Food waste opportunities within the food wholesale and retail sectors

FINAL REPORT

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ABOUT THE AUTHORS

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EXECUTIVE SUMMARY

Aim

The aim of this research project is to provide the NSW Environment Protection Authority (NSW EPA) with a better understanding of the opportunities and barriers to reduce the amount of food waste going to landfill from the wholesale, logistics and retail sector. This report presents the research findings and provides a series of recommendations as to how NSW EPA can most effectively engage with these sectors within the food supply chain to maximise performance while minimising disruption and costs.

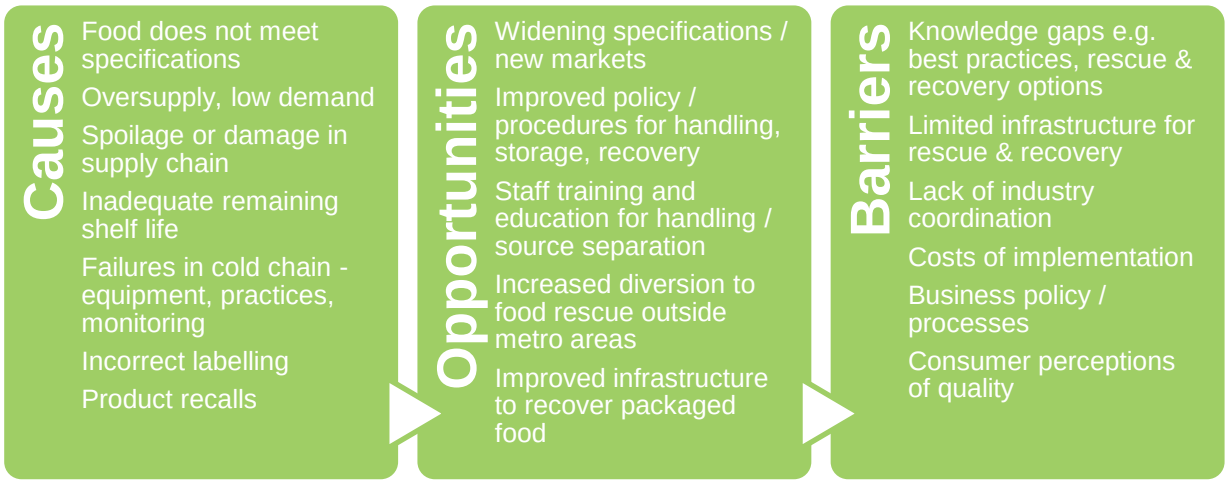
Methodology

The research involved 3 components:

1. **Literature review** to gather existing information from industry, government and academic sources
2. **Interviews** with 14 key industry stakeholders, including all of the major supermarket chains, several wholesalers, food rescue organisations and waste service providers
3. **Workshop** with 17 industry representatives to 'reality check' the preliminary findings and recommendations developed in the earlier stages of work.

Findings

The literature review and consultation found many **causes** of food waste; **opportunities** for avoidance, repurposing, rescue, reuse or recycling; and **barriers** to implementation. A high-level summary is provided below.



Recommendations

The following table provides a summary of recommendations to NSW EPA based on the research findings. It is also recommended that the EPA establish a government-industry working group to inform the further development and implementation of food waste reduction programs for the food wholesale/retail sectors.

Facilitating collaboration	Financial support	Resources for industry	Regulation	Research
1. Establish a food industry working group to inform EPA food waste programs 2. Work with DEE to coordinate food waste reduction strategies for businesses through the National Food Waste Strategy, including: A) a voluntary food stewardship program B) guidelines for food waste reporting in line with the *Global Protocol on Food Loss & Waste*	3. Continue Bin Trim program for SME food wholesalers/retailers with an additional process audit and focus on avoidance 4. Extend Bin Trim program to larger food wholesalers / retailers on a cost sharing basis, including assistance with data systems and value chain mapping 5. Split out Love Food Hate Waste grants program for business into separate grants program distinct from consumers, and target grants at education activities for major retailer executives and general staff in addition to SMEs. 6. Extend and better promote existing grants for organics collection and reprocessing targeting retailers/wholesalers, rescue organisations and recyclers 7. Provide funding for trialling of innovative commercial collection services	8. Build separate consumer and business channels for Love Food Hate Waste (LFHW) communications and target food wholesalers / retailers in parallel with food service/ hospitality 9. A) Develop and provide tools and resources for each stage of a business's journey: developing a company strategy, measuring & monitoring progress & taking action B) Develop a series of specific resources e.g. on consumer education, food rescue contacts, cold chain guidelines, packaging design and recovery technologies 10. Publish best practice case studies	11. Investigate a food waste levy or other financial incentives to reduce food waste 12. Work with other jurisdictions and Australian Food & Grocery Council on the feasibility of better regulation of 'best before' and 'use by' dates	13. Fund research to quantify food waste for specific product supply chains 14. Undertake or fund more research on opportunities and barriers for SMEs through a survey of Bin Trim participants or a random sample of businesses as well as meta-analysis of LFHW projects targeting food retailers 15. Fund research into the lifecycle impacts of aesthetic standards and ugly food campaigns 16. Fund research on the environmental impacts & benefits of alternative of recycling technologies

CONTENTS

1. INTRODUCTION

According to recent research on the commercial and industrial sectors (EPA NSW 2016) the wholesale and retail trade sectors are two of the principal contributors of food waste to landfill in NSW. The NSW EPA is therefore intending to design a new food waste reduction project(s) to help the domestic food wholesale and retail sectors, as well as the logistics supply chain between these sectors, to avoid, repurpose, rescue, reuse or recycle their food waste (collectively referred to in this report as 'reduction and diversion').

In order to proceed, NSW EPA has commissioned this research project to provide a better understanding of the opportunities and barriers to reducing the amount of food waste going to landfill from these sectors. Based on this research, this report provides a series of recommendations as to how NSW EPA can most effectively engage with all sectors within the food supply chain to maximise performance while minimising disruption and costs.

Specifically, this document provides a:

- summary of **current literature** on food waste generation, management, opportunities and barriers in the food wholesale, retail and logistics sectors
- summaries **primary research through targeted interviews and an industry workshop** involving a total of 21 business across the NSW food supply chain, including all 5 major food retailers
- **recommendations** to the NSW EPA on how best to build on existing efforts, facilitate new opportunities and remove identified barriers to implementation by industry.

About this report

This report is divided into two parts:

1. a **short body**, summarising the key information drawn from research, and the final conclusions
2. a **long appendix** setting out the detailed information gained from each phase of the research.

RESEARCH SCOPE

Target sectors

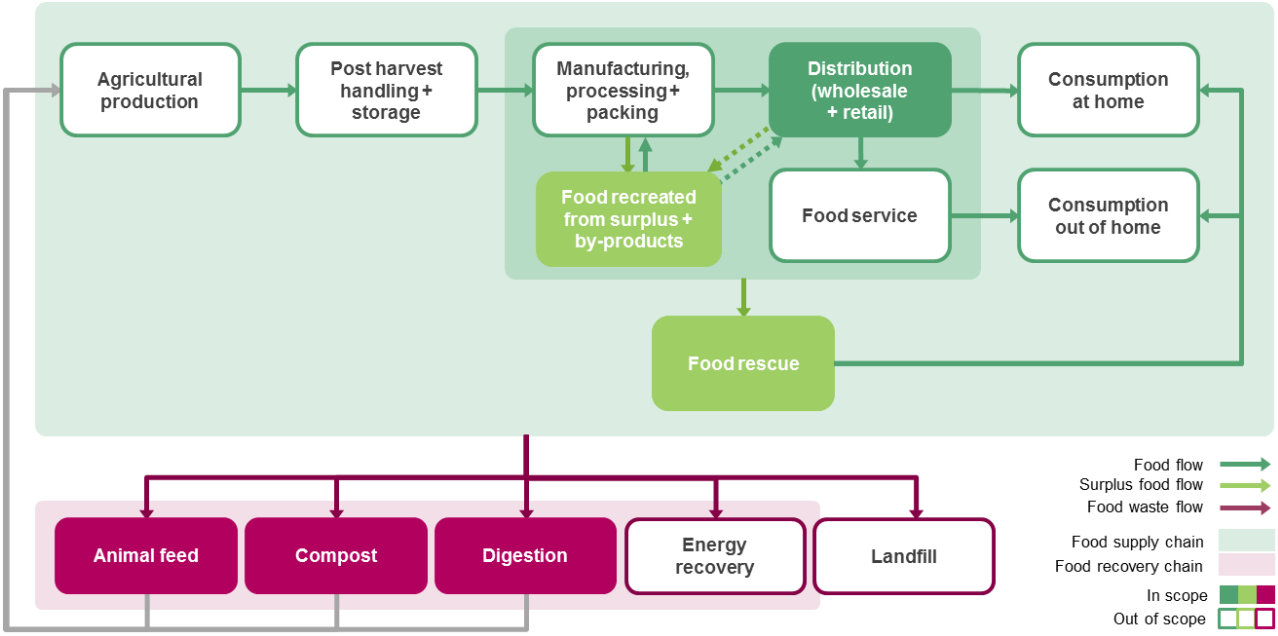
This literature review focuses on food waste occurring in the food wholesale and retail sectors of the food supply chain. Food wholesale and food retail are subsectors of the wholesale trade and retail trade sectors of the commercial and industrial (C&I) division. In this report, they will be referred to collectively as the **'food wholesale/retail sectors'**.

The target sectors are together commonly referred to as the 'Distribution' stage when looking at the full food supply chain (e.g. Gustavsson, 2011; Verghese et al, 2015). Their place in the food supply chain is shown in Figure 1. Individual food supply chains for different products are also provided in Appendix A.

In addition to looking at food waste that occurs within the Distribution stage, the other stages of the supply chain within the scope for this research project are the end of life stages shown in colour in Figure 1, which are the channels for repurposing and rescuing surplus food and/or for the reuse and recycling of food waste (as per the waste hierarchy below in Figure 4). It is important to note that the food wholesale sector also provides food to the food service sector, but to the extent possible, this review focuses on food wholesale that supplies food retailers.

Acknowledging the Institute of Grocery Distribution's analysis of waste prevention (2016), which states, "[w]aste is rarely caused where it occurs and analysing waste at one point in the chain often reveals causes elsewhere", we have also included the processing/manufacturing sector and the logistics activities associated with food wholesale/retail, to the extent that decisions made at these stages cause food waste in the food wholesale/ retail sectors.

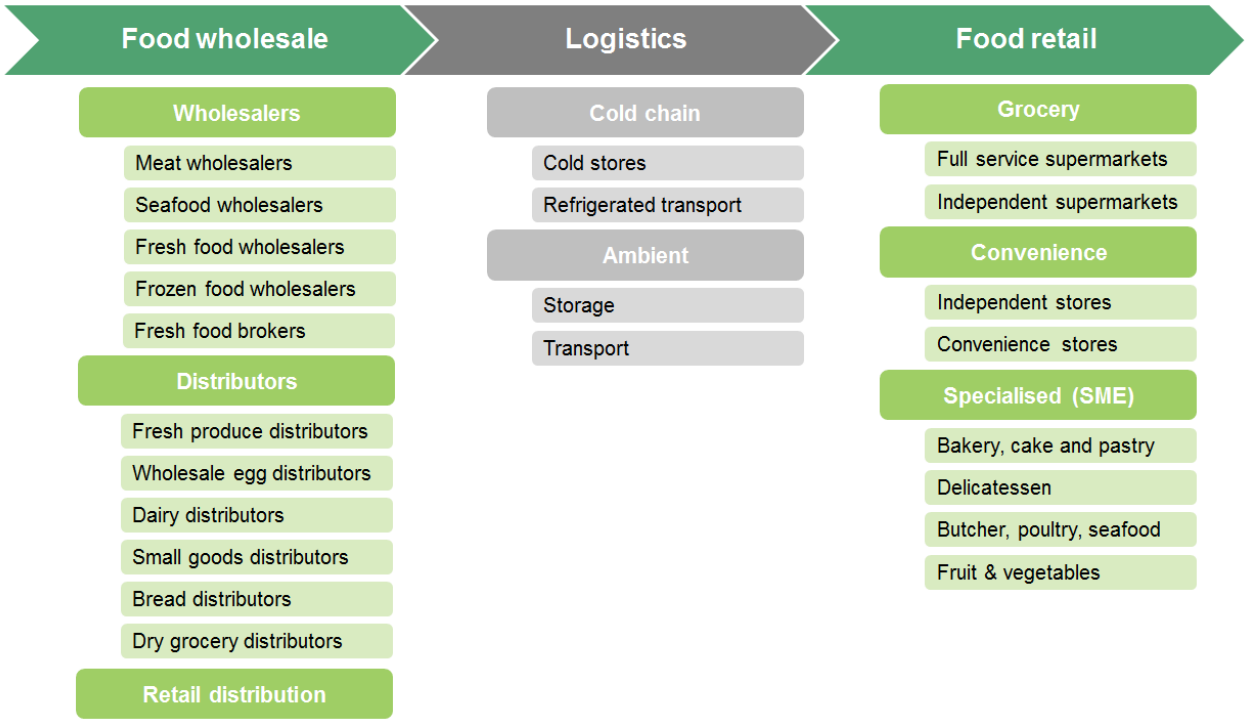
Figure 1: The food supply and recovery chain



Source: Adapted from Verghese et al, 2015.

Owing to the diversity in the food operations upstream of direct retail to customers (see Appendix A), for this review, we have defined 'retail' as being individual retail stores (which may or may not be controlled by a head office), and all operations before the individual stores, including retail distribution centres controlled by retailers, to be grouped with wholesalers and independent distributors under the heading of wholesale. This simplified sector breakdown is shown in Figure 2, setting out the main types of businesses in these sectors.

Figure 2: Main channels in the supply chain



Source: Adapted from Spencer & Kneebone (2012)

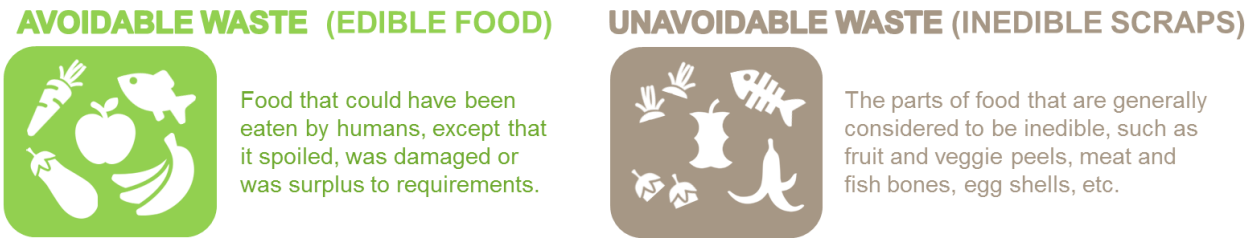
Originally the scope of the research also included food waste *occurring* at the logistics stage. This stage of the supply chain encompasses transport direct from producers/processors, and from third party logistics (3PL) warehouses (manufacturer) to wholesalers and retail distribution centres (DCs), and from wholesalers/ /DCs to retail stores. Most transport is by road in either ambient or refrigerated vehicles.

Early research identified, however, that virtually no waste actually *occurs* at this stage of the supply chain as all food products are either unloaded at the destination or returned to their source, meaning that associated food waste also occurs at the source or destination. However, this stage was identified as the known or likely *cause* of some food waste in the food wholesale/retail sectors as is therefore considered alongside manufacturing/processing under discussions of causes of food waste and opportunities to act.

Definition of food waste

A common definition of food waste is that set out by the Food and Agriculture Organisation (FAO) as the "discarding or alternative (non-food) use of food that [was at some point] safe and nutritious for human consumption" (FAO, 2013). In Australia, this would be called 'avoidable food waste', in contrast to unavoidable food waste, as shown in Figure 3. Another category of food waste is 'potentially avoidable' food waste, which represents items that are frequently discarded as inedible, but could actually be eaten by humans.

Figure 3: Avoidable and unavoidable food waste



Source: Adapted by UTS Institute for Sustainable Futures from NSW EPA Love Food Hate Waste website

Acknowledging these distinctions, for this review we adopted the following definition that expands on the concept of avoidable food waste, but is targeted to the food wholesale/retail sectors:

> *Food waste is "any food entering a [wholesaler, distributor, or retailer] which is not sold [and] has the potential to be reused, recycled, or sent to landfill" (Viridis, 2009).*

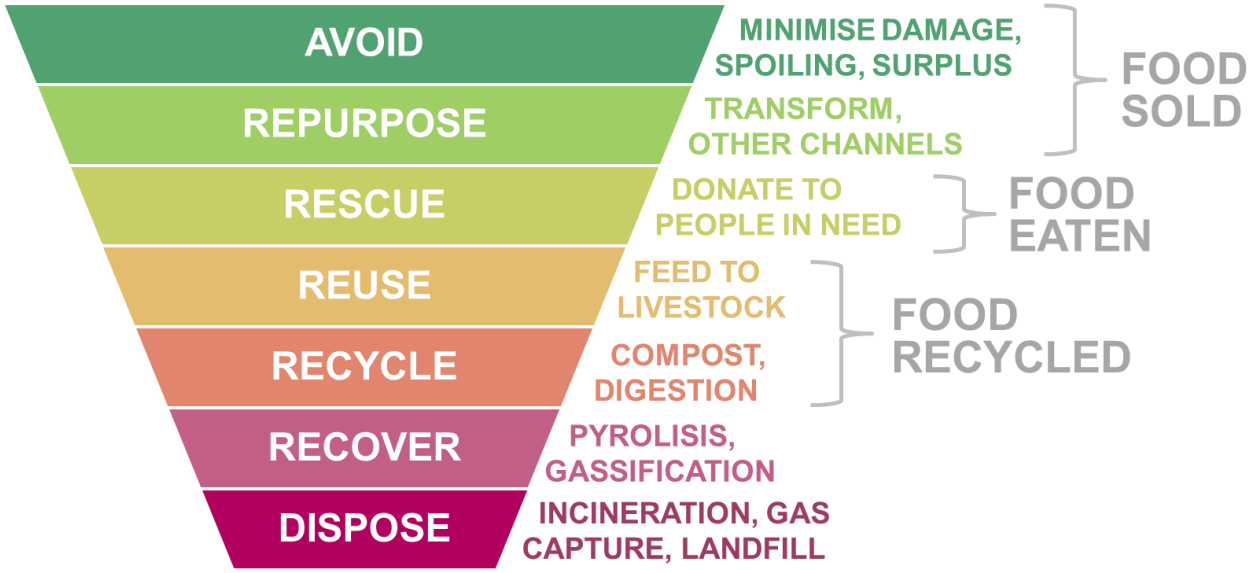
While the focus of this review is on avoidable food waste, we note however that unavoidable food waste may also be a noteworthy component of organic waste for some food wholesale/retail sectors. These businesses could therefore also target unavoidable food waste alongside avoidable food waste when taking actions to recover the nutrients and energy from food waste, e.g. through composting, animal feed and anaerobic digestion.

Food waste hierarchy

Actions and opportunities identified are classified according to the food waste hierarchy shown in Figure 4 below. This is an expanded food waste hierarchy developed specifically for the food wholesale/retail sectors through this project. It is based on existing waste hierarchies (set out in Appendix C2) and the findings from the stakeholder research. The main development is prioritising actions that allow food to be sold by retailers over actions that do not generate any income but still ensure food is eaten.

Actions and opportunities considered 'in scope' for this research include avoidance, repurposing, rescue, reuse and recycling – actions that either reduce food waste (avoid, repurpose, rescue), replace the use of 'virgin' food (reuse), or keep food waste material within the food supply system (recycle). Actions that simply recover energy from the food waste (whether diverted from, or onsite at landfill) are out of scope.

Figure 4: Expanded food waste hierarchy for food wholesale/retail



Source: UTS Institute for Sustainable Futures

RESEARCH METHOD

The research involved three components: an initial literature review to gather existing information; interviews with key stakeholders to confirm and dig deeper into the findings and develop preliminary recommendations; and finally, an industry workshop to 'reality check' the preliminary findings and recommendations developed out of the literature review and interviews.

Literature Review

The literature review involved an investigation of academic literature and publicly available information related to food waste occurring in the food wholesale/retail sectors of the food supply chain. The focus was on Australian literature and information, with international literature used to supplement Australian findings. In addition, the review included information provided directly by NSW EPA.

The majority of information available, particularly that with quantitative data, was found in academic literature focused on international experience. Only two pieces of academic literature were identified for the Australian context, one by the authors of this report. Grey literature (i.e. publically available information outside academic channels) was spread more evenly across Australian and international experience, though the only in-depth studies on food waste in food wholesale/retail sectors were again international.

Stakeholder interviews

A series of 14 stakeholder interviews were conducted by phone with 13 organisations across the target sectors, between May 11 – 29, 2017. In addition, another 12 informal interviews were attempted with small retailers ('SMEs') in a local area of inner Sydney, though only one was completed. Table 1 shows the 14 organisations participating in interviews.

The interviews incorporated company-specific information identified during the literature review, and also sought to confirm relevant findings from Australian and international contexts. Additional detail was also requested on current sources, actions and barriers. An example interview design is provided in Appendix F.

Industry Workshop

A half-day industry workshop was held in Sydney on Tuesday 30th May with 17 industry attendees representing 14 organisations, as shown in Table 1. Approximately half the attendees had also participated in an interview. This brought the total number of organisations engaged to 21.

The purpose of the workshop was to validate preliminary insights gained from the literature review and stakeholder interviews, particularly with regards to barriers, and then to refine and add to the list of draft recommendations for NSW EPA programs. The workshop agenda is provided in Appendix F.

Table 1: List of stakeholders engaged by the project

Organisation	Supply chain stage	Category	Interview	Workshop
Woolworths	Retail	Full service supermarket	Y (2)	Y (2)
ALDI	Retail	Full service supermarket	Y	Y
Coles	Retail	Full service supermarket	Y	N
Harris Farm	Retail	Wholesaler and retail franchisor	N	Y
Metcash (IGA)	Retail	Wholesaler and retail franchisor	Y	Y
Fogo Brazilia	Retail	SME Speciality retailer (Deli)	Y	N
Galuzzos (informal)	Retail	SME Speciality retailer (Fruit/Veg)	Y	N
Sydney Fish Market	Wholesale/retail	Wholesale/retail market	N	Y (2)
Sydney Markets	Wholesale/retail	Wholesale/retail market	Y	Y
Refrigerants Australia	Logistics	Peak organisation	Y	Y
[Anonymous]	Logistics	Transport	Y	N
Early Rise Baking	Manufacturing	Bakery manufacturer	Y	N
McCain	Manufacturing	Frozen food manufacturer	N	Y
Goodman Fielder	Manufacturing	Manufacturer (range of products)	N	Y
Unilever	Manufacturing	Manufacturer (range of products)	Y	N
Yume Foods	Rescue	Online resale marketplace	Y	Y (2)
OzHarvest	Rescue	Food rescue charity	Y	Y
Foodbank	Rescue	Food rescue charity	N	Y
Earthpower	End of life	Recycling facility	Y	N
Cleanaway	End of life	Waste management company	N	Y
Suez	End of life	Waste management company	N	Y
Number of organisations (individuals)		**Total**	14 (15)	14 (17)

Limitations

Lack of Australian literature and quantitative data

As noted above, the amount of literature available for the Australian context is limited, particularly ***quantitative*** data on the volumes, types and sources of food waste, and the volume of food waste reduced or diverted owing to specific actions. This was a limitation recognised in all major existing reports reviewed (Morgan, 2009; Mason et al, 2011; Encycle, 2013; Verghese et al, 2015). In addition, information on food waste occurring in the food wholesale sector, and food waste caused at the manufacturing/logistics stages were also scarce.

The lack of quantitative data for the Australian context makes it difficult to both identify the largest sources of food waste (and therefore the largest opportunities for impact), and the expected benefit from recommended actions.

Difficulty in securing input from small food wholesalers/retailers

The focus of the research was on food waste and associated recommendations for both major market players and small to medium enterprise (SME) businesses. Throughout the course of the research, significant effort was made to secure input from smaller food wholesale/retail businesses, but with limited success. Further research is required to fully understand the reasons for the poor response, but it can probably be attributed to resource constraints commonly experienced by SMEs and may not reflect a lack of interest or activity on food waste.

The majority of the information in this report therefore relates to the experiences of larger businesses in the food supply chain. Specific findings for SME retailers are set out in Appendix D4.

2. FINDINGS

This section sets out the key findings from the research. Full details of the results of each of the research stages are provided in Appendices C, D and E.

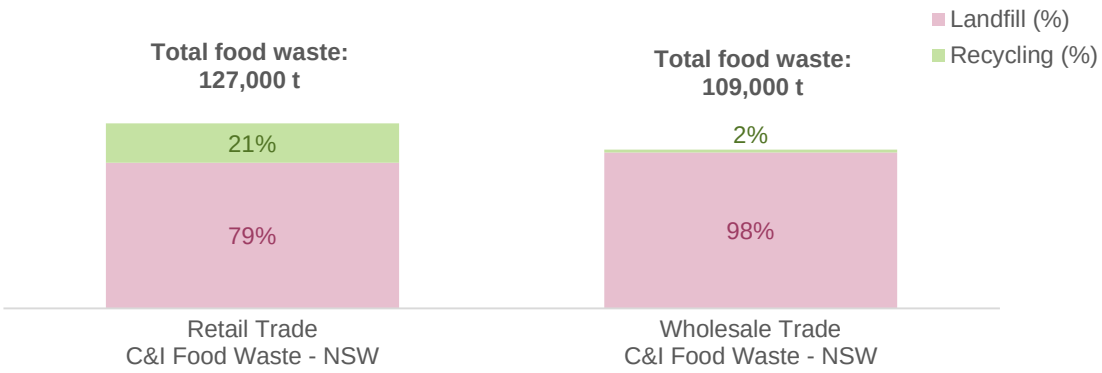
THE PROBLEM OF FOOD WASTE

Quantitative data on the volume and type of food waste in Australia is scarce. What data there is available is generally from one-off, point in time studies, with inconsistent definitions, methodologies and reporting.

According to recent data (NSW EPA 2016) the wholesale and retail trade sectors in NSW generate around 236,000 tonnes of food waste each year, of which only 13% is currently recycled. Recycling rates differ markedly between the two sectors though, with 21% of food waste from retail trade being recycled, compared to only 2% from wholesale trade. The breakdown between the two sectors is shown in Figure 5.

These recycling rates differ quite noticeably from data on the Australian-wide wholesale and retail trade sectors from 2012, where retail trade recycled only 11% and wholesale trade recycled 16% (Encycle, 2013, see Appendix B1 for more details). Unfortunately, it is impossible to determine the source of this variation. It may be due to methodological differences, changes over time or large variations between states.

Figure 5: Recycling and landfill of food waste (t) in retail and wholesale trade in NSW



Note: Figures based on data from WARR data 2012-13 with sector breakdowns from Disposal Based Audit 2014 (Disposal) and Bin Trim Round 2 Phase 1 (Recycling).
Source: NSW EPA (2016)

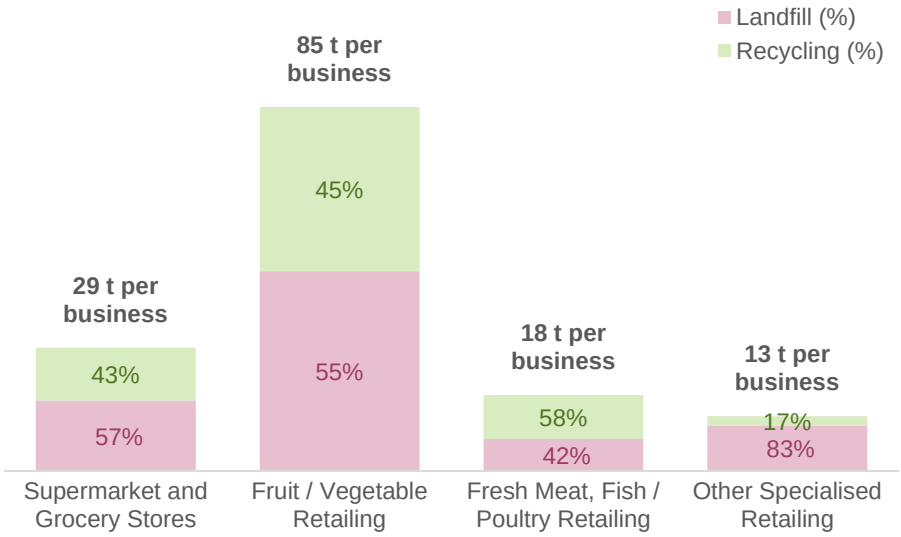
The wholesale and retail trade sectors include both specific food wholesale/retail and other wholesale/retail. No comprehensive data is available on food waste specifically at the food retail and/or wholesale levels, either in NSW or Australia.

Within the food retail sector, data on a subset of SME businesses who participated in the NSW EPA's Bin Trim program (shown in Figure 6) reveals large variations in the average generation of food waste across the different types of retail businesses. The largest generator of food waste was fruit and vegetable retailers, producing an average of 85 t of food waste per retailer per year, followed by supermarket and grocery stores who generated an average of 29 t per year.

The assessments revealed that recycling rates for these businesses (at 39%) is higher than any of the figures reported above. The proportion of food waste recycled varied substantially within the subsectors of food retailers, with the highest average recycling rates attributed to meat/fish/poultry retailers (58%), fresh fruit and vegetables (45%), and supermarkets/grocery stores (43%), and lower recycling rates for Other specialised food retailing (17%).

We note that that the Bin Trim dataset is unlikely to be representative of the entire food retail sector, as it represents only SME businesses, and of those, only the businesses that have chosen to participate in the Bin Trim program. Self-selection for Bin Trim assistance may indicate a greater willingness to recycle than the general retailing community.

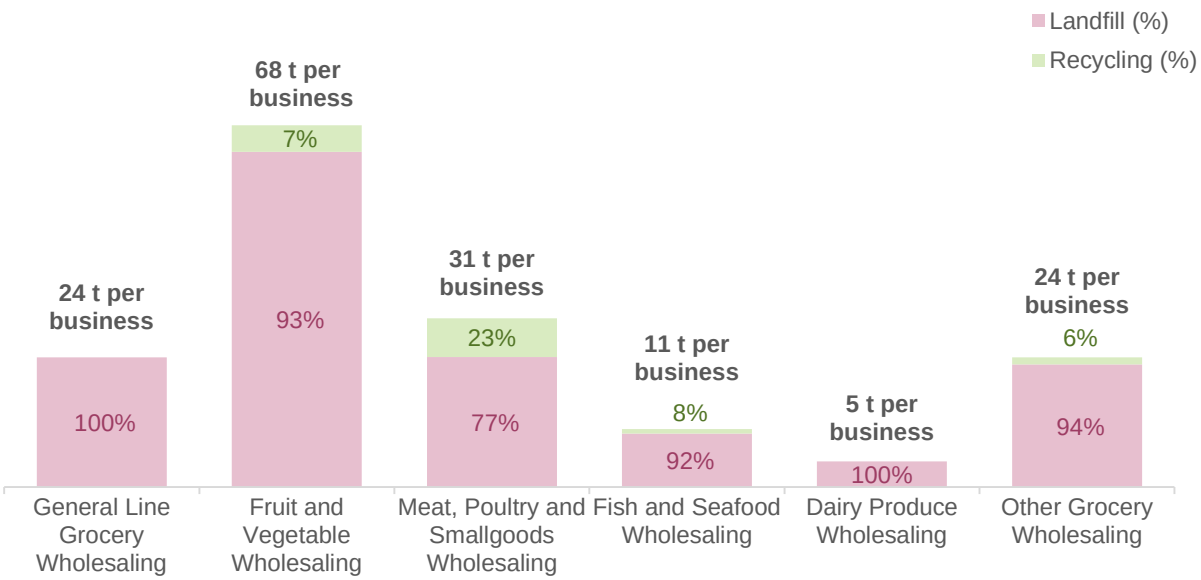
Figure 6: Recycling and landfill of food waste (t) for Bin Trim food retail business in NSW



Note: Figures based on initial assessment results which have been annualised and converted from volume to tonnage. Assessments were conducted between September 2015 and September 2016.
Source: Lethlean (2017)

Within the food wholesale sector, SME businesses in the wholesale food sector who participated in the NSW EPA's Bin Trim program recycled, on average, only 4% of their food waste (based on Lethlean 2017) (Figure 7). The highest recycling rate for food waste within subsectors was for meat, poultry and smallgoods (23%), followed by fish and seafood (8%), fruit and vegetables (7%), and other grocery wholesalers (6%). General line grocery wholesalers and dairy wholesalers disposed of all of their food waste to landfill.

Figure 7 Recycling and landfill of food waste (t) for Bin Trim food wholesale businesses in NSW



Note: Figures based on initial assessment results which have been annualised and converted from volume to tonnage. Assessments were conducted between September 2015 and September 2016.
Source: Lethlean (2017)

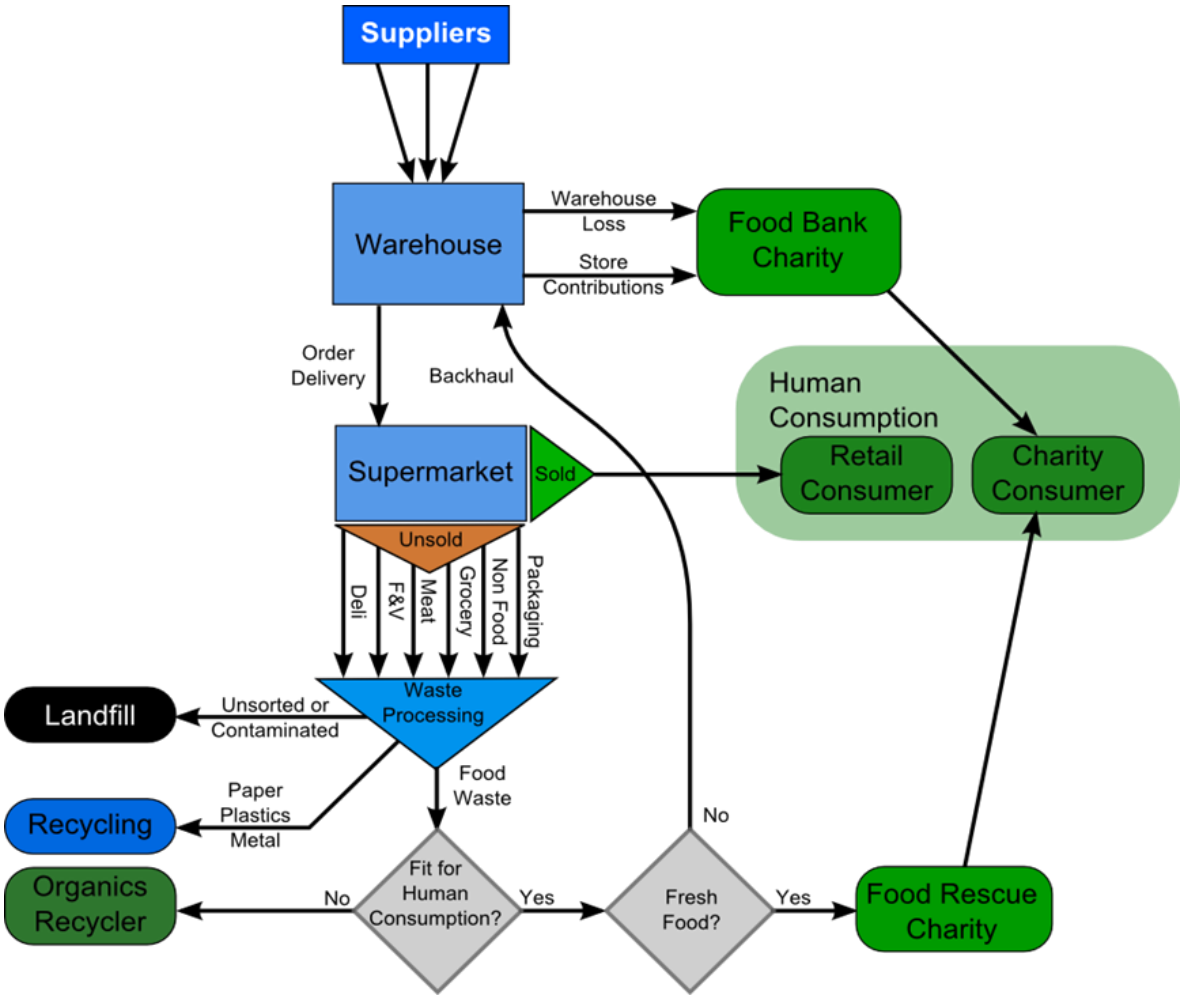
More details on these datasets and additional sources of data are provided in Appendix B1.

WHERE AND WHY FOOD WASTE OCCURS

The food wholesale/retail sectors include many different types of businesses and supply chains (see Figure 12 in Appendix A). Food waste is generated at many different points in these supply chains. In some cases, vertical integration between wholesale and retail activities makes it difficult to distinguish between the sectors, for example: Metcash is a wholesaler but also owns or franchises retail stores, and the major supermarket chains control the distribution of most products to stores through their regional distribution centres (DCs). The warehousing activities of retail distribution centres are similar in nature to general wholesale warehousing, and so these are considered as equivalent stages in the supply chain.

An example of the distribution chain for a large supermarket chain is shown in Figure 8, based on previous research conducted with supermarkets on behalf of the federal government. The distribution chain may vary slightly across different retail businesses and individual stores.

Figure 8: Supply chain for a supermarket



Source: Viridis (2008)

The following sections provide an overview of findings, highlighting where and why food waste occurs at wholesale/retail distribution level and at the individual retail store level (based on the literature review, stakeholder interviews and industry workshop). More detailed information is provided in Appendices C1, D1 and E1.

Wholesale/retail distribution

This stage of the supply chain includes retail distribution centres (DCs), fresh produce markets and specialist wholesalers. Table 2 summarises the reasons for food waste generation and potential root causes identified through the research.

Table 2: Reasons for food waste generation at wholesale/retail distribution

Stage in supply chain	Reasons for waste generation	Potential root causes
Wholesale/retail distribution - receipt	**Rejected** because product or packaging was damaged in transport and handling	Inadequate packaging which may have resulted in physical damage to packaging materials and/or prevented appropriate ventilation and cooling Poor handling practices, stacking equipment/processes, poor road condition
	Rejected owing to failures in the cold chain, i.e. produce spent time outside required temperature range (non-compliance with food safety regulations or industry standards)	Technical failure in trucking fleet, information about correct handling not transmitted through supply chain, poor methods for opening/handling truck doors, lack of compliance with guidelines
	Fresh produce **rejected** because it doesn't meet quality specifications, e.g. edible but blemished	High consumer expectations, strict retailer specifications, extreme weather affecting quality Inadequate packaging which may have prevented appropriate ventilation and cooling
	Rejected due to incorrect packaging/ labelling during manufacturing/ processing	Poor quality control at supplier
	Disposed of due to product being incorrectly selected at warehouse and sent back by retailer	Inadequate communication or business processes, disposal cheaper than re-packing on shelves
Wholesale/retail distribution - storage	**Disposed** of due to damage in storage or handling	Lack of staff training and/or engagement, insufficient handling procedures
	Disposed of as a result of spoilage, e.g. unsold and stored for too long	Inaccurate forecasting, low level of demand, poor inventory control, perishable foods with short shelf life
	Disposed of as a result of insufficient remaining shelf life (use by or best before dates)	As above
	Disposed of due to product being incorrectly picked at warehouse and sent back by retailer	Inadequate communication or business processes, disposal cheaper than re-packing on shelves
	Disposed of due to recall by manufacturer	Incorrect packaging or labelling during manufacturing/processing, product safety issue

Retail stores

This stage of the supply chain focuses upon operations and activities within the retail store environment. Table 3 summarises the reasons identified for food waste generation and potential root causes at this stage.

Table 3: Reasons for food waste generation at retail stores

Stage in supply chain	Reasons for waste generation	Potential root causes
Retail stores - receipt	Product **rejected** owing to failures in the cold chain, i.e. cannot guarantee produce remained at correct temperature	Technical failure in trucking fleet, information about correct handling not transmitted through supply chain, poor methods for opening/handling truck doors, lack of compliance with guidelines
	Product **rejected** because it doesn't meet quality specifications (e.g. fresh produce that doesn't meet retailer aesthetic standards) or damaged in transport	High consumer expectations, unnecessarily strict standards, spoilage/damage during transportation, information about quality standards not transmitted through supply chain
	Packaged product **rejected** due to packaging damaged in transport	Inadequate packaging, poor handling practices
	Packaged product **rejected** due to incorrect packaging/labelling by manufacturer/ processor	Poor quality control at supplier/wholesale
	Disposed of due to product being incorrectly selected at warehouse	Inadequate communication or business processes, disposal cheaper than return to warehouse
Retail stores – storage / shop floor	**Disposed of** as a result of damage in handling or display	Store practices, e.g. fresh produce stacked too high, poor staff handing e.g. produce not rotated adequately
	Disposed of as a result of damage by consumers handling fresh produce	Consumers picking over produce to find the perfect/ripe items Product falling off shelf, insufficient storage stability
	Disposed of as a result of spoilage	Inaccurate forecasting, low level of demand, poor inventory control, fresh produce has shorter shelf life due to being affected by extreme weather or poor practice earlier in supply chain
	Disposed of due to refrigeration failure, i.e. cannot guarantee produce remained at correct temperature	Poor maintenance, insufficient cold store capacity
	Disposed of packaged products as a result of insufficient remaining shelf life (use by or best before dates).	Inaccurate forecasting, low level of demand, poor inventory control, competing promotions
	Disposed of due to surplus product, e.g. bakery	Supermarkets want a full display of products at end of day, consumer expectations, unpredictable/fluctuating demand, over ordering, speculative purchasing
	Unavoidable fresh produce waste **disposed** (trimmings, scraps)	Inedible scraps, e.g. leaves on fresh produce such as cauliflower

SOLUTIONS AND BARRIERS

Food wholesalers and retailers in the food supply chain are already taking some action to reduce food waste generation and increase the diversion of food waste from landfill through food rescue or recycling initiatives. Levels of commitment do, however, vary significantly between the major retailers.

As part of the stakeholder research into actions and opportunities, it became clear that the initial food hierarchy we were using to classify solutions (see Figure 21 in Appendix C2) was not aligning with business priorities. We therefore adapted the hierarchy to take account of nuances in approaches. The biggest change was the addition of the repurposing level which accounts for a new type of action for retailers/wholesalers that still allows food to be sold, but in a different form or through a different channel. Figure 4 above presents the food waste hierarchy that we refined through this project into a more comprehensive model for the food retail/wholesale sectors. (This expanded hierarchy is likely to also be applicable to the food service industry).

Numerous opportunities to further reduce food waste were identified through the literature review and industry engagement, as well as barriers to these. An overview of these findings is provided below for waste avoidance and repurposing, food rescue and food waste reuse/recycling (the top 5 stages of the food waste hierarchy presented in Figure 4). Again, more details are provided in Appendices C2, D2 and E2.

Food waste avoidance and repurposing

The first two stages of the food waste hierarchy are food waste avoidance and food repurposing. Both actions maximise the amount of food sold by retailers.

Examples of existing initiatives in Australia to avoid food waste or repurpose include:

- new product specifications for less than perfect produce, e.g. ‘imperfect picks’ (Harris Farm) and ‘odd bunch’ (Woolworths)
- improved software for forecasting, ordering and inventory management to balance demand and supply
- supply chain rationalisation to reduce direct store deliveries, allowing better inventory management
- updating internal business and inventory management systems to monitor stock but to also track food waste levels and causes of waste
- continual review of remaining shelf life and use by / best before dates of products on shelf
- marking-down of produce that is slightly spoiled, damaged or close to end date labelling
- selling through alternative channels (i.e. outside the supermarket store, such as online platforms or discount/food rescue supermarkets) that have fewer restrictions, e.g. for aesthetics or end dates.

Table 4 summaries the opportunities and barriers for food waste avoidance or repurposing in wholesale and retail, along with associated opportunities and the barriers to implementing those opportunities.

Table 4: Opportunities for food waste avoidance and repurposing in wholesale and retail

Reasons for waste generation	Sector occurs (caused)*	Opportunities	Barriers
Doesn’t meet quality specifications, e.g. product/packaging damaged in transport	W, R (L)	Working with suppliers to identify the causes of damage in transport (e.g. inadequate packaging material, cold chain disruption, road conditions) Educate transporters on better handling, improve equipment Sell through alternative channels	Cost of R&D, equipment or packaging material changes Multiple stakeholders & unclear ownership in supply chain

Reasons for waste generation	Sector occurs (caused)*	Opportunities	Barriers
Doesn't meet quality specifications, e.g. fresh produce that doesn't meet retailer aesthetic standards	W, R (R)	Widening retailer specifications New product range (e.g. 'imperfect'; 'odd bunch') Advertising campaign to change consumer expectations Sell through alternative channels, transform into other food products (e.g. Pre-cut salad/soup packets, private label jams/drinks)	Perceived consumer preferences, retailers unwilling to sell poor quality Setup/implementation costs, new processes
Failures in the cold chain, i.e. cannot guarantee produce remained at correct temperature	W, R (L)	Vehicle & equipment maintenance Educate transporters on better handling Smart labelling and software to track through supply chain Improved communication throughout supply chain	Costs of equipment Lack of a legal standard Multiple stakeholders & unclear ownership/ responsibility of waste
Incorrect packaging/labelling	W, R (U)	Educate suppliers on importance of correct packaging and labelling, improved quality control in supply chain Sell through alternative channels	Staff disengagement Machinery malfunction
Short shelf life / spoilage, e.g. food unsold or stored for too long	W, R (W, R)	Work with suppliers to introduce or improve packaging to extend shelf life, or indicate climate control failure Logistics companies ensure climate control standards maintained	Costs of R&D for new packaging, costs of packaging materials and labour for packing produce Regulation needed
Insufficient remaining shelf life (use by or best before dates)	W, R (W, R)	Staff training (inventory control, stock rotation) Sell through alternative channels, transform into other ready-to-eat food products (e.g. cooking meat, ready-to-eat salads/soups)	Insufficient data collection
Product or packaging damaged during handling, storage, stocking shelves	W, R (W, R)	Standardisation of procedures, staff training	Staff disengaged Competing priorities
Products surplus to requirements, e.g. over-ordering, cancelled orders, demand less than forecast	W, R (W, R)	Improved forecasting, communication with suppliers Real time monitoring of sales & inventory along supply chain from supplier to retail	Costs of implementation Competitive value of data
Damage by consumers handling, 'picking over' fresh produce on shop floor and/or falling off displays/shelves	R (R)	Store signage highlighting effect of mishandling, e.g. tips for choosing ripe produce without squeezing Review and amend display and shelf design, add/adjust packaging	Consumer ignorance/ disengagement
Product recalls	W, R (U)	Improved quality control in supply chain	None specifically identified

Indicates the sector in which waste **occurs, and in brackets the sector where waste is **caused.** W = Wholesale/retail distribution, R = Retail store, L = Logistics/transport, U = Upstream (i.e. producer, processor or manufacturer).*

Food rescue

Where food is unable to be sold by the retailer and is at risk of becoming food waste, the next stage of the food waste hierarchy is food rescue, which enables the food to be redistributed to people at risk of hunger, ensuring that the food is still eaten.

All of the major supermarket chains have existing relationships with charities that recover edible food for redistribution to people in need, including Foodbank, OzHarvest, Second Bite, FareShare and local charities. This edible food includes excess stock, product which is close to use-by / best-before date labelling, or produce that may be slightly blemished and therefore unsaleable.

The following volumes of rescued food were reported by major Australian retailers:

- Woolworths reported donating more than 4,200 tonnes of food to food rescue in FY2016 (compared to 50,000 tonnes reused or recycled; amount sent to landfill unknown)
- Metcash reported donating 261 tonnes of food in 2016 (compared to 1,511 tonnes of food waste sent to landfill).

Table 5 summarises some of the reasons why edible food is not always diverted to food rescue organisations from retail stores, opportunities to divert more food and barriers to change.

Table 5: Opportunities to improve food rescue from wholesale and retail

Reason for waste disposal, i.e. not going to rescue organisations	Sector occurs	Opportunities	Barriers
Lack of information / uncertainty about regulations governing food waste donation	W, R	Promotion and dissemination of existing Food Donation toolkit and other resources on regulations around Donations to businesses Staff training	Limited time and competing priorities
Duplication of effort, inefficiencies, inconsistent requirements of different rescue organisation	W, R	More dialogue and resources to support collaboration between industry and all food rescue organisations	No formal process for collaboration
No formal, coordinated process to rescue food from individual stores – initiatives are ad hoc & rely on initiative of individual store managers and managers of different departments e.g. fresh food, bakery	R	Business policy & procedures for food rescue	Limited time, resources to implement
Insufficient or inadequate space / equipment / infrastructure within store to separate rescued food prior to delivery / collection by food rescue organisation	R	Work with food rescue organisations to ensure adequate space / infrastructure	Limited time, resources to implement, access to funding
Lack of space on back dock for food waste collection (retail)	R	Planning for new stores to include mandatory allocation of space for recycling bins	Local Government willingness to act Different services and infrastructure between recycling organisations

Reason for waste disposal, i.e. not going to rescue organisations	Sector occurs	Opportunities	Barriers
No local options easily available for food rescue	R	Food rescue organisations to expand capacity and tailor collections to suit the needs of the food wholesale and retail sectors, e.g. sometimes they can't collect every day or at the right time	Access to funding Retail staff not aware of local rescue operators Inadequate communication between food rescue organisations and food wholesale and retail sector
Insufficient options in rural and regional areas to rescue & redistribute food	R	Investment by food rescue charities to improve capacity to collect in these areas	Access to funding
Exceeded shelf life or date labelling therefore unable to redirect to food rescue organisations	W, R	Early identification systems	Cost of implementing data capture systems
Rescue organisations unable to use all available stock, e.g. ad hoc pallet loads or large volumes of one food type like bakery	W, R	Coordination between rescue charities Establishing/expanding online marketplaces Increased cool storage of fresh produce Package fresh produce in volumes suitable for smaller agencies to collect over a couple of days	Limited population and demand in regional areas, complexity of transport to other areas

W = Wholesale/retail distribution, R = Retail store.

Food reuse

When all efforts to reduce food waste or donate to food rescue organisations have been exhausted, then the next stage in the food waste hierarchy is food reuse. This refers to unsaleable food being separated and collected to donate to farmers for diversion to animal feed, restricting the amount of food waste going to landfill. This practice is more common in regional/rural areas where the distance to farms is shorter.

Currently in Australia a number of major retailers indicated they divert food waste to animal feed:

- Woolworths reports that currently about half of its 1,000 stores have a farmer donation program. It donated approximately 40,000 tonnes of food to farmers for animal feed, its most significant diversion activity.
- Coles reports that donations to farmers for feed is on a store by store basis. They were unable to provide volumes but report they are working to improve their capture of data.
- Anecdotes suggest stores of some retailers in rural areas have informal arrangements with farmers not captured through central systems.

Table 6 summarises some of the reasons why food is redirected to food reuse (e.g. animal feed) from distribution centres and retail stores, opportunities to divert more food, and barriers to change.

Table 6: Opportunities to improve food reuse (to animal feed) from wholesale and retail

Reason for food reuse, i.e. diverting to animal feed	Sector occurs	Opportunities	Barriers
Misshapen, blemished, damaged or otherwise edible but unable to be sold through store	W, R	Send to on-farm animal feed	Cost establishing relationships, storage and logistics Food safety regulations
Exceeded shelf life or date labelling therefore unable to redirect to food rescue organisations	W, R		
No local options easily available for food rescue	R		

W = Wholesale/retail distribution, R = Retail store.

Food recycling

Where food is unable to be rescued or reused as animal feed, the final stage of the food waste hierarchy that enables food to be kept within the food supply chain system is food recycling, where food waste is processed into products such as compost, fertiliser and soil conditioner which can be used as inputs into food production. In some cases, energy can also be recovered through recycling processes.

There are many different food recycling technologies, applicable at different scales that turn food waste into useful products, such as:

- anaerobic digestion (methane, fertiliser)
- composting/dehydrating (fertiliser, soil conditioner)
- worm farms (fertiliser).

During interviews the wholesalers and retailers expressed concern about the lack of sufficient collection services for food waste to allow them to recycle or recover food waste from all sites, particularly outside Sydney and in other jurisdictions. The only facility that was specifically mentioned by industry stakeholders was Earthpower, a joint venture between Veolia and Cleanaway. Located in Sydney, the facility is operating at capacity of around 52,000 tonnes per annum. Approximately half of this comes from the wholesale and retail food sectors. Feedback from Earthpower suggests that the company is operating at capacity and can be selective about the amount of food organics they accept. They do not accept waste with more than 5% packaging, which would be a major barrier for retailers like ALDI with high proportions of packaged produce.

Our research identified that major retailers currently only divert small amounts of food waste to recycling, mostly in NSW, and data collection is poor. The major retailers reported the following:

- Woolworths recycled approximately 15,000 tonnes of food was from individual retail stores, with only a small amount (less than 3,000 tonnes) from its distribution centres. Food waste is recycled through both anaerobic digestion and compost.
- Coles does not have data on the volume of food waste that is recycled. However, in Sydney they send some food waste to Earthpower for recycling and in WA some organics are sent to Richgrow, which has a depackaging facility. They are also trialling on-site food digesters.
- Metcash reported that only a small amount of food waste is diverted for soil injection, and only in NSW via Earthpower. They do not have data on volumes recovered and are unaware of whether food waste is recycled in other states. They are currently working with their major contractor to develop better data.
- Anecdotes suggest that some operators will not accept waste from supermarkets with high proportions of packaged products.

Table 7 summarises opportunities and barriers to recycling of food waste to composting or digestion processes.

Table 7: Opportunities for food waste recycling from wholesale and retail

Reason for food recycling	Sector occurs	Opportunities	Barriers
Staff not aware or not willing to source separate food waste from general waste, despite a system being available (wholesale, retail)	W, R	Improved education – about food waste, what they should do to manage it, and why they should care (motivation)	Cost to stores e.g. training
	R	Large retail chains: Benchmark stores against each other to motivate them to improve / provide financial incentives	Staff disengagement, competing priorities
Insufficient financial motivation to source separate	W, R	Government ban on disposal of food waste Increased landfill levy	State Government willingness to act Different State Government approaches – national consistency
Lack of space on back dock for food waste collection (retail)	W, R	Planning for new stores to include mandatory allocation of space for recycling bins	Local Government willingness to act Different services and infrastructure between recycling organisations
Cost of food waste recycling compared to general waste collection (heavy product, additional bins, pick-ups & transport and processing)	W, R	Educating managers on true costs/benefits, e.g. weight-based food waste collection vs volume based general waste	Limited knowledge, no easily accessible information
	W, R	Innovation, more efficient solutions from waste service providers to reduce costs	Length of existing contracts Willingness of waste services providers to provide service
	W, R	Increase cost of disposal to landfill, e.g. food waste levy	Government policy
Limited number & capacity of food rescue and food waste recycling facilities, particularly in regional / rural areas	R	Investment in food rescue infrastructure	Cost to implement
Lack of data on types of waste, where/why it occurs and how it is managed	W, R	Build data requirements into waste service contracts for end of life management (how much and where does it go?)	Willingness of waste services providers to provide service Cost of establishing instore-data collection and reporting systems
	W, R	Establish internal data collection systems on where and why waste occurs, how it is managed (mark down, rescue, farmers, compost, energy recovery)	Information on best software to use, appropriate metrics
Packaged food: packaging is a contaminant in the organic waste stream so most often goes to landfill. No depackaging unit in Victoria.	W, R	More equipment to separate food waste from packaging (depackaging units) installed at compost/ energy recovery facilities	Cost to implement

W = Wholesale/retail distribution, R = Retail store.

3. DISCUSSION & CONCLUSIONS

The clear message from the consultation with major food retail chains, fresh food wholesale/retail markets and logistics service providers is that they know they need to reduce food waste, they would like to do more, and are keen to partner with the NSW EPA to find solutions.

SOURCES OF WASTE

A key finding of the research is that much of the food waste that ***occurs*** at the wholesale and retail stages of the supply chain is actually caused (or influenced) by practices at earlier stages. This distinction is shown in Table 8 below, along with a summary of the sources of food waste identified during the research.

Table 8: Summary of where waste occurs and is caused

Source of waste	Sector at which waste:					
	Occurs		Caused			
	R	W	R	W	L	U
Product/packaging damaged during transport	✓	✓			✓	✓
Rejected for safety e.g. incorrect temperature management	✓	✓			✓	
Rejected for quality, e.g. aesthetic standards	✓	✓	✓			
Returned due to incorrect packaging/labelling, product recalls	✓	✓				✓
Surplus to demand, e.g. poor forecasting/inventory, mispicks, promotions	✓	✓	✓	✓		
Product/packaging damaged by handling e.g. packing, stacking, shelving	✓	✓	✓	✓		
Spoiled early e.g. due to lack of climate control during transport	✓	✓			✓	
Expired: low demand, poor rotation, misunderstanding dates	✓		✓	✓		
Spurned by customer, e.g. for appearance, shelf life, new product fails	✓		✓			

R = Retail store, W = Wholesale/retail distribution, L = Logistics/transport, U = Upstream (i.e. producer, processor or manufacturer).

OPPORTUNITIES TO ACT

Most of these organisations are already taking action with initiatives ranging from avoidance and minimisation through to food donations and source separation for recycling. It should be noted that the activities of the large businesses consulted for this research may not be representative of the sector as a whole; while all of the major supermarket chains and several large wholesalers were consulted, only two small retailers were able to be interviewed.

All of the industry stakeholders that were consulted for the research, including wholesalers, retailers, waste management companies and food rescue charities, were able to identify numerous opportunities to *further* reduce or recover food waste. These opportunities can generally be classed into one of the following 7 categories:

1. Supply chain system – organisation and information sharing
2. Product/packaging design/selection
3. Business technology/equipment/facilities
4. Business systems/software
5. Business policies/processes
6. Staff practices
7. End of life services.

A summary of the opportunities is presented in Table 9, with the relevant category from the above list indicated in brackets.

Table 9: Summary of options to reduce food waste in the wholesale and retail sectors

Understand	Avoid	Repurpose	Reuse or Recycle
Waste data capture & analysis [4,5]	Better forecasting / inventory mgmt. [4,5]	Transform into new private label products [2,5]	Improve source separation [3,5,6]
Value chain mapping [1]	Better handling / stacking, rotation processes & training [4,5,6]	Sell through alternative channels [5]	Establish relationships with farms/logistics for animal feed [1,3,5,6]
Knowledge sharing across supply chain (causes of waste and opportunities) [1]	Aesthetic standards, consumer education [5]	**Rescue**	Collation & collection services for SMEs [1,7]
	More / improved, smarter packaging & labelling [2]	Share/improve available information on rescue [1,7]	More infrastructure for processing (onsite + offsite) [3,7]
	Better handling/ climate control during transport [1]	Improve separation/ storage at source (facilities) [3,5]	Separating food from packaging [3,5,6,7]
	Executive KPIs / store benchmarking [5]	Coordination between rescue organisations [1,7]	Executive KPIs / store benchmarking [5]

BARRIERS TO ACTION

The barriers to implementation of these opportunities have been grouped into six categories, and these are discussed individually below:

1. limited knowledge
2. inadequate existing infrastructure and facilities for rescue, reuse and recycling
3. insufficient industry coordination
4. costs of implementation
5. lack of appropriate business policies and procedures
6. consumer perceptions.

Limited knowledge

There are clearly many knowledge gaps that limit the ability of wholesale and retail businesses to reduce waste. Some of these are illustrated in Figure 9.

Further consultation with the wholesale/retail industry on their specific knowledge gaps would be valuable to confirm the most appropriate responses (see Recommendation 1 in Section 4). In general, however, it appears that these gaps could be addressed through a combination of:

- **Guidelines, tools and information sheets** that could be downloaded from a dedicated and expanded section of the NSW EPA website.
- **Peer-to-peer learning**: provide opportunities for industry members to learn how industry leaders and others in the same sector are tackling the problem, how progress has been achieved etc.
- **Sector-specific research** funded by NSW EPA in collaboration with industry.

More specific knowledge gaps and targeted approaches to addressing them are discussed briefly below.

Figure 9: Knowledge gaps and barriers to food waste reduction and diversion

Where waste occurs and why

As one workshop participant said "*If you can measure it you can move it*". This is at the core of being able to manage food waste. The large supermarket chains are starting to explore data management systems, metrics and targets. Options for NSW EPA assistance include:

- Information on data management systems used elsewhere to measure and monitor food waste
- Guidelines and templates to identify sources of food waste and opportunities for improvement. An example is the Waste and Resources Action Programme's (WRAP) resource efficiency toolkits to assist companies to identify and address waste (e.g. for fresh produce) and RMIT's DIRECT tool for food manufacturing
- More detailed industry research on sources/reasons for waste in very specific food supply chains.

Opportunities to reduce food waste

Companies expressed a keen interest to know what else they can do, including what is working well for others.

- To address this gap, best practices could be consolidated in a series of best practice guidelines and case studies.

Reuse and recovery options

Some of the companies that were interviewed knew very little about available diversion options, beyond existing relationships with local farmers or food rescue organisations. Several expressed interest in knowing more about the alternative recycling technologies.

- Guidelines could be developed with a description of the technologies, their environmental benefits, costs, and the circumstances in which they could best be used. There are some existing resources, e.g. the Victorian food organics recycling guide.

Available grants and resources

Companies asked for more information on what grants and support are available from the NSW EPA or other government agencies.

- This could be provided through a marketing/promotion campaign for the grants targeting wholesalers and retailers, a more easily accessed section of the website (e.g. the dedicated food waste section mentioned above), and a simple information sheet with contact details.

Regulatory issues

Insufficient information or uncertainties around government regulations were also raised, relating to:

- food donation (relevant laws and what can and cannot legally be donated for human consumption). There is some existing information on the NSW EPA website. This could be disseminated to the wholesale/retail food sectors through a targeted marketing campaign, along with other resources on waste reduction.
- best-before and use-by dates (regulation and lack of industry alignment). This could be addressed through a voluntary industry initiative to develop standard guidelines that reduce the potential for avoidable waste.
- Inadequate infrastructure and facilities - food wholesalers and retailers are constrained by the limited number of facilities that can recover food waste for donation, composting or anaerobic digestion.

Food rescue

The ability of wholesalers and retailers to donate edible food to charities is limited by a lack of infrastructure and services outside metropolitan areas. OzHarvest also provided feedback that they have limited capacity and are unable to manage large volumes of food that can often occur in the supply chain at short notice. EPA already provides grants to food rescue organisations through the Organics Infrastructure (Large and Small) Program. Further consultation with industry would be required to understand if any modifications to the program are required to address these barriers.

Food recycling

Feedback from interviewees suggests that waste management infrastructure for collection and recycling of food waste is also limited. Earthpower, for example, recently received a grant from EPA to enable it to process more food waste, but apparently operate at capacity or close to capacity. Earthpower reported that there is more food waste in the market than they can process, and they can therefore be selective about which material they take. According to NSW EPA other recyclers such as ANL are not operating at capacity.

The increasing amount of packaged food waste is a constraint to recycling. Earthpower, for example, employs de-packaging machinery in its process but can only manage contaminated rates (i.e. the presence of packaging) of less than 5%. This is particularly an issue for retailers with high levels of packaged produce, which is not currently suitable for anaerobic digestion. Manual separation of food waste from packaging is cost prohibitive for both retailers and recycling organisations. One of the potential solutions is the installation of more depackaging units within the waste management and recycling sectors to remove contamination and open up additional markets in compost and animal feed. Current examples include equipment used by Earthpower and at SUEZ's Camellia Resource Recovery and Treatment Facility. The installation of more depackaging units could be facilitated through the NSW EPA's Waste and Recycling Infrastructure Fund.

This problem is likely to become more widespread in future. The local and international trend is for a shift away from loose fresh produce towards more pre-packed and processed foods (Verghese et al, 2015).

Industry collaboration and coordination

A number of the opportunities discussed below are limited by a lack of industry collaboration or coordination.

Consistent metrics for measuring food waste

Organisations are increasingly becoming aware of the need to improve the data capture and recording of what products become waste and which destination they are diverted to. While existing internal databases and stock inventories are being amended to capture more insights, there is no consistent methodology or approach being used. This presents an ideal opportunity to educate organisations about the *Global Food Loss and Waste Protocol*, which has been developed through a global collaboration and establishes an agreed framework and methodology for data collection and measuring food waste (see Appendix B3 for more details).

Food rescue

There is often a disconnect between the food that is rescued by charities and what they need or can process. They have to be as responsive as possible and take what they can. However, there are times when 'too much of something' becomes available and this can introduce barriers to collection and redistribution through the food rescue networks. EPA could provide financial support to either food rescue organisations or wholesales/retailers install adequate infrastructure to enable food rescue, e.g. refrigeration or transportation that allows the maintenance temperature control of perishable products during storage prior to pick up by food rescue organisations. Innovation grants could also help explore new models for food rescue, e.g. virtual marketplaces listing what products are available, collaboration across charities to align practices, supporting food rescue organisations and waste management companies to work together directly so that all food goes through one channel, and is separated by the enhanced charity/waste company to send edible food for rescue and inedible food for recycling.

'Best before' dates

There is ongoing confusion about the meaning of 'use by' and 'best before' dates by both retailers and consumers. While 'use by' dates are a regulated food safety measure, 'best before' dates are more subjective and open to interpretation. While this is recognised as an issue, some workshop participants suggested that this is an area that requires coordinated industry action. An agreed standard would ensure that best before dates are used appropriately and their meaning communicated to manufacturers, wholesale/retail staff and consumers. NSW EPA could facilitate this through an industry working group in conjunction with for example the Australian Food and Grocery Council (AFGC) and Food Standards Australia.

Improved communication/coordination through the supply chain

Numerous barriers to food waste reduction were identified through the research, based upon the various sectors in the supply chain failing to communicate with each other, or deliberately withholding information due to confidentiality concerns. Insights provided by Refrigerants Australia in particular noted that the logistics sector are often unaware of what they are moving and the specific needs of that produce to prevent waste.

Factors affecting food at the manufacturing, wholesale or logistics stages of the supply chain (e.g. extreme weather or insufficient refrigeration) may greatly decrease the shelf life of produce without the retailer being aware this damage has occurred, preventing proper planning to prevent wastage. This lack of communication also prevents the supply chain from predicting and adjusting for variances in supply and demand, resulting in oversupply and waste as a result.

Facilitating industry-government collaboration

There appears to be scope for a voluntary industry network to share ideas and identify opportunities for collaboration, e.g. through meetings/events or a community of practice. NSW EPA could explore a number of collaborative opportunities, potentially working with the Office of Environment and Heritage (OEH) to leverage the existing network of Sustainability Advantage food industry members and their wholesale/retail stakeholders.

Opportunities that could be explored include:

- interest in a voluntary industry commitment to food waste reduction, similar to the UK Courtauld Commitment. Discussions could be facilitated by NSW EPA. Ideally, a consistent national approach would be taken in collaboration with the Australian Department of Environment and Energy's product stewardship team.
- voluntary industry alignment (or regulate) 'use by' and 'best before' dates (alongside consumer education) to reduce confusion (done in conjunction with food processors/manufacturers). This project could be coordinated by NSW EPA and/or OEH or it could be one of the industry commitments under a Courtauld-style agreement with government.

Costs of implementation

The additional costs borne by organisations of food recycling compared to landfill were mentioned by several interviewees. This is associated with additional transport costs and the need for additional bins for source separation.

Suggestions that were provided by interviewees and workshop participants to address this included:

- a ban on commercial quantities of food waste going to landfill, which would provide a strong business case for action despite the additional cost
- planning laws mandating sufficient space in retail facilities for source separation
- direct subsidies to wholesalers/retailers for each tonne of food waste recycled through the landfill levy.

While these options are beyond the scope of this project there are other complimentary and specific activities that could be supported by NSW EPA to encourage further action:

- **Industry education:** Companies can reduce their waste disposal costs through the use of weight- rather than volume-based charging, with any savings used to pay for food waste recovery.
- **Source separation and recycling:** NSW EPA could reduce the costs of source separation and recycling by providing infrastructure grants for bins, depackaging equipment or on-site processing facilities through the Organics Infrastructure (Large and Small) Program and/or an expanded Bin Trim rebates/ equipment program.
- **Technical expertise:** Companies are constrained by limited staff resources to investigate waste reduction and diversion. NSW EPA could assist by providing technical assistance (consultants) to work with companies to undertake resource efficiency mapping.
- **Education and training:** Several interviewees identified staff education and training as an important strategy to improve food handling and waste diversion. Some organisations have started to raise awareness of food waste and separation through staff induction and training, but these activities could be supplemented with in-store visual information such as posters to extend the communication. The costs of these programs could be subsidised by NSW EPA.

Business policies and processes

Some of the barriers to food waste reduction and diversion relate to issues in the supply chain, such as inadequate communication and a lack of clarity around who 'owns' particular occurrences of food waste. This is a concern in the wholesale/logistics part of the supply chain, which one workshop participant described as the 'grey area'. One example provided is that sometimes when food waste is generated it is not clear who is responsible, i.e. the manufacturer, logistic-transport company, or the wholesaler/retailer that is holding the product. Delays in decision making often mean that the food is then unsuitable for donation to charity. One of the solutions mentioned is the need for clear policies and procedures.

Other barriers that were mentioned include:

- **lack of a corporate policy or target:** for food waste reduction
- **poor internal communication:** there is sometimes lack of awareness that a decision made at one part of an organisation can have flow on effects to other parts of the organisation. A participant at the workshop mentioned that procurement or those receiving product at the retailer DC are rejecting pallet loads of product because of damaged packaging and sending it back to the manufacturer – when in fact it could be directed to store and or food rescue
- **lack of clear procedures for donation**, e.g. discounting food to sell it before the best before date but not freezing it the last night so that it can still be donated to charity
- **retail product display policies** that build in a certain level of waste, e.g. for bakeries to have a full range of products on display even at the end of the day
- **strict retail specifications for fresh produce** (discussed under 'consumer perceptions' below), based on the assumption that supermarkets will lose market share if their produce is less than perfect.

While business policies and processes could be considered outside the NSW EPA's ability to influence, they could assist by providing guidelines and case studies (see 'limited knowledge' above).

Consumer perceptions

During interviews and the stakeholder workshop there was discussion about retailer specifications for fresh produce and who is driving the focus on visual 'perfection'. Manufacturers, processors, wholesalers and retailers are responding to consumer demand for quality produce, and fear losing market share if their produce is perceived to be of a lower quality than their competitors. Several retailers have introduced small-scale initiatives to sell less than perfect produce, for example Woolworths' 'Odd bunch' product lines, but at present these are relatively limited. More extensive changes to product specifications are unlikely to occur at present because of conflicting internal policies and competitive pressures. As one interviewee commented, '*No one is going to move in this industry unless everyone moves'*.

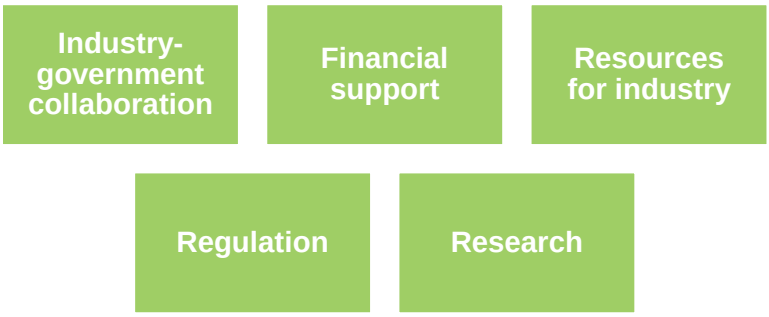
Bakery products face a similar problem. Feedback from a manufacturer and retailers is that consumers expect to see a full range of product in store at all times, even at the end of the day. Given that bread is one of the core products that brings consumers to the store, retailers aim to meet this demand despite the fact that it generates waste from unsold products. Food rescue charities are generally offered more bakery products than they can use on a daily basis. In some cases, the products are not appropriate for their clients. One example mentioned at the workshop was the inability of clients with poor dental health to eat crusty bread, so the preference is often for soft white bread rather than the many other types of bread sold in supermarkets and bakeries.

There may be an opportunity for NSW EPA to support a national market research and consumer education campaign that explores these issues in more detail. This could fall within the scope of the National Food Waste Strategy, which the Australian Department of Environment and Energy is currently developing in conjunction with key industry groups.

4. RECOMMENDATIONS

This section presents detailed recommendations that NSW EPA could explore to assist organisations in the food wholesale, logistics and retail sectors to reduce or divert food waste from their operations. The recommendations fall into six categories, presented in Figure 10.

Figure 10: Recommendation categories



Facilitating industry-government collaboration and voluntary commitments

1. **Establish a NSW EPA/food industry working group to inform the development/refinement and ongoing implementation/promotion of NSW EPA food waste programs for the food retail/wholesale sector.**

   The number of opportunities to reduce food waste (and the associated barriers) identified through this research is large, with sometimes wide variation across different business types. The list of recommendations is therefore also large and due to time available inevitably somewhat high level, and in some cases dependent on further research to clarify/prioritise. Further, a number of the recommendations relate to more targeted refinement and/or promotion of existing NSW EPA support rather than entirely new programs.

   The level of interest from those stakeholder groups who engaged with the research (particularly larger food retailers, food manufacturers and service providers, e.g. food rescue and waste recycling) was high, and most expressed a keen willingness to collaborate and assist the NSW EPA.

   We therefore recommend that the NSW EPA setup an industry working group with representatives from across the food supply chain to liaise on the further refinement and implementation of these recommendations, and the ongoing promotion of EPA programs to the sector. In the future, this could also be used to target food waste at other stages of the supply chain, such as on farm, manufacturing/processing, and industry actions to reduce consumer food waste.

2. **Continue to work with the Australian Department of Environment and Energy (DEE) and other jurisdictions on national opportunities through the development of the National Food Waste Strategy, including specifically:**

   a. **Investigate the potential for a voluntary product stewardship program for food waste reduction, similar to the UK Courtauld Commitment.**

      The UK Courtauld Commitment is a voluntary agreement with the food supply industry to reduce food (and associated packaging) waste across the entire supply chain. It brings together and supports players from each stage of the supply chain to set targets and take action to reduce both their own food waste and food waste generated up- and down-stream over which they have some control of influence.

      Due to the national nature of the Australian food supply chain and business structures of major food retailers, manufacturers and other industry players, the greatest benefit would come from a coordinated national stewardship scheme. The EPA could undertake preliminary discussions with the four major retailers to test their interest in this proposal before taking it to DEE and the Senior Officials Group for further discussion.

b. Roll out of a consistent data collection and benchmarking framework that is aligned to the *Global Protocol on Food Loss and Waste*.

The Global Protocol sets out global definitions and reporting requirements (see Appendix B3). The aim is to enable companies, countries and others to consistently and credibly measure, report on and therefore manage food loss and waste. Use of the protocol in NSW and across Australia would bring a number of benefits, including the ability to make comparisons between companies, industries, states, and between Australia and other countries. Use of the protocol could also be pursued independently in NSW.

Financial support for the wholesale/retail sector

3. Continuation of Bin Trim program (plus associated rebates for food waste recycling equipment) for SME food retailers/wholesalers, with additional business process audits and a strong focus on food waste avoidance strategies.

The current Bin Trim program is available to Small-to-Medium Enterprises (SMEs). Under the program EPA provides the business with access to an independent assessor, who conducts a free waste and recycling assessment and produces a tailored action plan. In addition, businesses may be eligible for a rebate of between $1,000 and $50,000 to help with the cost of recycling equipment. With its focus on all waste streams for a business, the current Bin Trim tool collects information at the generic 'food waste' category.

Given the EPA's priority on food waste in the food wholesale/retail sectors, we suggest that the Bin Trim process could be expanded to include a specific food waste module for this sector (and similarly for food service/hospitality) that:

- involves a more detailed business process audit and captures detailed data on food waste, including volumes, types, source of waste and root causes
- has a strong focus on avoidance to help businesses reduce food waste as much as possible in addition to diversion (the current focus is generally on recycling rather than avoidance)
- provides a more detailed action plan to the business with explicit references to the tools and resources developed under Recommendation 8 below (expansion of Love Food Hate Waste education resources). EPA could also consider delivering this through or in combination with the Love Food Hate Waste education grants.

It is recommended that the quantitative data collected through the program and the actions taken by businesses in response is collated by the EPA to inform future funding priorities and refine education materials.

4. Extension of the Bin Trim program to larger food retailers and wholesalers plus associated grants or technical support (consultants) for business to conduct detailed value chain mapping exercises to identify volumes and causes of food waste along the supply chain.

Large food retailers report difficulties in measuring food waste across individual stores, limiting their ability to quantify the impact of initiatives on food waste. The Bin Trim process with an additional food waste module could be adjusted and extended to larger businesses in these sectors. We recommend a cost-sharing arrangement rather than a free service, given the financial resources available to these businesses and the likely return on investment from food waste reductions.

A key element of the process for large retailers will be designing a data capture process for consistent use across the business' stores/warehouses. The associated Bin Trim rebates could be extended to cover the cost of purchasing data management software, or the use of a service such as LeanPath (see Appendix C4) which helps companies measure, track and report on food waste reductions with the help of an online tool and consultant.

The Bin Trim program could also include access to a specialist technical consultant, or grant/rebate for the cost of such, to enable large businesses to conduct a detailed value chain mapping exercise. This would involve observation and analysis of all business processes in the chain to identify any that contribute to food waste and other unnecessary costs. Value chain mapping is often undertaken using a combination of cross-functional workshops and a 'walk-through' audit of all of the activities across the full supply chain (ie. with partners upstream). Information collected from both the initial assessments/process audits, and the value chain mapping exercises should be collated by the NSW EPA.

5. **Split the existing Love Food Hate Waste (LFHW) education grants into clearly separate consumer and business grants, and allow the business grants to involve food waste education activities for both large and small businesses, focused on the following 3 activities: Educating food retail/wholesale SMEs (existing), educating executives/decision-makers of major food retailers (new), educating general staff of major food retailers (new). Make available to grantees a suite of the resources from Recommendations 8 and 9 below, as per current practice. Explore the potential to align the LFHW business grants with the Bin Trim program to enable comprehensive support to businesses.**

   Currently the focus of the LFHW food waste avoidance education grants is on consumers, with only 20% of the funding and projects focused on business. Further, despite an explicit invitation for Round 4 applicants to target businesses using the new LFHW business toolkit, no funds were awarded for business projects in 2016. We therefore recommend splitting the LFHW grants into separate grant programs for consumers and business. This will have two benefits: focusing grant applicant attention on the business sector, and also allowing for the alignment of LFHW and Bin Trim grants to provide comprehensive support to businesses by providing waste assessments and education activities/resources together, as well as capturing quantitative outcomes data on LFHW education activities in the same format as Bin Trim (allowing NSW EPA to quantify the additional benefit of LFHW education activities over Bin Trim).

   In addition, major industry stakeholders recognise the importance of both executive leadership, and staff education and training to reduce food waste generated through poor handling and storage policies and practices, and to encourage more source separation of food waste where these systems are in place. Financial support from EPA would encourage companies to implement educational initiatives that would not otherwise be undertaken due to lack of resources, or to undertake them more quickly. However, currently the business target audience of current LFHW grants is limited to SMEs in the food retail/hospitality sectors. We therefore recommend increasing the scope of the LFHW business grants to be extended to bigger businesses. Currently applicants and their partners must fully match requested funding with cash and/or in-kind. Noting the resources and expected return on investment for major retailers, we further recommend that applications for activities with major food retailers should be done in partnership with the retailers, and the retailers should be expected to make a cash contribution to the project equal to a certain percentage of requested funds, the threshold to be decided by the NSW EPA. To ensure businesses can demonstrate their return on investment, applications should include specific quantitative KPIs set by the business, and collect data against these KPIs (in addition to any Project Measures required by the NSW EPA).

   Further, for the education with major retailers, we recommend the NSW EPA specify two types of education activities: education of executives/decision-makers of major food retailers, and education of general staff of major food retailers to be undertaken separately or together. Grants for the former would focus on education and training of executives/department managers with regard to opportunities in categories 2, 3, 4 and 6 (product/packaging design/selection, business technology/equipment/facilities, business systems/software, business policies/processes and end of life services, specifically food rescue – see Table 9). Grants for the latter would focus on staff practices (category 5), and could include the production of educational materials (e.g. production of a training video) and/or delivery of training.

6. **Extension and better promotion of existing grants/incentives for infrastructure/equipment for retail/wholesale trade food waste recycling:**

   a. **Source separation equipment (e.g. bins, signage) at wholesale/retail facilities to support recycling**

   b. **Expansion of food donation grants program to include onsite collection/storage equipment at wholesale/retail facilities**

   c. **Onsite processing/recycling equipment at wholesale/retail facilities (composters/dehydrators/ digesters)**

   d. **Offsite commercial organics processing, including depackaging units, processing equipment, collection service infrastructure (e.g. trucks), etc**

The literature review and stakeholder research identified that a lack of available or affordable services, infrastructure and equipment was a key barrier to food rescue and recycling.

In some cases, the above are already eligible under existing infrastructure grants, and the priority is to increase awareness of them amongst the target sectors.

Should the further research under Recommendation 16 suggest a clear hierarchy in terms of onsite/offsite or digestion/composting approaches, the funding for the infrastructure should reflect this.

7. **Funding to trial *innovative* commercial collection services, for both food rescue and food recycling, combined with food rescue/recycling services.**

   A key barrier to food waste rescue and recycling identified in the literature and confirmed in the stakeholder research was the difficulty in collecting food for either donation or offsite commercial recycling, particularly for SME food retailers, and small and large businesses operating in regional/rural areas.

   A number of potential opportunities and examples were identified in the literature that could overcome this barrier for SMEs, including reverse logistics from retailers back to wholesalers/distributors and precinct collection and/or 'bring bank' spots for SMEs. These models involve collaboration across multiple businesses and would require initial feasibility research and stakeholder engagement in order to setup.

   We therefore propose a funding stream available to organisations such as Councils, shopping centres, resource recovery companies and not-for-profits/community organisations to support the research and development of such collection services. This funding stream should also provide for opportunities to trial innovative services for regional/remote locations.

Resources for industry

8. **Build separate consumer and business channels for LFHW, and target food retailers in parallel with existing food service resources.**

   The knowledge gaps that were identified in Section 3 are constraining the ability of food wholesalers and retailers to reduce food waste through avoidance, rescue or recovery. The research for this project found that while companies in the wholesale/retail sectors are very engaged in food waste and keen to do more, they often lack the staff resources or time to undertake the research required to design and implement food waste reduction programs.

   LFHW is the current channel for providing food waste education to consumers and businesses; however the current focus of business information and resources are focused on restaurants, cafes and food service businesses. Existing online information and resources, as well as the new ‘Your Business is Food’ resources could be adapted and extended to the food wholesale/retail sectors, in line with Recommendation 9. Similarly, resources developed by grant applicants in the LFHW avoidance grants programs could be reviewed and adopted.

   In addition, following international examples, we recommend that food waste education for business be undertaken through a dedicated business channel, with web presence and messaging specifically developed for a business audience. Currently LFHW resources are provided to both consumers and businesses through the same website. This is the only example we could find in our literature review, where information and resources for consumers and businesses were packaged together through the same channel.

   A general finding of the research was that many businesses were not aware of existing support or resources provided by the NSW EPA or other government departments (such as grants for infrastructure, or Bin Trim for individual sites). This suggests that there is a general opportunity to improve the reach of NSW EPA current communications into target industry sectors. The new ‘Your Business is Food’ campaign branding for food service/hospitality provides an excellent opportunity to develop a dedicated business web landing page and messaging to reach these business audiences, as evidence by UK WRAP’s incorporation of the Your Business is Food messaging into their business channel.

9. **Develop food retail resources, including the following:**

   a. **General tools and resources related to each stage of a business' journey:**

Getting started	• guidelines/tools for developing a food waste avoidance and diversion strategy; • guidelines/tools/training to improve understanding of true costs of food waste (purchasing, labour, waste storage, handling & disposal etc).
Measuring baseline and monitoring progress	• guidelines/tools/training for measuring and recording food waste; • information on data management systems that are available and how to link to existing data management and contracts etc; • guidelines/tools/training on identifying sources & causes of food waste (e.g. WRAP value chain mapping).
Taking action	• ideas for key actions to take; • information on better processes/practices; • resources for training staff to improve practices; • promotion of industry best practices, case studies.

   b. **Specific resources on:**

      i. **Recommendations on aesthetic standards and consumer education.** To overcome perceptions within industry that they would lose market share if they broadened their specifications, these could include suggestions for marketing campaigns designed to build consumer loyalty through food waste reduction.

      ii. **Information on food rescue, including the current Food Donation toolkit, specifics on relevant regulations and an online directory of food rescue organisations.** The research found that knowledge gaps relating to food rescue, including information on existing charity organisations and the implications of food safety regulations, are a barrier to action.

      iii. **Information on the importance of maintaining cold chain and refrigeration (work in collaboration with industry groups like Refrigerants Australia).** Food waste occurs due to equipment failures and lack of compliance with existing industry guidelines.

      iv. **Information on the role of packaging in minimising food waste and the need to design holistically with consideration of end of life waste management of packaging materials (in conjunction with groups such as Australian Packaging Covenant Organisation (APCO)).** Packaging can reduce food waste in the supply chain, but it can also be a barrier to recovery at end of life. These complex trade-offs could be addressed through the next update of APCO's Sustainable Packaging Guidelines and associated capacity building activities.

      v. **Information portal on current end of life waste management options including reuse (animal feed) and recycling. For food recycling, provide information on different facilities and technologies (e.g. composting and anaerobic digestion facilities) and contact details for key organisations working in this sector.** The research highlighted a desire by industry for more information on their options for food waste recovery.

      vi. **Information on financial support available to businesses through other NSW EPA programs/grants such as Bin Trim and Waste Less Recycle More grant programs.** The stakeholder interviews and workshops highlighted that in many cases business were desirous of financial support for activities that are already eligible under existing NSW EPA programs. However, businesses had no visibility of these existing support resources. Bringing all resources and support available to businesses into one place would facilitate the uptake of existing programs by the target sectors.

10. **Publish best practice case studies to promote adoption in similar organisations.**

Regulation

11. **Investigate the feasibility of a food waste levy/other financial mechanism, or a food waste ban from commercial premises to encourage source separation.**

12. **As per above, investigate in collaboration with other jurisdictions the feasibility of better regulating best before dates (e.g. working with the Australian Food and Grocery Council).**

Research

13. **Quantifying food waste along the supply chain for key food categories (fruit/vegetable, meat/seafood, bread/baked, dry goods).** To provide a complete view this should include food-related packaging. Data collected should be collected at each supply chain stage, and document the root causes of the waste and current end of life waste management practices (e.g. rescue, recover, landfill). This would assist the EPA and individual companies to understand and target the root causes of waste.

14. **Further research into food waste amongst SME businesses to corroborate findings from major retailers.** While the causes of food waste, opportunities for reduction and barriers to implementation amongst SMEs are likely to be similar to those for larger companies, these need to be confirmed to support the design of appropriate EPA programs. This research could be done through one of two options:

    (i) an incentivised survey amongst food retail businesses participating in the Bin Trim program. A disadvantage of this approach is that Bin Trim participants are likely to be more proactive on environmental issues than other businesses and therefore not typical of the sector, however the NSW EPA already has contact details for these business, and given their past participation this will likely result in a higher response rate, particularly with the use of incentives , or

    (ii) a random sample survey of SME food retailers in NSW. This would be more representative of the sector as a whole as participants could be selected from different sub-sectors, locations and business size categories; however the difficulties in getting responses to this research suggest that response rates for a general survey would be low, and as such it might be prone to similar levels of non-response bias as option (i).

    In addition, the research could undertake meta-analysis (review of evaluation reports) of past Love Food Hate Waste grant projects involving food retailers, and conduct primary research with project participants to understand what education activities and resources were more or less successful, in order to inform the development of resources under Recommendations 8 and 9 above.

15. **Research into lifecycle impacts of aesthetic standards and ugly food initiatives.** Retailers are introducing new product lines for ‘ugly food’ that reduce waste at the farm and processor stages, it is not known whether these initiatives reduce waste overall. There have been some suggestions, for example, that consumers who buy this produce are more likely to waste it because of the lower prices.

16. **Research into lifecycle impacts of anaerobic/aerobic digesters vs composting/dehydrators.** This would address one of the knowledge gaps identified in the research, i.e. confusion about the relative environmental impacts of existing and emerging technologies for recovering food waste. Some companies are unsure whether some technologies, e.g. dehydrators or disposal through waste water, achieve an overall environmental benefit. In addition, a number of food waste hierarchies identified in the literature review (see Appendix C2) prioritised onsite, local facilities over centralised facilities. The research should therefore take into account the scale/centrality of processing infrastructure.

Food waste opportunities within the food wholesale and retail sectors

APPENDICES

UTS:ISF INSTITUTE FOR SUSTAINABLE FUTURES

INDUSTRIAL DESIGN

RMIT UNIVERSITY

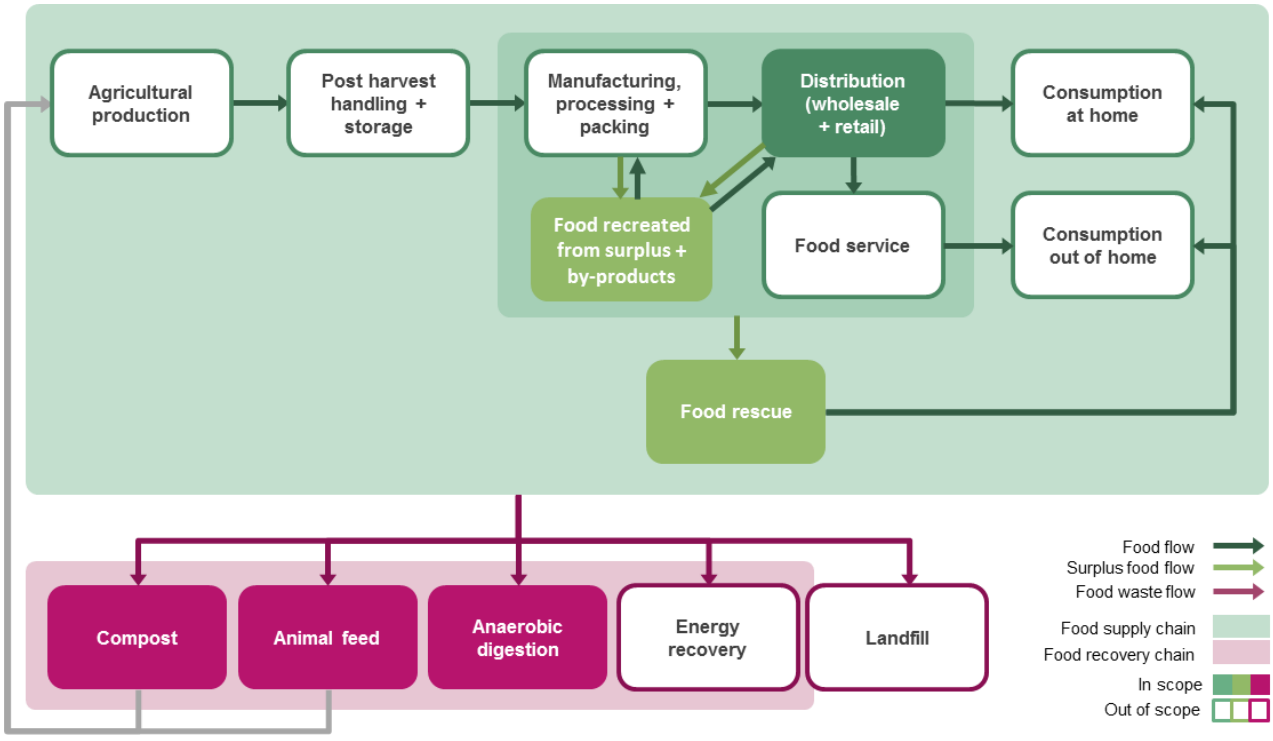
A.SECTOR OVERVIEW

A simplified overview of the food supply and recovery chain in Australia is given in Figure 11. The diagram shows that the food production system in Australia begins with agriculture (either within Australia or elsewhere) is subject to post-harvest handling, transport and storage, and undergoes manufacturing, processing and packaging. Food is then subject to further transport and storage before being sold wholesale and distributed. Finally, it is sold to consumers through food retailers, and also through the many service industries which serve or involve food – including hospitality, but also accommodation, health and aged care.

Surplus food and food by-products can be kept within the food supply chain through food rescue organisations, and the reprocessing of surplus food and food by-products into new food products. Any food waste is then disposed of in various ways, depending on the type of waste generated, and the choices of businesses. These choices might vary within the same company, such as when individual stores are independently owned (Metcash, interview, 2017). The food waste disposal pathways, include: going to animal feed, being used for nutrient recovery, compositing/ anaerobic digestion/ alternative waste treatment processing, direct selling (Earthpower, interview, 2017) or going to landfill (Riedy et al, 2010).

The key focus on this literature review is on food wholesale and retail, and the logistics between them. These sectors are together commonly referred to as the 'Distribution' stage when looking at the food supply chain (e.g. Gustavsson, 2011; Verghese et al, 2015). In addition to the Distribution stage, the other stages in scope for this review are the end-of-life channels shown in colour in Figure 11, which include repurposing and rescue of surplus food and/or reuse or recycling of food waste (as per the waste hierarchy in Figure 4). It is important to note that the Food wholesale sector also provides food to the Food service sector, but to the extent possible, this review focuses on food wholesale in order to supply food retailers.

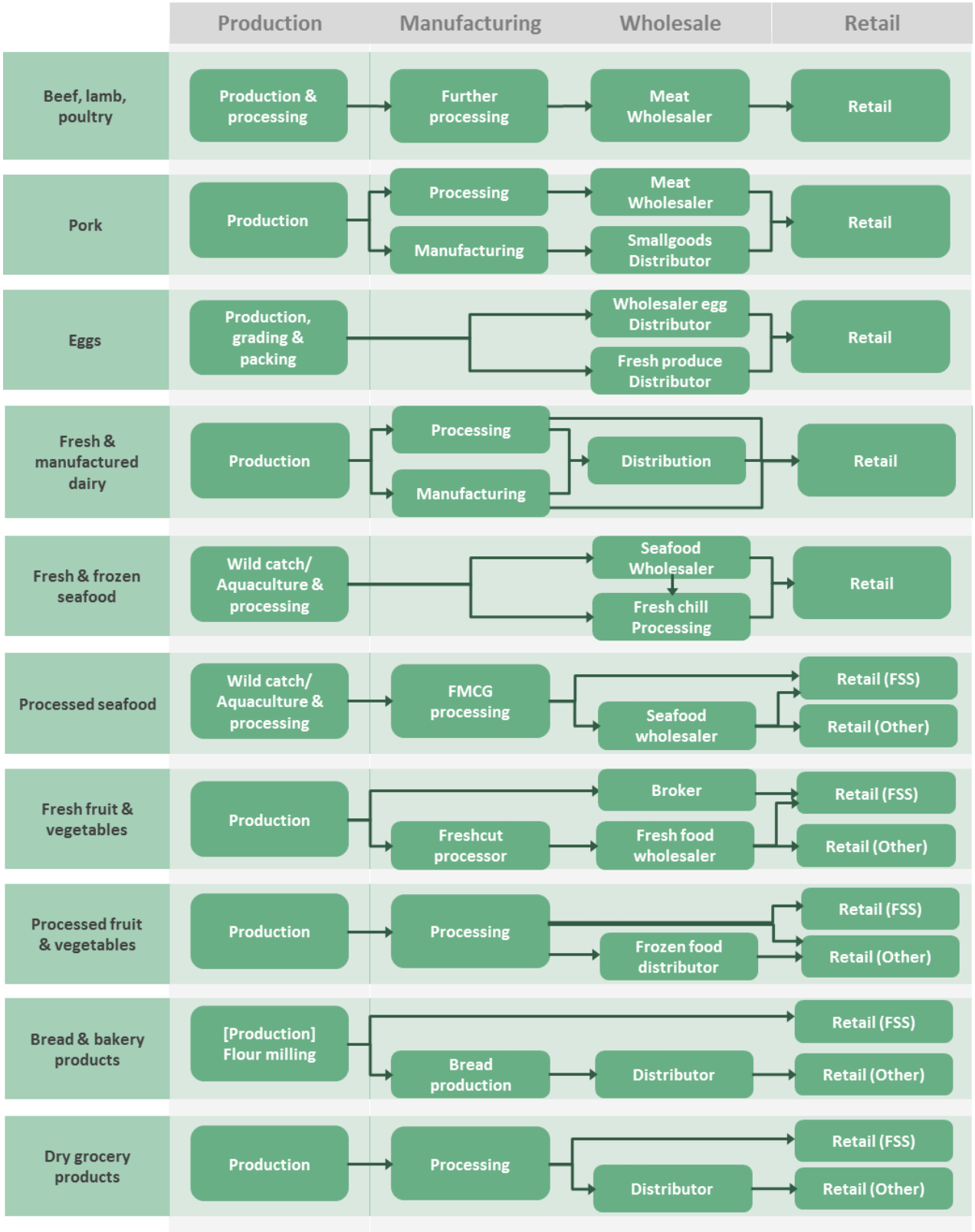
Figure 11: The food supply and recovery chain



Source: Adapted from Verghese et al, 2015.

The food supply chain differs in subtle or substantial ways for each of the major types of retail, as well as for individual food products. An overview of these differences is shown in Figure 12, showing particularly the diversity of wholesale channels (including wholesalers and distributors) for different foods.

Figure 12: The food supply chain of each main food product type

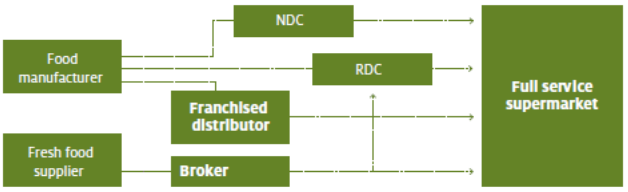


Notes: 'Retail (FSS)' means Full Service Supermarkets (chain/franchise). 'Retail (Other)' means independent supermarkets, convenience stores and specialised food retailers, such as butchers, bakers and green grocers. FMCG = Fast moving consumer goods.
Source: Adapted from Spencer & Kneebone (2012)

Figure 13 shows how the food supply chains differ for each of the major food retail types (full service supermarkets, independent supermarkets/convenience stores, and speciality retailers).

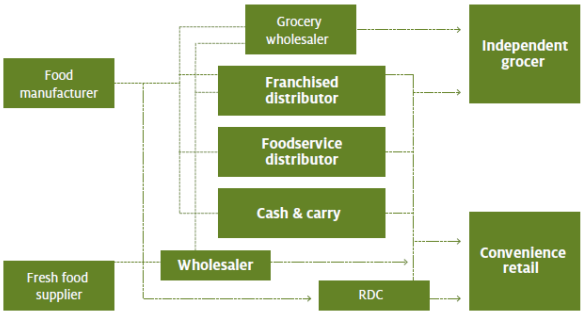
Figure 13: The food supply chain of each food retailer type

72. Full-service and other supermarkets



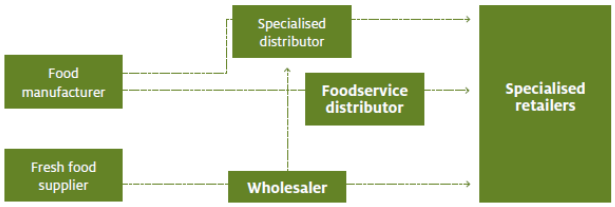
Chain	Numbers	Notes
Woolworths/Safeway	840	These include FSS and limited range supermarkets, but excludes liquor outlets and convenience/fuel stores.
Coles Group	741	
Supa-IGA	312	Number of Supa-IGA stores which offer a FSS proposition equivalent to major chains
ALDI	260	Limited-range discount stores
Franklins	80	This group is subject to a sale and purchase transaction at the time of publication.
Costco	3	Stores have a significantly larger floor space than a conventional FSS. Further stores are to be added.

73. Independent and convenience channels



Chain	Numbers	Examples of offering
Convenience		
Woolworths	581	Includes convenience stores as part of petrol stations (some aligned to a fuel partner), and small convenience stores in city locations.
Coles	620	
7-Eleven	600	
Other groups	300	
Independent supermarkets and food stores		
IGA	1300	Limited-range supermarkets
FoodWorks	700	
SPAR	260	
Other stores	3300	

74. Speciality retail channels



Category	Types of outlets
Fruit and vegetable	• independent fruit and vegetable grocers
Butcher, poultry and seafood	• independent butchers • specialist poultry retailers • fishmongers
Delicatessen	• independent outlets
Bakery: cake and pastry	• specialty stores under franchise structure • independent hot-bread shops/kitchens • cake and pastry specialists
Liquor	• chain stores under FSS chain ownership • independent outlets under common banner marketing • stand-alone independent outlets
Other	• independent outlets or participants in small retail chains specialising in a wide range of fresh and packaged organic foods

Notes: NDC = National Distribution Centre, RDC = Regional Distribution Centre, FSS = Full Service Supermarkets
Source: Spencer & Kneebone (2012)

The Australian and New Zealand Standard Industrial Classification (ANZSIC) codes related to the food wholesale/retail sectors are shown in Table 10.

Table 10: ANZSIC codes for food wholesale/retail sectors

F	WHOLESALE TRADE		
	36	Grocery, Liquor and Tobacco Product Wholesaling	
		360	Grocery, Liquor and Tobacco Product Wholesaling
			3601 General Line Grocery Wholesaling
			3602 Meat, Poultry and Smallgoods Wholesaling
			3603 Dairy Produce Wholesaling
			3604 Fish and Seafood Wholesaling
			3605 Fruit and Vegetable Wholesaling
			3609 Other Grocery Wholesaling
G	RETAIL TRADE		
	41	Food Retailing	
		411	Supermarket and Grocery Stores
			4110 Supermarket and Grocery Stores
		412	Specialised Food Retailing
			4121 Fresh Meat, Fish and Poultry Retailing
			4122 Fruit and Vegetable Retailing
			4129 Other Specialised Food Retailing

Source: http://www.abs.gov.au/ausstats/abs@.nsf/mf/1292.0

B.QUANTITATIVE FOOD WASTE DATA

B1. VOLUMES OF FOOD WASTE

As noted earlier, quantitative information on food waste in the Australian food wholesale and retail sectors in the public domain is scarce, and none exists for the logistics between them. A national assessment of food waste data conducted in 2010-11 found that there is very limited data available on pre-consumer food waste (Mason et al, 2011). A more recent review of food waste in Australia from 2015 similarly concluded "[t]here is no publicly available data on the percentage of food that is grown or sold in Australia for human consumption that eventually becomes waste" (Verghese et al, 2015).

This section provides an overview of what data is available on food waste in the Australian food wholesale, logistics and retail sectors. For all datasets reproduced here, it is not known whether the figures include only avoidable food waste, or both avoidable and unavoidable food waste. Variations in figures between the datasets may be explained in part by differences in data collection/analysis protocols and accounting assumptions/metrics (e.g. value, weight or estimation as well as by differences across jurisdictions). This demonstrates that there is clearly a need for uniformity in waste accounting across Australia.

NSW data

Food waste in NSW C&I wholesale/retail trade sectors

A study conducted for the NSW EPA in 2016 reported volumes of total food waste in NSW for the wholesale and retail trade (including food retail and food wholesale), as shown in Table 11. The combined total for the two sectors was 236,000 tonnes (127,000 for retail trade, and 109,000 for wholesale trade). These food waste figures represent 20% of all waste generated by the two sectors (17% and 25% of all waste generated by the Retail trade and Wholesale trade sectors respectively).

Only 13% of the food waste in the wholesale/retail trade sectors was recycled, with the remaining 87% going to landfill (21% recycling for retail and only 2% recycling for wholesale). This compares to a report in 2007 which found that, on average, supermarkets divert an average of 17% of total food waste to organics recyclers, up to a maximum of 33% (Viridis, 2007).

Table 11: Food waste (t) in C&I wholesale/retail trade in NSW

Food waste (t)	Total	Recycling		Landfill	
WHOLESALE TRADE					
C&I Food Waste - NSW	109,000	2,000	2%	107,000	98%
C&I Food Waste - NSW MLA*	84,700	100	0.1%	84,600	99.9%
RETAIL TRADE					
C&I Food Waste - NSW	127,000	27,000	21%	100,000	79%
C&I Food Waste - NSW MLA*	110,600	24,800	22%	85,800	78%
C&I Food Waste - NSW RLA*	1,910	490	26%	1,420	74%
C&I Food Waste - NSW NLA*	14,630	1890	13%	1,2740	87%
TOTAL WHOLESALE+RETAIL	**236,000**	**29,000**	**13%**	**200,700**	**87%**

**MLA = Metropolitan Levy Area, RLA = Regional Levy Area, NLA = Non Levy Area.*
Figures based on data from WARR data 2012-13 with sector breakdowns from Disposal Based Audit 2014 (Disposal) and Bin Trim Round 2 Phase 1 (Recycling).
Source: NSW EPA (2016)

Food waste in NSW C&I food retail businesses

Analysis of the confidential data collected as part of the initial assessment of Round 2 of the NSW EPA's Bin Trim program (provided by Lethlean, 2017) estimated that the 679 participating SME food retailing businesses produced an annual total of 15,098 tonnes of food waste, shown in Table 12. This represented a total of 62% of all waste generated by these businesses.

The data reveals large variations in the average amount of food waste generated per business across the four subsectors represented. The largest generator of food waste was fruit and vegetable retailers,

producing an average of 85 t of food waste each per year, followed by supermarket and grocery stores that generated an average of 29 t each per year.

The assessments revealed that in total 39% of the food waste generated by these participating businesses was recycled, almost double the proportion for the NSW C&I retail trade sector, and higher than the maximum proportion of 33% reported by Viridis (2007).

The proportion of food waste recycled also varied within the subsectors of food retailers, with the highest average recycling rates attributed to meat/fish/poultry retailers (58%), fresh fruit and vegetables (45%), and supermarkets/grocery stores (43%), and lower recycling rates for Other specialised food retailing (17%).

It should be noted that this dataset is unlikely to be representative of the entire food retail sector, as it represents only those businesses eligible for, and who chose to participate in, the Bin Trim program.

Table 12: Food waste (t) in food retail, for Bin Trim business in NSW in 2015-16

ANZSIC Class (Food retail)	All waste (t)	Total annual food waste weight (t)						No. businesses	Avg food waste per business (t)
		Generation		Recycling		Landfill			
		Total (t)	% of all waste	Total (t)	% of food waste	Total (t)	% of food waste		
Supermarket and Grocery Stores	10,203	6,177	61%	2,646	43%	3,531	57%	214	29
Fresh Meat, Fish, Poultry Retailing	3,805	2,507	66%	1,450	58%	1,056	42%	141	85
Fruit and Vegetable Retailing	4,089	2,643	65%	1,192	45%	1,451	55%	31	18
Other Specialised Food Retailing	6,088	3,771	62%	650	17%	3,121	83%	293	12
TOTAL	**24,655**	**15,098**	**61%**	**5,938**	**39%**	**9,160**	**61%**	**679**	

Note: Figures based on initial assessment results which have been annualised and converted from volume to tonnage. Assessments were conducted between September 2015 and September 2016.
Source: Lethlean (2017)

Australian data

Food waste in Australian C&I wholesale/retail trade sectors

The most recent data available at the national level for food waste in the retail and wholesale trade sectors was provided in a report on Commercial and Industrial (C&I) waste by Encycle (2013). The report did not provide overall food waste data in tonnes for the wholesale trade and retail trade sectors. Instead data was provided in a relative measure, kg per Employees (Full Time Equivalent) per year (kg/EFTE.yr) as shown in Table 13. The proportion of food waste that was recycled was 16% and 11% for the wholesale trade and retail trade sectors respectively, which vary considerably, compared to the NSW data shown in Table 11. Recycling rates for the Australian retail trade sector are almost half that of NSW retail trade sector (11% compared to 21%), while the recycling rate for Australian wholesale trade sector is 8x that of the NSW wholesale trade sector (16% compared to 2%).

Table 13: Food waste (kg/EFTE.yr) in C&I wholesale/retail trade in Australia in 2012

Food waste (kg/EFTE.yr)	Total	Recycling		Landfill	
Wholesale trade	450	70	16%	380	84%
Retail trade	870	100	11%	770	89%

Source: Encycle, 2013

The report also provides a breakdown for the food retail component of the retail trade sector. At least 178,000 tonnes of food waste was generated by NSW food retail, though the report notes the existence of a large 'Unknown' category of waste which is also likely to include food waste. This is shown in Table 14.

Table 14: Food waste (t) in C&I food retail in Australia in 2012

Food waste (t)	Total	Recycling		Landfill	
Food organics	**178,800**	9,000	**5%**	169,800	**95%**
Unknown*	248,400	21,300	9%	227,100	91%

** The 'unknown' waste type for food retail is a very large component (almost 50%) of the landfill waste stream which is "likely to be a mixture of all material types, particularly …further food organics" (Encycle, 2013).*
Source: Encycle, 2013

The value of food inputs that are ultimately thrown away or recycled by the C&I sector in Australia is estimated to be around $8.2 billion for waste to landfill and $2.3 billion for waste that is recycled (DOE, 2013).

In addition, in 2016, WWF reportedly conducted a food waste survey of commercial food businesses including food distributors and food retail to inform their food waste campaign. No results from the survey were published, but WWF may be amenable to sharing data with the NSW EPA.

Surplus food collected in Australia by food rescue organisations

In 2012-13, a total of 32,372 tonnes of food was reported as received by Australia's 4 major food rescue charities (DOE, 2013). The majority of this was processed food to Foodbank (25,662 tonnes). This would include food retailers/wholesalers, but not exclusively (food manufacturers are the largest source of donations to Foodbank). The remaining 6,710 tonnes was likely fresh/perishable food, as it was donated to SecondBite, OzHarvest and FareShare.

Stakeholder data

As part of the stakeholder interviews, food retailers and wholesalers were questioned about data they collect, analyse and report. The overall finding was that waste data collection is inconsistent and usually outcome-driven rather than objective. For example, retailers collect data on types and sources of food waste for costing reasons, for potential rebates from suppliers, and to meet specific internal targets.

Retailers collect data from their own food waste audits and waste service providers. Data on the amount of food donated to food rescue is also usually reported back to businesses by their charity partners. This was the most consistent and comprehensive data identified.

Data capture of food waste is usually conducted once the waste has been collected into bins for weighing or on collection by disposal/diversion companies, rather than at its point of origin. As such businesses generally have quantitative data on the total food waste they generate, but only general ideas as to specifically where and why this waste is created.

Retailers note the difficulties they face in measuring food waste due to the multiple levels at which they manage waste, as well as differences across stores. The accuracy of data collected is considered to vary due to differences in the way food waste is tracked in different stores and by different waste contractors.

In Woolworths' latest report to the Australian Packaging Covenant (2016), it reports that it reduced waste to landfill by an estimated 55,000 tonnes, including:

- 2,956 tonnes of food donated to food rescue
- 40,000 tonnes of food donated to farmers
- 11,070 tonnes recycled via commercial composting.

However, it does not report its overall volume of food waste.

Only one stakeholder provided actual data as part of the interviews, in confidence to the research team/NSW EPA, which included the amount to landfill and amount rescued. This stakeholder reported that they were unable to get data from their waste contractors on any food waste diverted from landfill to recycling. The main point of note from this data is the large variation in proportion of food waste rescued between states. This potentially reflects the penetration of food rescue organisations in NSW and Victoria. Other stakeholders indicated that they could potentially provide data under formal confidentiality arrangements.

B2. TYPES OF FOOD WASTE

Australian data

The literature review hoped to identify the types of food going to waste in the Australian food retail and wholesale sectors, as well as whether food waste was characterised as avoidable/unavoidable. While some of the above reasons for food waste are linked to particular types of food (e.g. chilled/frozen food, fresh produce, packaged food, etc), very little information was found in the Australian literature that set out food waste in the target sectors according to type of food. On the other hand, the majority of reasons identified related directly to food products that were intended for human consumption, aligning with our adopted definition of food waste.

Verghese et al (2015) reported that perishable products with a short shelf life, such as fresh fruit and vegetables, baked goods, meat and seafood, have a higher tendency to become waste than other products such as dry goods and processed produce, or frozen fruit, vegetables, dairy or seafood. Verghese also reports that fresh, ready-made meals (curries, pizzas, soups, salads, etc) are an increasing category of food waste.

International data

Food waste by product type

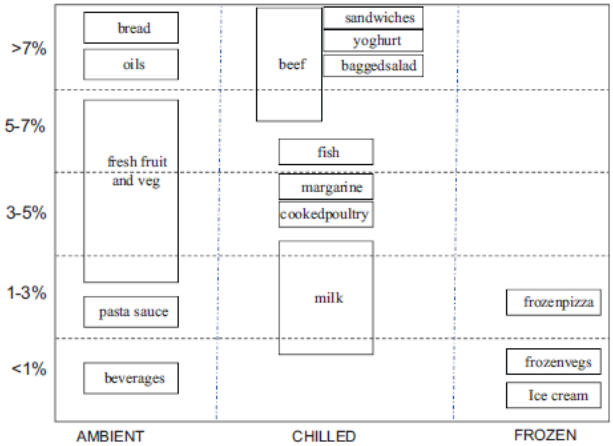
A report for the UN Food and Agricultural Organisation (FAO) estimates the following waste percentages for each food commodity group at the distribution stage (incl. retail) for North America & Oceania, as shown in Table 15. A study on food waste by product type at the retail level in the UK & Spain (in Verghese et al, 2015) provided a breakdown of the key product types classified as Ambient, Chilled and Frozen, as shown in Figure 14.

Table 15: Estimated waste of commodity groups at Distribution for North America & Oceania

Commodity	% wasted
Fruit & vegetables	12%
Fish & seafood	9%
Roots & tubers	7%
Meat	4%
Cereals	2%
Oilseeds & pulses	1%
Milk	0.5%

Source: Gustavsson et al (2011)

Figure 14: Product food waste at retail: UK & Spain



Source: Mena et al (2011)

Food waste by stage

The most comprehensive international data available on which stage of the wholesale/logistics/retail supply chain food waste occurs are a series of Resource Maps produced for select fresh fruit and vegetables by WRAP UK (2011), as shown in Figure 15.

The quantities of storage and packing loss shown can't be directly attributed to the wholesale stage, as many full service supermarkets have direct contracts with producers, but they do demonstrate the amount of food waste happening directly upstream of the retail.

Figure 16 shows a full Resource Map for one product (avocadoes), accompanying the figures with details of the main causes of food waste.

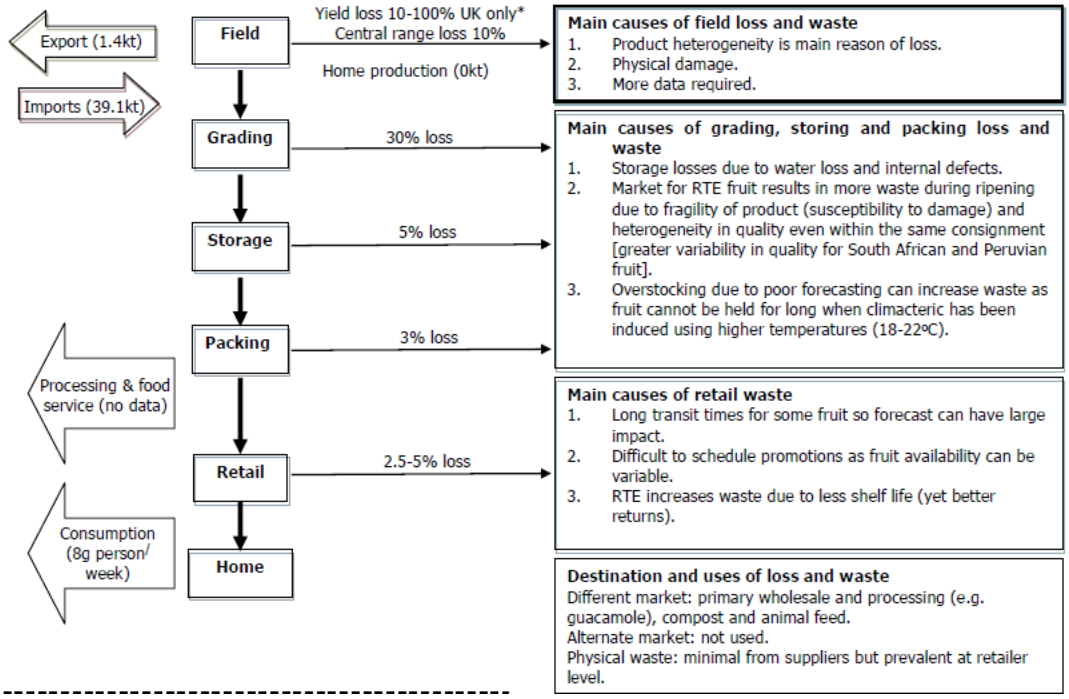
Figure 15: Summary of resource maps detailing food waste through supply chain

Product	Field loss (Central range)	Grading loss	Storage loss	Packing loss	Retail waste
Strawberry	2-3%	1%	0.5%	2-3%	2-4%
Raspberry	2%	No data	No data	2-3%	2-3%
Lettuce	5-10%	No data	0.5-2%	1%	2%
Tomato	5%	7%	No data	3-5%	2.5-3%
Apple	5-25%	5-25%	3-4%	3-8%	2-3%
Onion	3-5%	9-20%	3-10%	2-3%	0.5-1%
Potato	1-2%	3-13%	3-5%	20-25%	1.5-3%
Broccoli	10%	3%	0%	0%	1.5-3%
Avocado	No data	30%	5%	3%	2.5-5%
Citrus	No data	3%	No data	0.1-0.5%	2-2.5%
Banana	No data	3%	No data	0-3%	2%

NB. For presentational purposes the stages in the supply chain are shown sequentially. In practice, harvested product will either be graded and packed for immediate sale or where appropriate stored and then graded and packed. As a result the data for all stored products cannot be used cumulatively.

Source: WRAP (2011)

Figure 16: Resource Map of food waste for avocadoes



Source: WRAP (2011). RTE = ready to eat

Avoidable vs Unavoidable

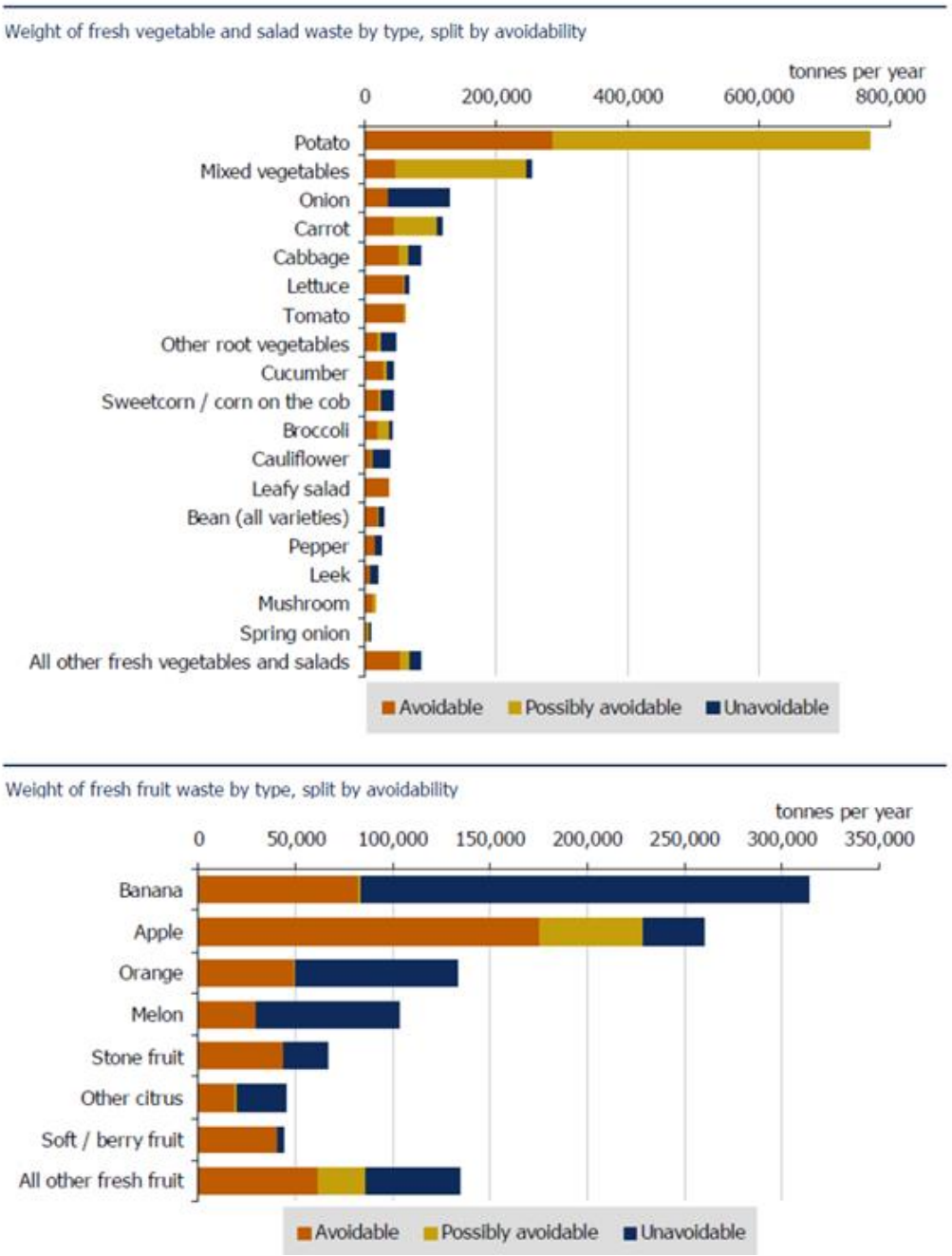
As part of developing their Resource maps for fresh produce, WRAP (2011) also quantified whether the identified waste was classified as avoidable, potentially avoidable or unavoidable (refer back to Figure 3 for definitions). This is shown in Figure 17.

Their analysis found that avoidable food waste generally comprised of 3 components:

- food that is downgraded or damaged
- food that exceeds proportion of shelf-life demanded by retailers by is still safe to eat
- food that exceeds shelf life.

The analysis shows a high level of variability across products in the amount of waste that is considered avoidable or not.

Figure 17: Food waste of fresh fruit and vegetables by whether avoidable



Source: WRAP (2011)

B3. FUTURE DATA COLLECTION & BENCHMARKING

Two key pieces of literature where identified that could be very useful for future efforts to improve food waste data collection, and potentially begin to benchmark businesses on the amount of food waste. These are the Global Food Loss & Waste Protocol and the Viridis Supermarket Benchmarking Study. Further details on each are provided below.

Global Food Loss & Waste Protocol

The Global Food Loss & Waste Protocol (FLW) is an international, multi-stakeholder effort convened by the World Resources Institute (WRI) to develop a global accounting and reporting standard for quantifying food waste. Its purpose is to enable a wide range of entities to account for and report in a credible, practical and internationally consistent manner how much food waste is created and where it occurs, enabling the targeting of efforts to reduce it.

The FLW Protocol is voluntary and designed for users of all types and sizes, across all economic sectors, and in any country. It is intended for use by any entity (government, business, industry associations, inter-governmental organizations, and others).

The FLW provides:

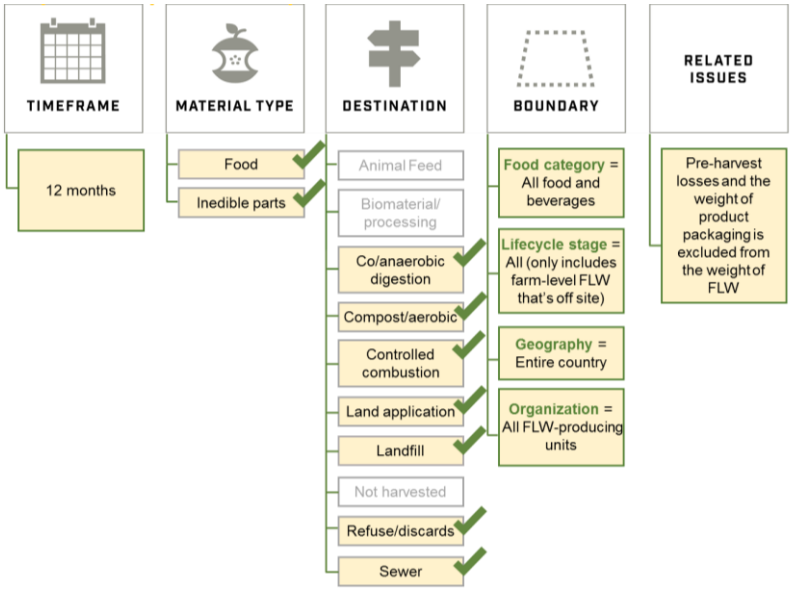
- a common language to define what is meant by “food waste” (i.e. the scope – see Figure 18)
- a short list of requirements to consistently and transparently account for and report clearly a food waste inventory (the figures, scope, and methodology – see Table 16)
- guidance to think about choices when selecting what and how to measure.

The key to the protocol is a set of standardised definitions and reporting requirements. Currently definitions and accounting methodologies vary widely making it difficult to compare and collate data and therefore develop effective evidence-based strategies.

For example, in 2015, The Consumer Goods Forum, which represents more than 400 of the world’s largest retailers and manufacturers from 70 countries, adopted a resolution for its members to reduce food waste from their operations by 50 percent by 2025, with baselines and progress to be measured using the FLW Standard. Some leading companies, like Nestlé and Tesco, are already measuring and publicly reporting on their food loss and waste.

FLW Protocol partners include: The Consumer Goods Forum, Food and Agriculture Organization of the United Nations (FAO), EU-funded FUSIONS project, United Nations Environment Programme (UNEP), World Business Council for Sustainable Development (WBCSD), WRAP (The Waste and Resources Action Programme) and World Resources Institute.

Figure 18: Modular components of Global Food Loss & Waste Protocol scope



Source: http://flwprotocol.org/flw-standard/faqs

A summary of the eight reporting and accounting requirements contained in the *FLW Protocol* (see Chapter 4) is provided in Table 16. Guidance on implementing these requirements is provided throughout the *FLW Protocol* with guidance about reporting a FLW inventory included in Chapter 13 of the protocol.

The case studies on the FLW Protocol website (www.flwprotocol.org) provide examples for how some entities are using this table to describe their FLW inventory.

Table 16: Reporting requirements of Global Food Loss & Waste Protocol

***FLW STANDARD* REQUIREMENTS (see www.FLWProtocol.org for details and guidance)**
1. **Base FLW accounting and reporting on the principles of relevance, completeness, consistency, transparency, and accuracy**
2. **Account for and report the physical amount of FLW expressed as weight**

3. **Define and report on the scope of the FLW inventory**
• Timeframe:
• Material type:
• Destination:
• Boundary:
  ○ *Food category*:
  ○ *Lifecycle stage*:
  ○ *Geography*:
  ○ *Organization*:
• Related issues:

4. **Describe the quantification method(s) used. If existing studies or data are used, identfy the source and scope**
5. **If sampling and scaling of data are undertaken, describe the approach and calculation used, as well as the period of time over which sample data are collected (including starting and ending dates)**
6. **Provide a qualitative description and/or quantitative assessment of the uncertainty around FLW inventory results**
7. **If assurance of the FLW inventory is undertaken (which may include peer review, verification, validation, quality assurance, quality control, and audit), create an assurance statement**
8. **If tracking the amount of FLW and/or setting an FLW reduction target, select a base year, identify the scope of the target, and recalculate the base year FLW inventory when necessary**

Source: http://flwprotocol.org/flw-standard/faqs

Supermarket food waste benchmarking

In 2008, on behalf of the Australian Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC), Viridis undertook a research process in collaboration with Australia's key retail supermarkets, to develop a "fair, robust, and useable benchmark for supermarket food waste, such that individual supermarket stakeholders will be able to measure and understand the level of food waste avoided or generated for a given store" (Viridis, 2008).

The research developed a set of preliminary equations to calculate a benchmark, which were design to be compatible with the NABERS approach to performance rating, such that business units could change in relative size, and or existence in particular supermarkets without penalising or benefiting the rating outcome. This was achieved by 'normalising' waste volumes using a measure of 'operational intensity' based on store parameters such full time equivalent staff.

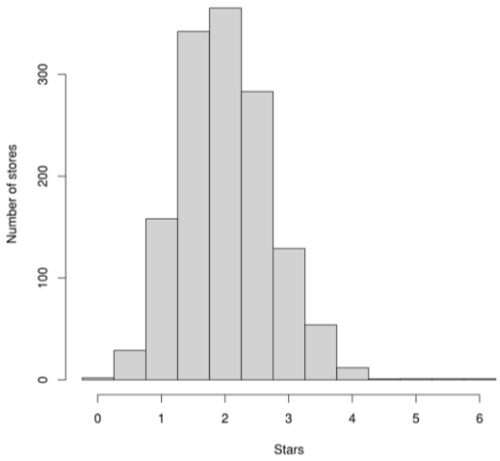
The ideal benchmark structure was designed to both: reward improved outcomes (according to the waste hierarchy), and not penalize or reward individual stores for their particular business model, such as on site processing of meat. It resulted in a ranking 0 to 6 stars, with scores of above 5 stars designed to be targets for future, improved performance, representing the stated ambitions of the industry to achieve as practically close to zero waste food as possible.

Development of the benchmark was based on a number of useful data sets provided by some of the major retailers. The datasets included four types of data: physical store parameters, operational store parameters, waste contractor data, and regional data. The research notes some substantial limitations around the data, particularly with regards to waste data provided by waste contractors:

> *Waste data provided by waste contractors can be of variable quality and or consistency. Direct measurement of bin weights as they are collected is rare, and can often be poorly calibrated, whilst volume to mass conversion figures are based on very broad approximations. Waste measurements derived from volume estimates are often inaccurate as the level to which bins are filled is not always accounted for, and in the reporting of some waste contractors is assumed to be full... Inaccuracies in waste contractor data are well known and have led the NABERS Offices Waste tool to not use data provided by waste contractors in any aspect of benchmarking. Given the lack of other data sources available for this project, contractor derived waste data was the primary source of information. (Viridis, 2008).*

When applied to the data available to Viridis, the benchmark produced the results shown in Figure 19.

Figure 19: Results of preliminary supermarket benchmarking by Viridis



Source: Viridis (2008)

Unfortunately, due to differences in information systems and confidentiality considerations, a unified data set containing all critical parameters was unable to be assembled by Viridis, which means that the benchmark could not be properly calibrated and therefore a final version remains as future work. As part of the analysis, Viridis tested a number of approaches to normalisation and benchmarking, which resulted in a proposed simple data request to industry which should enable easier data collection for future phases.

C. LITERATURE REVIEW FINDINGS

This section sets out the findings from the literature review. Findings are grouped into Australian and international literature, as information gleaned from international literature may not be directly relevant to the Australian context. Findings are referenced in brackets with the authors' last names and year of publication. The corresponding list of references is found in Appendix G.

C1. REASONS FOR FOOD WASTE

The reasons food waste occurs in the food wholesale and retail sectors are many and varied. The following sections set out what is known in the Australian literature about where food waste is occurring and why, for each stage of the supply chain. These findings are followed by potential insights identified from the international literature. These international findings were tested with Australian businesses during the stakeholder engagement phase to confirm their applicability to the Australian context.

Manufacturing/processing

Although food waste occurring in the manufacturing/processing sector is out of scope for this literature review, there are a number of factors at this stage of the supply chain that contribute to food waste occurring at the food wholesale, logistics and retail stages. For those food retailers and wholesalers who are also brand owners (e.g. Woolworths, Coles, Metcash, Aldi) these factors are to some extent under the control of these food retailers/wholesalers.

No information was identified in Australian literature about factors at the manufacturing/processing stage that result in food waste at the food wholesale, logistics or retail stages.

International literature

In the international literature, the following factors were identified at the manufacturing/processing stage, which are also likely to result in food waste downstream in the food wholesale and retail stages in Australia:

- non-perishable foods can be mislabelled; food products with erroneous or misleading labels are often discarded at the food wholesale or retail stage, due to impracticability of recalling for relabelling or reprocessing (Alexander & Smaje, 2008; Canali et al, 2016)
- out-of-date promotional packaging often results in food being discarded at the retail level, due to impracticality of recalling for relabelling or reprocessing (Alexander & Smaje, 2008)
- new product testing or development can have high failure rates, resulting in food left on retailer shelves that have to be discarded once they expire (Alexander & Smaje, 2008; Buzby et al, 2011)
- inappropriate packaging that causes or allows for damage to products results in food having to be discarded at the food wholesale and retail stages (Buzby & Hyman, 2012; Priefer et al, 2016).

Wholesale/retail distribution

Australian literature

There was no Australian literature on sources/reasons for food waste at the food wholesale stage. For food that has a direct path from manufacture/processing to retail via distribution centres (i.e. retail distribution), the following reasons for food waste were identified in the Australian literature. Some of these are likely to apply to food wholesalers also:

- fresh produce **doesn't meet specifications** for shape, size and freshness set by the retailer (Verghese et al, 2015)
- **problems with the packaging**, such as bar codes that are unreadable (Verghese et al, 2015)
- **packaging has been damaged** through rough or improper handling as it moves through the supply chain (Verghese et al, 2015)
- **surplus to requirements** (unsold leads to spoilage) (Mason et al, 2011).

International literature

The following factors were identified in the international literature, which are also likely to result in food waste at the wholesale or retail distribution stage in Australia:

- failures in cold-chain (i.e. maintaining the correct temperature required for food safety regulations) (Mena et al, 2014)
- incorrect application of inventory turnover that can cause excessive prolongation of product storage and consequent rejection by retailers (Canali et al, 2016)
- lack of coordination between wholesale and logistics and in retail leading to food waste: big retailers only accept products with a high proportion of shelf-life remaining (Canali et al, 2016); individual stores may not require what they forecasted (Gunders, 2012).

Logistics/transport

Australian literature

The following are some of the reasons for food waste during transport/logistics between the wholesale, retail distribution and individual retail stores in Australia:

- losses while in transit [spoilage, damage] (Riedy et al, 2010), which could include injuries from punctures (due to inappropriate containers and packaging) and impacts and vibration (due to rough roads and driving behaviour) and exposure to high or low temperature or moisture (Bosona, 2014)
- poor containment or storage conditions [spoilage, pest damage] (Reidy et al, 2010)
- unloading and stocking of food at retail outlets [spoilage, damage] (Reidy et al, 2010).

International literature

The following factors from the international literature are also likely to be relevant to Australian logistics:

- excessive handling (Mena et al, 2009)
- failures in cold-chain [spoilage, or food safety regulations] (Mena et al, 2014; Priefer et al, 2016) excessive or insufficient heat (Buzby & Hyman, 2012; Nunes et al, 2009); while inconsistent refrigeration is less of a problem now, it will still occur during truck malfunction or accident, or when it sits too long at loading docks (Gunders, 2012).

Retail stores

Australian literature

The following are some of the reasons for food waste at the food retail level in Australia:

- **poor inventory management –** over-ordering (Verghese et al, 2015), speculative purchasing based on forecasted demand (Mason et al, 2011). There are extreme instances where goods are ordered to fill shelving without any prospect of sale (Encycle, 2013)
- **overstocking of shelves** -- which can damage fresh produce due to compression at the bottom of the display (Verghese et al, 2015)
- **poor stock rotation by staff** -- with older products not being moved to the front of the shelf for immediate purchase where ‘best before’ or ‘use by’ dates can be compromised (Verghese et al, 2015)
- **confusion over best-before and use-by dates** - confusion about the meaning of these terms can result in food that is still edible being removed from supermarket shelves and thrown away (Encycle, 2013)
- **quality standards** -- fresh produce being thrown away because it no longer meets quality standards (Verghese et al, 2015)
- **surplus to demand** – market volatility leading to unsold food (Mason et al, 2011).

International literature

Additional reasons for food waste identified in international literature:

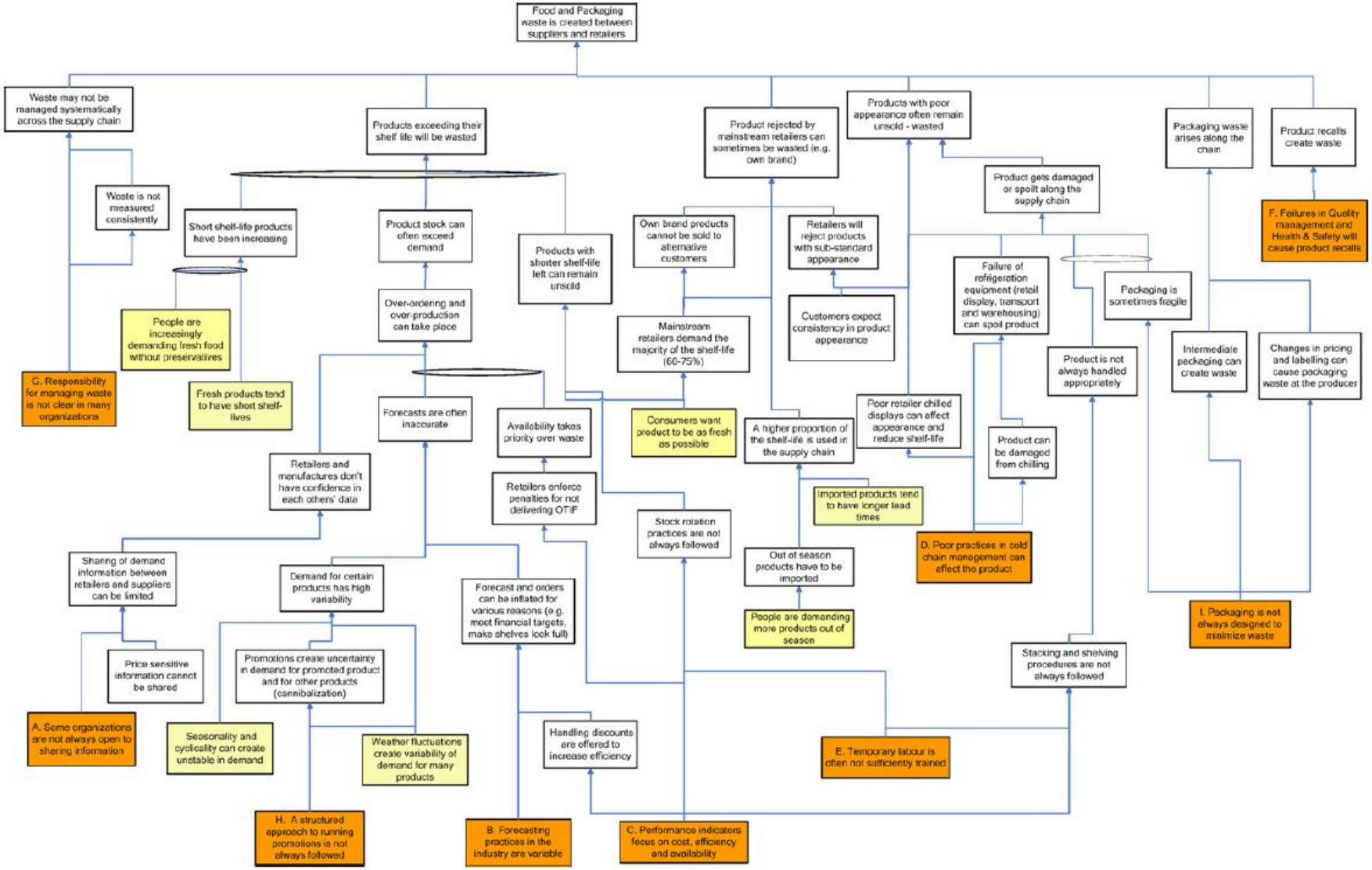
- rejected deliveries (Mena et al, 2014) and out-grading of blemished, misshapen, or wrong-sized foods in an attempt to meet consumer demand (Buzby & Hyman, 2012), including mould, pests (Mena et al, 2014)
- damage to items through poor handling during unpacking, stacking, shelving and stock rotation (Buzby & Hyman, 2012) – can be due to poor processes, poor training, or employee practices (Mena et al, 2014)
- out of shelf-life, due to either: insufficient shelf space available (Mena et al, 2014), or quality expectations of consumers, product left on shelf (mainly fresh produce) (Mena et al, 2014)
- unpurchased speciality holiday food, e.g. Easter eggs after Easter, fruit cake after Christmas, etc (Buzby & Hyman, 2012)
- high variety ('proliferation') of products that need to be stocked (Mena et al, 2014); wide range of products/ brands in supply, because consumers also expect a wide range of products to be available in stores (Gustavsson et al, 2011)
- obligation for retailers to order a wide range of products and brands from the same producer in order to get beneficial prices (Priefer et al, 2016; Gustavsson et al, 2011)
- well-filled shelves increase attractiveness of products, but continually replenished supplies mean that food products with lesser shelf life are often ignored by consumers in preference for those with longer shelf life (SEPA in Gustavsson et al, 2011)
- longer opening hours, which require fresh food to be displayed for longer periods of time (Canali et al, 2016)
- purposeful discards before expiry dates due to consumer perceptions that long shelf life means low quality (Halloran et al, 2014; Canali et al, 2016)
- promotions that cause variability in normally stable base demand, not only for the products being promoted but also for alternative products due to 'cannibalization', i.e. lower than expected sales of similar alternatives (Mena et al, 2014)
- technical malfunction (Buzby & Hyman, 2012); failure in refrigeration, (rare but high impact) (Mena et al, 2014) general temperature management in store (Buzby et al, 2011; Mena et al, 2014)
- recalls (rare but high impact, predominantly milk, and fruit/veg) (Mena et al, 2014)
- packaged fruit/veg: cannot repack if one item in the pack becomes diseased or out of specification, whole pack is thrown away (Mena et al, 2014)
- packaging renewals due to marketing campaigns, delisting products (Canali et al, 2016).

Mena et al's (2011) analysis also found that most causes are part of a complex web of interdependent causes and effects. They therefore undertook root cause analysis to create a causal map showing the root causes at the bottom, leading to symptoms at the top. This is shown in Figure 20 over the page.

The main 'management' root causes (over which retailers have some control, shown in Orange in Figure 20) were identified as:

- forecasting difficulties and poor ordering
- performance measurement and management
- cold chain management
- training
- product quality management
- promotions management
- packaging.

Figure 20: Root causes map of food waste in UK supermarkets



Source: Mena et al (2011)

Waste management

The following are some factors relating to the waste management industry, identified in Australian literature that might result in food waste at the food wholesale, logistics or retail sectors:

- food waste can also be 'caused' by inadequate infrastructure for recycling, and the low value of this material compared to other recyclables (Verghese et al, 2015)
- focus on recycling (waste management), rather than waste minimisation - recycling has a high profile in terms of community/industry/government campaigns, and in general corporate sustainability efforts (Reidy et al, 2010)
- structural incentives often prioritise actions lower down the food waste hierarchy, rather than optimal outcomes (Canali et al, 2016).

There were no additional factors identified in the international literature.

Other – cross cutting

The following general factors were also identified in Australian and international that might result in food being wasted at the food wholesale, logistics or retail sectors:

- waste created along the cycle is not considered as lost resources as companies often are not accounting for it (Reidy et al, 2010)
- standardization and regulations for food safety can lead to increased food waste (Halloran et al, 2014). Safety standards are often perceived as too strict and make the recycling or alternative valorisation of discarded food legally or technically impossible (Canali et al, 2016)
- lack of awareness or interest in recycling options, lack of management commitment, lack of key performance indicators relating to waste (means waste will be sacrificed at the expense of other performance indicators, e.g. cost, efficiency and availability (Mena et al, 2014)
- consumer trends: increasing demand for fresh products and moving away from foods with preservatives; increasing demand for products out of season (requiring longer supply chain) (Mena et al, 2014)
- food supply chain system where the direct costs of waste management or incentives for reduction are separated from the organisation responsible for generating the waste (Eriksson et al, 2017).

Upstream and downstream waste

In addition to the above, there are some practices of supermarkets that might reduce food waste in their operations, but are in fact only shifting this waste up- or down-stream from the food wholesale/retail stages. For example, takeback agreements where retailers return unsold/damaged products to suppliers reduce waste in store, but generally see these products become waste upon reaching the supplier (Canali et al, 2016; Eriksson et al, 2017). Similarly, large discounts on products soon to expire/spoil can simply shift the waste of these products to the consumption stage. Impacts of shifting are out of scope for the current review, but are important when holistically considering the amount of food waste in the Australian food supply chain.

C2. CURRENT ACTIONS AND OPPORTUNITIES

Food waste has been recognised as an important issue to address, and there are a number of reports of current actions being taken by Australian businesses, as well as a number of opportunities identified from the international literature which might be relevant to the Australian context. This section provides an overview of the range of actions and interventions identified.

The vast majority of actions and opportunities identified related to the retail stage, so these have been presented first, with the rest of the supply chain reported in reverse order back up the chain.

Food waste hierarchies

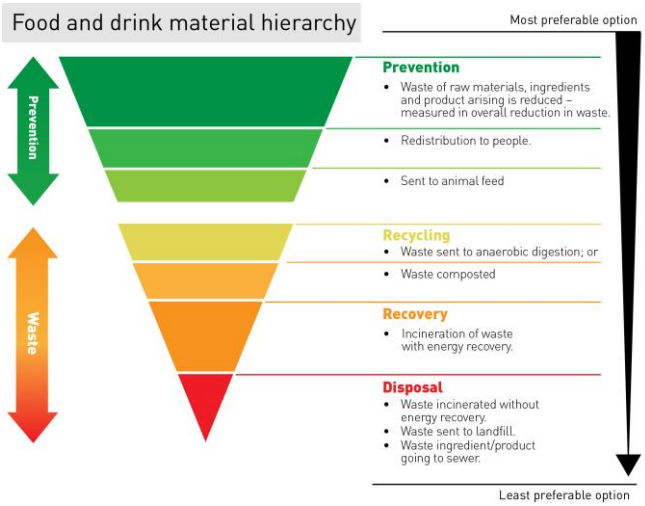
An appropriate waste hierarchy is critical to prioritising actions and opportunities to address the issue of food waste. A review of Australian academic and grey literature did not identify any existing models of a food waste hierarchy. Initially, therefore, a food waste hierarchy developed previously by the ISF research team was used. This hierarchy was developed by specifying explicit food waste actions for each of the existing levels of the NSW EPA Waste Hierarchy, and was compared against popular food waste hierarchies in use in the US and UK, all of which had much in common. These are shown in Figure 21 (a) to (d). When it was, it was identified during stakeholder research that the initial food waste hierarchy was not full in capturing stakeholder priorities, additional research was conducted for more novel hierarchies for inspiration. These are shown in Figure 21 (e) and (f). The levels of all of the identified hierarchies are compared in Table 17.

Figure 21: Food waste hierarchies from the literature

(a) UTS:ISF based on NSW EPA

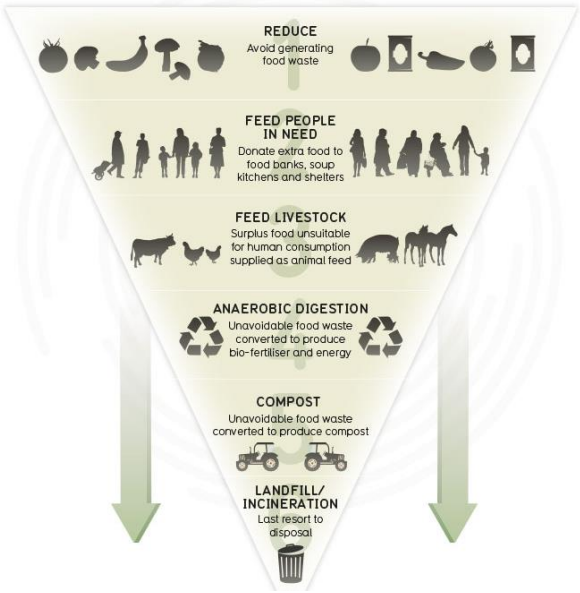
Original source: http://www.epa.nsw.gov.au/wastestrategy/waste-hierarchy.htm

(b) WRAP (UK)



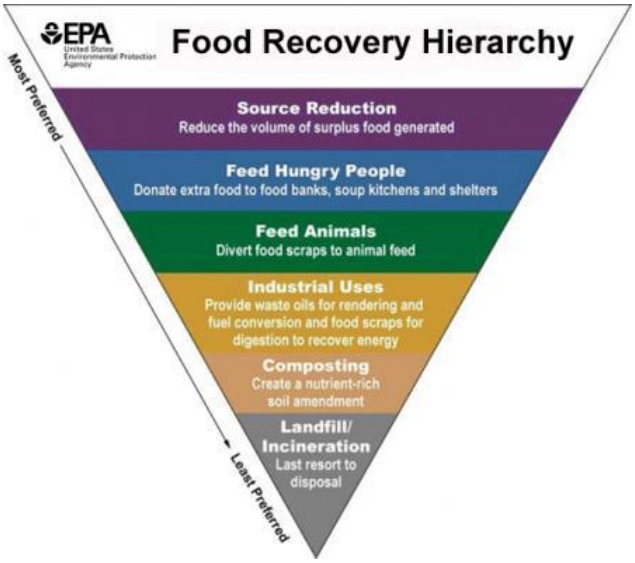
Source: http://www.wrap.org.uk/content/why-take-action-legalpolicy-case

(c) ReFood's Vision 2020 (UK)



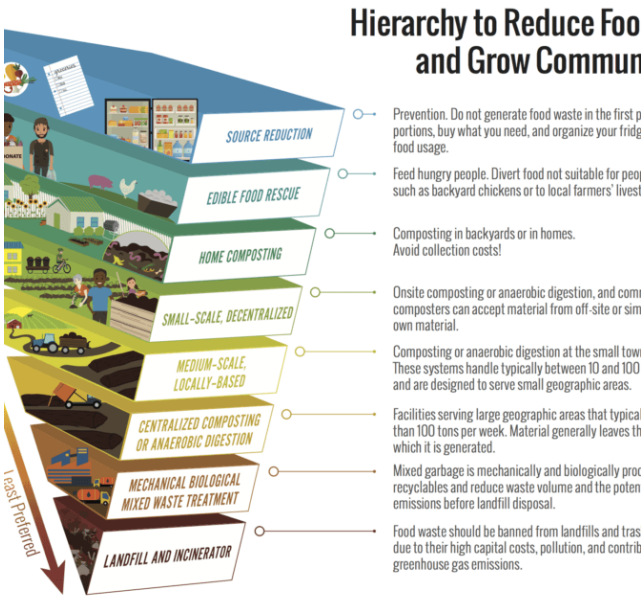
Source: http://www.vision2020.info/ban-food-waste/the-food-waste-hierarchy/

(d) EPA (US)



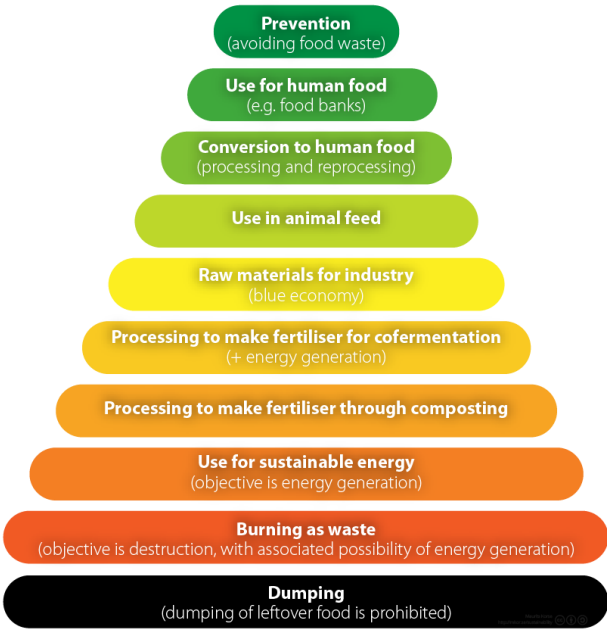
Source: https://www.epa.gov/sustainable-management-food/food-recovery-hierarchy

(e) Institute for Self Reliance (US)



Source: https://ilsr.org/food-waste-hierarchy/

(f) "Moerman's Ladder" (Origins unknown)



Source: https://blog.mauritskorse.nl/en/2016/01/waste-hierarchy-explained/

Table 17: Comparison of waste hierarchy levels

ReFood, Vision 2020 (UK)[1]	WRAP (UK)[2]	EPA (US)[3]	Institute for Local Self-Reliance[4]	"Moerman's Ladder"[5]
Reduce	Prevention	Source reduction	Source reduction	Prevention
Feed people in need	Optimisation - redistribution to people	Feed hungry people	Edible food rescue	Use (as is) for human food
				Conversion (reprocessing) to human food
Feed livestock	Optimisation - animal feed	Feed animals		Use in animal feed
				Raw materials for industry (blue economy)
Anaerobic digestion	Recycling - Anaerobic digestion	Industrial uses (digestion)	Small-scale composting /AD	Processing to make fertiliser for cofermentation + energy generation
			Medium-scale composting /AD	
Compost	Recycling - compost	Composting	Centralised composting /AD	Processing to make fertilisers through compost
			Mixed waste treatment	
	Recovery (incineration)			Use for sustainable energy
Landfill/ incineration	Disposal/ incineration/ sewage	Landfill/ incineration	Landfill/ incineration	Incineration
				Dumping (landfill)

Sources:
(1) http://www.vision2020.info/ban-food-waste/the-food-waste-hierarchy/
(2) http://www.wrap.org.uk/content/why-take-action-legalpolicy-case
(3) https://www.epa.gov/sustainable-management-food/food-recovery-hierarchy
(4) https://ilsr.org/food-waste-hierarchy/
(5) https://blog.mauritskorse.nl/en/2016/01/waste-hierarchy-explained

Retail stores

The following is a list of current practices and opportunities for food retailers, which we have characterised by the stage of the food waste hierarchy at which they occur.

Avoidance – current retail practices in Australia

- Woolworths and Coles have already achieved significant savings and reduced product waste by improving the efficiency of their procurement, transport and distribution systems. These efficiencies have helped to reduce the length of the supply chain for many products, with associated benefits for waste reduction (Verghese et al, 2015). For example:
  - Coles Supermarkets reduced its costs of doing business by around $400 million in 2011-12 through a number of supply chain improvements. For example, Coles Supermarkets are now buying grocery and dairy products through an automated sales-based system that forecasts demand for a particular store and makes orders based on a just-in-time approach (Deloitte in Verghese et al, 2015).
  - Woolworths has also achieved efficiency improvements by reducing 'shrinkage' (product loss) and further reducing direct store deliveries (Verghese et al, 2015).
- Aldi undertakes continual optimisation of their planning and ordering processes to try to sell all food products before the end of their shelf life. The ALDI South Group is also setting up an international recycling and waste monitoring system and will coordinate the measures at a national level. National organisations are currently working on systems that can comprehensively monitor the various types of waste. One topic here is to avoid food waste as much as possible (Aldi, 2015).
- Large supermarkets make considerable efforts to reduce store stock losses through better handling practices and systems for stock control (Encycle, 2013).
- Supermarkets regularly apply a discount to encourage sales prior to the product reaching end of life (Encycle, 2013) or for products with damaged packaging (Verghese et al, 2015).

Avoidance – opportunities for retail from Australian and international literature

- Aim for choice of products, not proliferation (Mena et al, 2014)
- Routinely maintaining refrigeration equipment to prevent temperature failure (Buzby et al, 2011; Mena et al, 2014)
- Centralized control of inventory for long-life products reduce safety stock and therefore waste (Mena et al, 2014)
- Clear promotional planning process can help reduce the negative impact of promotions on waste, e.g. some companies sacrifice availability (i.e. don't overstock) during promotions to prevent waste (Mena et al, 2014)
- Improved supply-chain wide sharing of information can reduce fear of stock-outs and therefore overstocking (Mena et al, 2014)
- Collection of detailed data on where waste is occurring and feedback to retail distribution, wholesale and processing (Verghese et al, 2015)
- Movement among stores of short-life products to balance inventory (Mena et al, 2014)
- Look for varieties that last longer, or have local production (so shorter lead times) so that shelf-life is extended (Mena et al, 2014)
- Training employees to treat product better, leading to less damage in store (Mena et al, 2014)
- Reducing quality standards, and or discounting/ugly food campaigns, with consumer education, reduces rejects at store and wholesale (Mena et al, 2014)
- Market or sell product with a short shelf-life left through alternative channels such as specialist discounters (online or stores) (Mena et al, 2014), collaborate on common channels for products not meeting specifications (Priefer et al, 2016)
- Trend towards online food retailing has potential to reduce food waste, because warehousing rather than in-store display could reduce food waste through better storage and optimised ordering (Verghese et al, 2015).

Barriers to avoidance by retailers:

- Attitudes of retailers that processes are already optimised (NSW EPA, 2016)
- Investment required to improve systems and technology (Mourad, 2016)
- Acceptance that waste is a part of a business, and in fact may be a sign of food business practice "Industry executives and managers view appropriate waste as a sign that a store is meeting quality control and full-shelf standards, meaning that blemished items are removed and shelves are fully stocked" (Gunders, 2012)
- Perverse incentives —sometimes it makes business sense in terms of labour, time and other resources to discard still-edible food and buy new food (Buzby et al, 2011)
- Focus on food rescue because of social benefit/good news, but food donations are a minor part of solution and cannot alone solve the problem of food losses for logistic, political and hygienic reasons (Beretta et all, 2013)
- Inability to order food in desired quantities (especially independent and SME retailers) because produce arrives in pre-set quantities according to case size, limiting the flexibility to purchase exactly the amount needed (Gunders, 2012)

Repurpose – opportunities for retail from Australian and international literature

The international literature identified a number of opportunities to 'repurpose' food to avoid food waste, by transforming unsellable food into new products or selling through alternative channels:

- Supermarkets like Thornton's Budgens use surplus food, or food close to its expiration date to prepare ready-to-eat meals to sell directly to consumers (FAO, 2013)
- Jeronimo Martins takes vegetables that fail their usual aesthetic standards and redirects to its 4th range produce category: pre-washed and cut vegetables for salads/soups (Consumer Goods Forum, n.d.)
- ICA, a Swedish retail collects blemished and misshapen food that customers are not purchasing and sends these back for processing into private label jams and drinks (Consumer Goods Forum, n.d.)
- Ahold Delhaize developed a partnership with a local brewery to send unsold bread to produce local beer, which is then sold in their stores (Consumer Goods Forum, n.d.)
- Ahold Delhaize also launched a new business line Instock Restaurants, which uses unsold food from stores to build creative, fresh and delicious meals (Consumer Goods Forum, n.d.).
- FoodStar partners is a start-up enterprise that takes excess fruit and vegetables from farmers and retailers and sells them under the FoodStar brand at discounted prices, for a limited time. When they receive a bulk load of a particular product they notify customers through text messages and emails of a flash sale (Guardian, 2014)
- Daily Table is a new grocery store that sells basic groceries and ready-to-eat meals at discounted prices, using food that has insufficient shelf life to sell in normal supermarkets (Guardian, 2014).

One Danish supermarket only sells products past their expiry date or damaged in such a way that they wouldn't usually be sold. Selling expired food is legal in Denmark as long as it is clearly advertised and there is no immediate danger to consuming it (The Guardian, 2016). In a similar vein in Australia, OzHarvest has opened a supermarket that sells only rescued food (OzHarvest, 2017). Australian retailers could mimic these by opening stores that sell food heavily discounted that they wouldn't sell through their normal stores.

No barriers to repurposing were identified in the literature.

Rescue – current retail practices in Australia

Woolworths

- Woolworths partners with several food relief programs such as OzHarvest, Foodbank Australia, SecondBite and FareShare (Woolworths, 2016a). In 2015 the company announced a partnership with OzHarvest to help achieve their goal of zero food waste to landfill by 2020 (Woolworths, 2015).
- In 2014, Woolworths donated 1,381 tonnes of food waste to charities (Woolworths, 2014a), in the 2014-2015 financial year this increased to 2,956 tonnes (Woolworths, 2016a). In 2016, 79% of their supermarkets (913 stores) had a food rescue charities program (Woolworths, 2016b).
- In the 2014-2015 financial year, Woolworths donated 40,000 tonnes of food waste to animal feed through a 'farmers donation program' (Woolworths, 2016a). In 2016, 65% of their supermarkets (752 stores) had a farmer's donation program (Woolworths, 2016b).

Coles

- In 2016, Coles Supermarkets increased their total food donations by 50% to more than 7,800 tonnes through a partnership with SecondBite and Foodbank (Wesfarmers, 2016b).

  In 2014-15, Coles expanded donations to SecondBite to include frozen meat at more than 200 stores (Wesfarmers, 2016a).

Other retailers

- 81% of stores in the ALDI South global group work with charitable organisations such as food banks to donate food that is still consumable to those in need (Aldi, 2015).
- A number of small fresh food retailers who sell through farmers markets take bruised or over-ripe fresh produce and use to create juices and pasta sauces (Downes & Cordell, 2016).

Rescue – opportunities for retail from international literature

Two international examples were identified that could be modelled in Australia:

- In the UK, virtual marketplaces assist redistribution of food to charities. Retailers list the types, quantities and locations of food they have available, and charities respond based on the type of food they need and the logistics they can arrange. Several food waste apps are available in the UK to make this happen, including FoodCloud and Plan Zheroes (Stuart & Jarosz, 2017).
- In the US, Food Cowboy is similar, but products are listed by food truckers instead of stores (because of different supply chain arrangements). When products are listed on the Food Cowboy website, Food Cowboy reaches out to food rescue organisations in the local area, who can then call the trucker. Food Cwoboy diverts about 550 tonnes of food a year, and charges equivalent of 20c per kg (US$0.10 a pound) (Guardian, 2014).

Barriers to rescue by retailers:

- Differences between current food rescue organisations (Schneider, 2013)
- Administrative gaps or tensions between retailer, broker and charities (Alexander & Smaje, 2008)
- Onsite storage, refrigeration and transportation constraints (FWRA, 2016)
- Concern about the danger of branded product being sold on or inappropriately disposed of by the charities or their end use clients (Alexander & Smaje, 2008)
- The shorter shelf life of food at the retail stage, and lack of knowledge by businesses and employees about shelf life, because charities might reject food if they think it will expire/spoil before they can distribute it (Verghese et al, 2013)
- Food rescue is thought to only divert a small proportion of major retailers' food waste. However there is no publically available data to confidently quantify this proportion in Australia. In the UK, a major food rescue retailer estimates that they are accessing just 2% of supermarkets' available

food surplus (Stuart & Jarosz, 2017).

Reuse and Recycling– current retail practices in Australia

Most information available comes from the large food retail companies who publish Annual sustainability reports and participate in other reporting programs.

Woolworths

- Has an ambitious target of diverting all food waste from landfill by 2020 (where facilities are available) (Woolworths, 2015).
- In 2016, only 50% of supermarkets (584 stores) were using a commercial food waste recycling program, though 97% (1,131) had at least one food recycling program (Woolworths, 2016b). No data was provided on tonnes recovered in 2016, but earlier reports for 2014 stated that they diverted **14,655 tonnes** of food waste to compost or energy (Woolworths, 2014a), including **11,070 tonnes** to commercial composting (Woolworths, 2016a).
- Has a "Hearts and Minds" program to educate employees about the why, what and how of separating organic and non-organic waste. All stores now have colour-coded bins and display materials. The training program includes a training guide for managers, interactive activities and e-learning. They are encouraging continuous learning through a customised app that is gamified and by communicating improvement overall and by store. Stores are incentivised to compete against each other in a league table (Woolworths, 2016b).

Coles

- In 2014-15, diverted 20,953 tonnes of organics - this includes redistribution to food rescue organisations SecondBite and Foodbank as noted above (Wesfarmers, 2016b).
- Initiated a program in 2016 in selected NSW supermarkets where more than 3,000 additional tonnes of organic material were converted to energy (Wesfarmers, 2016a).

Aldi

- Some unsold food products that are not donated are used for agricultural purposes or for the production of biogas across the Aldi South global network – this may or may not include Australian stores (Aldi, 2015)

Recycling– opportunities for retail from Australian and international literature

If food is no longer fit for human consumption, it should be reused as a beneficial resource in the food supply chain in line with the food waste management hierarchy. The most common uses are as livestock feed or fertiliser products (Viridis, 2007).

For many retailers, certain food products (particularly unpackaged, fresh produce) can be separated from other waste relatively easily.

Options for individual retailers include:

- onsite composting (or vermiculture/other solution) (Encycle, 2013), or digestion technologies such as dehydration-sterilisation (e.g. GaiaRecycle, EcoVim) (Encycle, 2013)
- sent offsite for animal feed, e.g. donating to farmers (Woolworths, 2017)
- sent offsite for composting (or other organics recycling mechanism) (Encycle, 2013)
- sent offsite to anaerobic digestion (Morgan, 2009)
- other offsite valorisation opportunities (production of biofuels, enzymes, bioactive compounds, biodegradable plastics, and nanoparticles among many other molecules) (Ravindran & Jaiswal, 2016, Girotto et al, 2015).

Opportunities to improve recycling for individual retailers include:

- provision of local government recycling facilities (DOE, 2013)
- precinct collaborations to ensure a viable volume for collection services, or have a greater take up of food rescue services, or enable precinct-sited facilities (DOE, 2013), small business industry

partnerships is establishing “waste bring-bank sites” specifically for SMEs (DEFRA in Reidy et al, 2010), is “corporate loyalty” SMART cards to weigh recyclables (or food waste) deposited by specific companies and reward them accordingly (DEFRA in Reidy et al, 2010).

Barriers to recycling of food waste by retailers:

- Staff training required (Encycle, 2013)
- Difficulty in separating food waste from the rest of the waste stream, particularly removing food from packaging (Verghese et al, 2015)
- Large financial investment for onsite infrastructure (Mourad, 2016)
- Off-site services may not be readily available locally (particularly for small businesses) (Encycle, 2013) or may not be promoted by waste service providers (DOE, 2013)
- Economic incentives are required to build commercial (and industrial) material recovery facilities and alternative waste treatment (SCECA in Morgan, 2009)
- Onsite storage and transportation constraints (FWRA, 2016)
- Smaller business may not generate sufficient consistent volumes of food waste to make collection economically viable for waste collection companies (DOE, 2013)
- Small businesses only happy to recycle if it costs the same or less than their current waste collection contracts (DEFRA in Reidy et al, 2010)
- Lack of on-site waste storage facilities (DEFRA is Reidy et al, 2010)
- Many organics recycling systems do not tolerate any contamination and failure will discourage businesses from continuing with the system (Encycle, 2013)
- Perverse incentives (need for materials, reduced donations and prevention efforts) (Mourad, 2016)
- Potential for food waste to be used in direct land application or animal feed in a manner that contravenes NSW DPI and Australian Government biosecurity laws and regulations in order to avoid the costs of waste disposal (and payment of the NSW Government landfill levy) (ORU, 2011)

General barriers for retail:

- retailers typically have many locations with multiple food related departments, each of which can have different processes or requirements for how food waste is handled or diverted (FWRA, 2016)
- the wide variety and unpredictability of unsaleable food generated in stores as well as the number of locations, and departments within such locations, that create a high level of variability in food waste processes and tracking (FWRA, 2016)
- longer opening hours and provision of fresh, ready food right until closing, requiring shelves to remain fully stocked of fresh item, e.g. One US grocer estimated that his store threw away a full 50 percent of the rotisserie chickens that were prepared, many of those from the last batch of the day (Gunders, 2012)

Wholesale/retail distribution

The following is a list of current practices and opportunities for food wholesalers, which we have characterised by the stage of the food waste hierarchy at which they occur. As noted earlier, information is scare for this sector.

Current practice in Australia

- **Rescue:** Metcash donated **236 tonnes** of non-saleable packaged food to Foodbank in 2014/15 (Metcash, 2016)

- **Recycling:** In 2012, it was reported that some Metcash supermarkets were composting food waste on or off site (Fifth Estate, 2012) but no detailed information has been published since that time. In 2014/15 Metcash recycled **45 tonnes** of organics (37% decrease on 2013/14) (Metcash, 2016).

Opportunities from Australian and international literature

- **Avoidance:** investment in infrastructure and transportation (Cicatiello et al, 2016)
- **Rescue:** Connect with food rescue organisations - food donated before the retail phase is more likely to be fit-for-purpose than food at the end of the retail phase (Alexander & Smaje, 2008)

No recycling opportunities were identified in the literature.

Barriers for wholesale:

- No specific barriers identified for wholesalers in the literature, but there would be many overlaps with those identified for retail, such as technology and equipment, business systems, policies and processes, and employee practices.

Logistics/transport

No specific examples of current practice for the Australia logistics sector were identified.

Opportunities from Australian and international literature

The following is a list of sent offsite **avoidance** opportunities identified in the international literature:

- Feed information back to food brand owners and content packers on the demands on packaging during transport, storage and handling (Verghese et al, 2015)
- Optimise balancing of trade-off between quality of retail product and logistics costs of achieving it (Higgins, 2011)
- Maximising market value/sales through greater flexibility/capability in logistics to match (or even control) demand trends (Higgins, 2011)
- Improve the condition of transportation (e.g. refrigerated vehicles) (FAO, 2013); investment in infrastructure and transportation (Cicatiello et al, 2016).

No **reuse** or **recycling** opportunities were identified in the literature.

Barriers for logistics/transport:

- As for food wholesalers, no specific barriers identified for food logistics in the literature.

Processing/manufacturing

A number of large retailers are vertically-integrated brand owners who are responsible for the processing/manufacturing of their own branded products. Retailers can therefore control certain aspects of processing/manufacturing that can directly impact the amount of food waste produced in store.

The following is a list of current practices and opportunities to address factors at the manufacturing/processing stage that result in food waste at the food wholesale, logistics or retail stages.

Avoidance – current practices in Australian

- Reusable display pallets have been adopted by some Australian supermarket chains. These can provide a ‘one-touch solution’ that deliver products from the point of manufacture through to the point of sale. They reduce handling and product damage in the distribution chain because they don’t need to be unpacked at the distribution centre or retail store. Fractional pallets (half or quarter size) can improve stock rotation by allowing stores to match the merchandising unit with the rate of sales. This can also have benefits for waste if it reduces the likelihood of product going out of date (Verghese et al, 2015).

Avoidance – Opportunities from Australian and international literature

- Design packaging that is fit for purpose so that it doesn't fail during distribution and retail (Verghese et al, 2015)
- Pre-packing food and 'retail ready packaging' (RRP – food is packed at the production stage in a manner that allows direct display at the retail stage):
    - Can reduce food waste in retail stores by reducing handling, improves stock rotation and increases product turnover through better visibility/availability (Verghese et al, 2015)
    - Can reduce food waste in food wholesale by facilitating better product recall processes, promoting more efficient stock accountability and less waste in the process (Verghese et al, 2015)

  It should be noted, however, that packaging can make recycling of food waste more difficult – design must take into account end of life; and Single-use RRP can increase food waste from product damage during transport and storage due to lower strength – reusable RRP like plastic crates for fresh product is likely to lead to less damage (Verghese et al, 2015).
- Innovative packaging materials and design to extend shelf life (Verghese et al, 2015)
- Intelligent packaging and data sharing – reduces excess stock, improves knowledge of expiration dates, indicators of temperature exposure (Verghese et al, 2015), integrate information on best-before dates in the barcodes, allowing automatic price reductions at the checkout (Kreutzberger and Thurn, 2011). Intelligent labels (like Time-Temperature-Indicators, TTI) which show the state of a product via colour change should be further studied in pilot projects (Priefer et al, 2016)
- Improve date marking (Verghese et al, 2015).

Barriers for processing/manufacturing (for retail-owned products)

- Trade-offs that need to be made in decisions about packaging, e.g. where certain types of packaging might enable food waste avoidance but hinder food waste recycling (Verghese et al, 2015)

Benefits from realising opportunities

No Australian literature quantified the financial or environmental benefits that could be expected from taking up the opportunities identified above.

Only one international study was identified that quantified the financial benefit from acting to reduce food waste (Champions12.3, 2017). The European study evaluated financial cost and benefit data for 1,200 sites across 700 companies in 17 countries spanning the food manufacturing, retail, hospitality and service sectors. It found that 99% of sites earned a positive return on investment (ROI) to reduce food waste. The four food retailers examined saw an average saving $5 in operating costs for every $1 invested.

The returns on investment comes from not buying food that would have been lost or wasted, increasing the share of food that is sold to customers, introducing new product lines made from food that otherwise would have been lost or wasted, reducing waste management costs and other savings. The types of investments companies made include: quantifying and monitoring food loss and waste, training staff on practices to reduce waste, changing food storage and handling processes, changing packaging to extend shelf-life, changing date labels, and reducing stock kept on-hand.

C3. BEST PRACTICE CASE STUDIES

Case studies were identified as an important tool in helping business minimise and/or recover food waste. This section sets out some examples of the types of case studies which could be included in future information and education campaigns.

Australian case studies

Only a few Australian case studies of 'best practice' were identified in the literature review:

- **Woolworths' Foodbank expansion** from retail distribution centres (DCs) to individual stores through "reverse logistics" - collecting non-saleable products from stores, sending these items back to their major distribution centres (DCs) in trucks that would otherwise be travelling empty, and providing these to Foodbank via the DCs. The program involves the collection of food and grocery items 'fit for use' but not suitable for sale (i.e. close to end date) at individual Woolworths stores (575 metro stores and 250 country town stores) (Verghese et al, 2015).
- **The Market's Greenpoint program** at Sydney Markets increased the organic waste diversion rate from 15-16% to 66% (Sydney Markets, interview, 2017). The standout tenant is Harris Farm based on sustainability policies and diversion of food waste (Sydney Markets, interview, 2017).

International examples

A large number of case studies were identified in the education resources detailed below. The following is a small selection of these.

- **Changing displays to reduce food display volumes:** Stop and Shop in the US conducted a thorough analysis of freshness, product loss and customer purchases in all of its perishables departments. In the end, the "pile 'em high, watch 'em fly" philosophy did not ring true. The analysis, which began with product displays, discovered alternatives to overflowing displays, as well as whole stockkeeping units that weren't necessary. It also found that overfilled displays led to spoilage on the shelf, customers were displeased with the spoiled product, and it required more staff handling to sort out the damaged items. Customers did not notice reduced choice and less-full displays and, in fact, their satisfaction rose, as produce was on average three days fresher than before (Gunders, in FAO, 2013). The authors note that some major Australian supermarkets have also similarly moved to smaller displays of fresh vegetables, but no public information on these actions could be found.
- **Less baking, more often:** Tesco (UK) instigated a policy of less food, more often, where less food was placed on display on the shop floor, but replenished more often. In fresh produce, the extra staff time of replenishing was offset by reduction in time spent sorting out damaged items from overfull displays. In the bakery department which moved to less bread baked per batch, but more batches, they reduced the amount of bakery goods that went stale before purchase. To help embed this, KPIs for bakery managers were balanced between achieving sales and minimising waste rather than focussing solely on sales. In addition, bakery and store managers now review and allocate excess bakery space to other categories so that bakery shelves still look full but with much lower waste levels.
- **Reusing surplus or soon-to-expire food in hot meals:** Thornton's Budgens is an independently owned retail store in London's Crouch End that introduced an in-store hot food counter. An in-house chef, uses fresh ingredients from the store's shelves such as parsnips, peppers, aubergines and pulses that are approaching their sell-by date or are unlikely to be sold. He prepares delicious, fresh and nutritious meals like tagines, soups, curries and pickles. This has given the store a new market outlet for surplus food products. Bob's curries are very popular with customers, which means that this is an extra source of revenue for the store with very low costs (FAO, 2013).
- **Expanding food rescue:** FareShare in the UK expanded its role to involve brokerage with existing waste management companies, such that *FareShare First* can divert fit-for-purpose food into its existing charitable network and pass on the remainder without having to build the full infrastructural capacity that would otherwise be required. By offering a single, tailored waste management solution including charitable donations alongside waste recovery it becomes a more attractive proposition to retailers than the existing model which is supplementary to the retailer's waste disposal responsibilities. (Alexander & Smaje, 2008)

- **Orange County commercial food waste collection service:** a local composting company collects the food waste from 20 establishments three times a week. Businesses are offered the service at no charge under the following conditions: 1) they participate in the county's commercial glass, metal and plastics recycling program; 2) they have a minimum of two tons per month of food waste to be collected; 3) they have adequate space for the collection containers; and 4) they must be serviceable by the collection vehicle. The food waste materials are placed in either 65-gallon roll carts or Dumpsters for service by a rear loader. It should be noted that some stops serve multiple businesses, allowing smaller generators to meet the two-ton minimum by combining waste. Once collected, the contractor transports the materials to its composting facility. To support the efficacy of the program and to "close the loop," the Orange County Solid Waste Management Division then purchases the compost from the contractor for sale to the citizens of Orange County. The profits from the compost sales are used to reduce the costs incurred for the food waste program.

International examples – policy and regulation

- **Massachusetts Commercial Food Waste Ban:** added commercial organic material to an existing waste ban regulations. Under these regulations, businesses and institutions may not dispose of one ton or more of commercial organic material per week in the trash (MassEEA, n.d.).
- **Ireland's Food Waste Regulations** (since 2010) require major producers of C&I food waste to segregate and recover food waste material for separate collection. The food retailing industry are now required to make C&I food waste available for a separate collection service, or to compost the food waste on-site. Part of the compliance with the Food Waste Regulations involves each company producing a food waste management implementation report about the "use, type, quantity, origin, management arrangements and destination of food waste" (Ireland EPA, 2009).
- **Food retail and manufacturing industry voluntary agreement**: The Courtauld Commitment: a voluntary agreement to reduce food waste and household packaging, and was signed by 42 signatories representing over 92% of major food retailers and manufacturers. Phase 2 of the Courtauld Commitment was launched in March 2010 with 29 major retailers and brand owners signing on, and with a focus on reducing food, drink and non-food product waste along the UK supply chain, as well as reducing the carbon footprint of product packaging. Participants in the first Courtauld Commitment focused their efforts on diverting food waste from landfill by sending it to anaerobic digestion facilities or to food redistribution charities such as FareShare. A further focus is on changing the retail environment (i.e. how food is sold; different portion sizes; re-sealable packaging; tools such as storage containers) (WRAP, n.d.).
- **Date labelling legislation and voluntary industry agreement:** Last year two US politicians introduced legislation to standardise date labels in order to reduce consumer confusion, simplify regulatory compliance for companies, and cut supply-chain and consumer waste of food and money. The standard clearly distinguishes between foods that bear a label to a) indicate peak quality from b) foods that may become unsafe to consume past the date. For the former, the legislation requires the use of the terminology "BEST if used by", for the latter, simply "USE By". This terminology was selected based on consumer perception surveys that identified this as the language that is the most clear and accurate to consumers. The law was not passed initially, but peak industry bodies adopted the standard early this year in a new voluntary initiative. The legislation is planned to be reintroduced shortly (Environmental Leader, 2017).

C4. EXISTING RESOURCES

Australian resources

NSW EPA currently dedicates approximately 20% of its Love Food Hate Waste Food Waste Avoidance Education grants to projects targeting SMEs in the food retail/hospitality sectors (see Table 18).

Table 18: NSW Love Food Hate Waste grants for business

	Total Grants		Grants for Business	
	Funding	#	Funding	#
Round 4 (2016)	$214,125	7	$0	0
Round 3 (2015)	$324,310	10	$69,794	1
Round 2 (2014)	$237,684	8	$80,772	3
Round 1 (2013)	$356,797	10	$89,049	3
Total	**$1,132,916**	**35**	**$239,615 (21%)**	**7 (20%)**

Source: NSW Environmental Trust, www.environment.nsw.gov.au/grants/foodavoid.htm

The following is a description of the seven projects, funded through the NSW LFHW grants for business, conducted over the last four years. A number of these refer to the development of educational resources:

- **Tackling Food Waste at Farmers Markets and Festivals (Total Environment Centre Inc, 2016)** The Total Environment Centre is working with the Institute of Sustainable Futures, University of Technology to develop a toolkit for festival and farmers market stall holders. The toolkit will contain information that will help stall holders reduce food waste at events. The tool kit will be piloted at the Pyrmont Festival in May 2016 before being made available for use at all festivals and farmers markets.
- **Eat, taste, create - A $ave more waste less initiative (Canada Bay Council, 2015)** This project will work with food related businesses from different cultural backgrounds across the Canada Bay local government area to help them reduce food waste. Activities will highlight what local businesses are doing in their own kitchens and link to cultural events such as the Chinese Moon Festival and Good Food and Wine month. Local chefs will also share their tips and success stories to help other businesses reduce their food waste. Recipes from the events will be accessible and promoted on City of Canada Bay's website with tips, local growers markets, and waste-focused workshops.
- **Food business waste minimisation - SME education project (Cessnock City Council, 2015)** Council will work with 30 small to medium food related businesses to help them cut their food waste in half. The resources will be made available to Environmental Health Officers across the region to help other businesses do the same.
- **Food2Take (Riverina Eastern Regional Organisation of Councils, 2015)** The Food2Take project will develop a food donation initiative in the area which will connect businesses that have surplus edible food with not-for-profit organisations that distribute the food to those in need. This project will also include the development of an automatised alerts system which will notify recipients that donated food is available for collection. Both donors and recipients will receive one-on-one training to help them with reducing food waste.
- **Waste less, $ave more - food waste avoidance for food businesses (Canada Bay Council, 2014)** Waste less, $ave more is a food waste avoidance project developed by Canada Bay Council targeting local food retail businesses. The project will promote best practice in food waste avoidance as well as highlighting real life tips from business owners who have successfully reduced their food waste. Achievements from this project will be showcased at a pop-up event in Rhodes Shopping Centre and at two major street festivals.

- **Better business through Love Food Hate Waste industry training (Hunter Councils Inc, 2014)** The Hunter group of councils will develop a pilot Hospitality Training program which incorporates the key principles of Love Food Hate Waste. Course content will be developed by industry and will be incorporated into selected Certificate 3 Cookery Units. Content will focus on the economic and environmental benefits of avoiding food waste and will include a series of videos and other materials
- **How to turn food waste around on Lord Howe Island (Lord Howe Island Board, 2014)** The Lord Howe Island Board will develop a food waste avoidance education program for businesses on the island. Businesses will attend a workshop where they will learn the key principles associated with food waste avoidance and also be supported by one-on-one sessions.

In addition, information for the Round 4 grants states that the Love Food Hate Waste program had recently developed new "Your business is food" resource kits for hospitality/food service businesses to identify and avoid food waste by providing an all-in-one information package. The fourth round for Love Food Hate Waste encouraged applications where partners worked with the local food businesses in using the kit, though no applications of this type were received. Following a pilot, and partnering with Bin Trim, Your Business is Food will be officially launched in September 2017 and made available to applicants for the next round of grant funding, being run by the EPA. The kit includes:

- templates
- how-to videos
- forms to complete a food waste review
- action plan to avoid spoilage, preparation and plate waste
- tools to educate staff and customers.

These resources could be adapted to suit the needs of food wholesalers and retailers.

In addition, WWF reports on its website that on the basis of a survey it conducted with leading Australian food businesses, it is working with business and councils to promote the most successful food waste production programs around Australia. The EPA is currently working with WWF to develop a suite of resources for the food services sector. Other sectors are scheduled to follow.

International resources

The following are a selection of existing resources found to support the target sectors in other countries, which could serve as a model for, or input into developing similar resources for the Australian context.

- **UN FAO: Food waste footprint toolkit.** PDF documents describing issues and actions according to the waste hierarchy, including actions for policy makers http://www.fao.org/docrep/018/i3342e/i3342e.pdf
- **UK WRAP: Retail.** Data on volumes, information, education, tools, voluntary commitment, supply chain analysis and partnerships for Food Retail http://www.wrap.org.uk/category/sector/retail
- **The Institute of Grocery Distribution (US): Waste Prevention.** Website containing information, education, tools and case studies specifically for the manufacturing, wholesaling and retailing sectors http://www.igd.com/Research/Supply-chain/Waste-prevention/Six-to-fix-to-prevent-waste/
- **Consumer Goods Forum: Case studies.** Showcases an array of successful approaches to food waste from consumer goods companies up and down the supply chain http://www.theconsumergoodsforum.com/sustainability-strategic-focus/waste/food-waste-case-studies
- **LeanPath food waste data capture and reporting system.** A food waste tracking system for food service http://www.leanpath.com/

D. INTERVIEW FINDINGS

To supplement the literature review, a series of 14 interviews were conducted to gather first-hand experience from key players throughout the food supply chain. The intention of these interviews was to understand current food waste volumes, types and causes in the interviewees organisation and sector, their thoughts on how this waste can be better minimised or managed, and particularly to identify barriers and opportunities that may exist for improved practice.

D1. SOURCES OF FOOD WASTE

Information received through these stakeholder interviews revealed a mixture of shared and unique factors depending on the context of each business. These reasons are discussed below based on each sector interviewed, with common themes and specific opportunities summarised below.

Manufacturing/processing

No interviews specifically touched on factors at the manufacturing stage which affected food waste at the wholesale/retail levels.

Logistics/transport

The transport and logistics of food connect all other stages of the supply chain and have significant impact on the quality and shelf life of produce. However, our research indicates this sector has very little food waste itself, as any potential food waste is offloaded along with food at the destination. However a number of factors at the logistics stage were identified as root causes for food waste occurring downstream at the wholesale/retail levels, and that there were frequently significant gaps in responsibility for food waste caused during logistics/transport.

- **Inconsistent management practices** – both the quality and use of transport refrigeration systems varies significantly between individual trucks and drivers. Some will operate properly sealed systems at the correct temperature, while others may operate insufficiently cooled/sealed systems that are only turned on once the produce is loaded.
- **Lack of management standard for industry** – Refrigerants Australia promotes standards for operation for the transport industry, however these are voluntary in nature. No data is gathered on compliance with these standards making it difficult to establish the extent of compliance.
- **Lack of communication within the industry** – Refrigerants Australia is in the process of establishing collaborative groups within the industry to address these inconsistencies, however the diversity of the transport industry remains a significant barrier to consistent standards.
- **Lack of communication between transport and other sectors** – Transport operators and other stages of the supply chain currently do not share sufficient information to ensure produce is properly managed, with many drivers being unaware of what they are shipping and how it needs to be handled, and receiving wholesalers/retailers unaware of how the transport conditions may have affected the product quality or longevity. Responsibility for product damage/spoilage is subsequently unclear when it does occur, leading to legal disputes.

Anecdotal evidence suggests that the major impact of logistics on food waste at the wholesale/retail level occurs in transporting fresh produce (fruit and vegetables, meat and dairy, etc) from agricultural production direct to wholesale/retail distribution, due to the long distances travelled, the poor state of many of the roads and the amount of fuel that can be saved by turning off refrigeration for some or all of the trip.

Logistics between retail distribution and individual retail stores was not considered by one stakeholder to have any impact on waste, as the major retailers pack products contained in carefully selected secondary and tertiary packaging into roll cages in the warehouse and then roll them on and off the trucks. And at least for urban retailers, the product generally only travels short distances from peri-urban warehouses.

Wholesale/retail distribution

Information was collected both from two large-scale food markets as well as from four large-scale retailers/wholesalers who operate distribution centres to service their retail outlets. The information gathered from the interviews indicated two major causes of food waste in this sector, shared by all stakeholders: oversupply and shelf life, with a number of additional causes also being expressed:

- **Shelf life** is the most significant factor in creating food waste at this stage of the supply chain, as produce must be received, sold and exported within a distinct timeframe in order to be sellable at the retail level of operations. Fresh produce in particular is subject to quick spoilage, resulting in it being unsellable and requiring disposal.
- **Oversupply** is the other significant factor at this stage due the exceptional difficulty in predicting demand, and the necessity of ensuring there is always sufficient supply to meet that demand. Particularly for fresh produce this results in largescale spoilage of oversupplied items which must then be disposed of.
- **Produce** failing to meet either legal or retail standards often results in produce being rejected at this stage, resulting in a large volume of fresh produce being disposed of by the wholesaler (e.g. if fish catches include prohibited species) or returned to the manufacturer (e.g. oversupply or failing aesthetic standards).
- Regarding fruit and vegetable produce in particular, **weather conditions** can create significant wastage due to significant impact on supply, damage to produce before it arrives at the markets (rejected at gate), or by affecting the shelf life of the produce once received.
- Internally, food waste is also generated due to **staff mishandling of produce**, leading to damage of stock or reduction of shelf life due to failure to properly store/rotate stock.

Other factors include: machinery faults, offcuts, returns on product and products not meeting specifications.

Retail stores

Due to interaction with the general public, food waste at the retail stage of the supply chain occurs for a wide variety of reasons, many of which are only broadly understood. Retailers interviewed were largely proactive in attempting to manage or prevent food waste, however numerous common uncertainties complicated this:

- **Over-supply** – as with the wholesale sector, accurately anticipating supply and demand of produce is exceptionally difficult, and the need to ensure that sufficient supply is always available means that oversupply is a common problem, resulting in produce expiring and needing to be disposed of.
- **Shelf life** – The limited lifetime of produce, especially fresh fruit, vegetables, bread and milk, creates a limited timeframe before they become unsellable and require disposal. The retail sector is at the end of the supply chain, meaning handling/storage at prior stages will affect the shelf life significantly at the retail stage – retailers may not be aware of this, causing products to expire earlier than expected.
- **Consistent supply** – Retail customers expect a full range of products to be available at all times of the day, requiring retailers to stay fully stocked even in the hour before closing. This is particularly true for items considered essential such as bread, milk and eggs. This can result in produce being overstocked and unsold by the close of business, wasting shelf life while the outlet is closed and leading to product expiring and needing disposal.
- **Customer expectations** – Research conducted by retailers regarding customer purchasing preferences demonstrate aesthetic standards play a significant role. These standards are constantly changing over time and result in unsold produce where it does not meet these expectation – retailers respond to this with purchasing standard to prevent wastage, however this only shifts the problem back to the wholesaler or producer.
- **Staff awareness/performance** – Retailers note significant variance in food waste prevention and effective management between stores. Policies are consistent across franchises, indicating staff awareness of these policies and/or engagement in employing these standards are the critical factors in performance.

Retailers attribute food waste to a difficult balance between availability of products and overproduction. This balance is particularly hard to achieve in bakery and the cost of transporting bread is uneconomical. One retailer also noted the importance of the appearance of products to consumers.

End of life

Where food cannot be sold through the normal supply chain, efforts are usually taken to prevent the economic loss of simple disposal. However numerous barriers exist to these efforts which can lead to recoverable food being disposed to waste:

- **Packaging contamination** – Much fresh produce is packaged by retailers to improve shelf life and control portion sizes, which helps reduce food waste, however if the product is not sold this packaging becomes a major impediment to recycling of this food due to the difficulty and cost of removing the packaging first. Depackaging machines do exist but are rare and have limited capacity.
- **Limited disposal options in many stores** – Regional and rural businesses often have less options available for the recycling of food waste compared to urban operations, resulting in higher rates of disposal, or redirection to low-value recovery options such as stock feed.
- **Oversupply volumes** – the difficulty predicting supply and demand can result in significant volumes of produce oversupply which many recovery options (particularly food rescue) do not have the capacity to manage spontaneously.
- **Staff incorrect disposal** – unaware or disengaged staff have been noted to dispose of otherwise recoverable food waste via inferior options, i.e. food with potential for rescue or resale may be sent to stock feed or composting, or simply disposed of to landfill.
- **Upfront cost of improvements** – Many businesses are aware of machinery or infrastructure that would help them better manage food waste, however the upfront costs of these improvements are prohibitive.
- **Lack of information regarding management options** – While many businesses are proactively informed regarding management solutions for food waste, others demonstrated they were unaware of some management options, including resale through Yume Foods, recycling via anaerobic digestion, diversion of contaminated food from landfill via depackaging, etc.

D2. CURRENT ACTIONS AND OPPORTUNITIES

Data received through the interview process confirmed that food waste is recognised as an important issue to address by industry stakeholders, as per the information gathered through the literature review. Each sector within the supply chain is currently employing a variety of methods to improve food waste prevention and management, and a number of opportunities exist to improve upon these practices if existing barriers are better understood and removed.

Retail stores

As the end of supply chain and customer-facing businesses, the causes of food waste in the retail sector are complex and difficult to map. However, retailers have employed a number of methods to prevent food waste where possible and capture its value where not.

Avoidance/ reduction

The following are current practices reported being taken by stakeholders:

- Individual store managers meet daily to monitor and modify stock to reduce losses.
- Education at the store level (e.g. staff induction training) to minimise waste and profit loss.
- Provision of signage and posters aimed at staff.
- Stock management procedures.
- The most effective avoidance strategies are those that produce financial benefits for stores.

The following were identified by stakeholders as further opportunities:

- Developing benchmarking initiatives will allow retailers to compare performance between stores and promote awareness/engagement.
- Food waste forums involving retailers and food rescue organisations would greatly improve communication and maximise capture.
- Communication through the supply chain would help improve understanding of supply and demand patterns, greatly helping the prevention of oversupply.

Barriers to avoidance by retailers:

- Insufficient food waste knowledge and awareness among staff
- Limitations in ordering software limit ability to track product shelf life and proactively manage oversupply
- Customer priorities on appearance (the 'would I eat it' test) and desire for low prices limit what food can be sold
- Need for constant availability of certain items (e.g. bread, milk, eggs) despite random demand patterns
- Competitive advantage of having the best-looking produce on show
- Up-front costs of avoidance to companies
- Competition between retailers to have their best produce on display and labour costs of smaller displays

Repurpose

Stakeholders in the retail sector did not mention any examples of repurposing food.

Rescue

The following are current rescue practices reported being taken by stakeholders:

- All major retailers reported formal partnerships with one or more food rescue charities. Two retailers reported goals of having 100% of stores to have an arrangement with at least one food rescue organisation, with one of these also aiming for 100% of the distribution network to have a similar arrangement.
- One retailer is trialling a partnership with OzHarvest and NSW EPA to provide education to store staff on proper separation and storage of waste food rescue, while another mentioned efforts to improve the quality of food for rescue.

The following was identified by stakeholders as a further opportunity:

- One retailer suggested employing a dedicated person to segregate produce fit for human consumption, to increase donations, and reduce contamination or 'shifting' of waste to charity.

Barriers to rescue by retailers:

- Lack of infrastructure for rural supermarkets and finding partners for remote stores.
- Disconnect between high waste products, and what charities actually need and can use. Charities take unusable food because they do not feel able to turn down food, but they don't necessarily get the kinds of food they need.
- Limited availability of commercial providers for all stores and lack of infrastructure.
- Food rescue organisations generally have limited capacity and are unable to manage large volumes of rescuable food which can often occur throughout the supply chain on short notice.

Recycling

The following are current practices reported being taken by stakeholders:

- One retailer has a public target of “towards zero food waste to landfill by 2020 (where facilities are available)” but acknowledges the complexity of the causes of food waste may make this impossible to measure or achieve completely.
- One retailer uses commercial service provider, Cleanaway, to collect waste for composting and anaerobic digestion in metropolitan NSW. Cleanaway then sends this waste to Earthpower in Sydney. In Western Australia, all waste goes to anaerobic digestion.
- One retailer indicated they have recently set a target to recover food waste and the figure will be released to the public shortly.

The following were identified by stakeholders as further opportunities:

- Ensure new and upgraded stores have space for multiple bins to overcome limited waste storage capacity at back of house.
- Invite food rescue organisations into stores to separate food waste from other non-organic waste, e.g. packaging.
- Add a step in the waste management process requiring staff to specify where an item is going once removed from sale and how much it will cost to dispose to landfill.
- Collaborations with universities to discuss the relative environmental impacts and benefits of alternative technologies.

Barriers to recycling of food waste by retailers:

- Costs for retailers associated with storage space, additional bins, transport and service costs.
- Low cost of disposal through lower landfill levies, especially in Queensland, and charging for general waste often being based on volume rather than weight, which is favourable for high density food waste.
- The use of packaging to extend shelf life, which contaminates food waste and therefore makes food recycling uneconomical compared to current landfill disposal costs
- The expense and technical difficulty of depackaging and separation of organic and non-organic waste.

Wholesale/retail distribution

As the intermediaries between producers/manufacturers and retail, wholesalers and markets deal with bulk volumes of food on a daily basis – as a result when food waste occurs it can involve significant volumes requiring large-scale management or disposal.

Avoidance/ reduction

The following are current practices reported being taken by stakeholders:

- One market organiser provides education for tenants; they avoid supplying stallholders with large bins to minimise disposal of organics to general waste, and fine stallholders for any food waste placed in general waste bins.
- One retailer uses a data warehouse management system to ensure that products are sent out to stores at the right time to avoid spoilage.

The following were identified by stakeholders as further opportunities:

- Improved communication throughout the supply chain would greatly assist wholesalers to predict demand and prevent oversupply.
- Improved tenant awareness and engagement at Sydney Markets would help prevent food waste creation in markets.
- Larger volume freezer systems would enable food to be stored for longer at markets, helping to better manage differences between supply and demand.
- Machinery upgrades in a bakery to minimise waste created through human error and line faults.

Repurpose

Interviewees in the wholesale/retail distribution sector did not mention any examples of repurposing food. YUME Foods, an online wholesaler of surplus food, did attend the workshop, however.

Rescue

The following are current practices reported being taken by stakeholders:

- Metcash donated **236 tonnes** of non-saleable packaged food to Foodbank in 2014/15 (Metcash, 2016). Metcash (interview, 2017) has an 8-year relationship with Food banks and also provides food donations in small quantities to other charities.
- Over the past 12 months, Sydney Markets gave 500 tonnes to food rescue organisations.

The following were identified by stakeholders as further opportunities:

- Larger volume freezer systems would enable the storage of excess food that food rescue groups cannot handle immediately.
- Improved networking between wholesalers and rescue organisations would allow better capture of food from all locations.

Recycling

The following are current practices reported being taken by stakeholders:

- In 2012, it was reported that some Metcash supermarkets were composting food waste on or off site (Fifth Estate, 2012) but no detailed information has been published since that time. In 2014/15 Metcash recycled **45 tonnes** of organics (a 37% decrease on 2013/14) (Metcash, 2016). Metcash (interview, 2017) also works with Remondis on soil injection in NSW.
- 66% of waste generated at Sydney Markets is recovered, of which 53% is organic waste (Sydney Markets, interview, 2017). Some food waste from Sydney Markets (interview, 2017) goes to organic recyclers and growers on site. The Markets Greenpoint program has been in operation for 11years, resulting in an increase from 15-16% to 66% in organic waste.

The following opportunities were also identified by stakeholders:

- increased efficiencies in the food supply chain and documentation of food waste generated.

Barriers for wholesale sector improvement:

- The cost of transporting food waste.
- Unpredictable demand from retailers.
- Limited influence and coordination among independent retailers or market stallholders.
- Limited commercial recycling and food rescue services.
- Lack of buy-in from waste contractors.

Logistics/transport

The logistic/transport sector connects all other parts of the supply chain and as such, has a significant impact upon product quality and shelf life.

As noted early, food waste generally does not occur at the logistics stage because food products are offloaded at the destination, and any waste occurs upon receipt. However, a number of potential causes of food waste were identified at this stage, which if addressed, could help avoid food waste downstream at the wholesaler/retail level.

Avoidance/ reduction

The following are current practices reported being taken by stakeholders:

- Refrigerants Australia maintains and promotes standards for refrigerated transport for the transport sector, however this standard is currently voluntary and lacks awareness through the sector.
- Refrigerants Australia is part of the Australian Government Climate Change Coalition and is in the process of setting up the Australian Food Cold Chain Council to provide collective, strategic approach to the problem.

The following were identified by stakeholders as further opportunities:

- A legislated or otherwise compulsory standard for refrigeration equipment and operation in transportation would reduce food waste resulting from products spending time outside the required temperature range.
- Improved communication throughout the supply chain would assist transport companies to better understand the importance of proper management of transported produce.
- Establishment of data monitoring of truck temperatures, compliance with standards and volumes of food damaged/waste produce would greatly improve understanding of where and why these problems occur, as well as effective strategies to manage.
- Clarifying who is responsible for damaged/wasted food through the supply chain will improve ownership for proper management and accountability for failures.
- The establishment and promotion of carbon credits for food waste avoidance would add financial incentive to improved, proactive management (a limited opportunity to generate and receive funding for carbon credits is available through the Australian Government's Emissions Reduction Fund).

Repurpose/rescue/recycling

Waste generated in logistics/transport ends up elsewhere, i.e. returned to the manufacturer or disposed at the wholesale or retail facility. Decisions about repurposing, rescuing or recycling food waste are therefore not generally made by businesses within this sector.

Barriers for logistics

- Achieving technical standards in the trucking fleet increase the cost of containers.
- Lack of communication between trucking companies; retailers and manufacturers.
- Lack of interest and recognition for good performance.

D3. INTERVIEWEE RECOMMENDATIONS

A wide variety of food waste prevention and management efforts are currently underway throughout the food supply chain. Significant benefit can be achieved through better coordination between the various sectors to share information and prevent duplication of infrastructure and investment.

A significant gap in existing efforts was identified in the logistics/transport sector where food waste is poorly understood and its management is still in preliminary stages – direct support within this sector may result in significant improvements.

Communication/Collaboration

- Provide opportunities for companies to network and share best practices.
- Enhance cooperation among food rescue groups and facilitate dialogue between industry and rescue groups.
- Unify metrics for measuring waste to better capture data.
- Create a unified database on food waste.
- Set up trial sites for retailers to see a waste project through from inception to trial.
- Assist retailers to provide education to staff and consumers.
- Implement consumer education campaigns (e.g. Love Food, Hate Waste) on freshness and appearance.
- Provide education on regulations relating to food waste donation (e.g. What can and cannot be donated).

Infrastructure investments

- Support the development of new technologies to recover food waste.
- Provide assistance to separate food waste from and non-organic waste.

Legislative intervention

- Introduce Legislation to prevent organic material to landfill.
- Generate licensing regimes and industry-wide initiatives on food waste.
- Support implementation of existing guidelines.
- Conduct internal and external audits.

Financial intervention

- Create financial incentives to divert and prevent food waste through a food waste levy.
- Raise the landfill levy to make further diversion financially appealing.
- Provide incentives to the logistics/transport sector to monitor temperatures.

D4. SMALL FOOD RETAILERS

Small retailers are distinct from large retailers both in having a significantly smaller scope of operations, but also in reduced capacity to predict or manage contributing factors to food waste creation. Management of food waste is subsequently very dependent on local context. The following summarises the insights into small-to-medium businesses from interviews with two SME speciality food retailers and comments from other stakeholders.

Efforts to engage small food wholesalers/retailers

Substantial effort was put into engaging small food wholesalers/retailers with limited success. These efforts included directly searching for small food retailers and wholesalers through search engines, white pages and lists of Australian food retailers and wholesalers. Invitations for interviews were sent via email but no responses were received. Contact details for five businesses who had previously participated in the NSW EPA's Bin Tim program were provided by the NSW EPA and these were contacted initially by email and followed up by phone. Only one business agreed to an interview. To supplement this, the research team attempted to conduct on location, informal interviews with a number of SME food retailers located in a local shopping precinct in inner Sydney. Of the twelve businesses approached, only one agreed to an interview. Prior to the workshop, phone calls were made directly to those small businesses contacted earlier within the inner Sydney area to invite them to the workshop or to participate in an interview. These were followed up with further emails. None of these businesses responded.

Sources of food waste

Where food waste is generated in small retailers is high dependant on the nature of the business, however several consistent messages have emerged;

- **Damage during transport** – poorly packed fresh produce is often damaged during transportation, shortening shelf life and sometime requiring disposal at the point of delivery. Whereas large retailers/wholesalers may have the influence to return damaged goods, small retailers usually lack the influence to do so. In addition, many small retailers collect food themselves from wholesale markets and so are responsible for the loading, driving and unloading of trucks.
- **Mishandling during unloading** – occasional mishandling of produce during unloading can result in damage, shortening shelf life and/or destroying produce. Unloading is generally done manually, without the use of sophisticated equipment such as roll cages.
- **Weather impacts** – as with wholesalers, severe weather has an impact on the quality and shelf life of fresh produce, sometimes requiring premature disposal.
- **Cooked product turnover** – where product is cooked, it must be sold within a highly limited timeframe before it needs to be disposed of.
- **Customer expectations** – as with major retailers, well-stocked displays are considered more pleasing to customers than displayed stock to match demand levels, requiring more product being used than is likely to sell.

Current practices

Small retailers usually operate out of a single location, have little to no control over distributors or local infrastructure, and have limited spare resources for data capture and strategic planning. As such their approaches to managing food waste are highly variable, and often ad hoc in nature:

- **Demand prediction** – managers gain an informal idea of demand patterns over both short and long-term periods and attempt to scale product prepared to demand, however unlike major retailers, this prediction is usually intuitive and rarely based on data.
- **Waste tracking** – food waste represents lost income, so many small retailers track the volume of food waste produced both through formal mechanisms and informal monitoring. Unlike large retailers, waste is often considered unacceptable (or unaffordable) – it is not just a cost of doing business.
- **Marking down** – similarly to large retailers, product approaching the end of saleable life is sold at a discount rate to encourage sale.

- **Food donation** – some small retailers give away product that is no longer sellable but still fit for consumption to school programs or other small businesses for use as ingredients. Unlike large retailers they rarely engage directly with the major food rescue organisations.
- **Recycling** – some small retailers employ collection services to collect their organic waste for recycling purposes, such as composting. This is done at the retailers' expense. Some retailers have onsite equipment that processes food waste into liquid waste which is then collected and recycled.
- **Centralised organics collection** – where small retailers operate out of a shopping centre complex, centralised organics bins are occasionally provided, allowing retailers to recycle food waste via these systems.
- **Landfill** – similarly to large retailers, many, if not most small retailers simply dispose of food waste directly to landfill.

Barriers

- **Unpredictable demand** – as with large retailers, predicting customer demand is very difficult, often resulting in oversupply. These challenges are amplified for small retailers due to a common lack of resources for monitoring and strategic management.
- **Limited resources** – Small retailers lack the capital for investment into infrastructure or strategic management/data collection that could help them improve their practices.
- **Lack of control** – as they rarely own the location they operate out of, small retailers are often reliant on landlords for provision of waste facilities or space therefor, and cannot realistically alter these circumstances. Small retailers also have substantially less influence over the rest of the supply chain compared to large retailers, meaning they often bear the cost of damaged produce from the wholesale/logistics sectors.

Opportunities

- **Improved communication with landlord** – small retailers struggle to predict demand patterns, however landlord groups such as shopping centres may be able to assist by communicating customer movement patterns for the centre as a whole.
- **Improved representation through supply chain** – exposure of small retailer needs/challenges to other sectors in the supply chain will allow for better awareness of causes of food waste, and better coordination of management solutions.
- **Improved infrastructure** – one interviewee noted that the shopping centre they operate in has a centralised organics collection bin, but does not provide retailers with small organics bins to collect and transport food waste to the central location. As a result this centralised system is rarely used.
- **Assistance for data capture** – small retailers often lack the time, funds and skills necessary for effective monitoring of demand patterns, food waste generation and other critical data for food waste management. The development of simple, streamlined software or other recording mechanisms would greatly assist with this.

E.WORKSHOP FINDINGS

Following the literature review and stakeholder interviews discussed above, an Industry Workshop was held on Tuesday 30th May, 2017 at the University of Technology Sydney. The purpose of this event was to:

- present and reality check the findings from the research about where and why food waste is occurring in these sectors, and what opportunities there are to avoid, rescue, reuse or recycle food waste
- share industry success stories of where food waste is already being minimised or recovered (i.e. diverted from landfill)
- identify and prioritise the main barriers to greater food waste minimisation and recovery in the industry
- contribute to the design of recommended programs for the NSW EPA to implement to support industry.

Seventeen representatives from industry stakeholders attended the Workshop, along with six research staff from UTS and RMIT Universities, and two representatives of NSW EPA. The Workshop format involved an iterative process, facilitating attendees to list and map food waste throughout the food supply chain in the following order:

1. **Sources** – where food waste occurs within business and sector (yellow notes).
2. **Causes** – why the waste occurs, what makes this waste necessary/unavoidable (dark blue notes).
3. **Current management** – where food waste currently generated ends up (pink notes).
4. **High-value opportunities** – how identified food waste can be avoided, reduced or repurposed (purple notes).
5. **Lower-value opportunities** – how identified food waste can be rescued, reused or recycled (pink notes, second level).
6. **Barriers** – what factors currently prevent these opportunities being acted upon (light blue notes).

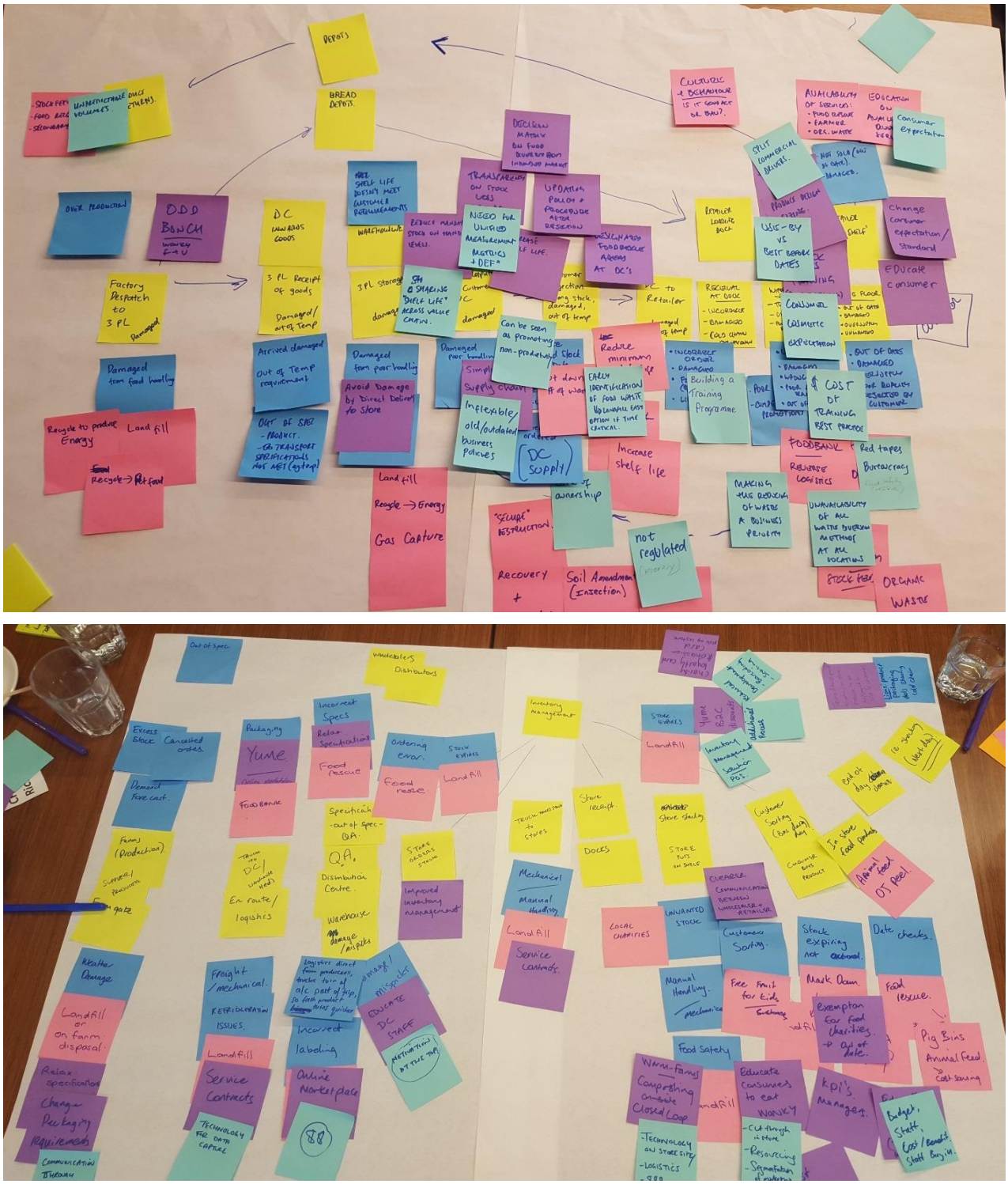
These maps were laid out into a singular map tying specific sources to opportunities and barriers for improvement, greatly clarifying the relationships throughout the supply chain and building understanding between different stakeholders and sectors – see Figure 22 below.

Following this mapping process, solutions were developed by each group based on the relationships identified (orange notes). These solutions were then mapped against a Value versus Difficulty matrix and presented back to the attendees for review and prioritisation.

This methodology ensured that the solutions developed were verified against the practical realities of each sector and are realistically possible and effective options for implementation. It also offered the additional benefit of promoting communication and coordination both within and between sectors, in many cases for the first time, which greatly expanded participant understanding of the flow-on impacts of food management, and opportunities for improvement from a high-level strategic perspective.

The outputs of the workshop are shown in Figure 22 and Figure 23, and detailed further below.

Figure 22: Workshop system mapping



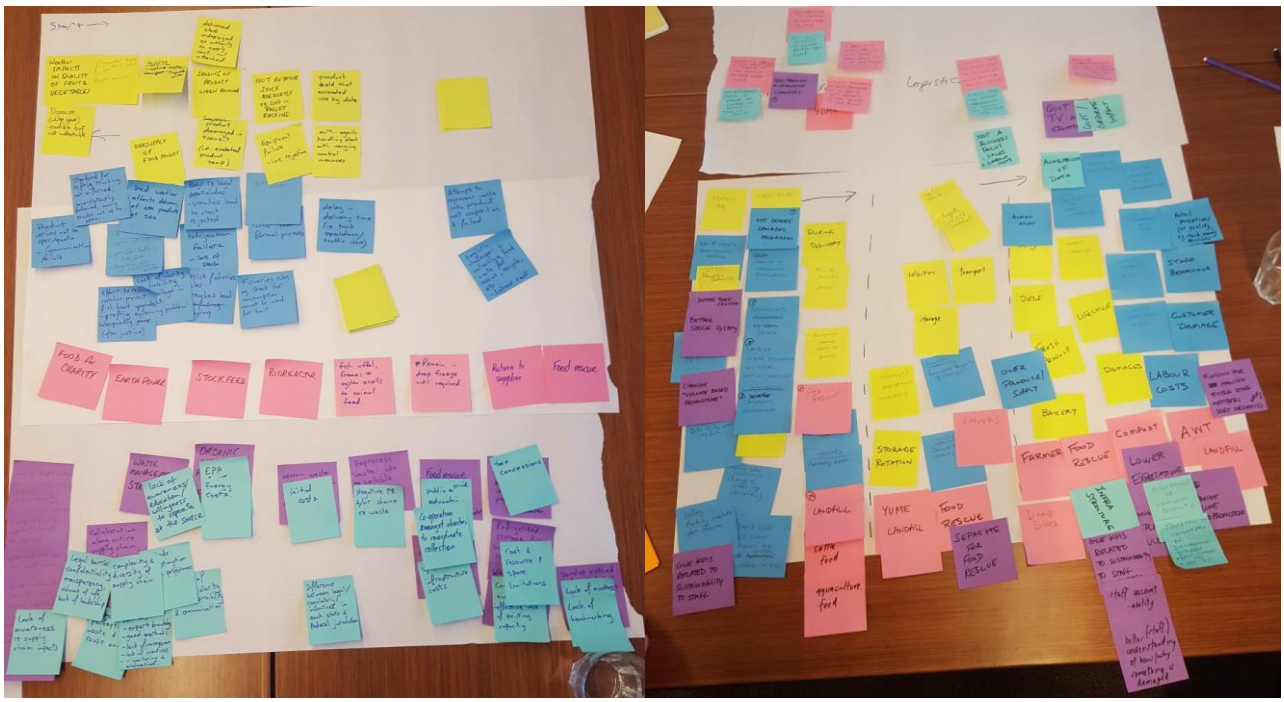


Figure 23: Workshop recommendations brainstorming

E1. SOURCES OF WASTE

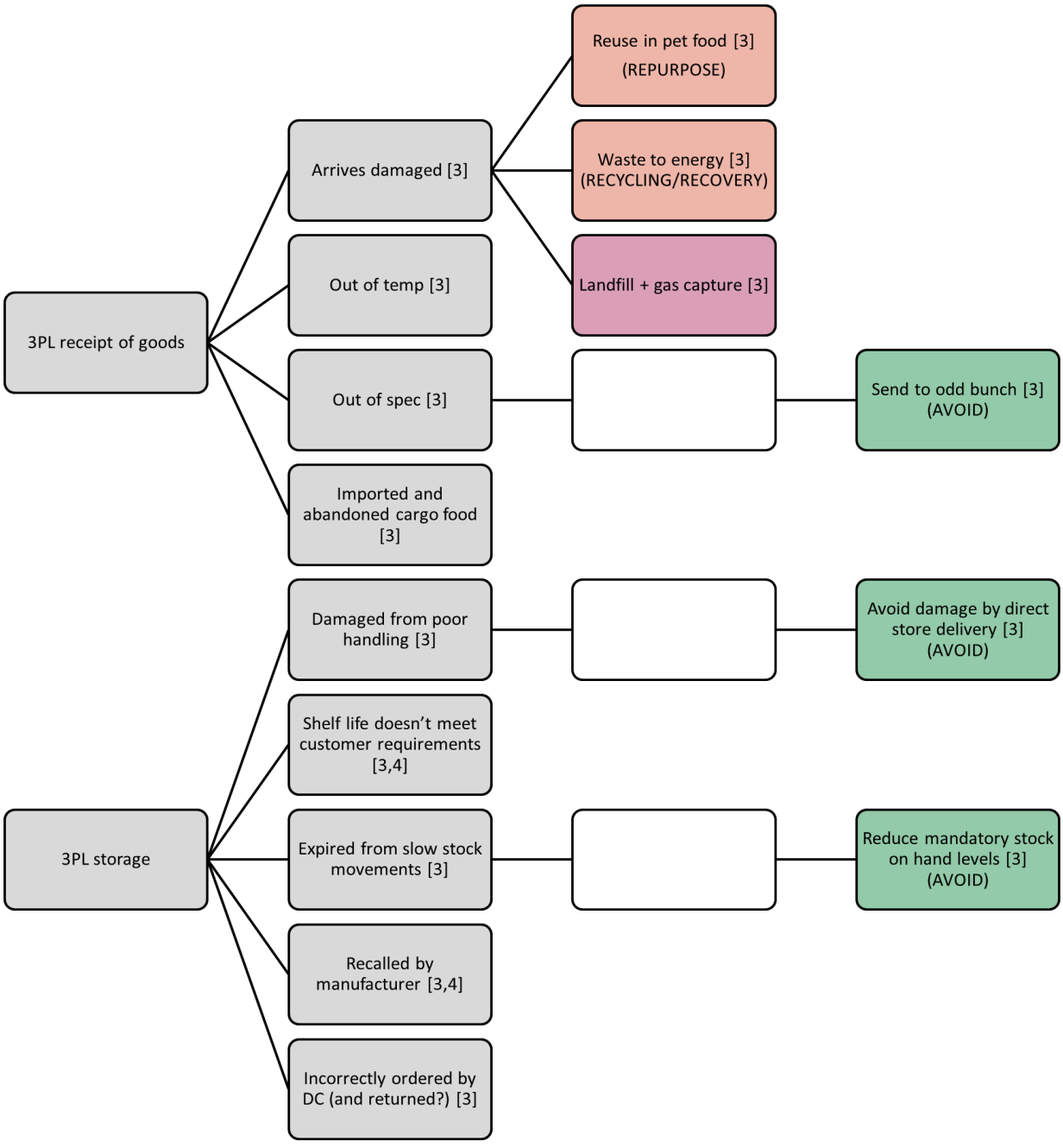
The first stage of the mapping exercise captured three key elements of information: source and cause of waste, current end of life (if known) and opportunities. Groups at each of the four tables drew up their own maps, and after the workshop these were collated and reproduced as a series of flowcharts, using the following colour coding.

Source/cause of waste	Avoidance	Rescue	Reuse/ Recycling	Energy recovery / Landfill	Unknown / Not specified

There were four tables. The numbers listed for each cause or opportunity represent the individual tables who noted it.

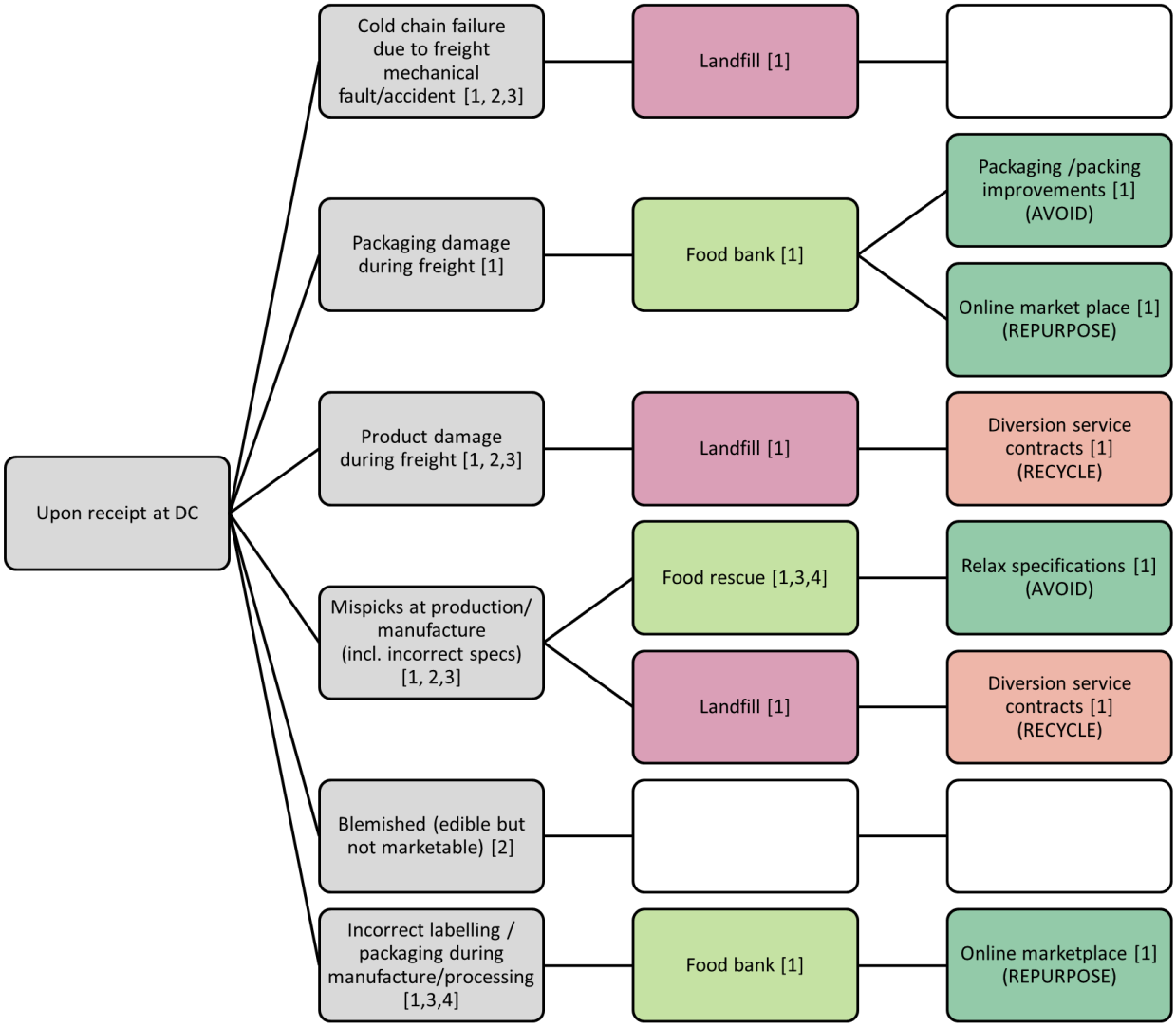
Third party logistics (3PL)

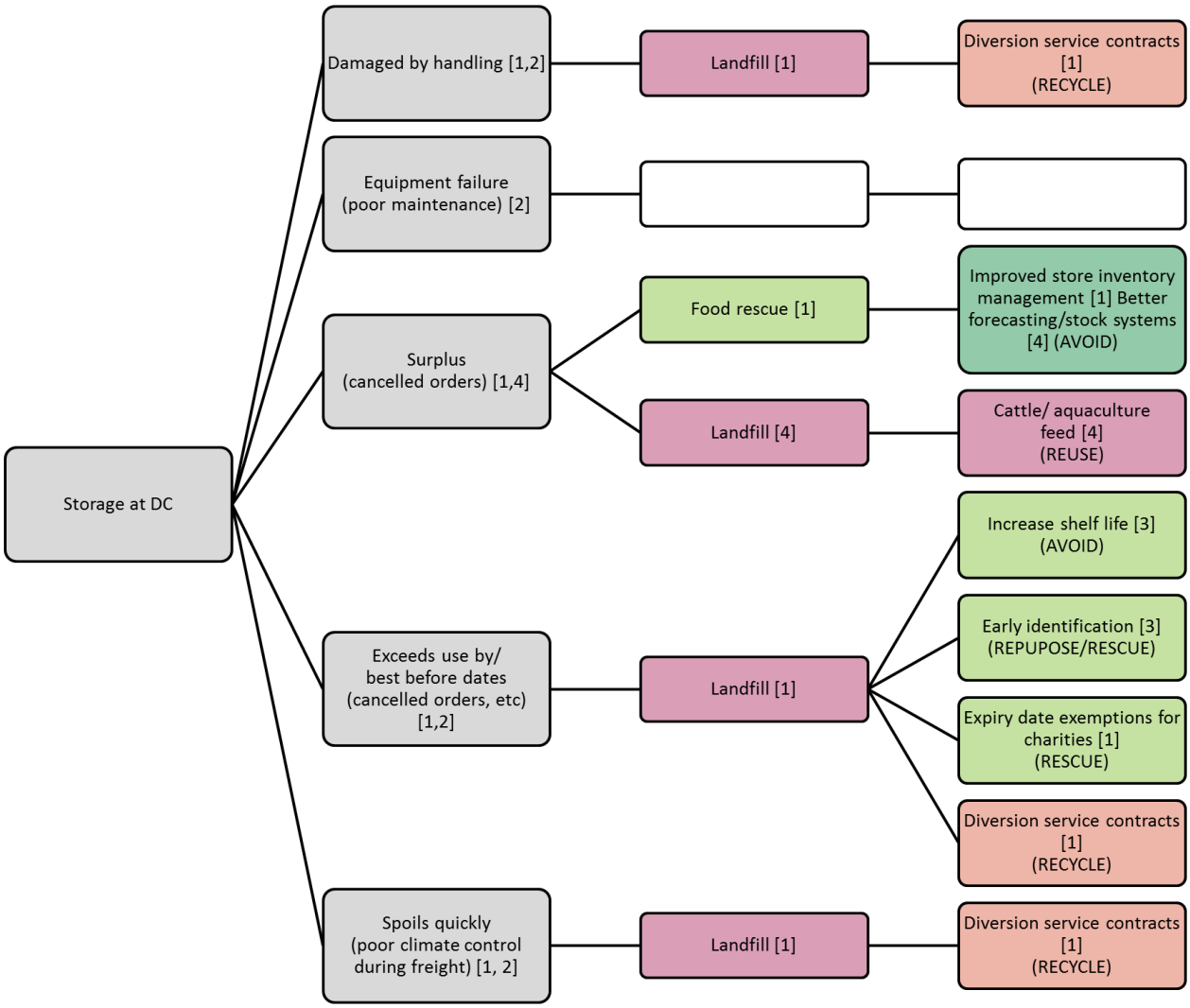
Figure 24: Source of waste during third party logistics (pre-wholesale/retail distribution)



Wholesale/retail distribution

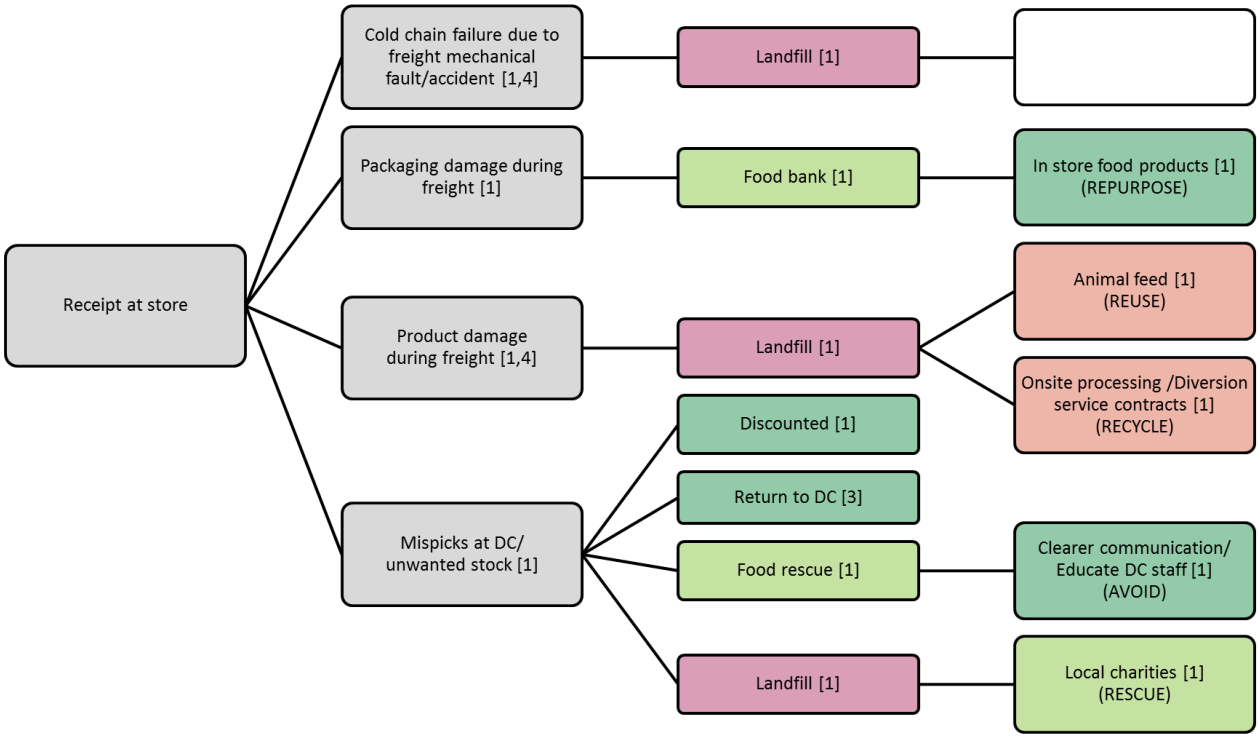
Figure 25: Source of waste during wholesale/retail distribution

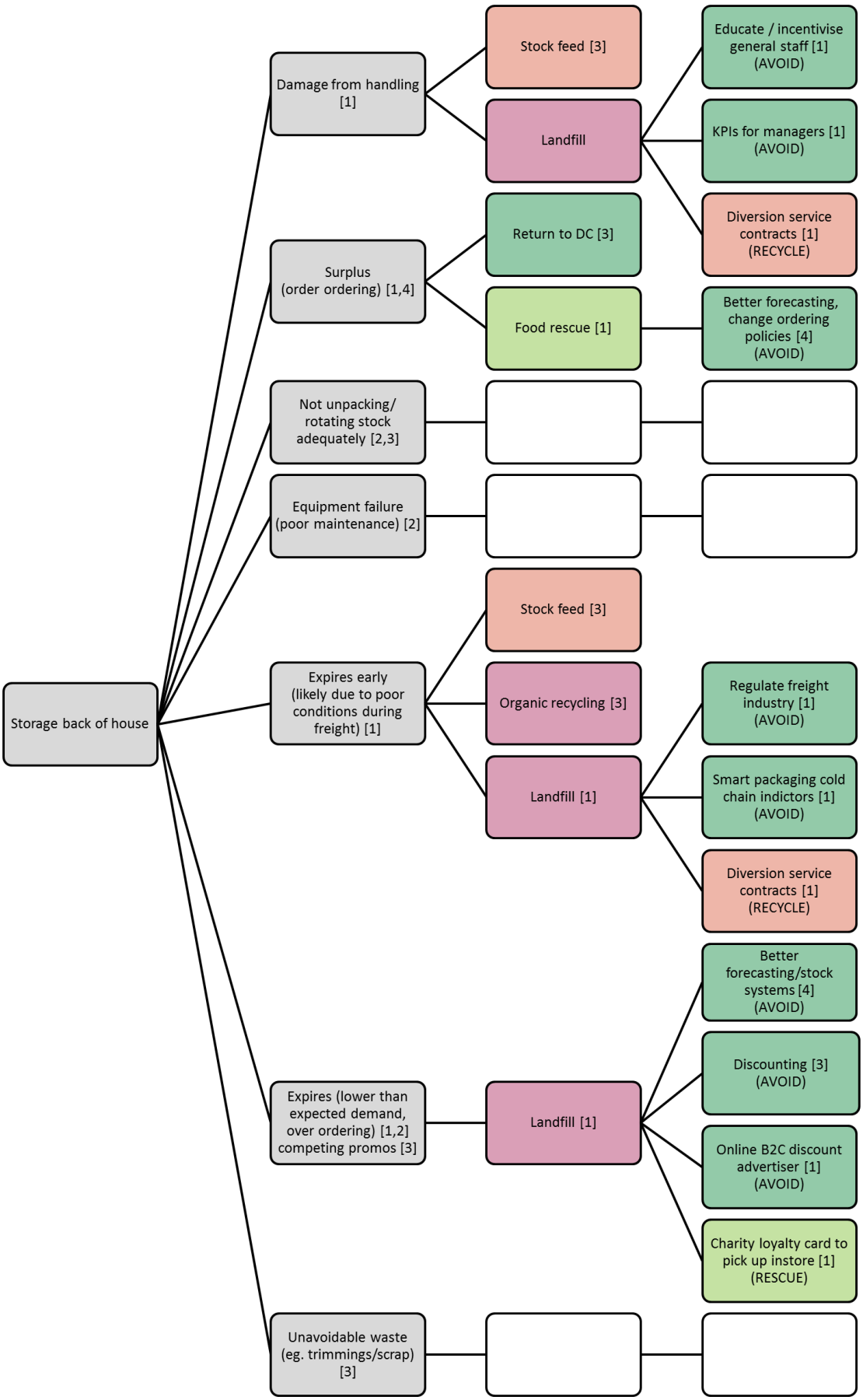


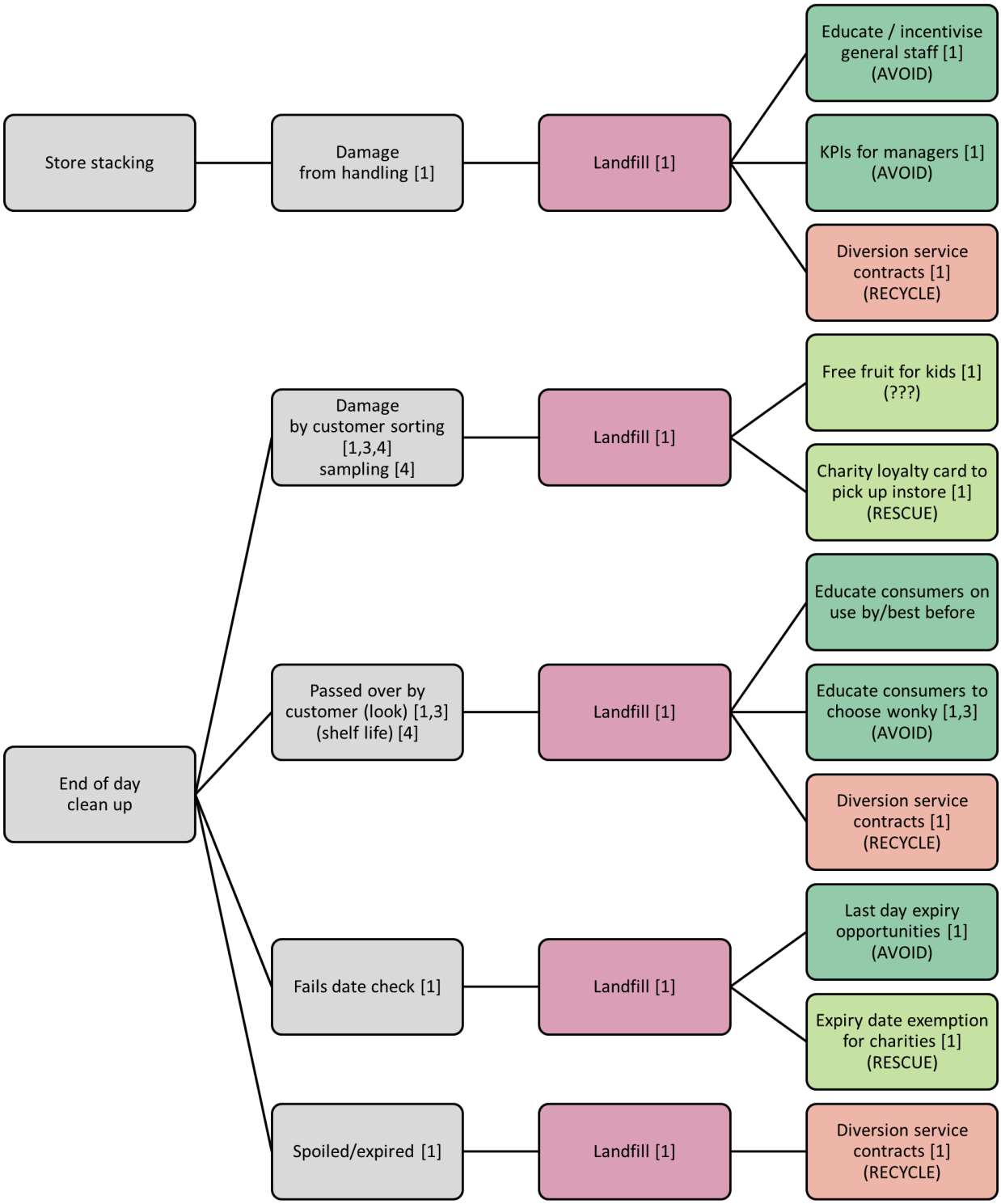

Storage at DC
Damaged by handling [1,2]
Landfill [1]
Diversion service contracts [1] (RECYCLE)
Equipment failure (poor maintenance) [2]
Surplus (cancelled orders) [1,4]
Food rescue [1]
Improved store inventory management [1] Better forecasting/stock systems [4] (AVOID)
Landfill [4]
Cattle/ aquaculture feed [4] (REUSE)
Exceeds use by/ best before dates (cancelled orders, etc) [1,2]
Landfill [1]
Increase shelf life [3] (AVOID)
Early identification [3] (REPUPOSE/RESCUE)
Expiry date exemptions for charities [1] (RESCUE)
Diversion service contracts [1] (RECYCLE)
Spoils quickly (poor climate control during freight) [1, 2]
Landfill [1]
Diversion service contracts [1] (RECYCLE)

Retail stores

Figure 26: Source of waste during retail




Storage back of house
Damage from handling [1]
Stock feed [3]
Landfill
Educate / incentivise general staff [1] (AVOID)
KPIs for managers [1] (AVOID)
Diversion service contracts [1] (RECYCLE)
Surplus (order ordering) [1,4]
Return to DC [3]
Food rescue [1]
Better forecasting, change ordering policies [4] (AVOID)
Not unpacking/ rotating stock adequately [2,3]
Equipment failure (poor maintenance) [2]
Expires early (likely due to poor conditions during freight) [1]
Stock feed [3]
Organic recycling [3]
Landfill [1]
Regulate freight industry [1] (AVOID)
Smart packaging cold chain indictors [1] (AVOID)
Diversion service contracts [1] (RECYCLE)
Expires (lower than expected demand, over ordering) [1,2] competing promos [3]
Landfill [1]
Better forecasting/stock systems [4] (AVOID)
Discounting [3] (AVOID)
Online B2C discount advertiser [1] (AVOID)
Charity loyalty card to pick up instore [1] (RESCUE)
Unavoidable waste (eg. trimmings/scrap) [3]


Store stacking
Damage from handling [1]
Landfill [1]
Educate / incentivise general staff [1] (AVOID)
KPIs for managers [1] (AVOID)
Diversion service contracts [1] (RECYCLE)
End of day clean up
Damage by customer sorting [1,3,4] sampling [4]
Landfill [1]
Free fruit for kids [1] (???)
Charity loyalty card to pick up instore [1] (RESCUE)
Passed over by customer (look) [1,3] (shelf life) [4]
Landfill [1]
Educate consumers on use by/best before
Educate consumers to choose wonky [1,3] (AVOID)
Diversion service contracts [1] (RECYCLE)
Fails date check [1]
Landfill [1]
Last day expiry opportunities [1] (AVOID)
Expiry date exemption for charities [1] (RESCUE)
Spoiled/expired [1]
Landfill [1]
Diversion service contracts [1] (RECYCLE)

E2. OPPORTUNITIES AND BARRIERS

Workshop participants were asked to identify specific opportunities to avoid or better manage food waste for each of the sources of waste identified in the previous figures. They also identified any particular barriers they could foresee to implementing these opportunities. These are both presented in Table 19.

Table 19: Opportunities and barriers from stakeholder workshop mapping

Opportunity	Barrier
GENERAL	
Collaboration along entire supply chain, improved communications	• Legal barriers, confidentiality, transparency, volume of info, lack of leadership • Attitude, over-estimation of own performance • Lack of data, lack of clarity on responsibilities • Complexity & diversity of supply chain
FEDERAL	
Develop incentives under Federal Government for food waste avoidance, e.g. emission reductions fund/ carbon credits	• Lack of benchmarking • Lack of awareness & integration into practice
MANUFACTURING/PROCESSING	
Product design & size	• Communication/influence up supply chain
Change packaging requirements	
LOGISTICS	
Certify every element of food cold chain meets relevant standards, enforce standards for refrigeration trucks	• Lack of incentives, responsibility, clarity re liability for spoilage in transit • Lack of awareness/concern re supply chain impacts, not my problem • Difficulty knowing/proving that cold chain has been broken • Harder to regulate for fresh produce where temperature control only relates to shelf life, not to food safety
Ongoing temperature monitoring	
Ensure maintenance of refrigeration systems	
Ensuring clarity of legal responsibility / who pays for food loss	
RETAIL DC - POLICIES	
Simplify supply chain	• Inflexible old/outdated business policies
Transparency on stock loss at DC	• Need for unified measurement metrics and definitions
RETAIL STORE - POLICIES	
Change display ‘rules’	• Consumer preferences
Reduce mandatory stock on hand levels	• Sharing of ‘shelf life’ info across value chain
Relax aesthetic specifications	• Consumer actions (habits) don’t match stated intentions

RETAIL DC/STORE – STAFF PRACTICES	
Educate DC staff	• Motivation at the top • Cost of training (budget, staff time, cost-benefit) • Expert knowledge, best practice methods to build a training program • Staff buy in • Use by vs best before • Lack of consequences & incentives • Lack of monitoring & evaluation
Educate and incentivise staff instore, particularly stock loss training	
Train of store managers in waste audit participation	• Variability across stores, individual manager decisions
Give sustainability Key Performance Indicators (KPIs) to staff	
RETAIL STORE – CUSTOMER PRACTICES	
Educate consumers to choose wonky	• Cut through in store • Resourcing • Segmentation of marketing
Lower customer expectations of aesthetics/shelf life	
General stakeholder education	• Negative perceptions of waste & reuse on site
RETAIL STORE – ALTERNATIVE CHANNELS	
Online marketplace for selling close to excess or expiry food through other (non-store) channels	• Technical development of online system, linked to barcodes • Inventory management system linked to point-of-sale • Cost of set up and rollout • Additional process for staff to follow
Online marketing of discounts to draw consumers into store to purchase close to excess or expiry food	
Charity/concession card program allowing people in need to pick up food directly from store (would require online system to notify people of what food available, when and where)	
Reprocess surplus/waste into sellable food	• Negative PR and/or shame re waste • Attempts to reprocess waste into products has previously met competition and failed
FOOD RESCUE	
Simply process within organisation to donate to food rescue rather than dump, identify food earlier in life	• Lack of data, inventory management system to identify food that might need to be rescued • Requirements of some wholesalers to de-brand products before donating
Designated ambient and refrigerated storage for better handover to food rescue	• Cost and space limitations • Communication, awareness, ineffective use of existing capacity
Improve capacity and efficiency of transport for collection of rescued food, provide funding to cover logistics costs, broker arrangements between stores and local charities	• Resources • Cooperation needed amongst charities to coordinate collection
Create/improve tax incentive to donate rather than dump	• No monetary transaction from retailer to charity to value donation in dollars

RECYCLING	
Develop evidence-based waste management strategy	• Lack of awareness of options/benefits • Difference between legal/regulatory rules and financial incentives in each state and federal jurisdiction
Improved onsite source separation of organics	• Staff and infrastructure costs • Lack of staff understanding of “real cost” of dumping
Onsite composting, worm farm, processing technologies	• Infrastructure and energy costs • Space constraints • Technical operating knowledge • Difficulties source separating waste
Improve waste service diversion contracts	• Technology for data capture • Cost and timing of collections • Lack of incentives • Unavailability of all waste diversion methods at all locations • Need of secure destruction of some products
Vacuum waste collection system for efficient collection	• Initial costs, disruptions
Encouraging/supporting dumpster diving	• Health and safety responsibilities
Soil amendment/injection	• Not regulated

Table 20 sets out a prioritisation exercise of the above opportunities, with each table taking the key opportunities identified and classifying them according to the level of likely impact (high vs low) and the ease of implementation (easy vs hard).

Table 20: Key opportunities from stakeholder workshop prioritisation exercise

EASY to do, High impact	HARD to do, High impact
• Training + education • Marketing to consumer (e.g. odd bunch) • Increase shelf life/packaging improves • Education • Improve prevention systems to identify “at risk” product early enough • Funding for food rescue organization • Improving tax incentives for donation • Education/consumer campaign • Relax specifications/educate retailers • Access carbon credits (already exists) • Waste management strategy • Collaboration along supply chain • Stakeholder education – refrigeration maintenance • Reduce contamination of waste for recapture • Increase capacity of food rescue • Centralise refrigeration for logistic efficiency (wholesale markets)	• Supply chain simplification • Data analysis – sources of waste (current focus is sales) • Marketing • Lower consumer expectations • Getting extra assistance to sort waste • Exemption for food charities for out-of-date products • Educate consumers • Develop technology to allow retailers to offer discounted product in real-time to consumers • Refrigeration for food rescue • Reprocess waste to food
EASY to do, Low impact	**HARD to do, Low impact**
• Educate DC staff • Water extraction (dehydration) for easier disposal • Vacuum collection system	• Process organic waste onsite (logistic and cost benefit)

E3. WORKSHOP RECOMMENDATIONS

Workshop participants nominated the following types of Government assistance as useful to helping their business reduce food waste. These were categorised using an affinity mapping exercise during the workshop.

Information and education resources

- Food waste reduction advocacy officer/office in government
- Food waste portal on NSW EPA site to link to food rescue organisations and their contacts
- Multiple communication methods so we hear about support, funding etc
- Government could work to collect and disseminate data on food waste
- Types and location of food waste
- Details on costs and benefits for companies in avoiding food waste
- Awareness raising as it relates to schemes and programs to reduce food waste
- National, state, local maps of available services
- Food rescue app – make it easy
- National unified metrics for measuring waste
- Increase visibility on recycling trends and initiatives
- Education templates for retailers to use in store

Financial assistance

- Tiered levy/incentives based on waste hierarchy
- Carrots financial incentives KPI's
- Waste levy % to assist businesses to improve in waste management
- Rebate programs
- Subsidise costs to business for 100% food re-use or recycling
- Provide funding for technology for data capture
- Provide incentives for food wasted avoidance
- Extend energy efficiency programs to include "food efficiency"
- Direct funding for food waste reduction/sorting infrastructure (not R & D)
- Support to expand food rescue and resale of excess supply to market – maximum efficiency and cost effectiveness
- Operational funding for food rescue to assist with warehousing and logistics costs
- Best practice stock list and cost + benefit report
- Information on technology
- Extend education grants to all businesses to allow them to educate consumers (e.g. Large)
- Training program for staff including financial incentives
- Education grants to business to show benefit of re-use
- Reverse logistics support
- Bin Trim program for large businesses

Industry collaboration

- Collaboration between creators of waste and rescue and recycling agents
- Data benchmarking
- Sharing information on NSW EPA website

Research

- Research on consumer perception of imperfect
- Common definitions of food waste
- Decision support tools to trade off environmental impacts

Direct actions by NSW EPA

- Promote existing NSW EPA programs (i.e. grants)
- Run an education campaign on ‘best before’ vs ‘use by’ (for food industry and consumers)
- Promote importance of hunger relief – why important for companies to act
- Educate the public about accepting imperfect looking fruit and vegetables (from the full price shelf)
- Lobby for tax incentive to donate rather than dump
- Graduate placement program to support identification and implementation of food waste reduction projects
- Support the new Australian Cold Food Chain Council

Regulation

- Change regulation on best before for charities
- Regulate food transportation (refrigeration)
- Cut red tape
- Alignment between regulators (e.g. NSW Food Authority and NSW EPA)

Other

- Common waste objectives between local, state and federal areas
- Government infrastructure on waste transport system

F. DATA COLLECTION TOOLS

Interview questions

The following is an example of the questions that would be asked of a major food retailer.

INTRODUCTION

- Confirm length, people on call, purpose of interview

ETHICS CONSENT

0. Do you understand what the research is about and how we will use the information you provide? Are you happy to proceed with the interview on that basis?

DEMOGRAPHICS

1. Name:
2. Role:
3. Organisation:
4. Type of business/Sector:

UNDERSTANDING YOUR BUSINESS

5. We'd like to begin by understanding the food supply chain for your stores. Can you describe how food comes into your organisation and how it moves through your business?

UNDERSTANDING FOOD WASTE

The focus of this interview is on food waste, which we are defining as 'food that was intended to be sold for human consumption, but for any reason is not'. We're interested in ways that your business does, or could, either: **minimise** this food waste, by ensuring that more of the food coming into your business is sold, and that any still edible unsold food is redistributed such as food rescue organisations, or **divert/recycle** any food that could not be redistributed, either by turning into new food products, composting or processing through technology such as anaerobic digestion.

6. Does your organisation measure and record the amount of food that isn't sold, and that becomes food waste? Do you record what happens to the unsold food/food waste (e.g. food rescue, landfill, composting onsite, offsite)? If so, how do you capture these types of data? (e.g. for prompting only, who measures and records, what is recorded, what system in the information entered into?) Are you happy to share this data (confidentially)?
7. Can you describe *where* food waste is generated in your business? (Refer to diagram to prompt) Where/why do you think *most* of the waste occurs?
8. Can you describe how you currently deal with unsold food and food waste in your business? E.g. to food rescue, landfill, composting, etc
9. Does your organisation have a **policy or target** to reduce or recover food waste? If yes is it a public statement and where is it available?

AVOIDING FOOD WASTE

10. Thinking first about food waste occurring within individual stores, has your organisation implemented or considered any deliberate **waste avoidance/minimisation** measures? How do they perform? Do you have any data or estimates on the volumes of waste they prevent?
11. Now thinking at a broader level, has you organisation implemented any initiatives beyond individual stores, e.g. business wide policies such aesthetic standards, practices in distribution centres, or private label product selection or design, etc?
12. What do you think are the most effective initiatives? Have you identified any key learnings while implementing food waste avoidance initiatives?

RESCUING FOOD WASTE

13. Do you work with any food rescue organisations? Can you tell us about how these initiatives work in your business? Do individual stores deal directly with the organisations? Do you have any centralised processes? Can you estimate how the proportion of food that gets donated compares to the proportion of food that ends up being recycled or disposed?

RECYCLING FOOD WASTE

14. Has your organisation implemented or considered opportunities to **recover** food waste? Can you estimate the volume of waste diverted per annum?
15. What do you think are the most effective initiatives? Have you identified any key learnings while implementing food waste avoidance initiatives?

OPPORTUNITIES AND BARRIERS

As we noted earlier, this research is to inform ways that the NSW EPA could support businesses to further minimise or recover food waste. We are therefore particularly interested in where the challenges lie for your business.

16. What barriers do you identify to further **minimising** the amount of food waste generated?
17. What barriers currently exist to **recovering** more of the food waste generated?
18. Imagine reducing the food waste your organisation produces to zero – how could this be achieved? What internal and external factors would need to be managed?
19. What assistance could NSW EPA or other government agencies provide to help you work towards this goal, e.g. grants, business or technical assistance, guidelines, networking opportunities etc.?

OTHER

20. Do you have any other comments or suggestions in relation to reducing food waste in your organisation or sector?
21. We would be interested in talking to a wholesale supplier or distributor about their food waste and solutions. Are you able to provide us with a contact?
22. We will be holding an industry workshop on Tuesday 30th May in Sydney to present and discuss our draft recommendations for new EPA food waste programs for your sector. We'd like to invite your organisation. Would you be interested in coming and/or sending a colleague?

Workshop agenda

Food waste opportunities in the food wholesale & retail sectors

WORKSHOP AGENDA

Tuesday 30 May 2017, 1:00pm-4:30pm

University of Technology Sydney, Broadway, Ultimo
Building 11, Level 12, 105.BoardRoom

Guest arrival & coffee/tea/fruit	
1.	**Welcome and introduction**
2.	**Understanding the problem** • Insights from the research: where and why food waste • Food waste mapping exercise **Purpose:** To develop a deeper understanding of **where and why** waste occurs in your food supply chains.
3.	**Opportunities to minimise and recovery waste** • Insights from the research: opportunities for action • Opportunity mapping exercise **Purpose:** To develop a better understanding of, and prioritise, opportunities to avoid, rescue, recycle or recover food waste at each relevant stage of the supply chain.
Afternoon tea	
4.	**Barriers to minimising and recovering waste** • Insights from the research: barriers to action • Barriers mapping exercise **Purpose:** To develop a better understanding of the key barriers to implementing the opportunities identified in previous exercise.
5.	**Government assistance** • Insights from the research: recommended NSW EPA support • Government assistance brainstorming exercise **Purpose:** To develop a wish list of support that the NSW EPA could provide to businesses, and prioritise these by highest likely impact.
6.	**Wrap up, thank you and next steps**
Close	

G. REFERENCES

References have been grouped by type, and geographical coverage of document in order to enable easier referencing to particular bodies of literature. Within each category they are listed in alphabetical order.

They are grouped into:

- Australian grey literature (publically available information outside academic channels)
- Australian company reports
- International grey literature
- International academic literature.

Australian grey literature

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