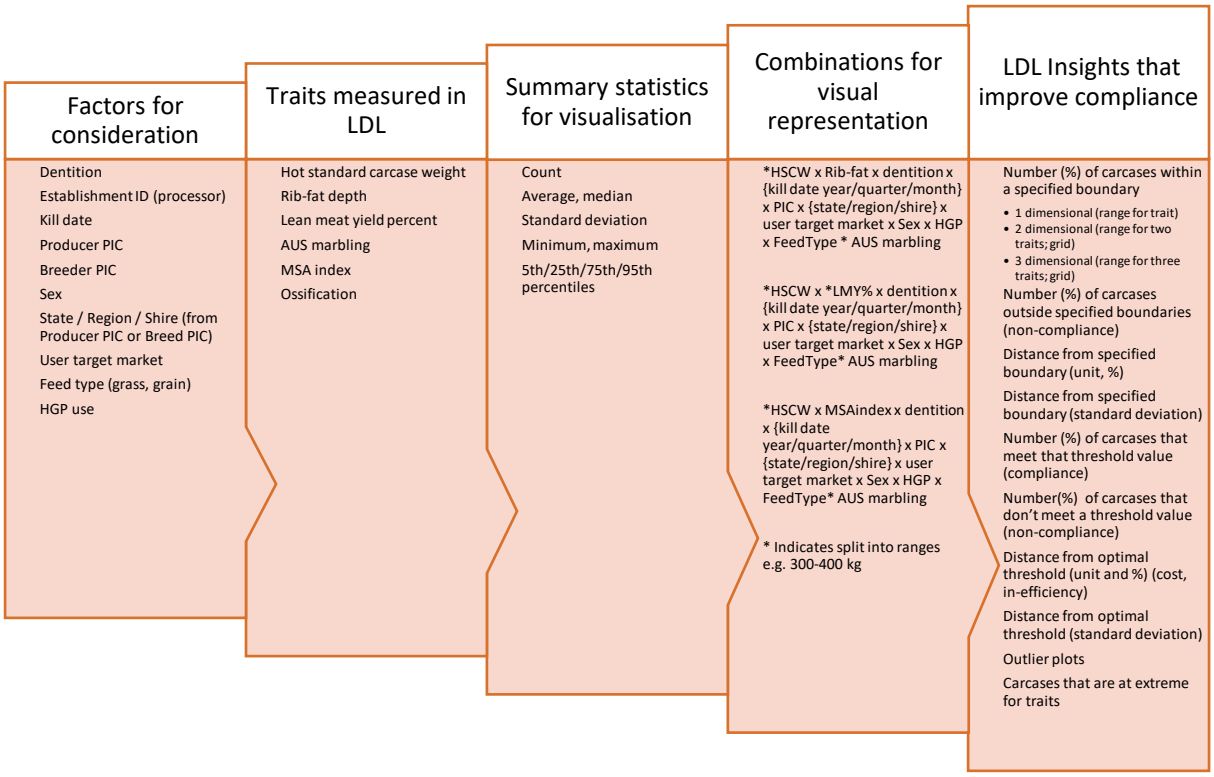
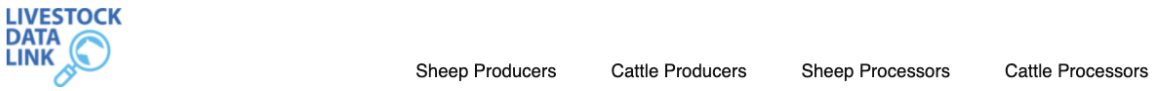


Figure 1. LDL insight map for cattle that was developed in V.LDL.1902.

Four interactive dashboards, one each for sheep producers, cattle producers, sheep processors and cattle processors, were developed with eight interactive visualisations each (Figure 2).

Figure 2. Layout for links to dashboards

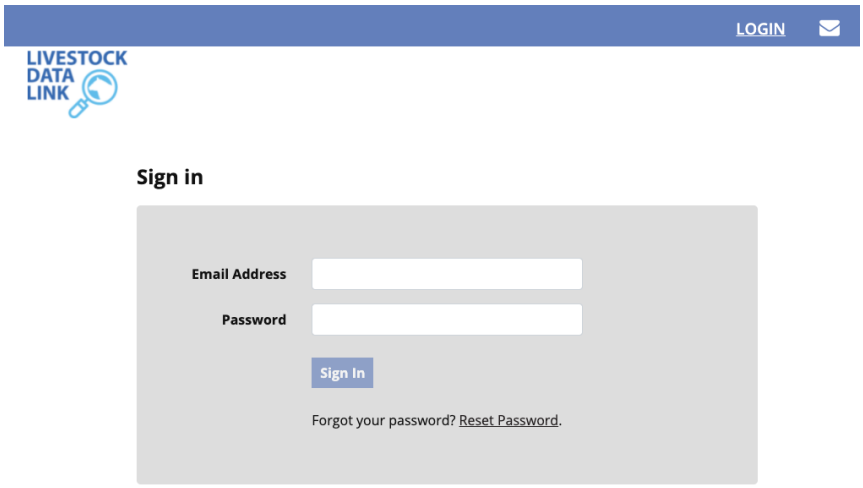


The dashboards were integrated in the web-based application and two instances of the application deployed: ldlinsights-uat.une.edu.au to conduct user research and ldlinsights-dev.une.edu.au for development and internal testing of the system.

Access to the system was controlled with user logins by invitation only (

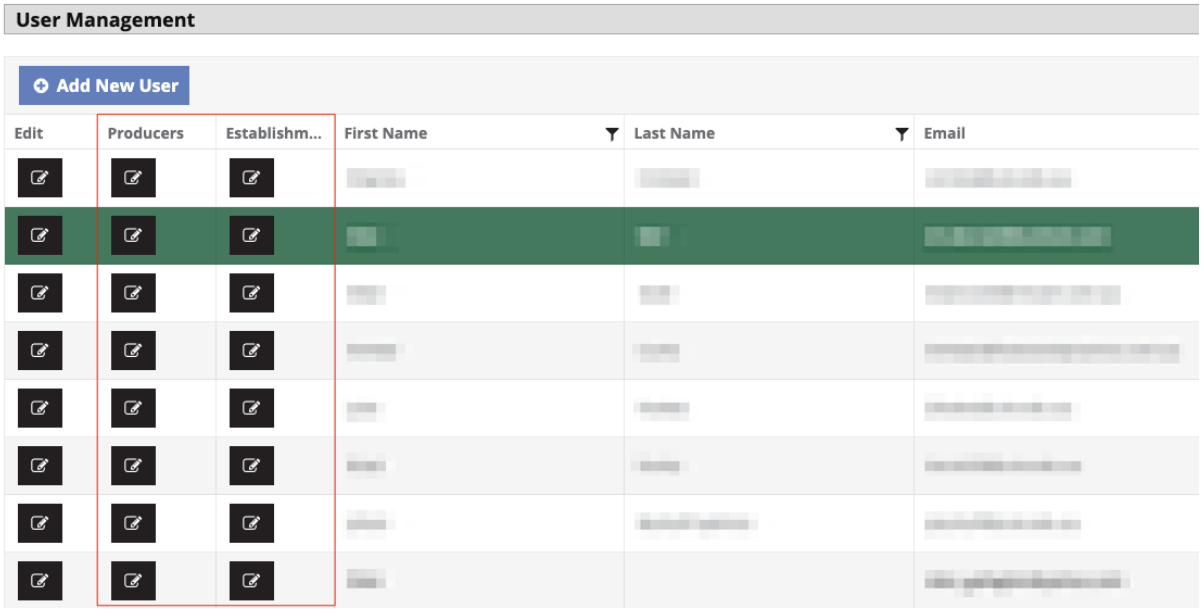
Figure 3).

Figure 3. Layout for user login.



The dashboards that are accessible depend on which processor establishments and or producer PICs are linked to the user login account (Figure 4).

Figure 4. Layout for adding users and identifying whether producers or processors.



3.1.2 Concept Dashboard Layout

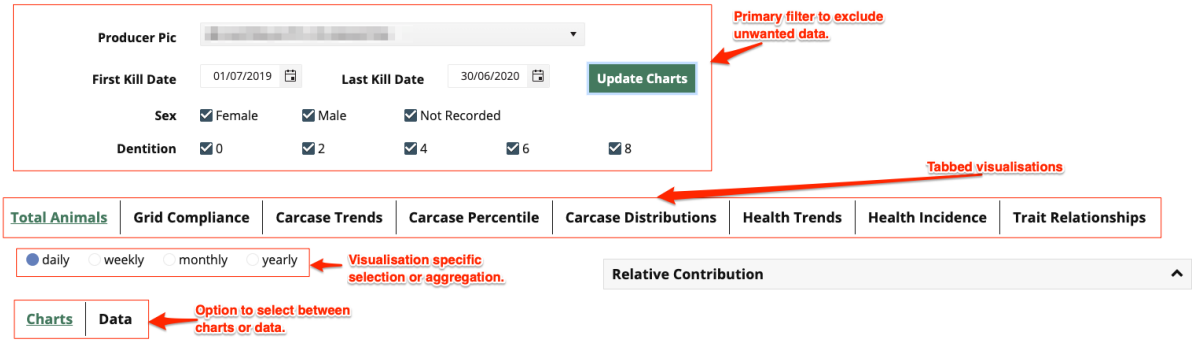
All the enhanced dashboards are structured in a similar fashion with a number of user selectable options that act as primary filters for the data. Those filters were designed to allow the end user to customise the data aggregation based on a range of scenarios defined by the users. These primary filters only select data that match the set criteria and are unique for each dashboard. Examples include:

- PIC (user definition)
- date range (first kill date to last kill date)
- sex (male, female or not recorded)
- dentition (based on the AUSMEAT carcase language definitions used for sheep and cattle)

In order to ensure that the user has a defined and descriptive series of dashboards to navigate through, a series of related tabs are used to allow the user to select each of the dashboard visualisations. Each visualisation allows for user selectable options specific to the visualisation and some allow user access to graphs and data (Figure 5).
These visualisations, described in following sections, are:

- Total Animals
- Grid compliance
- Carcase trends
- Carcase percentile
- Carcase distributions
- Health trends
- Health incidence
- Trait relationships.

Figure 5. Example of user selectable options including primary filters, choice of visualisation and visualisation specific selections.



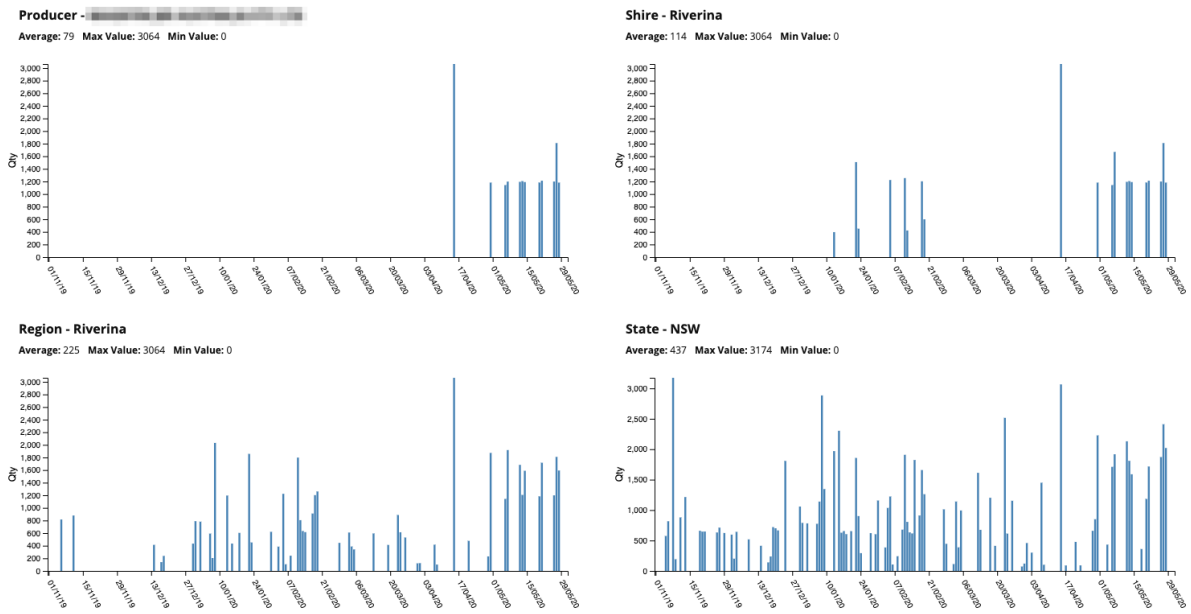
3.1.3 Visualisations developed for each dashboard

Visualisations included in each of the dashboards are illustrated in the following sections.

3.1.3.1 Total animals

A graphical series (PIC, shire, region, state) that displayed the number of animals killed across time (Figure 6).

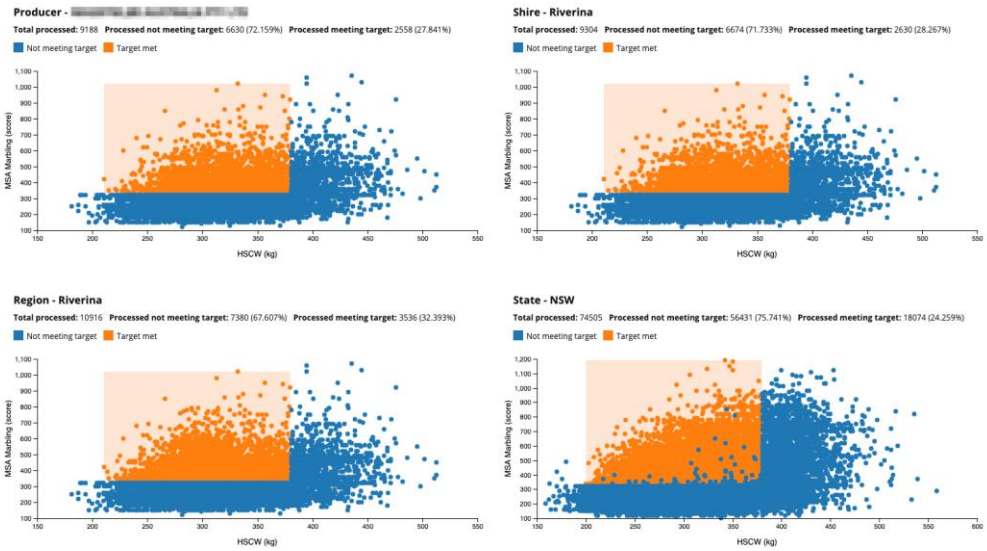
Figure 6. Example of the 'Total animals' visualisation showing number of animals processed by date for each of the producer's PIC, shire, region and state.



3.1.3.2 Grid compliance

This is an interactive tool that enabled producers to use a slide bar to set (and save) boundaries for up to 15 traits to represent a multi-dimensional grid. The grid was then displayed as a shaded area on a two-dimensional view of traits (Figure 7).

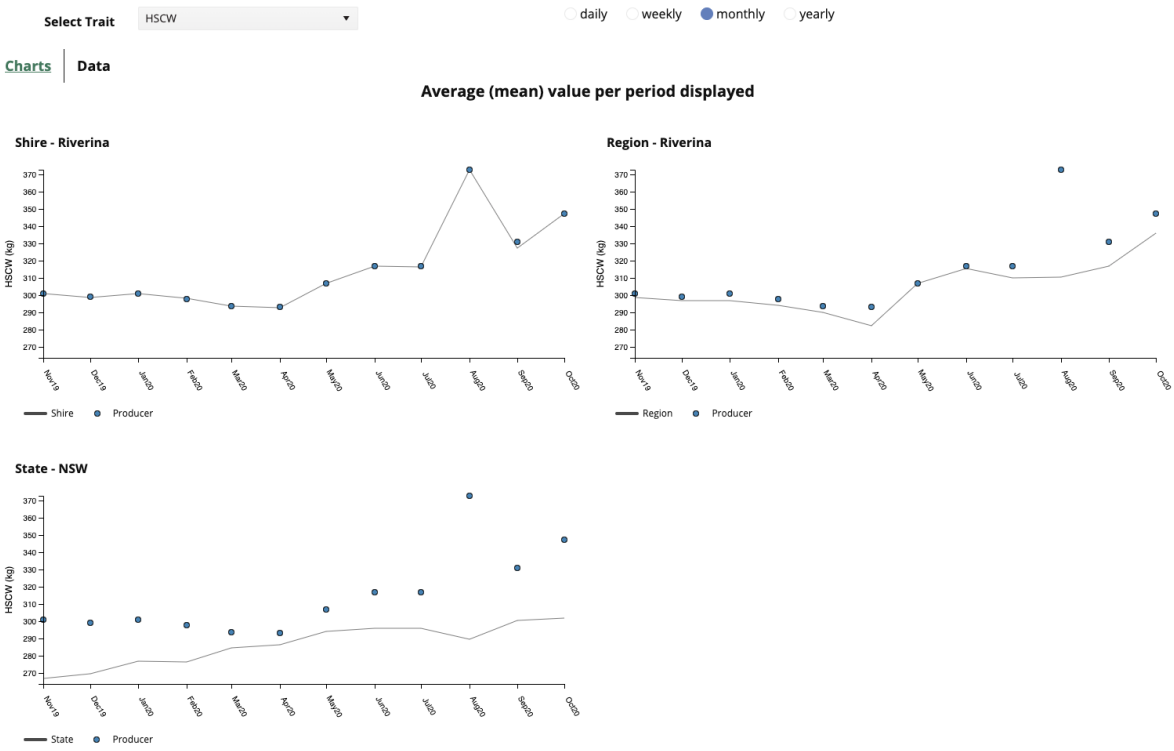
Figure 7. Example of the 'Grid compliance' visualisation showing target zone for MSA marbling and hot standard carcase weight over a scatter plot of all carcases.



3.1.3.3 Carcase trends

Consist of a graphical series of the mean of each trait relative to time (daily, weekly, monthly, yearly) (Figure 8).

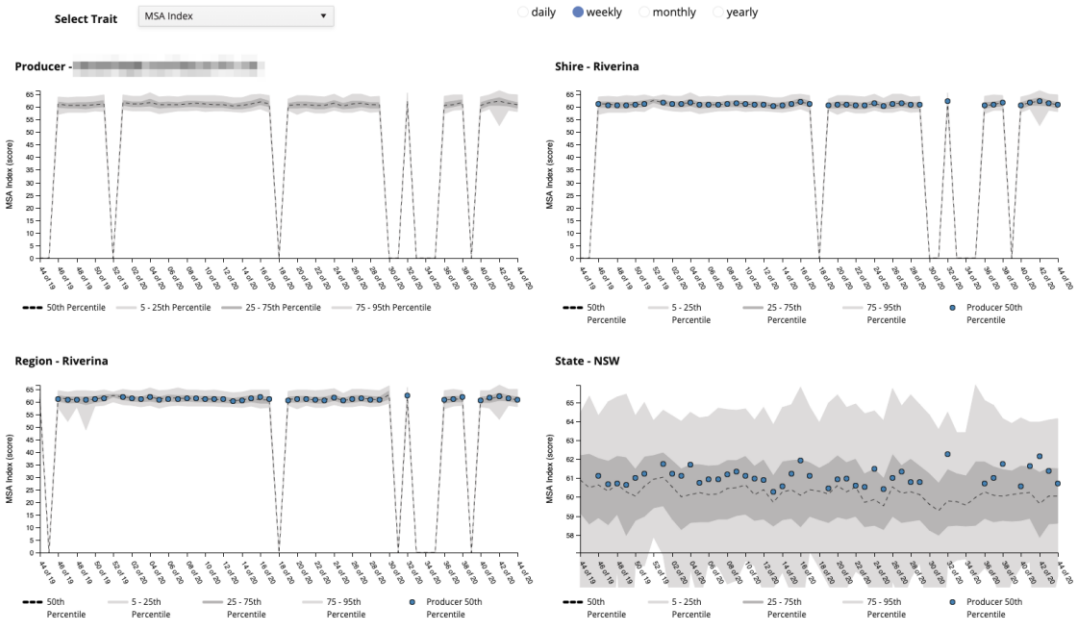
Figure 8. Example of the 'Carcase trends' visualisation showing monthly trend in hot standard carcase weight (HSCW).



3.1.3.4 Carcase percentiles

A graphical series that overlays the producer's data on percentile bands (0-5%, 5-25%, 25-50%, 50-75% and 75-95%) for each trait relative to time (Figure 9).

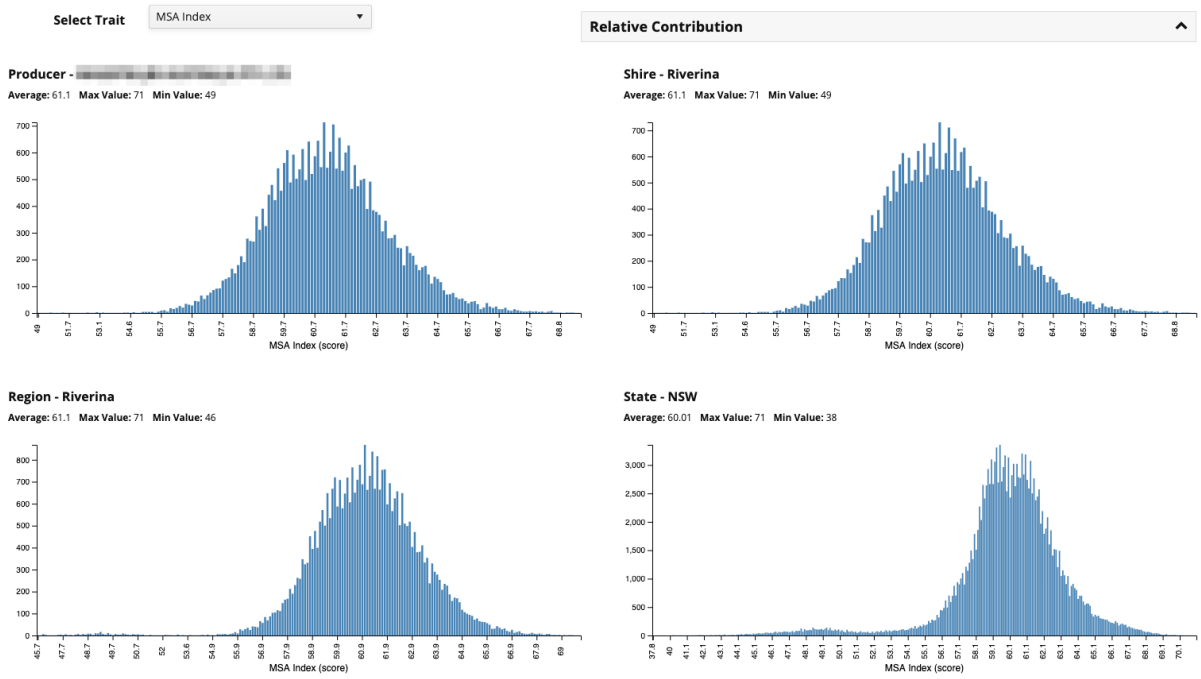
Figure 9. Example of the 'Carcase percentiles' visualisation showing percentile bands for MSA index for the PIC, shire, region and state.



3.1.3.5 Carcase distributions

These graphs include a distribution of selected trait distributions (Figure 10).

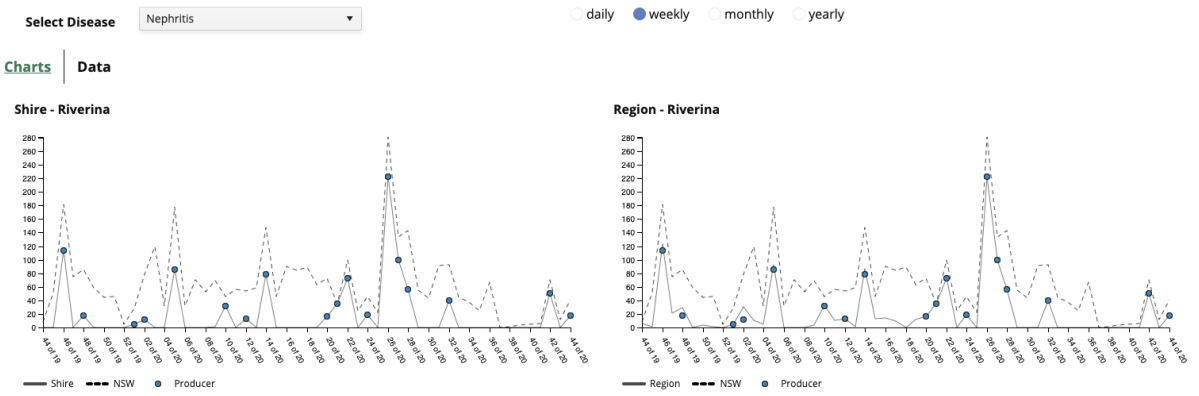
Figure 10. Example of the 'Carcase distributions' visualisation showing the distribution of MSA index for a producer's PIC, shire, region and state.



3.1.3.6 Health trends

These graphs consist of the incidence of animal health and processor management traits relative to time (Figure 11).

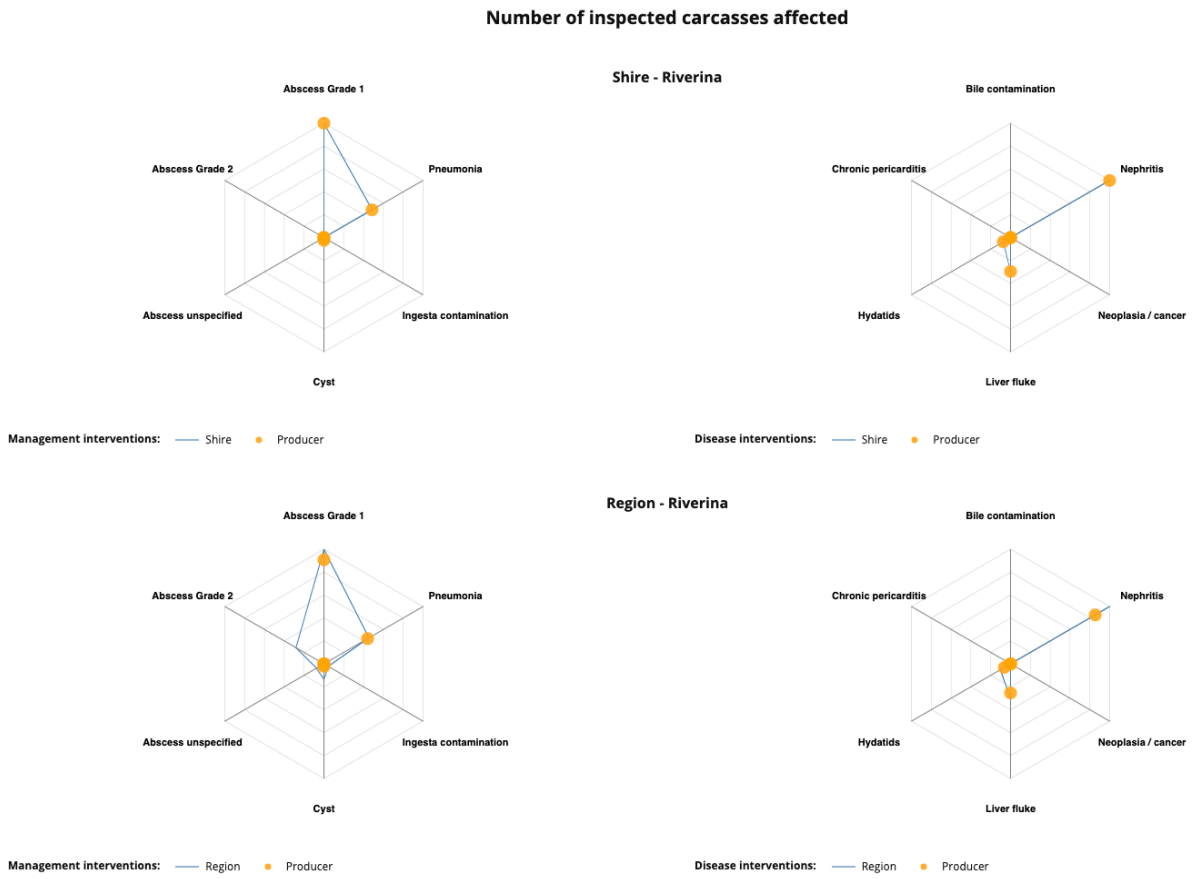
Figure 11. Example of the 'Health incidence' visualisation showing the weekly incidence of Nephritis for the producer, and the producer's shire, region and state.



3.1.3.7 Health incidence

Graphs consist of radar (or spider-web) charts of animal health and processor management traits (Figure 12).

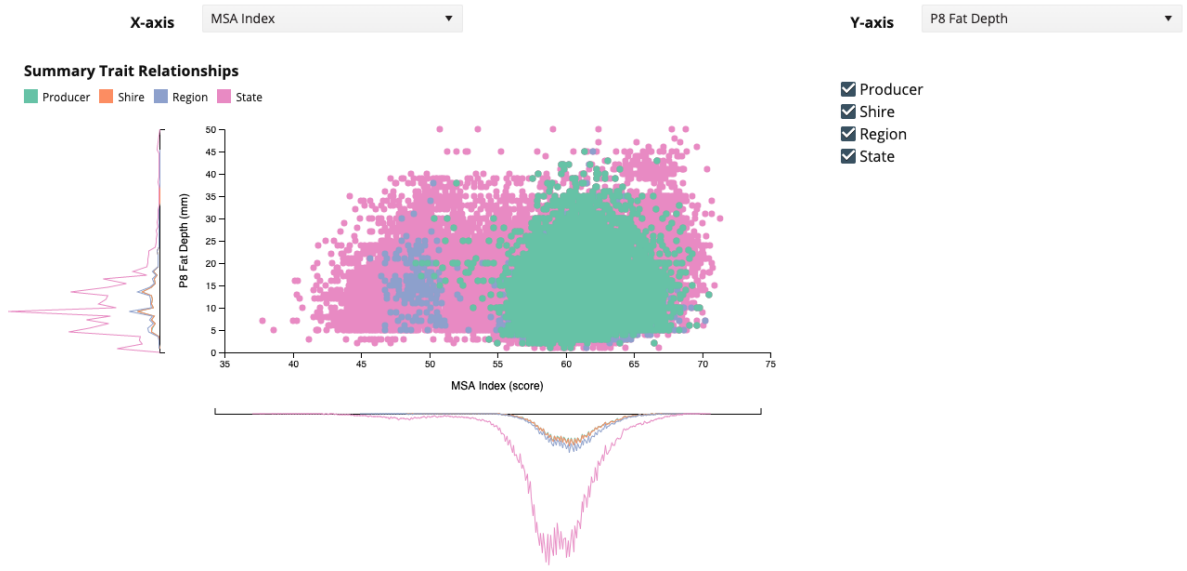
Figure 12. Example of the 'Health incidence' visualisation showing incidence of animal health and processor management traits by shire and region.



3.1.3.8 Trait relationships

These graphs consist of combined histogram/scatterplot of the relationships between two traits (Figure 13).

Figure 13. Example of 'Trait relationships' visualisation. This example shows a scatter plot of P8 fat depth against MSA index with different colours for the producer, shire, region and state. Frequency distributions for each trait and each geographic level are aligned with the X and Y axes.



3.1.3.9 Relative contribution

Displays the number of animals producers sent for processing relative to their shire and region (Figure 14).

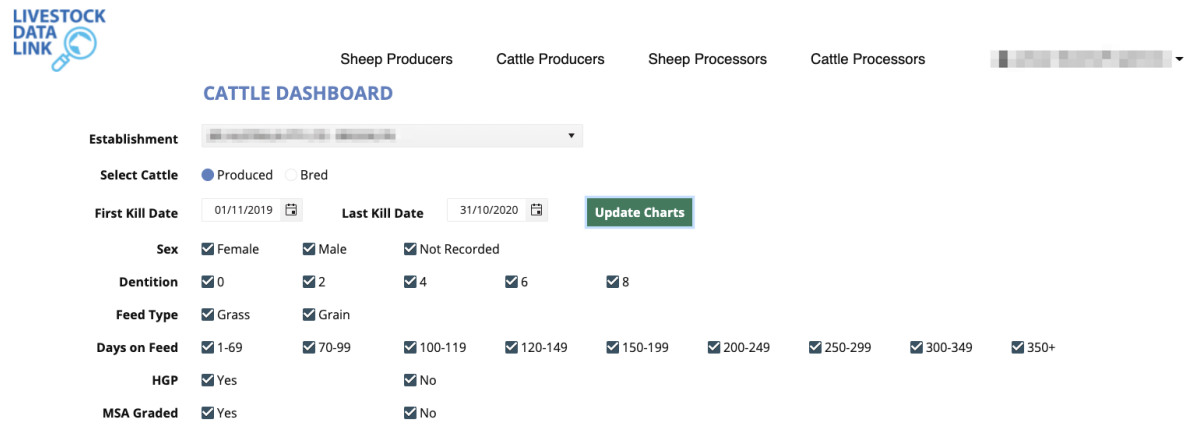
Figure 14. Example showing the relative contribution of carcases from the producer, shire and region.

3.1.4 Cattle Processor Dashboard

The cattle processor dashboard allows for the visualisation of selected establishments (processing plants) based on the following primary filters (shown in Figure 15):

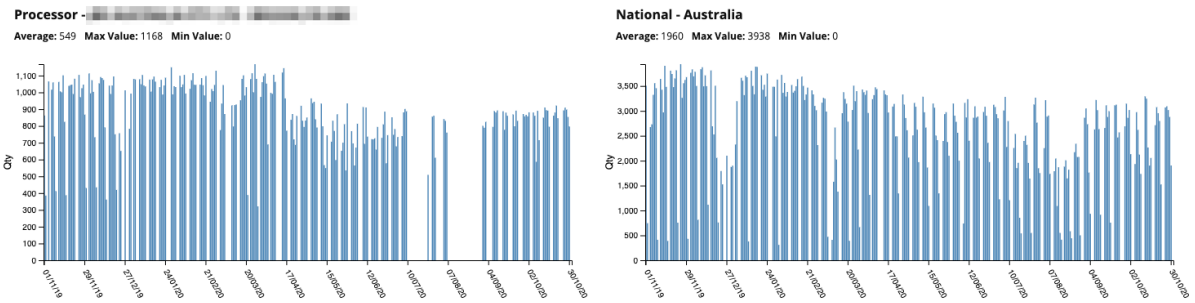
- establishment (processing plant)
- produced or bred
- period (first kill date to last kill date)
- sex
- dentition
- feed type
- days on feed
- HGP
- MSA graded.

Figure 15. The primary filters as presented in the cattle processor dashboard.



Due to the small number of processors contributing to the datasets, a decision was made to limit comparisons for processors to national data only to prevent access to competitor production and performance data (Figure 16).

Figure 16. Example of the 'total animals' visualisation comparing a processor with the national data (all records).

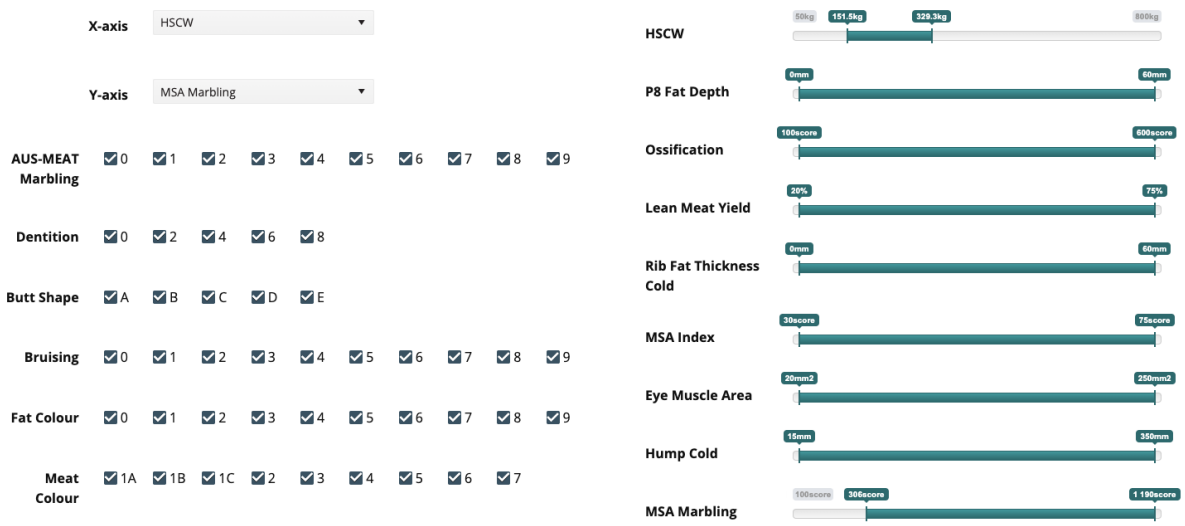


Specific notes about visualisations:

- Total Animals visualisation can be aggregated in a daily, weekly, monthly and yearly report.
- Grid Compliance: Multi-dimensional grid can be specified (Figure 17) using the following traits: HSCW, AUS-MEAT Marbling, P8 Fat Depth, Ossification, Dentition, predicted Lean Meat Yield percent, Rib Fat Thickness Cold, MSA Index, Butt Shape, Bruising, Fat Colour, Meat Colour, Eye Muscle Area, Hump Cold, MSA Marbling.

  Producers can be ranked on compliance to the customised grid that is set and this is described in the Data section of this report. Grid specifications can be saved for future retrieval. This was a key highlight for all users.

Figure 17. Illustration of the input panel for specifying a grid.



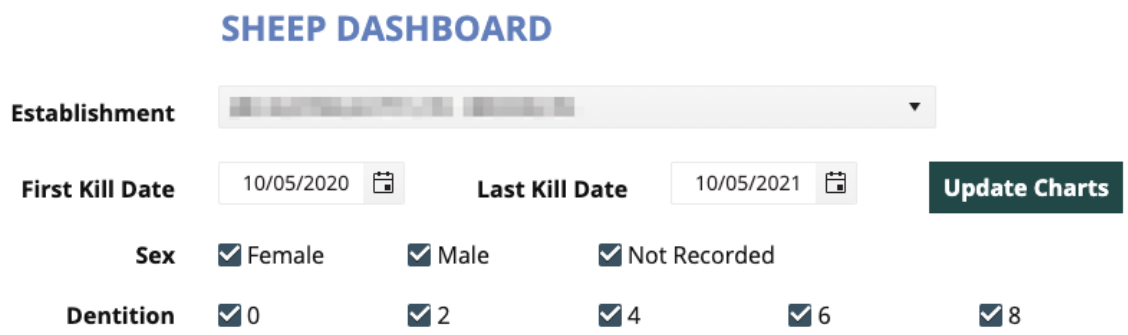
- Carcase Trends: Trend graphs can be aggregated to daily, weekly, monthly or yearly and generated for the following traits: HSCW, P8 Fat Depth, Ossification, predicted Lean Meat Yield percent, Rib Fat Thickness Cold, MSA Index, Eye Muscle Area, Hump Cold, MSA Marbling.
- Carcase Percentiles: Data can be aggregated to daily, weekly, monthly or yearly and visualisations are available for the following traits: HSCW, P8 Fat Depth, Ossification, predicted Lean Meat Yield percent, Rib Fat Thickness Cold, MSA Index, Eye Muscle Area, Hump Cold, MSA Marbling.
- Carcase Distributions: Distribution visualisations are available for the following traits: HSCW, P8 Fat Depth, Ossification, predicted Lean Meat Yield percent, Rib Fat Thickness Cold, MSA Index, Eye Muscle Area, Hump Cold, MSA Marbling.
- Health Trends: Visualisations are available for the following diseases: Abscess Grade 1, Abscess Grade 2, Abscess unspecified, Bile contamination, Chronic pericarditis, Cyst, Hydatids, Ingesta contamination, Liver fluke, Neoplasia / cancer, Nephritis, Pneumonia.
- Health Incidence: This visualisation displays spider graphs for diseases with possible management interventions: Abscess Grade 1, Abscess Grade 2, Abscess unspecified, Cyst, Ingesta contamination, Pneumonia; and disease interventions: Bile contamination, Chronic pericarditis, Hydatids, Liver fluke, Neoplasia / cancer, Nephritis.
- Trait Relationships: Visualisations are available for any pair of these traits: HSCW, AUS-MEAT Marbling, P8 Fat Depth, Ossification, Dentition, predicted Lean Meat Yield percent, Rib Fat Thickness Cold, MSA Index, Butt Shape, Bruising, Fat Colour, Meat Colour, Eye Muscle Area, Hump Cold, MSA Marbling.

3.1.5 Sheep Processor Dashboard

The sheep processor dashboard allows for the visualisation of selected establishments (processing plants) based on the following primary filters shown in Figure 18:

- establishment (processing plant)
- period (first kill date to last kill date)
- sex
- dentition.

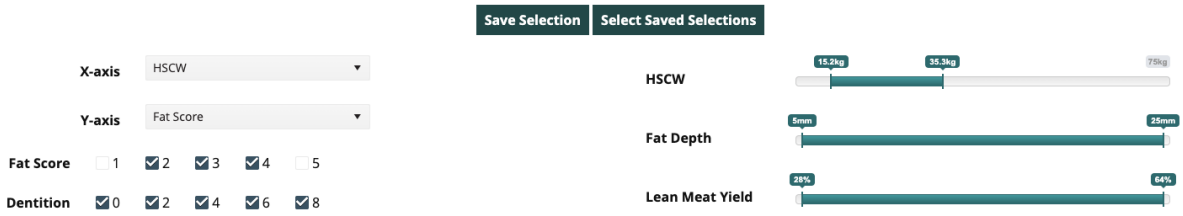
Figure 18. The primary filters as presented in the dashboard for sheep processors.



Specific notes about visualisations:

- Total Animals visualisation can be aggregated in a daily, weekly, monthly and yearly report.
- Grid Compliance: Multi-dimensional grids can be specified using the following traits: HSCW, Fat Score, Fat Depth, Dentition, predicted Lean Meat Yield percent (Figure 19).

Figure 19. Illustration of the input form for specifying a sheep selection grid.



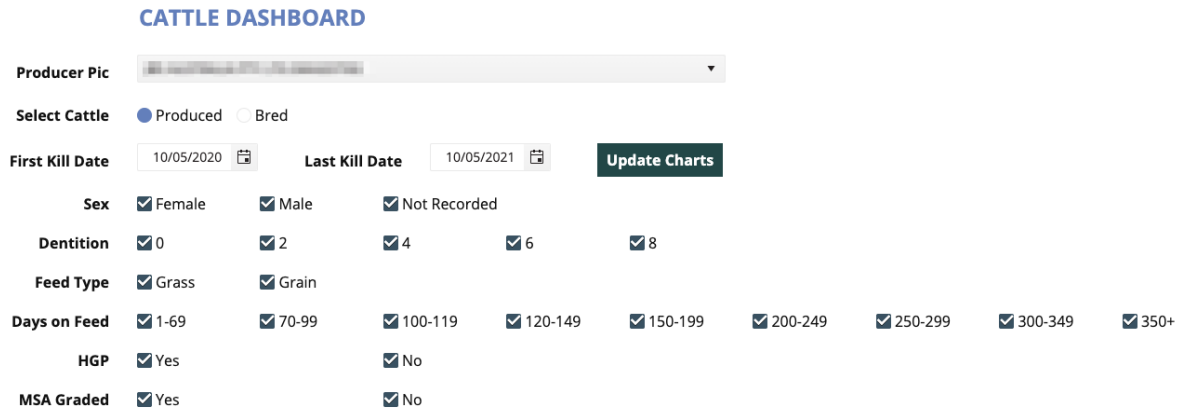
- Producers can be ranked on compliance to the customised grid set and this is described in the Data section of this report. Selections can be saved for future retrieval.
- Carcase Trends: Trend graphs can be aggregated to daily, weekly, monthly or yearly and generated for the following traits: HSCW, Fat Depth, predicted Lean Meat Yield percent.
- Carcase Percentiles: Data can be aggregated to daily, weekly, monthly or yearly and visualisation is available for the following traits: HSCW, Fat Depth, predicted Lean Meat Yield percent.
- Carcase Distributions: Distribution visualisations are available for the following traits: HSCW, Fat Depth, predicted Lean Meat Yield percent.
- Health Trends: Visualisations are available for the following diseases: Arthritis, Bruising, CLA, Cystten, Dogbites, Grass seed lesions, Hydatids, Knotgut / nodworm, Liver fluke, Lungworm, Nephritis, Pleurisy, Pneumonia, Rib fractures, Sarco, Sheep measles, Vaxination lesions.
- Health Incidence: This visualisation displays spider graphs for diseases with possible management interventions: Bruising, Cystten, Dogbites, Grass seed lesions, Hydatids, Pneumonia, Rib fractures, Sarco, Vaxination lesions; and disease interventions: Arthritis, CLA, Knotgut / nodworm, Liver fluke, Lungworm, Nephritis, Pleurisy, Sheep measles.

3.1.6 Cattle Producer Dashboard

The cattle producer dashboard allows for the visualisation of selected producer PICs based on the following primary filters shown in Figure 20:

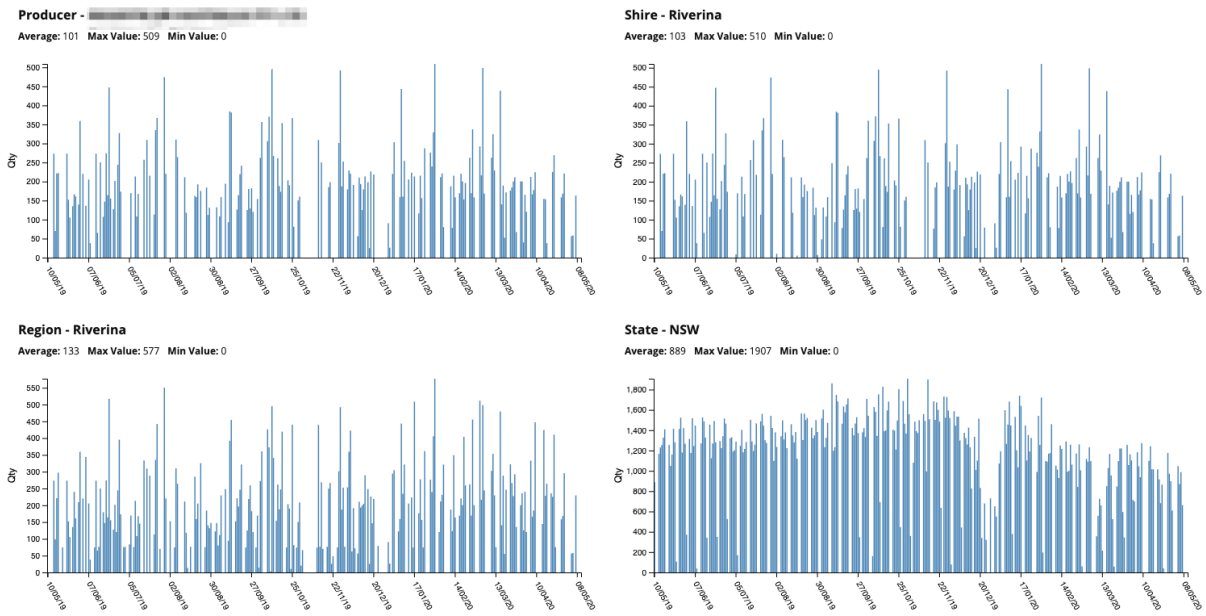
- establishment (processing plant)
- produced or bred
- period (first kill date to last kill date)
- sex
- dentition
- feed type
- days on feed
- HGP
- MSA graded.

Figure 20. Example of the primary filters available to a cattle producer.



Comparisons are available between the producer, their shire, their region and state:

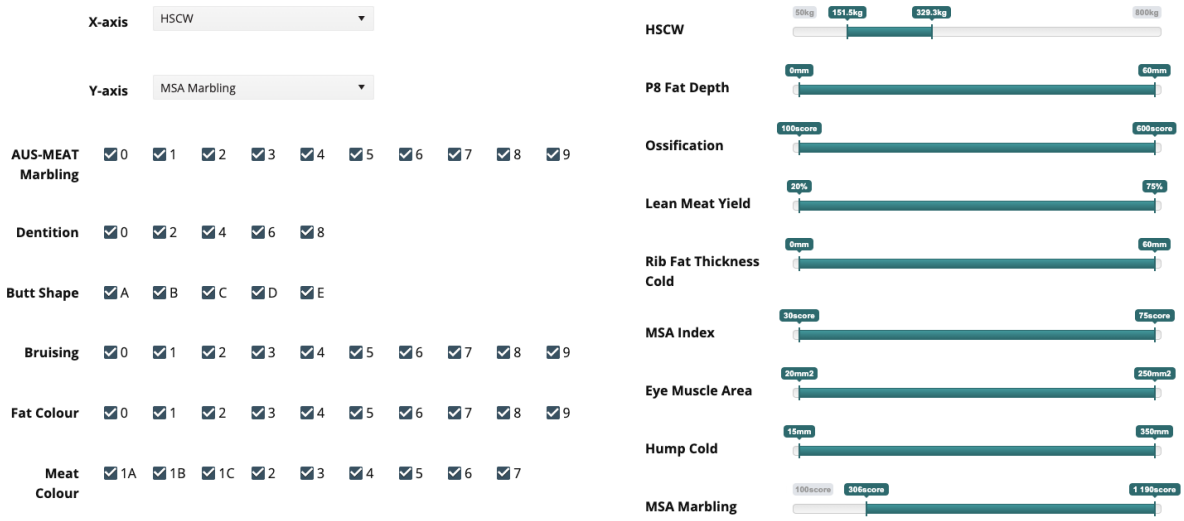
Figure 21. Example of 'Total animals' visualisation for a cattle producer shown results for their PIC, shire, region and state.



Specific notes about visualisations:

- Total Animals visualisation can be aggregated in a daily, weekly, monthly or yearly report.
- Grid Compliance: Multi-dimensional grid can be specified (Figure 22) using the following traits: HSCW, AUS-MEAT Marbling, P8 Fat Depth, Ossification, Dentition, predicted Lean Meat Yield percent, Rib Fat Thickness Cold, MSA Index, Butt Shape, Bruising, Fat Colour, Meat Colour, Eye Muscle Area, Hump Cold, MSA Marbling.

Figure 22. Example of the grid selection input form for a cattle producer. The selected parameters of the grid are used to determine grid compliance.



Breeders supplying to either the producer or the feed lot can be ranked on compliance to the customised grid set and this was available in the Data section of this report. Selections can be saved for future retrieval.

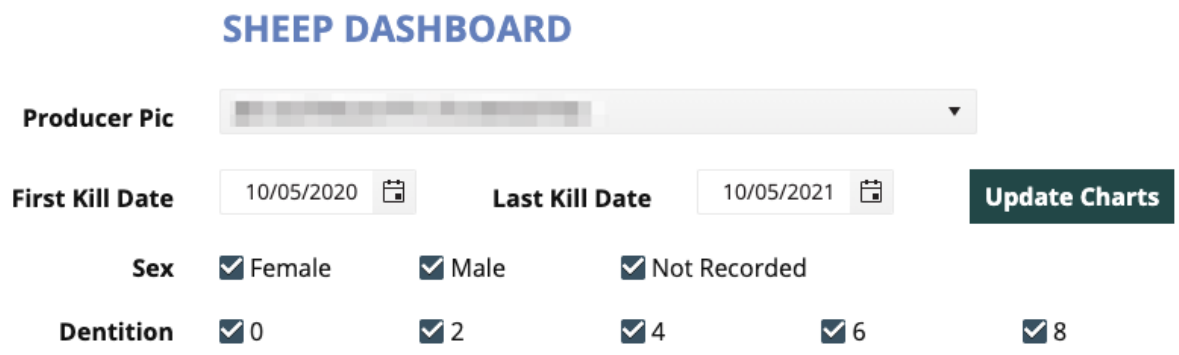
- Carcase Trends: Trend graphs can be aggregated daily, weekly, monthly and yearly and generated for the following traits: HSCW, P8 Fat Depth, Ossification, predicted Lean Meat Yield percent, Rib Fat Thickness Cold, MSA Index, Eye Muscle Area, Hump Cold, MSA Marbling.
- Carcase Percentiles: Data can be aggregated daily, weekly, monthly and yearly and visualisation is available for the following traits: HSCW, P8 Fat Depth, Ossification, predicted Lean Meat Yield percent, Rib Fat Thickness Cold, MSA Index, Eye Muscle Area, Hump Cold, MSA Marbling.
- Carcase Distributions: Distribution visualisations are available for the following traits: HSCW, P8 Fat Depth, Ossification, predicted Lean Meat Yield percent, Rib Fat Thickness Cold, MSA Index, Eye Muscle Area, Hump Cold, MSA Marbling.
- Health Trends: Visualisations are available for the following diseases: Abscess Grade 1, Abscess Grade 2, Abscess unspecified, Bile contamination, Chronic pericarditis, Cyst, Hydatids, Ingesta contamination, Liver fluke, Neoplasia / cancer, Nephritis, Pneumonia.
- Health Incidence: This visualisation display spider graphs for diseases with possible management interventions: Abscess Grade 1, Abscess Grade 2, Abscess unspecified, Cyst, Ingesta contamination, Pneumonia; and disease interventions: Bile contamination, Chronic pericarditis, Hydatids, Liver fluke, Neoplasia / cancer, Nephritis.
- Trait Relationships: Visualisations is available for a combination of: HSCW, AUS-MEAT Marbling, P8 Fat Depth, Ossification, Dentition, predicted Lean Meat Yield percent, Rib Fat Thickness Cold, MSA Index, Butt Shape, Bruising, Fat Colour, Meat Colour, Eye Muscle Area, Hump Cold, MSA Marbling.

3.1.7 Sheep Producer dashboard

The sheep processor dashboard allows for the visualisation of selected producer PICs based on the primary filters shown in Figure 23:

- establishment (processing plant)
- period (first kill date to last kill date)
- sex
- dentition.

Figure 23. Example of the primary filters presented on the dashboard for sheep producers.

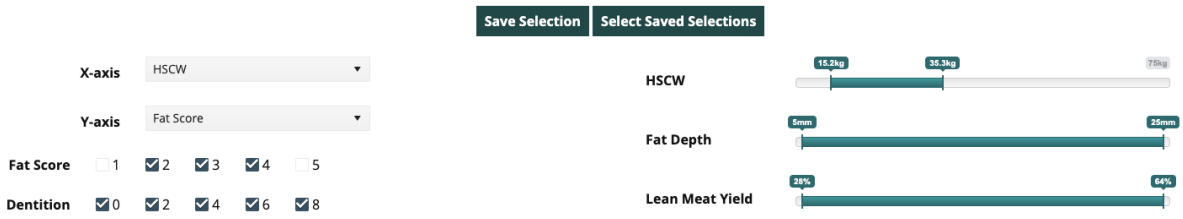


Specific notes about visualisations:

- Total Animals visualisation can be aggregated in a daily, weekly, monthly or yearly report.

- Grid Compliance: Multi-dimensional grid can be specified (Figure 24) using the following traits: HSCW, Fat Score, Fat Depth, Dentition, predicted Lean Meat Yield percent. Selections can be saved for future retrieval.

Figure 24. Example of the grid selection input form for a sheep producer. The selected parameters of the grid are used to determine grid compliance.



- Carcase Trends: Trend graphs can be aggregated daily, weekly, monthly and yearly and generated for the following traits: HSCW, Fat Depth, Lean Meat Yield
- Carcase Percentiles: Data can be aggregated daily, weekly, monthly and yearly and visualisation is available for the following traits: HSCW, Fat Depth, Lean Meat Yield
- Carcase Distributions: Distribution visualisations are available for the following traits: HSCW, Fat Depth, Lean Meat Yield
- Health Trends: Visualisations are available for the following diseases: Arthritis, Bruising, CLA, Cystten, Dogbites, Grass seed lesions, Hydatids, Knotgut / nodworm, Liver fluke, Lungworm, Nephritis, Pleurisy, Pneumonia, Rib fractures, Sarco, Sheep measles, Vaxination lesions
- Health Incidence: This visualisation display spider graphs for diseases with possible management interventions: Bruising, Cystten, Dogbites, Grass seed lesions, Hydatids, Pneumonia, Rib fractures, Sarco, Vaxination lesions; and disease interventions: Arthritis, CLA, Knotgut / nodworm, Liver fluke, Lungworm, Nephritis, Pleurisy, Sheep measles
- Trait Relationships: Multi-dimensional grid can be specified using the following traits: HSCW, Fat Score, Fat Depth, Dentition, predicted Lean Meat Yield percent

3.2 Trialling of the enhanced dashboard with industry participants

These dashboards were prototyped and tested by the project team using an extract of four years data from LDL. Once satisfied these dashboards were stable and functioning correctly, videoconference demonstrations were arranged with processors and producers.

After consultation with ISC management, two key processor users of LDL were identified and invited to trial the enhanced dashboards using data from their own respective datasets contrasted against state and national perspectives. Following those initial workshops processors were asked to nominate producers (sheep, beef and feedlots) that they believed are active users of the current LDL system, had different production scales, were in different regions or were people that sought carcase feedback information. Contacts were provided and an email invitation was then sent to 25 producers and 4 feedlots. A further 10 producers that has previously expressed interest in LDL in previous projects conducted by the consultants were also contacted. The geographic distribution of interviewees is shown in Table 1.

Table 1. Geographic location of interviewees

Location of interviewee	Number
NSW	9
VIC	7
QLD	5
SA	2
WA	1

An online survey was developed to capture their thoughts on the enhanced dashboards and suggestions for further improvements. Both processors and producers were invited by phone and email to complete the survey.

3.2.1 Consultation Overview

An important component of this project was to provide a qualitative and quantitative assessment of whether the proposed enhanced interactive dashboards are meeting the expectations and need of industry stakeholders. That is, does the information, benchmarking and insights shown within the dashboards provide valuable information in a format that is conducive to achieving adoption of best practice animal carcase and health feedback and ultimately more effective decision making by industry stakeholders.

3.2.2 Zoom video conference interviews

The first series of the consultations was held with a representative of a major sheep and beef processor and representatives from another major beef processor. These consultations were approximately 90 minutes in length and allowed the UNE team to demonstrate both a producer and processor view of the enhanced dashboards to the processor representatives. This achieved two outcomes:

- Feedback from key processor stakeholders on their likes, dislikes, and requirements from the enhanced LDL dashboards, and
- They gained sufficient confidence in the dashboards to recommend both sheep and beef producers who they believed would provide useful feedback on the producer dashboard concepts.

To ensure that there was a widespread coverage of both beef and sheep stakeholder groups that are known to have used LDL, processor representatives were asked to nominate producers that they know use LDL and that they believed would provide constructive feedback. In addition, several producers who had expressed an interest in LDL were also added to a proposed consultation list. From that list 35 people were sent invitations to participate in a consultation meeting. Twenty-five people agreed to be interviewed.

Interviews were all conducted via online videoconference and ranged in length from 35 to 90 minutes. All interviewees were informed prior to completing the consultation that their responses will be kept confidential to the consultants and will only be used in this review in a de-identified form, generally through aggregation and synthesis of information. Respondents were also advised

that the evaluation review will be provided to ISC management and that any further distribution will be entirely at the discretion of that organisation.

3.2.3 On-line survey to obtain qualitative and quantitative responses

One of the key lessons from the initial consultations with processors was that it is difficult to get effective and comprehensive feedback whilst demonstrating the dashboards. People required time to reflect on what they were shown and what priorities and rankings they wanted to allocate each visualisation within the dashboards.

To gather this feedback in an effective, efficient, and consistent manner a comprehensive series of interview questions in an on-line survey format was developed. In line with the project's objective, this survey was framed to help determine the priority ranking and ratings for the dashboards, what works well and what does not, what improvements are required and the overall performance of each insight dashboard in general. The questions were structured to extract opinions on each of the dashboard concepts.

Then following those responses, survey questions were added to identify any gaps in what had been asked and to identify additional future needs and priorities.

4 Results

4.1 Synthesis of the consultation and synopsis of aggregated results

4.1.1 Interview demographics

Despite the promotion of the on-line survey during the consultation meeting and then with email and phone call follow ups there was a low response rate from industry stakeholders (approximately 50%). While disappointing, this is consistent with other survey/interview processes that have been conducted by the project authors and generally reflects time constraints and higher priorities of these stakeholders. It also highlights the difficultly of obtaining user input into technology design, when there is not direct and immediate impact. Several interviewees wanted immediate access to the dashboards and were disappointed to find out that the process for implementation was still to be determined.

The demographics of the survey respondents is represented below (see Table 2). An important qualifier is that several of the survey responses were completed by multiple parties (that is 2 or more people from the same organisation completed the one survey response). It was obvious within those multiple party responses that the depth of feedback and the balance of information provided was more considered often reflecting diverse opinions, yet in most cases there was clear consensus on priorities and ratings.

Table 2. Number of survey respondents by role (processor, producer) and species (Beef, Sheep)

	Processor	Producer
Beef	3	5
Beef and sheep	1	1
Sheep		2

A question was asked to determine the current use and future use pattern of LDL. Respondents indicated that they probably would not change current use patterns but would be more targeted in their use (see Table 3). While not directly reflected in the feedback several respondents indicated that the enhanced dashboards would promote more strategic use rather than opportunistic views.

Table 3. How frequently do you access LDL currently; How frequent would you access the proposed enhanced LDL?

Frequency	Currently	Enhanced	
Do not use LDL	1		
Daily	2	2	

Weekly	1	1	
Monthly	2	2	
As required	6	4	
Other		3	• Every 2 - 3 weeks as cattle are processed. • Whenever I consign cattle, or when I get curious of other things to try and see. • Varying, depends on what we are currently focusing on and production etc.

Table 4 provides a summary of responses to the features or functions that LDL currently offers that were most important. Benchmarking of carcase traits (MSA index) and comparative performance are high priority for both producers and processors. Animal health reports were important to processors and to sheep producers.

Table 4. Responses to 'What is the most important function or feature that LDL currently offers?'

Producers	• The ability to benchmark against other producers locally. (Beef) • Understanding how to best provide the right cattle for the best grid price. (Beef) • Very quick analysis of many combinations of carcase data and also compares it with local and state details. (Beef) • For me it would be disease and carcase damage reporting. (Sheep) • MSA Index. (Sheep and Beef) • Individual animal feedback. (Sheep) • Comparison against Shire, Region, State; downloadable dataset. (Beef)
Processors	• Combines both hot carcase data and cold data. MSA and company spec. Benchmark's producers against compliance. (Sheep and Beef) • I find the Animal Health Feedback an excellent function that is a great steppingstone into encouraging producers to utilise the data within LDL. (Beef) • Personally, the ability to provide animal health data back to producers. (Beef)

4.1.2 Rankings and ratings of enhanced dashboards

Processors and producers were asked to rank each of the component dashboards in priority order. The following three figures (Figure 25, Figure 26 and

Figure 27) provide a quantitative assessment of the ranking with the mean rank given for all respondents and then for the processor and producer subset, respectively. A lower value for mean ranking (shorter bars) indicating higher priority.

Surprisingly, there was mixed alignment between both producers and processors in the rankings. Grid compliance was ranked highest while trait relationships was ranked last. Processors ranked total animals highly (looking for trends in supply), whereas producers ranked that dashboard last. Other dashboards were ranked in various orders.

Figure 25. Average ranking (lower numbers indicate higher priority) for each dashboard from all respondents (n=10).

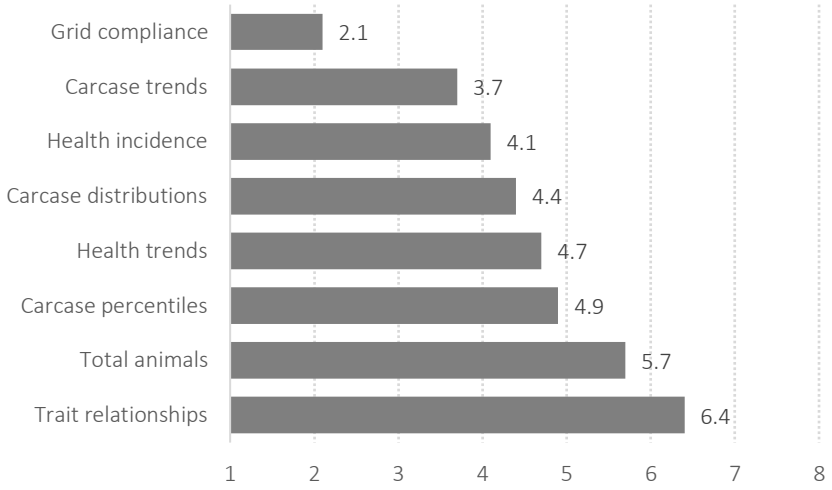


Figure 26. Average ranking (lower numbers indicate higher priority) for each dashboard as assigned by producers (n=9).

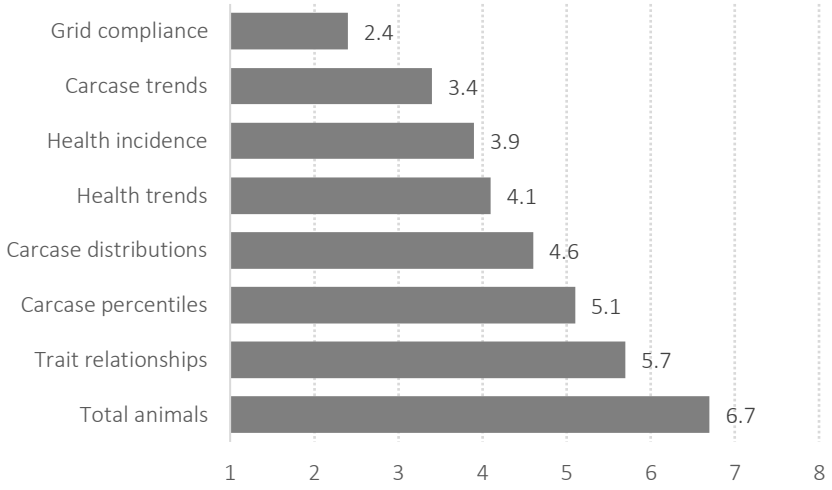
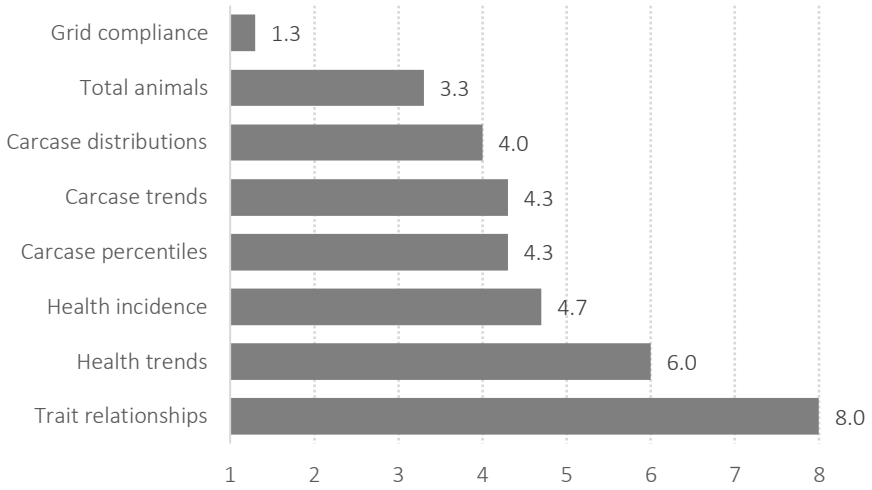
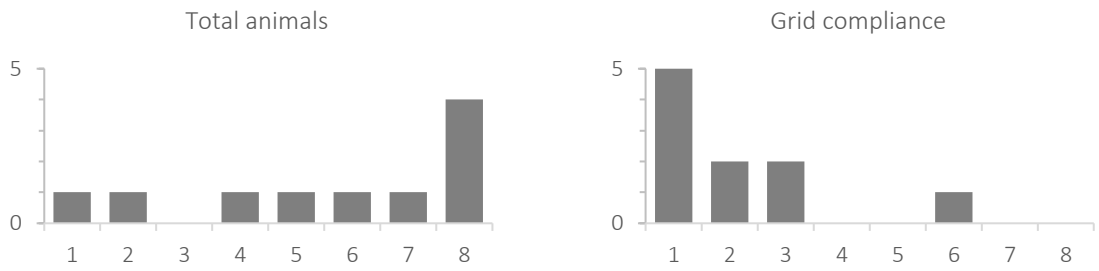


Figure 27. Average ranking (lower numbers indicate higher priority) for each dashboard as assigned by processors (n=4).



Of note, Table 5, shows the frequency distribution of the rankings for each dashboard. This is important as it demonstrates the variance in responses and the problems with using a mean response (mean responses can mask the variation). As an example, carcase percentiles had an average ranking and yet it was either ranked very highly or lowly, whereas grid compliance and trait relationships consistently ranked highly and lowly respectively.

Table 5. Frequency distribution indicating the number of times the dashboard was ranked 1 (highest) to 8 (lowest).



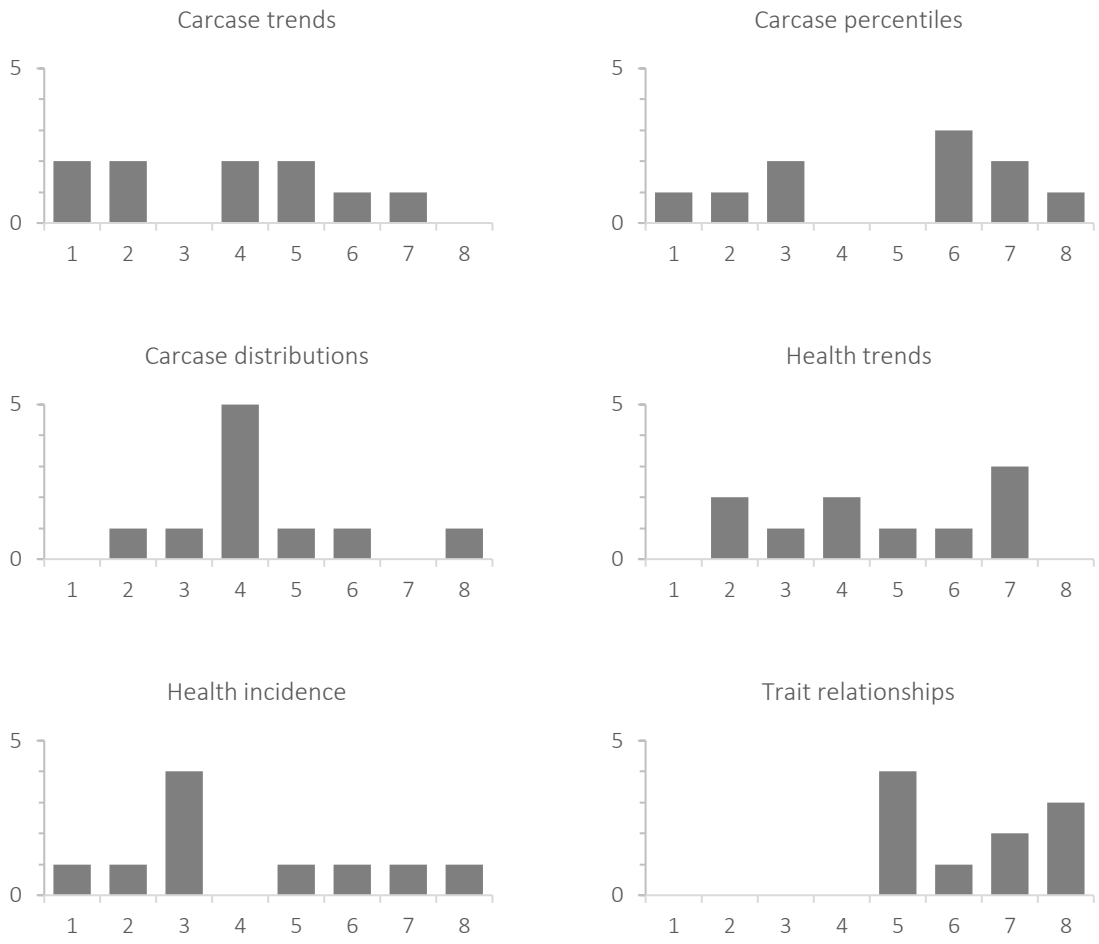


Figure 28 shows the average rating (scored from 1-5) for each of the concept dashboards. Differences in ratings given by producers and processors are illustrated by differences in the coloured bars.

The rating of the dashboards differs to ranking in that ratings are more a reflection of the desirability or usefulness of each of the dashboards. All dashboards rated either average-high or high-excellent. As noted earlier the alignment between processors and producers was not perfect, but there was a stronger relationship for the ratings. Grid compliance, health incidence, and carcase trends all rate high to excellent for producers. Interestingly although both groups ranked trait relationships as low, they rated it average-high.

Figure 28. Comparison of average rating (scale: very low (1), low (2), average (3), high (4), excellent (5)) for each dashboard given by producers (n=8) and processors (n=4). Dashboards sorted in descending order as rated by all respondents.

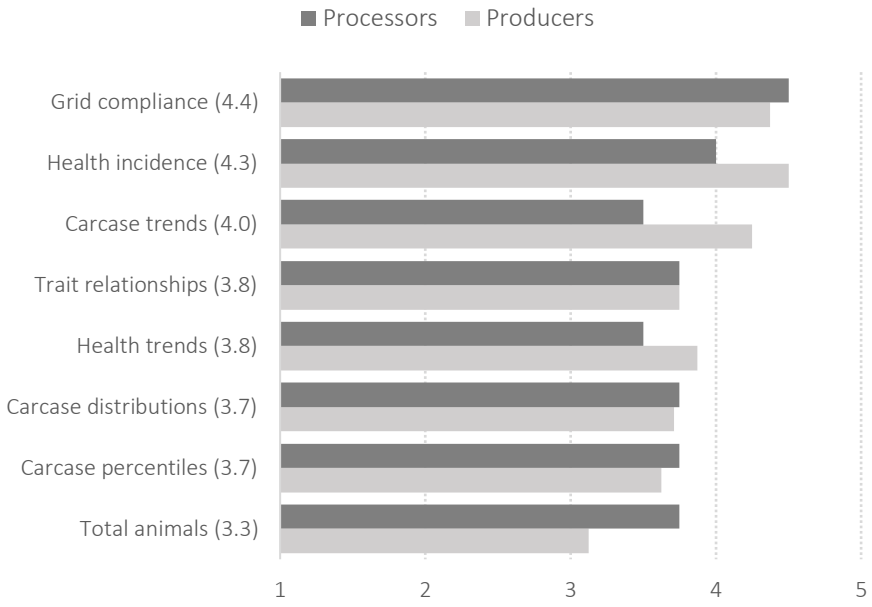
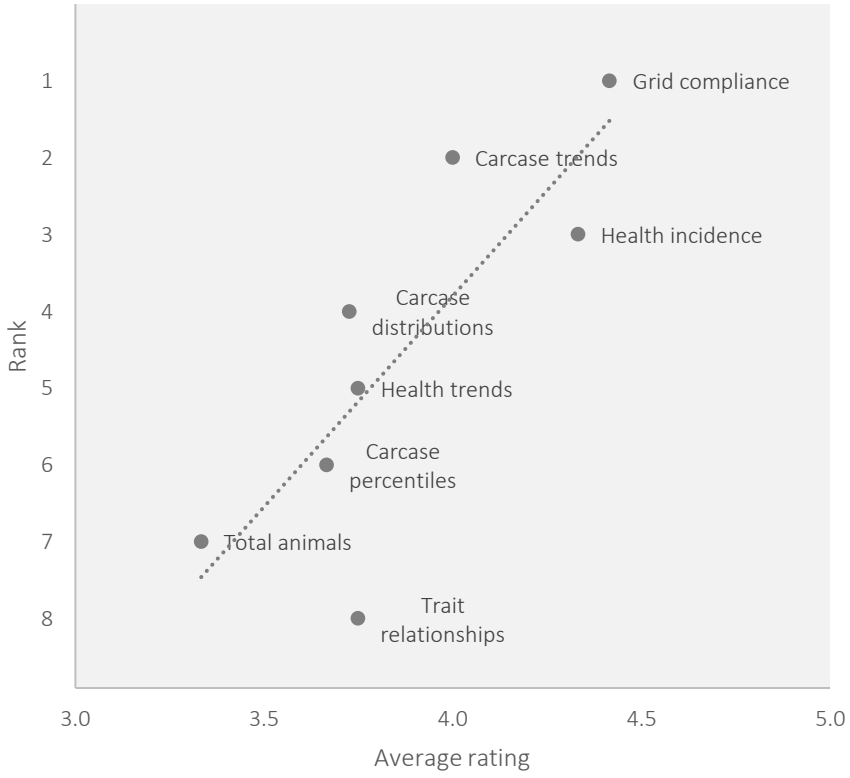


Figure 29. Relationship between rank order and average rating of the dashboards given by producers and processors. Higher ranking and rating is toward the top right of the figure.



As illustrated in Figure 29, there is a moderate correlation (r=0.8) between ranking and rating for the dashboards. Grid compliance, carcase trends and health incidence all have relatively high ranking and higher ratings. As indicated earlier, 'trait relationships' is different in that whilst it received a lower ranking, its rating was similar to several other dashboards.

4.1.3 Understanding and utilisation of the enhanced dashboards

Overall, there was a positive response to use of the dashboards with most trialists indicating that there was no difficulty or misunderstanding, however given these responses were received after a consultant had guided both processors and producers through each of the dashboards, this response was expected (see Table 6). All respondents indicated that the enhanced dashboards provided more information in an easier to understand framework than was available in the current LDL implementation. In terms of suggested changes, processors and producers requested the addition of a ranking tool that established compliance against a given grid for either supplying producers (processor) or from breeder producers (producers and feed lots). This has now been added within the grid compliance dashboard.

The capability of using the arrow keys to fine tune the grid values should be implemented in the next iteration of the dashboards.

Further suggested improvements include changing the radar (spiderweb) graph to a bar graph to assist with interpretation and a general improvement in colours. All producers were very keen to see the addition of a hot button (searchable) for each animal so they could identify outliers by NLIS ID. Another consistent comment that came up during the consultations but was not reflected in the survey feedback was that once producers understood the information in the dashboard, they were then very motivated to ask questions on how to improve performance. In this project the consultant running the feedback session was very experienced in understanding carcase feedback and was able to provide direct answers to those questions. However, what this observation does demonstrate is the need for highly interactive tools that assist in identification of improved performance practices for producers that do engage with LDL. Examples of such tools include hyperlinks to examples of using the MSA index calculator, hyperlinks to BREEDPLAN EBV percentile reports etc.

Table 6. Review of the eight dashboards presented asking for each one (a) if there were any difficulties or misunderstanding, (b) for suggested improvements and (c) for any other comments.

Dashboard	Difficulties and misunderstandings	Suggested improvements	Other comments
Total animal	• Responses: 9 • 'No difficulties or found it easy reported' reported by 9 respondents. • 'No, I found it quite easy to understand.'	• To be able to trace an individual beast via the NLIS tag and view origin of cattle purchased. • I need to make sure Coles makes the data available	• To amalgamate our cattle into the same graph but be shown in a different colour to view them.
Grid Compliance	• Responses: 9 • 'No difficulties or found it easy	• To be able to view a particular Processors	• Need more time using the

Dashboard	Difficulties and misunderstandings	Suggested improvements	Other comments
	reported' reported by 8 respondents. • Couldn't get graphs to load	acceptability Grid compliance. • Improvements were made from initial discussions. • Calculate a consistent yield and relate that back to a live weight number to cut off. Which will aid compliance. • It took me a while to realise that you could use the arrow keys to fine tune the grid parameters. My first response was to try and type in the numbers. Controlling the mouse to fine tune will be difficult for someone like Dad, who would like to use the tool.	dashboard to make a comment. • The font on the sliders is quite small/hard to read. • 'Definitely a step in the right direction from where grids currently are, I believe.'
Carcase trends	• Responses: 9 • 'No difficulties or found it easy reported' reported by 9 respondents. • 'there it a lot of "stuff" in here to use.'	No suggestions provided	
Carcase percentiles	• Responses: 9 • 'No difficulties or found it easy reported' reported by 7 respondents. • One respondent was not able to source any information.	No suggestions provided.	No comments provided.

Dashboard	Difficulties and misunderstandings	Suggested improvements	Other comments
	• 'Better once Alex explained it as a control chart. The producer chart on its own I find hard to draw any conclusions from, whereas the other charts offer a better comparison.'		
Carcase distributions	• Responses: 9 • All responses 'No difficulties or found it easy'	No suggestions provided.	• Not very relevant to our business, at this time. [Beef producer]
Health trends	• Responses: 9 • 'No difficulties or found it easy reported' reported by 7 respondents. • One respondent did not find any info in this section.	• Show district health implications. • 'Maybe it needs to be a logarithmic graph? Not sure what it is now, but with such a small producer data set it is hard to see much in the trends when overlaid against the shire/region.'	No comments provided.
Health incidence	• Responses: 9 • 'No difficulties' reported by 5 respondents. • The radar charts were found to be hard to read by 3 respondents. • 'The graphs aren't all that user friendly'. • 'Having not used radar charts, I don't	• 'The spider web chart was very challenging to read. A column graph would be easier for us to read.' • 'Present data as % rather than just totals.'	• 'To be able to trace an individual beast via the NLIS tag and view origin of cattle purchased. To be able to know if health issues are active or historical scarring (sic) [such as in Liver Fluke].'

Dashboard	Difficulties and misunderstandings	Suggested improvements	Other comments
	find them very intuitive.'		
Trait relationship	• Responses: 9 • 'No difficulties or found it easy reported' reported by 8 respondents	• Meat colour doesn't seem to be working yet?	• 'The first graph overlaying the different data sources is excellent.'

As indicated earlier the processors and producers once engaged and using LDL tend to do so relatively frequently and more often when their livestock are being slaughtered (see Table 7). As expected, benchmarking against shire, region, state and nationally was rated either very useful or extremely useful reflecting the desire of both processors and producers to obtain clear comparative performance information and to use that information in future decision making. The ability to understand regional patterns of supply and to contrast performance of individual HSCW, MSA index and animal health against others was important to most trialists (see Table 8).

Respondents when asked whether they would recommend the use of the enhanced dashboards to other livestock producers or lot feeders were overwhelmingly positive with nine trialists indicating highly likely and three indicating likely. As word of mouth and peer to peer training is highly important to the adoption of technology in Australian agricultural industries, having producer advocacy to support the role out of enhanced LDL dashboards is extremely valuable.

Table 7. How often would you access the enhanced LDL dashboard?

Frequency	Number of responses	
As required	4	
Daily	2	
Weekly	1	
Monthly	2	
Other	1	every 2 - 3 weeks as cattle are processed
	1	Whenever I consign cattle, or when I get curious of other things to try and see
	1	Varying, depends on what we are currently focusing on and production etc.

Table 8. Is the benchmarking by shire, region, state and national important to you?

Extremely useful	4
Very useful	7
Somewhat useful	1

4.1.4 Future improvement in enhanced dashboards

Table 8 provides a summary of the additional features that would be useful in the next iteration of enhanced LDL dashboards. Several trialists wanted to select a graph or report and print that graph / report at the time of the interview either to have as a reference point or to share with other decision makers in the farming business. A key learning was that if producers saw information of value, they wanted to immediately capture that information for reflection and decision making during the consultations. They also wanted to have the function of selecting a graph and saving that for emailing to fellow producers (breeders), processors or supporting livestock consultants as a way of transferring information that could be used to enhance decision making. Therefore it is important that ISC consider the printability and format of saving for key information that allows producers to quickly and effectively 'save' the information that is immediately important to their business.

Linkage to genetic reports was a common theme as producers generally indicated that genetic improvement was the key to improvement of the carcase traits. A smartphone friendly format was also highlighted as an opportunity for the future.

As many trialists were very complimentary and could not indicate substantive change, it is assumed that the current enhanced dashboards are meeting most of the expectations that processors and producers have for LDL. The ability to set and compare benchmarks appears to be the compelling reason for engagement with LDL (see
Table 10).

Table 9. What additional features in the enhanced LDL dashboards would be useful?

• **To be able to trace an individual beast via the NLIS tag and view origin of cattle purchased. To be able to know if health issues are active or scarring [such as in Liver Fluke].**
• **Supermarket lambs be included**
• **Being old school, I like to print out the odd report to show people or for further discussion so easy printing options would be fantastic for me.**
• **I would like to get a better look at it have it easy to use on an I phone now it is a bit of a problem to use**
• **nothing**

• **Relation back to for genetic trends and aiding selection on farm.**
• **Being able to select Produced and Bred at the same time. I can't seem to do that yet. pH and/or Meat Colour as a parameter available to be set when making a grid**
• **Personally not too much at this stage, besides being able to download an Excel or CSV sheet with the breakup of all your animal's individual data (which is already possible in the current LDL in the 'Details' section).** • **Also, the supplier ranking page in the current LDL is very useful, I think from memory you could rank suppliers for certain things in this new LDL interface, but I know the one in the existing LDL is good also.** • **Eventually, providing farmers with a real cost dollar figure loss would be my end goal. This is definitely difficult with all the different grade codes and different plants grids but at the end of the day that is the carrot that will drive change from the producer end, the opportunity cost they have forgone.**

Table 10. Any other comments about the enhanced LDL dashboards?

• **It is very useful to be able to see how your results compare with other producers.**
• **As we have different trading partnerships associated with the one PIC, it would be good to be able to separate the feedback if desired.**
• **I think it is a fantastic improvement because we can really zoom in on the traits that have a direct impact on profitability**
• **Thanks for getting me to be part of this.**
• **I like the set up and the ease of functions in the enhanced dashboard, I hope that its upgrades are enough to encourage producers to take the time to look on what they can do to improve their Carcase or Animal Health compliance**
• **I know a lot of my answers for the dashboards are very generic, but that is because I do think they are useful and good as they are. Only really mucking around with it further and being asked to gather certain info would assist with any extra tweaks (and producer feedback would be useful, as at the end of day, they are who we want to aim it at). Also, the fact that I am quite computer literate has made it easier for me to understand the reports I feel and that we definitely do need feedback from user groups who may not be as literate.** • **The question 15 answer is not so much from a processor perspective, but a producer one, as I know that many of our producers' value being able to 'rank' or 'compare' (benchmark, essentially) themselves to their shire, region, state and nation. Therefore, it is important to me because it is important to them.**

4.1.5 Follow-up by UNE team

When asked if the respondent would be interested in having the UNE team follow up on their answers,

- four said 'no',
- six said 'yes' (two processors, four producers), and
- two did not answer.

This provides an indication of engagement to expect from user testing when the dashboards are developed into a live system.

4.2 Logic Map Developed

Following the feedback and commentary received from the interviewees, the following logic map was created to provide ISC management with a process for determining the key outcomes and required activities to support the achievement of those outcomes. This logic map recognises that each of the eight dashboards are discrete learning tools and provide / convey different levels of information and insight. An important component of the logic map is the identification of supporting tools or activities / sign posts that ISC should consider when implementing elements from this project.

Figure 30. Structure of logic map presented in Table 11.

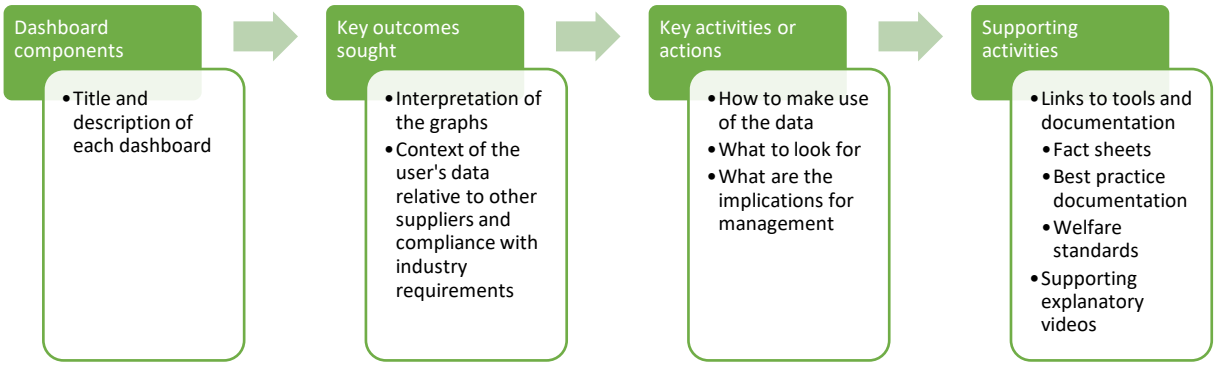


Table 11. Logic map for the implementation of LDL enhanced dashboard components.

LDL enhanced dashboard component	Key outcomes sought	Key activities or actions	Supporting activities
Total animals: A graphical series (PIC, shire, region, state) that displayed the number of animals killed across time.	Confirmation of animals by slaughter date Supply patterns by shire, region, state and national (processors) Year on year comparisons of supply Impact of seasonal events on supply Segmentation based on market and location	Current year view to confirm slaughter dates and numbers Data tab to confirm numbers Current year view to confirm supply pattern Relative patterns within shire, region and state Abnormal supply interventions Year on year view (three year) to see seasonal consistency and trend Supply within segments	Shire, region and state supply patterns explored, peak and troughs of supply discussed Supply relative to feed demand and lambing/ calving pattern Supply relative to feedlot demand Price overlay relative to supply COP tool integration
Grid compliance: An interactive tool that enabled producers to use slide bars to set (and save) boundaries for 9 traits to represent a multi-dimensional grid. The grid was	Development of multi-dimensional grids and compliance to those grids Number of animals that meet or do not meet compliance (actual) and percentage Comparison of compliance to custom grid by shire, region and state (national for processors)	Setting up 1st custom grid Sliders vs in out dimensions Understanding of grid dynamics Showing multi-dimensional grids in two dimensional segments	Tools for benchmarking MSA index vs marbling, carcase weight and yield Improving trait compliance

then displayed as a shaded area on a two-dimensional view of traits. Data function enables producers and processors to rank suppliers	Visual representation of how close non-compliant animals are to compliance with individual traits Multiple custom grids to do "what if" scenarios across time and within categories Detection of outliers or high performance Ranking of suppliers by grid compliance standards	Heat maps of compliance and non-compliance Decision support scenarios Ranking of suppliers relative to multiple grids	Understanding gird structures and where heat maps of compliance exist Correlations between multiple grids (future tool development)
Carcase trends: A graphical series of the mean of each trait relative to time.	Variance within producer or processor dataset for range of traits relative to time Comparative variance performance (mean) relative to shire, region and state Impact of management or seasonal interventions Supply patterns for traits rather than animals (carcase weight, marbling)	Understanding seasonal and market impacts on carcase trends Review of trend relative to shire, region and state Highlight of extremes (high and low) Feedlot vs grass Dentition and cow turnoff Seasonal impacts on meat colour	Recognition of regional differences in supply Linkage to genetic and management intervention tools Targeted supply Targeted regions for processors
Carcase percentiles: A graphical series that overlays the producer's data on percentile bands (0-5%, 5-25%, 25-50%,	More detailed view of variance by trait. Comparative benchmarking of own performance within percentiles against shire, region, state and national	Benchmarking relative to percentiles Highlight of extremes, are they within accepted boundaries	Linkage to genetic and management intervention tools Linkage to BREEDPLAN and MSA percentile charts

50-75% and 75-95%) for each trait relative to time and shire, region, state, and national.		Variance in different production systems	Linkage to MyMSA
Health trends: Incidence of animal health and processor management traits relative to time.	Process control chart to identify deviations from normal pattern Incidence of animal health by disease and or processor management subcategories Comparative performance relative to shire, region and state Impact of season or management interventions Hot spots and times for disease awareness	Own incidence versus shire, region or state Highlight seasonality of incidence Highlight of regional hot zones (processors) Induction and source (feedlots)	Linkage to disease management and best practice animal health Code of practice for animal welfare Vaccination principles Fit to load (bruising and curfew management) For processing health and management, review of fit to kill Best-practice / health requirements
Health incidence: A radar (or spider-web) chart of animal health and processor management traits.	Highlight of relative priority or incidence of disease Snapshot of comparative performance Awareness of local disease occurrence (risk)	Self-assessment of disease ranking Highlight key management and animal health interventions	Animal health and farm biosecurity plans Best practice for animal handling Low stress stock management Proactive disease management Links to other farm practices

Trait relationships: A combined histogram/scatterplot of the relationships between two traits.	Trait by trait relationships and dependencies Comparative performance Outlier identification Management intervention to shift compliance and performance	Correlations and constraining relationships between traits Relative performance High performance targets and objectives Changing target positions (weight, fat, marbling)	Genetic and management interventions Timing of reproductive potential Feed demand and management Minimum requirements for MSA

5 Conclusion

5.1 Key findings

The consultation process with both producers and processors was valuable to the project and to those trialists that were keen to see the next generation of LDL. The initial effort placed into development of the dashboards (including multiple internal iterations) provided a substantive range of dashboard concepts for comparison, ranking and rating.

A review of the ranking and ratings for the dashboards showed that although there was positive response to all dashboards, there was strong preference for grid compliance, carcase trends and health incidence.

Recommendation 1. That ISC prioritise the development and implementation of enhanced dashboards for grid compliance, carcase trends and health incidence to improve the engagement and utilisation of the current LDL platform.

Throughout the consultation process, there was a strong willingness by all trialists to fully understand and engage with each of the dashboards. As producers were nominated by their processors as participants for trialling, having the endorsement of the processors was incredibly important. Furthermore, as producers became engaged, they became focused on what could improve performance. This prompted a series of questions that led to increased time being spent on the consultations which probably led to greater appreciation and endorsement of the enhanced dashboard concepts.

Recommendation 2. That future projects focused on improvements within the LDL platform use participating processors to recruit producers that can trial and advise on those enhancements and improvements.

Recommendation 3. That ISC consider including links to on-line tools or other programs that can assist with improving performance of carcase and animal health traits.

Recommendation 4. That ISC in the implementation phase of this project devote resources to the development of "information buttons" and YouTube videos or webinars that simply explain the functionality of each dashboard.

As indicated, processor and producer engagement in the trialling process was critical. However as direct interaction with an experienced consultant will not be available during the implementation phase. The concept of "plug and play" is important to adoption of technology by livestock producers. That is, time poor producers do not have the resources to spend time on learning complex systems. As a result, resources allocated to the development of a full system of "information buttons" within each of the dashboards that can be linked to the 'Solutions to Feedback Library' within the current LDL platform coupled with on-line YouTube videos or saved webinars that can guide producers through each of the dashboards would significantly improve utilisation and adoption rates.

Recommendation 5. That ISC assess the feasibility and utility of developing smartphone versions of LDL dashboards.

The widespread uptake of smartphones and their always 'at hand' convenience presents a significant opportunity for producers to access information as and when needed. Producer feedback indicated that a smartphone friendly version of LDL including the enhanced dashboards should be considered.

Implementation of the enhanced dashboard should include a tracking function to better understand which dashboards are being used and for which inputs (e.g., traits).

Recommendation 6. It is recommended that a tracking function should be included in the production system to assist in understanding how the dashboards are being used and guide future development or refinement.

As these dashboards are conceptually different to traditional industry support systems, there is a severe risk of failure if they are not supported by appropriate aids to understanding. Our experience of introducing these dashboards to motivated potential users indicated a need to support them to (a) operate the dashboards, (b) understand and interpret the graphics (and tables of data) produced, and most importantly (c) assist them to read the messages and understand the implications of their output.

Recommendation 7. Concurrent with deployment, it is recommended that in addition to basic instructions on how to use the dashboards and context sensitive help, support materials should be available that include online videos, worked examples, and direct links to the relevant industry information that can assist to translate the data insights into actions that make a difference to their business and benefit the supply chain.

During pilot testing, our users were absorbed in understanding the purpose and merit of what had been developed. As a result, there were very few suggestions for further enhancement. We expect that over time as the users become fully acquainted with the current suite of dashboards, they will be better placed to offer additional suggestions for new features and perhaps new dashboards.

Recommendation 8. It is recommended that in a future deployment plan, resources be allocated to undertake a performance review and user satisfaction assessment six months after deployment.

5.2 Benefits to industry

Availability of these decision support tools that use real time data, can enable both producers and processors to systematically review carcase and animal health data. This review enables them to spot carcase and health trends earlier and act through either genetic, management or purchasing decisions. It can lead to better health outcomes, better grid compliance and more informed supply decisions.

After the interviews, although most people indicated that they would not change their use patterns for LDL, the majority indicated that they would be far more strategic and active in sourcing and identifying information that would lead to better practice change within their business. As a result, the project achieved a key outcome in equipping processors and producers to be more engaged users of the LDL system if the enhanced dashboards are implemented.

The logic map shows a series of outcomes that were identified from the interviews that both processors and producers are seeking from the enhanced dashboards. Being able to work through the data systematically, interactively and dynamically with a series of filter applications within each of the dashboards reinforced with producers where there were obvious areas for change and improvement. Several producers were immediately able to identify purchasing (genetics; breeder cattle source), management or animal health treatments that impacted on individual animal and mob performance.

Being able to contrast performance against shire and region allowed them to context the impact of season vs the impact of intrinsic management decisions on key performance indicators. The overall industry benefit is a network of producers that are much more informed about historical performance of carcase and animal health trends, allowing them to be more strategic in future management interventions.

For processors being able to set customised multiple grid options and contrast performance of suppliers, regions and states against through multiple scenarios was extremely important. Being able to see seasonal performance within regions and states provided an opportunity for the processor to be much more targeted in procurement of livestock to meet key market scenarios. This benefits whole of industry by reducing the potential for non-compliance and through allowing processors to be much more active in providing information through the producers.

6 Future research and recommendations

In the key findings section several recommendations have been identified. These recommendations have been sub-grouped into three categories being those that should be considered for future R&D activities, those that will guide and assist ISC in the implementation stage and those that will increase utilisation and adoption potential of future LDL platforms and insights. In summary, the project identified a series of dashboards that met most user requirements from the future LDL platform. In the implementation phase careful consideration should be given to ensuring that users of the dashboards are guided through an interactive user experience rather than having to navigate the system with no support. The YouTube and a webinar series would be the most cost effective and efficient way of achieving that initial user support. Once a user is engaged, the ISC through a range of tools and resources such as 'Solutions to Feedback Library' can assist the user to identify and make more informed management interventions.

The following table contains the key recommendations arising from this project.

Table 12. Summary of Recommendations

Recommendation Theme	Recommendation
Future R&D activities	Recommendation 2. That future projects focused on improvements within the LDL platform use participating processors to recruit producers that can trial and advise on those enhancements and improvements. 43 Recommendation 8. It is recommended that in a future deployment plan, resources be allocated to undertake a performance review and user satisfaction assessment six months after deployment. 53
Implementation	Recommendation 1. That ISC prioritise the development and implementation of enhanced dashboards for grid compliance, carcase trends and health incidence to improve the engagement and utilisation of the current LDL platform. 43 Recommendation 4. That ISC in the implementation phase of this project devote resources to the development of "information buttons" and YOUTUBE videos or webinars that simply explain the functionality of each dashboard. 51 Recommendation 5. That ISC assess the feasibility and utility of developing smartphone versions of LDL dashboards. 43 Recommendation 6. It is recommended that a tracking function should be included in the production system to assist in understanding how the dashboards are being used and guide future development or refinement. 53
Improving utilisation and adoption potential and impact	Recommendation 3. That ISC consider including links to on-line tools or other programs that can assist with improving performance of carcase and animal health traits. 43 Recommendation 7. Concurrent with deployment, it is recommended that in addition to basic instructions on how to use the dashboards and context sensitive help, support materials should be available that include online videos, worked examples, and direct links to the relevant industry information that can assist to translate the data insights into actions that make a difference to their business and benefit the supply chain. 53

7 References

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