PROJECT SUMMARY

'WHOLE OF MEAT SUPPLY CHAIN FOOD LOSS AND WASTE MAPPING AND INTERVENTIONS – PHASE 1'

KEY POINTS

Knowledge about food loss and waste in Australian meat supply chains has been patchy to date. This project aimed to improve understanding of the processes of waste creation and address data gaps.

Phase 1 focused on beef supply chain stages from livestock receipt to packaged beef products at retail door (for domestic markets) or at port (for export markets). It included primary processing at abattoirs (to primal cuts), secondary processing at value-add plants (to retail cuts), tertiary processing at food manufacturers (to prepared foods containing beef) and cold chain distribution.

The aim of the project was to generate a clearer picture of beef meat losses and waste, including:

- sources of losses and waste,
- causes and potential solutions,
- approximation of the quantities and cost of losses and wastes.

Causes and potential solutions were identified through engagement with supply chain actors (processors, retailers, packaging specialists, distribution specialists). This provides a basis for future planning of loss reduction initiatives, including a Sector Action Plan as part of the National Food Waste Reduction Strategy.

An important observation was that collaborative solutions to address losses co-created by multiple supply chain actors are potentially more important than solutions by individual actors.

In particular, beef product rejected at retailers (due to packaging or temperature maintenance failures) will require supply chain collaboration, including improved standardisation, data transparency and sharing.

The project also compiled approximations of the amounts and cost of beef meat losses from the processing stages. There was insufficient data to generate a comprehensive and representative picture, but it provides a framework for further data collection.

THE CHALLENGE

The prior lack of consistent and comprehensive information about meat losses makes it difficult for the meat sector to prioritise and plan its response to the Australia's Food Waste Reduction Strategy. It has been suggested that the volumes of meat losses are lower than other food types, but that the financial value of the losses and their environmental impacts are potentially high. The challenge was to generate a clearer picture of meat losses for the processing and distribution stages to inform future loss reduction initiatives.

THE OPPORTUNITY

There is a recognition of the economic and societal case for food loss reduction that is broader than the traditional business case of cost savings for individual supply chain businesses. It considers interventions that tackle losses through supply chain collaboration of multiple actors to deliver benefits to whole industry sectors and the wider public at large. This project provided the opportunity to also examine losses with a whole of supply chain perspective and pilot a transferable methodology for other industry sectors.

OUR RESEARCH

Our method aimed to follow WRAP's "whole of supply chain waste mapping and resource efficiency". It was applied to individual supply stages through a set of three case studies, to identify sources, causes and solutions to each supply chain stage.

We also took a whole of supply chain view by bringing supply chain actors together in workshops to examine losses that are co-created and require collaborative solutions.

These qualitative processes were complemented with some mapping and estimation of the amounts and costs of losses. There was insufficient data to generate a representative picture, but it provides a framework for further data collection.

Case Study Assessments of Supply Chain Stages

Four case study assessments collected information about the key sources of losses for each stage:

CS1 Primary processing.
CS2 Secondary processing
CS3 Tertiary processing.
CS4 Cold chain distribution.

For CS1, CS2 and CS3, site visits were conducted at the participating plants to observe and collect information about losses. Simple materials flow analyses were

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constructed representing generic industry processes and data described in literature.

For CS4, for which physical observation of transport/distribution processes was prohibitive, researchers consulted with industry specialists in meat product distribution, especially packaging and temperature maintenance.

Supply Chain Workshops

Two workshops brought together experts and stakeholders (representing processors, industry peak bodies, cold chain specialists, data management specialist, government policy agencies) to identify priority loss aspects, causes and solutions, and initiate transparency and collaboration to facilitate whole of supply chain solutions.

Estimating quantities and costs of beef losses

Approximate loss factors at key points along the supply chain were derived from literature, from observations of stakeholder consulted and from the case study analyses. These were compiled into a beef loss account for the sector. This data complements the qualitative information by giving a sense of where the most significant loss reduction may come from.

The Dynamic Industry Resource Efficiency Calculator Tool (DIRECT) was used for the first time for meat (https://empauer.com/solutions/direct/) to estimate the cost of waste and potential cost savings, which could guide further action planning.

OUTCOMES

Defining meat loss and waste

An important first outcome was to define meat losses, and those considered food waste. Animal parts not destined for human consumption are not considered losses (hides, hoofs, bones, inedible and condemned offal). They are directed to rendering for processing into non-food products (meat and bone meal, tallow, pet food), which are important revenue streams for the industry. Some fractions of edible meat and offal, which would otherwise be destined for human food, and which are hard to harvest, may be directed to these non-food destinations as a cost-effective means of value recovery. These have been categorised as **food losses**, but not food waste. Only losses of edible meat and offal that go to landfill, wastewater, composting, digestion, combustion are considered **food waste**. The project aimed to identify food losses (edible meat and offal directed to other products) and food waste.

Hot spots sources of meat loss and waste

The following key points/sources of losses and waste were identified for each stage.

Primary processing:

- Food losses
  - Meat that cannot practically be trimmed from bone and fat during boning and trimming.
  - Meat trimmings that drop to the floor.
  - Edible offal with no market as human food.
- Food waste
  - Nil. Above losses go to pet food and meat and bone meal, which are not waste destinations.

Secondary processing:

- Food losses
  - Meat offcuts and products damaged during packaging, that cannot be reprocessed or repackaged.
- Food waste
  - Above losses that cannot be recovered to rendering or pet food, and instead go to a waste destination (for example landfill).

Tertiary processing:

- Food losses
  - Rejected or spoiled meat ingredients.
  - Meat residues left in mixing equipment.
  - Product lost due to packaging failures.
- Food waste
  - Above losses that cannot be recovered (food rescue, animal feed), and instead go to a waste destination (typically landfill, composting).

Cold chain distribution:

- Food losses
  - Product rejected by retailer due to not meeting specification, lack of temperature maintenance and packaging failures.
- Food waste
  - Above losses that are not recovered (mark-down, food rescue), and instead go to a waste destination (landfill).

Causes and potential solutions

The workshops generated an array of causes of losses at each supply chain stages, and a catalogue of potential solutions were proposed. These can be taken forward into future food loss and waste reduction efforts by the industry.

A particular emphasis was placed on causes of beef product rejected by retailers, commonly due to packaging faults (e.g., 'slow leakers') or temperature management failures. These can be caused by

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multiple problems involving multiple supply chain actors. An important outcome from the workshop participation by multiple supply chain actors was the chance to consider this shared responsibility for the co-creation of losses. The following were identified as key root causes for this priority area of loss:

- Fixed shelf-life determination, not allowing adjustment based of the product's journey;
- Reduced shelf-life due to packaging vacuum seal failures and abuse ('slow leakers');
- Reduced shelf-life due to temperature maintenance failures;
- Insufficient detection of slow leakers and temperature maintenance failures;
- Labelling problems for both bulk boxed and retail products (for e.g., incorrectly labelled);
- Service level pressures from economic or contractual commitments at any point in the supply chain; an
- Shared responsibility for co-creation of losses
- Insufficient incentives and systems to keep rejected product out of landfill at retail.

Quantities of beef loss and waste

The beef meat loss and waste account (at the sector scale) approximated the amounts beef loss based on information gathered during the project. It cannot be regarded as comprehensive or representative due to a limited survey sample. However, the following broad observations will help target future loss reduction planning efforts:

- Primary processing losses of edible meat and offal are expected to be small as a fraction of input (~1-2%), but may account for a reasonable quantum overall, particularly if the large volumes processed for export are considered. These losses are recovered via processing into products deemed to not be food waste destinations, much of which stays in the human food chain indirectly as animal feed (pet food, meat and bone meal, tallow and others). Therefore 'food waste' quantities are minimal to zero. However, there are opportunities to keep more of these losses in the direct human food chain.
- Secondary processing losses are expected to similarly be a small fraction of inputs (~1-2%) but smaller in total quantum since only beef for domestic supply is processed (36%). When there is access to rendering or pet food manufacturers this can be directed to other non-food waste destinations as per primary processing. Otherwise, losses may go to waste destinations and become food waste, but the fraction and amounts could not be determined.
- Tertiary processing losses as a fraction of inputs are expected to be higher than for primary or secondary processing (~2-2.5%). However, the total quantum will be low as only 20% of beef post-secondary processing was assumed to be further processed into prepared foods. Some losses of finished products are expected to be recovered through food rescue, but the remainder will go to landfill as food waste. Those fractions could not be determined.
- Cold chain distribution losses are expected to be between 1% and 3.4% of distributed product, which are the earlier estimates of the National Food Waste Baseline and a Brodribb and McCann (2020) study, respectively. In this study the occurrence of 'slow leakers' (an important cause of reject product) was noted to be 1-2%, but this does not include other causes of rejection. Destinations were reported to include mark-down, food rescue or collection for rendering (not food waste), or landfill (food waste), but fractions are not known.

Conclusion

This research offers a compilation of the key sources and causes of meat loss and waste for beef supply chains between receipt of livestock to the retail door.

A preliminary catalogue of loss reduction solutions has been co-designed through engagement with industry, which may be useful to consider in the development of a Sector Action Plan as part of Australia's Food Waste Reduction Strategy.

In the primary and secondary processing, most losses can be recovered if there is access to rendering facilities or pet food manufacturing, resulting in low or no losses that would be categorised as food waste. For tertiary processing, opportunities for loss recovery are more limited, resulting in food waste generation, but total amount is expected low due to low beef ingredients prepared foods. For refrigerated transport and distribution, estimates of losses are the highest of the assessed stages, but how much becomes food waste is still a data gap due to lack of information about destinations. It appears that opportunities for loss reduction and waste avoidance appear are greatest for the cold chain distribution stage, which requires collaborative solutions.

A key finding was that the most significant loss reductions will come from collaborative supply chain solutions that target loss reduction in refrigerated transport and distribution. This hinges on greater

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supply chain harmonisation, transparency, communication and collaboration between supply chain stages and actors.

The project also trialled the use of the DIRECT tool for estimating the cost of meat losses in the processing stages, which may help the processing sector understand the potential cost savings from reducing beef meat losses.

IMPACT

The impact for the beef industry is information to enable i) future planning of meat loss reduction initiatives and the financial saving that will accrue for supply chain actors, and ii) participation in the National Food Waste Reduction Strategy with the increased social licence that brings. It also provides impetus for increased collaboration and transparency along the supply chain to unlock innovation.

Consideration of environmental benefits from beef loss reduction were outside the scope of this project, but some commentary on the links between meat loss reduction and improved environmental outcomes is also provided.

NEXT STEPS

The information generated by this project would likely be useful for the development of Sector Action Plan (SAP) under Australia's Food Waste Reduction Strategy, particularly the findings information about causes and potential solutions.

This project was not able to generate a complete account of beef meat losses and waste for the assessed supply chain, despite best efforts, due to limited information and data about the amounts and destinations of losses. Therefore, some data gaps remain. In particular, better understanding the quantities and destination of beef product rejected by retailers will require the collaboration of multiple industry actors, including cold chain carriers.

It is recommended that in-depth root cause analysis workshops be adopted as an industry approach to loss/waste analysis. The collaborative discovery of waste creation processes appears to facilitate the design and implementation of effective collaborative solutions across supply chain actors.

The research methodology and findings provide a foundation for the next phases of the CRC research program examining other meat types and downstream supply chain stages.

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PROJECT REPORTS/PUBLICATIONS

RENOUF, M. A., MESSNER, R., HILL, A., HURST, B., MANN, A. & RICHARDS, C. 2023. Whole of meat supply chain food loss and waste mapping and interventions - Phase 1. Final Report. Meat and Livestock Australia (MLA). Final Report for Project V.MFS.0457.

PROJECT WEBPAGE

Whole of Meat Supply Chain Waste Mapping and Interventions – Phase 1

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