



Consumer Perceptions and Understanding of Packaging **JOURNEY MAPPING**

Industry Report Insights



FIGHT FOOD WASTE
Cooperative Research Centre
REDUCE - TRANSFORM - ENGAGE



Australian Government
Department of Industry, Science,
Energy and Resources

Business
Cooperative Research
Centres Program

DISCLAIMER

The Fight Food Waste Cooperative Research Centre (CRC) gratefully acknowledges the Australian Government Department of Industry, Science, Energy and Resources' financial contribution through the Cooperative Research Centres program as well as the participants of this project.

This document should be cited as Lockrey, S., Hill, A., Langley, S., Ryder, M., Francis, C., Brennan, L., Verghese, K., and Fight Food Waste CRC (2020) Consumer Perceptions and Understanding of Packaging: Journey Mapping Industry Report: Insights, Adelaide, Australia.

© Fight Food Waste Limited 2020
Level 1, Wine Innovation Central Building
Cnr Hartley Grove and Paratoo Road
URRBRAE SA 5064
enquiries@fightfoodwastecrc.com.au
+61 8 8313 3564

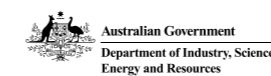
This report may be reproduced for the purposes of research, discussion, record keeping, education use or other public benefit, provided that any such reproduction acknowledges the Fight Food Waste CRC.

Consumer Perceptions and Understanding of Packaging Journey Mapping

Industry Report: Insights

Dr Simon Lockrey
Allister Hill
Sophie Langley
Maddison Ryder
Dr Caroline Francis
Professor Linda Brennan
Associate Professor Karli Verghese
RMIT University and
Fight Food Waste CRC

The CRC Program supports industry-led collaborations between industry, researchers and the community.



Executive summary

This report summarises the qualitative journey mapping research conducted for the Fight Food Waste CRC Project 'Consumer Perceptions of the Role of Packaging in Reducing Food Waste'. A journey map was built from the user's point of view, beginning with an understanding of the perspectives of the user i.e. their awareness. It then examined the sorts of things the user might consider in their food purchases and food consumption journeys, including any emotional, social, and technical issues they may face in understanding food and food consumption.

The journey mapping methodology was designed to map and understand the role of packaging in consumers' food waste journeys, including how packaging is used, how consumers respond to packaging (changes, designs, styles, and types), and how consumers waste (or do not waste) their food. The research mapped consumer food waste journeys through households' shopping, storage, cooking, and disposal habits, characterising the role of packaging throughout the journey. This was done with the intention of contributing to answering the following research question:

What are the parameters (contributors, barriers, facilitators, etc.) for the most wasted foods (i.e. why, who, when, how packaged or not, how much is wasted/how much could be saved)?

Five main food waste group categories were defined for the research: bakery; dairy and eggs; packaged and processed food; fruit and vegetables (fresh); and meat and seafood (fresh/frozen). Thirty-seven consumer journeys were mapped across these categories.

As tends to be the case with qualitative research, and based on the sample size of the journeys mapped for each food category, the results are not statistically generalisable. However, they do offer deep and rich insights into consumers' perceptions of and practices with the different food categories and the packaging associated with those categories.



What are the parameters (contributors, barriers, facilitators, etc.) for the most wasted foods (i.e. why, who, when, how packaged or not, how much is wasted/how much could be saved)?

The journey mapping results revealed a range of different behaviours, motivations, practices, and obstacles for consumers across different food categories. These insights reveal several challenges and opportunities for food packaging to play a role in reducing consumer food waste, regardless of whether that packaging is designed to reduce food waste. Key insights are:

- A range of planning and purchasing behaviours were observed across product categories. Some consumers purchased food based on price, others on portion size. People's values seemed to influence how they made choices about what to buy and whether they planned their shopping. However, the relationships between values and food behaviour were not always clear cut. For example, for some consumers for whom price was a consideration, and who we could say have economic or financial values in mind when they are shopping, the effect of economic values meant having a list and only buying what they needed. For others, shopping according to economic values meant shopping based on what food items were on special. These two different approaches, though they have a similar motivation, could lead to vastly different outcomes in terms of food wastage.
- Household demographics and dynamics were substantive influences on when shopping happens, what is purchased, how it is stored, and what is wasted. Consumers often felt that waste was more influenced by the rest of the food chain than choices in the home.
- Packaging was essential to the purchase and often the storage of food. Consumers recognised a tension between the positives and negatives of packaging regarding food purchase, storage, and consumption. This tension was not necessarily linked to the function of reducing food waste, especially when it came to fresh produce.

- There was an interrelation between packaging issues and storage issues in consumers' homes. Consideration of packaging was related to the size of the food product available, the consumers' available storage space, and food quality. There was also some confusion about how best to store food i.e. whether to keep food in its packaging or in other storage containers. The ability to reseal food was seen as a way packaging might reduce waste, but there was a recognised trade-off between the price and quality of resealable packaging.
- Packaging materials mattered to consumers, who overall felt that if a material is recyclable then it is a net benefit for the environment, as is food and packaging that is readily composted (or biodegradable over time, rather than compostable at home). Though there were some recognised trade-offs between the suitability of different materials for storage and purchase, anti-plastic sentiment remained high. However, plastic was still used by consumers to a large extent.
- Consumers expressed a complex relationship with date labels: either confusion, distrust, or a lack of concern. This led to participants ignoring the labels all together and relying on their senses instead.

The journey mapping stage of this project builds on a baseline literature review and interim findings, which also informed the structure of the Consumers' Existing Perceptions of Packaging Survey. The resultant journey mapping insights will inform several other research activities to help build a better picture of the role of packaging within households and in relation to consumer perceptions of packaging. These include a series of online workshops with industry stakeholders, and pack information interviews (PIIs) with consumers.



Contents

Section 01

INTRODUCTION 12

1.1. Background literature 13

Section 02

METHODOLOGY 17

2.1. Recruitment and demographics 19

Section 03

INSIGHTS & DISCUSSION 23

3.1. Household disagreements about which (purchasing, storage, disposal) practices are best 25

3.2. Other areas of the food chain are considered worse for food waste 26

3.3. Role of packaging 27

3.3.1. Packaging a 'necessary evil' 27

3.3.2. Packaging not necessary on fresh produce 28

3.3.3. Tension between benefits of packaging and downsides 29

3.4. Packaging issues in consumers' storage practices 30

3.4.1. Storage space capacity 30

3.4.2. Serving/pack sizes impacting wastage 30

3.4.3. Confusion about best storage option 31

3.4.4. Resealability identified by consumers as reducing waste 32

3.4.5. Freezer storage issues with food quality 32

3.4.6. Different packaging formats allow flexibility for consumers 32

3.5. Packaging material matters 35

3.5.1. Anti-plastic sentiments 33

3.5.2. Recyclable or compostable packaging materials 34

3.6. Date labelling issues 36

3.6.1. Confusion about 'best before' and 'use by' dates 36

3.6.2. Ignoring date labelling 37

3.7. Discrepancy between beliefs and practices 37

3.8. What counts as waste? 38

Section 04

RECOMMENDATIONS 41

ACKNOWLEDGEMENTS 47

REFERENCES 48

APPENDIX 1

Further journey mapping methodology 52

7.1. Structure and focus of journey mapping sessions 52

7.2. Field work and breakdown of journey map sessions 53

7.3. Analysis of data 55

APPENDIX 2

Collated respondent journey map summaries 56





01

Introduction

RQ1

What are the parameters (contributors, barriers, facilitators, etc.) for the highest wasted foods (i.e. why who when how packaged or not, how much is wasted/how much could be saved)?

Reducing food waste is widely seen as a way to lower production costs while increasing the efficiency of the food system, improve food security and nutrition, and contribute towards a more environmentally sustainable food system [1]. Food waste is a significant environmental, economic, and social issue [2]. Food loss and waste (FLW) occurs along the food supply chain, encompassing both edible and inedible parts of food [3] and the loss of food quantity and quality [1].

While food waste is a growing concern globally, consumers' perceptions of food waste and the role of food packaging in minimising or eliminating food waste has gained significant attention over the past five years [4]. Numerous studies have been conducted assessing consumer perceptions of food packaging and food waste [5-8]. However, social perceptions are rapidly changing, due to a growing awareness of and desire to respond to issues impacting the environment. Current consumer perception studies that investigate the overlapping fields of food waste and food packaging are therefore pertinent in assessing current perspectives and social behaviours.

This qualitative journey mapping research is the second sub-project conducted for the Fight Food Waste (FFW) CRC Project 1.2.2 'Consumer Perceptions of the Role of Packaging in Reducing Food Waste'. The journey mapping stage is built on a baseline literature review, and interim findings have informed the structure of an existing perceptions of packaging survey. These sub-project stages will in turn be followed by several other research activities aimed at building a better picture of the role of perceptions of packaging within the household. The aim of FFW CRC Project 1.2.2 is to enable packaging solutions that reduce food waste.

The journey mapping stage was focused on seeking answers to the following 1.2.2 Project question:

RQ1

What are the parameters (contributors, barriers, facilitators, etc.) for the highest wasted foods (i.e. why who when how packaged or not, how much is wasted/how much could be saved)?

1.1**Background literature**

While there is a solid body of research about consumer perceptions of and attitudes towards food waste, there is very little that examines whether and how these perceptions and attitudes affect consumers' understandings of the role of packaging in reducing food waste [9]. Similarly, there is little existing research that examines how different variations in household makeup – for example, the number of household members, and whether the household includes children – affects consumers' perceptions of and behaviour with food waste and packaging that may reduce that waste, particularly in relation to issues such as packaging's role in food storage, appropriate portion sizes for household needs, and the impact of date labelling. While particular functions of packaging that may help reduce food waste have been identified by existing research, it is not clear whether and how these technologies relate to the drivers of food waste identified in consumer research. A handful of studies examine consumer perceptions and the likelihood of acceptance of emerging packaging technologies [see, for example, 10, 11].

Household food waste is a significant contributor to food loss and waste (FLW). In Australia, for example, household food waste is estimated to contribute 34% of total FLW [12]. Existing interventions aiming to reduce food waste in households have included consumer education interventions [see 3, 13, 14] and technological interventions in household appliances, packaging, and technologies for food planning and sharing [see 3, 15, 16]. Households with more than two adults and households with children were found by a handful of studies to produce more food waste [17-19]. The impact of having children in the household could be explained by the higher likelihood of children having changing food preferences and eating patterns [20]. The impact of larger households could be due to the likelihood of a range of different tastes that need to be catered for [21]. Age has also been found to be a factor in determining the likelihood of wasting food, with older consumers found to be less likely to waste food [13, 22], and the reverse established amongst younger consumers [19].

Food packaging plays a vital role in food waste reduction across the food supply chain through functional measures [23].

Existing packaging designs and integrated technologies span physical, chemical, sensory, and microbiological protection innovations [24-30]. While there has been extensive research into how well packaging features can extend the shelf-life of food, such as using physical-chemical and microbiological protection, research specific to packaging functions that save food from waste ('save food packaging') is considered an immature field [5, 29].

As shown in the recent (2019) INCPEN & WRAP study and others [8, 31, 32], consumers' commonly feel some angst towards packaging, specifically plastic packaging, as the highest cause of environmental harm, despite the research that suggests packaging represents a small percentage of environmental impact within the food systems. Consumers' lack of awareness of this holistic perspective of the food-packaging relationship, ultimately hinders food saving techniques employed through emerging packaging technologies [7, 32, 33]. This suggests a need for consumer education about packaging technologies and an expansion of understandings of how consumers perceive and engage with existing packaging technologies, as well as innovative packaging developments. An expansion of research that focuses on particular food types and research that identifies food types that contribute significantly to food waste in particular geographic locations - such as life cycle assessment (LCA) - is also necessary. Existing literature suggests, for example, that refrigerated foods of varying types could be a useful area of focus [9].

This summary report explains the in-depth qualitative research that contributes to closing gaps in knowledge about consumers, FLW, and packaging. We summarise the results of our journey mapping sessions, conducted via in-home interviews with consumers, mapping the food waste journey through their households' food shopping, storage, cooking, and disposal habits. We report on top-level insights regarding consumers' perceptions of the role of packaging in the journey of food that is wasted and identify some of the barriers to and opportunities for packaging playing a greater role in reducing food waste in households.





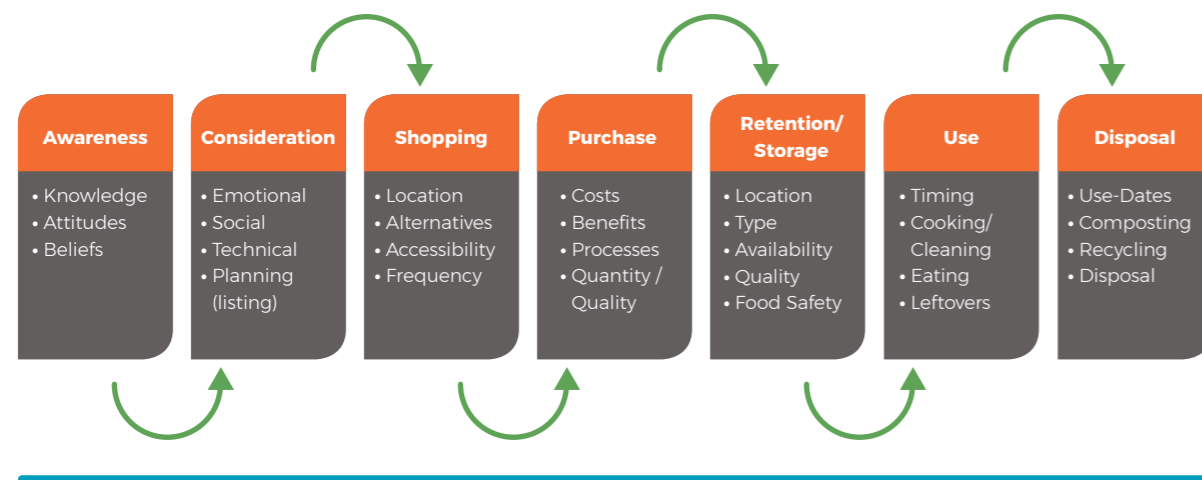
02

Methodology

The focus of the journey mapping was on food purchase for and consumption in the home. The journey mapping process aims to use the underlying methods associated with rapid ethnography [34, 35]. Journey maps developed in this way are a key tool for understanding customer and user experience [36, 37]. There are many consumer decision-making models available to frame analyses of consumer journeys. One is summarised in Figure 1 to provide an example of what a journey map may be expected to look like, as well as the journey stages that the research team worked through: awareness, consideration, shopping, purchase, retention/storage, use, and disposal.

A journey map is built from the user's point of view. It starts with an understanding of the perspectives of the user i.e. their awareness. It then turns to the sorts of things the user considers in the food purchase and food consumption journey, including emotional, social, and technical issues they may face in understanding food and food consumption. For example, does meal planning take place? If so, what are the barriers and benefits associated with meal planning? Are there more people in the household to be considered and how are these people included in the decision-making process? The list is potentially endless, and it depends on the consumer as to what things they consider in their journey.

FIGURE 1
Journey mapping example



Each consumer is likely to take a different journey and it is the mapping of the multiple journeys that makes the landscape being examined visible to any organisation wishing to make decisions based on results of the journey mapping process. A journey map could easily take four or five hours of consumer time to produce, however it is not usually feasible to go through all components of the journey with consumers over such a long period.

The journey mapping methodology of this research was designed to map and understand the role of packaging in consumers' food waste journeys, including how packaging is used, how the consumers respond to packaging (changes, designs, styles, and types), and how the consumers waste (or not) their food. Further detail of the methodology is included in **Appendix 1**.

2.1

Recruitment and demographics

Recruitment of consumer respondents for this study was conducted by market research agency Stable Research, to provide access to consumers and conduct the sessions in-home. Consumer respondents were broadly recruited to meet the following targets:

- Food purchasers/preparers
- Both male and female (1/3 male and 2/3 female – broadly representative of those likely to be both primary/co food purchasers and preparers in households)
- Representative, in terms of Australian/Victorian population, of age, education level, and household income and structure, for those food purchasers/preparers aged 18 years and over (as far as is possible, with natural fallout instead of hard quotas)
- Ten users in each of the five food waste group categories under consideration (i.e. 50 people in total approximately).

¹ This list has been adapted from Sustainability Victoria's 2018 'Love Food Hate Waste' report and is based on the products consumers identified as being the most wasted in their households (Sustainability Victoria 2018). [22]

The five main food waste group categories defined for this project are: bakery, dairy and eggs, packaged and processed, fruit and vegetables (fresh), and meat and seafood (fresh/frozen)¹. Although leftovers have been identified in various studies as a major contributor to household food waste, this category is beyond the scope of this project as cooked meals no longer involve the packaging in which the food was sold.

The initial target of 50 consumers was reduced to a total of 37. As tends to be the case with qualitative research and because only a handful of consumers were interviewed for each food category, the results are not statistically viable. However, they do offer qualitative insights into consumers' perceptions of and practices with the different food categories and with packaging associated with those categories. **Table 1** provides a summary of the demographic profile of the consumer respondents and how they were assigned to relevant journey mapping category sessions. **Appendix 1** provides further detail on how fieldwork and analysis progressed.



TABLE 1

Breakdown of consumer respondent demographics

Food waste category	Bakery	Dairy & eggs	Packaged & processed	Fruit & vegetables	Meat & seafood	Total
Total	7	7	10	7	6	37
Group 1	4	4	5	3	3	19
Group 2	3	3	5	4	3	18
Gender						
Male	3	3	3	2	2	13
Female	4	5	7	4	4	24
Age						
18-24 years	0	0	2	0	1	3
25-34 years	2	3	1	2	2	10
35-44 years	2	1	1	2	0	6
45-54 years	0	1	3	1	2	7
55 years and over	3	2	3	2	1	11
Education Level						
Did not complete secondary school	1	0	0	0	0	1
Completed secondary school	0	2	3	0	2	7
Certificate qualification	2	2	1	1	1	7
Diploma, degree or higher	4	3	6	6	3	22
Household Income						
Under \$25,000	1	0	0	1	0	2
Between \$25,000 to \$50,000	3	1	5	1	2	12
Between \$50,001 to \$75,000	0	1	1	2	2	6
Between \$75,001 to \$100,000	0	2	1	0	0	3
Between \$100,001 to \$125,000	1	2	0	0	1	4
Over \$125,000	1	1	3	2	1	8
I prefer not to answer	1	0	0	1	0	2
Household Structure						
I live alone	3	2	2	4	1	12
I live in a house that includes children under 18 years	1	3	2	1	1	8
I live in a house with one other adult over 18 years and no children	2	2	4	0	3	11
I live in a house with two or more other adults over 18 years and no children	1	0	2	2	1	6

Extensive results of the journey mapping are detailed in Lockrey et al (2020). See **Appendix 2** for summary visualisations of journey mapping for each food category analysed. Summary insights from the results of journey mapping are presented below.



03

**Insights &
Discussion**

People's values had an effect on how they made choices about what to buy, whether they planned their shopping, and so on. However, these relationships were not always straight forward.

In this section, we summarise some broad themes that emerged from the journey mapping data. Some of these themes are relevant to all or most of the food categories, however, it is clear, too, that the different food categories present particular challenges and opportunities both for consumers, and for food packaging as a way of reducing food waste.

The journey mapping sessions showed that there are a range of behaviours, motivations, practices, and obstacles for consumers across the different food categories. These reveal several challenges and opportunities for food packaging to play a role in reducing consumer food waste – whether or not packaging is currently designed to help reduce food waste.

Broadly speaking, a range of planning and purchasing behaviours were observed across product categories (e.g. bread was a regular purchase for many participants). Some consumers purchased food based on price, others on portion size. As previous research has suggested [17, 38, 39], people's values had an effect on how they made choices about what to buy, whether they planned their shopping, and so on. However, these relationships were not always straight forward. For example, for some consumers for whom price was a consideration, and who we could say have economic or financial values in mind when they are shopping, this meant having a list and only buying what they needed. But for others, this same value meant shopping based on what food items were on special. Though they have a similar motivation, these two different approaches could lead to significantly different outcomes in terms of food wastage.

A number of other more specific insights emerged, which we highlight below.

3.1

Household disagreements about which (purchasing, storage, disposal) practices are best

Household demographics such as size, gender, and age groups had an impact on the levels of food waste in those households. The mapping showed that household size influences the choices consumers make about the portion sizes they buy. For example, some consumers who lived alone or in small households said they would be less likely to buy smaller portion sizes of staples such as bread and margarine, partly because they believed they would still waste a similar portion (though that would equate to a smaller amount overall), but also because it would mean they would need to go shopping more regularly, and they did not have time to do this.

Temporal rhythms of the household – as in how much time household members had, and what other activities were competing for that time – can also impact on how consumers organise their shopping [21]. The importance of household dynamics was seen in some of the issues raised by consumers in our research. For instance, one consumer talked about their frustration with their partner's purchasing of bulk baked goods because it was not possible for the household to consume the products before they spoiled. There were also different ideas between how they and their partner about how best to store gluten-free bread, and different interpretations of best before and use by dates.

It is likely that in this household, its two members might have different individual perceptions of the role of food packaging in reducing food waste, but that their willingness – in practice, rather than only in theory – to accept particular types of packaging might depend largely on what they think other members of their household would accept. This has implications for the design of packaging to save food waste. Packaging can be adaptive to different priorities within and between households. Previous research [6, 40] has also found issues with waste due to limited product availability, and promotional savings when consumers buying in bulk that lead to self-reported wastage.



3.2

Other areas of the food chain are considered worse for food waste

Consumers across the different food categories commonly questioned whether households were the main producers of waste, or if they were responsible. For instance, some consumers said they believed that restaurants were the worst offenders when it comes to food waste; others said they believed supermarket chains were responsible for large amounts of food waste. However, it is clear from existing research that consumers are the source of a considerable portion of food waste in the supply chain. It has been estimated that in Australia in 2016/17, households generated 34% of food waste, the same amount as primary production [12]. While food waste during transportation and storage is often not accounted for, when there are higher standards of infrastructure (especially with regard to the 'cold chain') as there is in Australia, a number of studies have indicated that transport losses are much smaller than during other stages [1, 12, 41].

Waste at the consumer end of the supply chain does not lie solely with consumers. Causes of food waste within households also include factors for which there is a shared and distributed responsibility – for instance, retailers encouraging consumers to purchase larger pack sizes through quantity discounts. There are opportunities for changes in packaging design initiated by parts of the food chain prior to the consumer that could reduce food waste in households. These opportunities include fit-for-purpose secondary packaging, more single and smaller serve products, intelligent packaging and data sharing, and retail-ready and recoverable packaging. In line with recommendations from previous studies [42, 43], several consumers we interviewed said they would like to see more communication and education around food waste. Part of this education could include information about how each part of the supply chain contributes to waste generation and may include communication of this on pack.

3.3

Role of packaging

Packaging can reduce food waste. For instance, packaging might play a protective role, it might facilitate efficient handling of the product, or it might communicate information about the product to a consumer that helps reduce waste [6, 23, 44]. Some participants expressed an understanding that packaging had an important role to play, though this was not always directly related to reducing food waste. Broadly speaking, participants judged whether packaging was 'necessary' or not based on a number of factors, detailed in the sections below.

3.3.1

Packaging a 'necessary evil'

Several consumers acknowledged that packaging was "kind of a necessary evil", as one participant put it. Another consumer put the conundrum in the context of packaging materials:

"So there's a lot of controversy about plastics. Plastic absolutely has a place...We've really got to weigh up the benefits. So I think it depends on what it is."

Whether participants deemed packaging necessary seemed to depend on whether they could recognise its function in relation to the food it contained. Packaging's functions, such as protection, communication, and utilisation (i.e. assisting handling), were visible to consumers.

"So there's a lot of controversy about plastics. Plastic absolutely has a place...We've really got to weigh up the benefits. So I think it depends on what it is."

The protective functions of packaging were most commonly mentioned by consumers as necessary. For example, several consumers recognised the benefits of packaging for keeping bakery items fresher for longer, such as resealable bread bags. One consumer noted that they thought meat packaging was necessary in the supermarket because other people might be touching it, whereas at the butcher the number of people handling the product is limited so less packaging is needed. Several consumers saw resealable bags for shredded cheese and grated parmesan cheese as keeping the cheese fresher for longer (as well as being convenient for them). There were similar views about resealable sliced cheese and sliced ham packaging, as this consumer notes:



“I think that packaging that you can re-close, like, you know, on some hams and cheeses and things like that. I think they’re beneficial. You don’t have to, you know, to keep them into something else. You know, because they keep things fresh.”

Some consumers also recognised the utilisation of packaging, or the ways it enables transportation and retailing of the product and facilitates handling by the consumer. This was especially the case for some food items in the dairy and eggs category (milk, eggs), though several consumers also understood that an item such as cherry tomatoes had to be bought in a plastic container because the container keeps the fruit fresh and protects it during handling and transportation. Some other consumers said they had tried squeezable herbs and/or tomato paste in a tube and found that they could use only what they needed and store the product in the container in the fridge. Pre-mixed salads (and other pre-prepared fresh foods) in packaging were also viewed by some consumers as a way to both save preparation time and to avoid waste by only using the amount needed.

Some consumers also recognised the necessity of packaging as a way of providing food quality and safety information through date labelling. This was especially the case in the dairy and eggs category and the meat and seafood category. Some consumers said a bag of carrots with a ‘best before’ date helped them when they were shopping to assess how long the carrots would last. However, some consumers also described quite complex relationships with date labels, as discussed in [section 3.6](#).

3.3.2

Packaging not necessary on fresh produce

In contrast to many of the other categories, many consumers in the fresh produce category expressed strong negative views about packaging on fresh fruit and vegetables. This view was shared by consumers who were interviewed about other categories, who, when prompted to think about packaging, sometimes veered away from discussing the category they had been asked to keep in mind, in order to express a negative view about, for example, “plastic on cucumbers”. This suggests that consumers may not be able to see the functions

packaging is performing in these examples. For instance, “plastic on cucumbers” may, in fact, perform a protective function, extend shelf life considerably, or allow the food to be transported more easily [45].

3.3.3

Tension between benefits of packaging and downsides

Some consumers talked about a tension they saw between the various considerations around food packaging. These included the benefits of packaging for food quality and food safety, food waste or packaging waste, and financial cost. For instance, one consumer talked about how their partner buys multipacks of muffins in plastic packaging because the partner believes the items stay fresher this way. However, the partner does not eat the entire number of muffins and ends up wasting them. This over-purchasing problem has also been identified previously in relation to various kinds of foods [4, 15, 46]. This consumer said that if the individual muffins were in plastic packaging, it would seem like a waste of plastic, and if they were in more ‘environmentally friendly’ packaging it would be more expensive, which is currently true of bio-degradable packaging (though those costs are coming down as production scales up) [47, 48]. Another consumer said that when they were younger most packaging was easily recyclable, but they also expressed an understanding that, for instance, glass is heavier and therefore more expensive and difficult to transport. Together, these two examples suggest that there is at least some awareness among consumers that calculating the impact of different types of packaging can be complex [49]. This may represent an opportunity for further engagement for companies looking to open a conversation with consumers about packaging’s ability to reduce food waste.



3.4

Packaging issues in consumers' storage practices

In many of the food categories, the benefits of or issues with packaging became most apparent when consumers stored food in their home. Some of the issues related to storage were not only due to a lack of understanding on the consumers' part but also related to the size of food products available, the consumers' available storage space, and food quality issues.

3.4.1

Storage space capacity

Several consumers talked about having limited storage space available in their pantry and refrigerators and freezers. For example, one consumer said they had a very small refrigerator with almost no freezer space. This obviously limited their capacity to store foods that required cooling or freezing, regardless of the packaging they came in. Others talked about limited space due to existing food stored already, particularly in freezers. To this point, some respondents had a separate freezer specifically to alleviate storage space issues and to ensure they had frozen food on hand. Others were in the habit of decanting food into stackable containers to make better use of the storage space available.

3.4.2

Serving/pack sizes impacting wastage

Related to storage capacity, some consumers found they were not able to buy foods in a suitable serving size – either for their storage capacity or for their level of consumption. Storage capacity and consumption was also related to the consumers' frequency of shopping. For instance, one consumer, who lives alone, said they often waste fresh milk because a one litre bottle was not enough for them but a two litre bottle was too much. This same consumer also talked about wanting bread to be available in smaller loaves, to account for single-person households, and that they would be happy to pay just over half the price of a regular-sized loaf for the half-size. On the other hand, another consumer said they would be unlikely

to buy a smaller loaf of bread if it was available and cost effective, even though it would suit their usage more closely. This was because buying smaller loaves would mean they would need to go shopping more frequently, which they do not have time to do. But some consumers also spoke about how packaging formats – for example, cans of tuna – come in a range of serving sizes, which means they can purchase the necessary portion for the planned meal or household configuration.

3.4.3

Confusion about best storage option

Several consumers in a variety of food categories expressed some confusion about how best to store an item, either generally or once it was opened. For example, some consumers said they were confused about whether to store eggs on the counter or in the refrigerator – one based their decision on whether they had found the eggs in the supermarket on the shelves or in a refrigerator. Other consumers wondered whether butter could be stored on the counter rather than the refrigerator, and a few consumers stored it this way.



Some consumers expressed confusion about whether to store food in its original packaging or decant it into a container. For example, one consumer expressed confusion – and a recent change in practices – about whether leftover canned goods should be stored in their can or has to be transferred into another container. The information on the label of some canned goods suggests placing the contents into a separate container. Another consumer talked about how they removed lettuce leaves from the packaging they came in because they felt the leaves would 'sweat' in the packaging and deteriorate more quickly, even though this packaging might actually be designed to increase the shelf-life of this product. Other consumers' pantries showed dry goods that had been placed in new containers or placed inside their original packaging in a container. In some cases, the associated date labelling on a product was lost from the product when the original packaging was discarded. On-pack information about storage might also be missing on some products altogether, or consumers may not be aware of the information even though it is present.

3.4.4

Resealability identified by consumers as reducing waste

Resealability (or lack thereof) was a common packaging function that consumers identified as something that contributed to their capacity to store food for the time they needed to. This was particularly a concern in relation to cheese, bakery, and meat products. Due to current packaging formats of cheese, for example (e.g. a cheese block), consumers explained they sometimes re-wrap the opened food in extra plastic or put it into a container to protect it from drying out while it is refrigerated. Often the packaging formats have been designed to be lightweight, so they are an efficient use of material, but this saving of material is undone if consumers need to use additional materials in their homes to keep the product fresh.

3.4.5

Freezer storage issues with food quality

Several consumers who used the freezer to store food described issues they or someone in their household had with the quality of the food once it had been stored this way. This was especially the case with bread and meat products, where freezing either in the original packaging or in alternative wrapping or containers could sometimes result in freezer burn on the food. Wikström and colleagues [5] have previously suggested that packaging could include information about how to store a food product in the freezer – for instance, optimal storing temperature or the length of time a product can be frozen – which may help to preserve food quality and reduce waste.

3.4.6

Different packaging formats allow flexibility for consumers

Some consumers talked about how different packaging formats were convenient for them, allowed for stockpiling the food items, and for flexibility in purchasing of products that could be used at a later time.

3.5

Packaging material matters

Several consumers across different categories expressed beliefs about the benefits or otherwise of different packaging materials. Consumers' acceptance of materials were based either on the recyclability of the material or its perceived environmental impact. This is pertinent, as packaging materials that packaging are currently under scrutiny from industry and governments. The Australian Packaging Covenant Organisation is working towards a 2025 target of 100% reusable, recyclable, or compostable packaging, 70% of plastic packaging recycled or composted, 50% of average recycled content included in packaging, and the phasing out of “problematic and unnecessary single-use plastic packaging”[50].

3.5.1

Anti-plastic sentiments

Anti-plastic sentiments were expressed by several people – though some were more direct and adamant than others. For instance, one consumer talked about how “the world is drowning in plastic that never breaks down” and plastic is “getting into fish bellies”, “getting into the sea and into our bodies by extension”. They said they had deliberately brought their child up to avoid plastic food packaging. Another consumer talked about how they “don’t love the amount of plastic”, seemingly in relation to whether packaging is recyclable or not. They said “I don’t like this plastic packaging,” and suggested cookies could come in a soft bag, which could be recycled through the supermarket soft plastics scheme. “Okay, damaged cookies,” they said, “I get it, you know, but it might be better.”



When prompted for thoughts on food packaging, most participants talked largely or even exclusively about plastic, which suggests that the problems associated with plastic as a material have been highly publicised. Another consumer spoke directly to this idea, and said they see plastic as a more obvious issue than food waste because the problems with plastic are more prominent in mainstream media.

3.5.2

Recyclable or compostable packaging materials

Several people expressed feeling confused and wanting food packaging materials to be made from something other than plastic.

This suggests that consumers can focus more on plastics than food waste because alternative materials to plastic exist so the problem of food packaging appears easier to solve than food waste, which remains a little known issue. However, many participants who expressed anti-plastic sentiments bought and stored a lot of food in the plastic it came in, even placing fresh fruit and vegetables in plastic bags, suggesting that the normality of plastic packaging outweighs most objections to it.

Several consumers talked about the benefits of different materials for packaging in relation to whether the materials were recyclable or compostable. Only some consumers were able to identify where certain packaging materials might be necessary for particular foods. Many instead valued the recyclability or compostability of materials above its functionality as packaging.

Several people expressed feeling confused and wanting food packaging materials to be made from something other than plastic. For instance, another consumer had complaints about trying to properly dispose of food packaging and that food packaging is difficult to dispose of and rarely recyclable. This consumer said that when they were younger, most packaging was recyclable, and they suggested cardboard needs to be used more because it is more easily recycled.

One consumer weighed up the benefits of different types of packaging for baked goods. Muffins in paper packaging might seem 'better', they said, but this means the visibility of the product was impaired, so a mixed material might be used with a 'viewing window'. However, this consumer expressed concern that this window's material is not recyclable, and therefore decided that a wholly recyclable package for these goods is preferable, allowing you to both see and recycle the package.

Another consumer also made reference to considering the materials packaging is made out of, in particular materials that claim to be compostable or biodegradable (and they used these terms interchangeably). Some of the food this consumer regularly buys comes in this kind of packaging, but they are sceptical about the truthfulness of these claims:

"I remember a while back I think one of the supermarkets had bags they said would break down. That seems to be a while ago, I think I might have put one in the compost, I'm not sure but I was very cynical. Very sceptical about it... Because they're paying lip service to it, you know, and their heart really isn't in it."

Another consumer talked about how they live in a council area where the recycling is currently "going to landfill", and how this frustrates them. This consumer said they would make different choices about packaging if it was more common knowledge that what was recyclable was not, in fact, being recycled. Another consumer mentions that they are less concerned now about soft plastics than hard plastics because of supermarkets' soft plastic recycling scheme, and a lack of trust in the council's recycling scheme for hard plastics. This consumer also talked about how some types of packaging are better or worse than others:



only 49%
of packaging in Australia is recovered and recycled into material suitable to be used in other applications

"I was just told that styrofoam was terrible, and you should never buy it. But then followed by that sort of hard plastic container. So I try not to buy too many things in that sort of plastic. I also have no idea what to do with foil packaging. I'm like I don't know if it's recycled... I just don't know what to do with it."

This quote also speaks to a confusion about the recyclability of packaging. The outcome of such confusion is clear. In Australia, there are approximately 5.5 million tonnes of packaging material placed on the market each year, and only 49% of that packaging is recovered and recycled into material suitable to be used in other applications [50]. Much of what is not recycled is instead ending up as landfill or litter [50].

A nuanced awareness and related behaviour around recycling, whether correct or not, is consistent with consumer studies that highlight recycling as the major issue of global consumers' relationship with sustainability [31, 51]. Further education of consumers regarding the role of packaging in food waste reduction and the relative reduction of environmental impact such strategies enable compared to recycling would therefore be beneficial. A consumer echoed this:

3.6

Date labelling issues

“Education is really important. So I think the majority of people do not understand that food waste is just a huge environmental issue. I had no idea. You know, I thought it was just composted I didn’t realise it turns into methane. So education is huge.”

Many consumers expressed a complex relationship with date labels – either confusion, mistrust, or a lack of concern.

3.6.1

Confusion about ‘best before’ and ‘use by’ dates

In line with existing research, many consumers reported confusion – either their own, or that of someone else in their household or other people they knew – about date labels. Different kinds of date labelling on food indicate different things, though this is not always clear to consumers. ‘Best before’ dates are an indication of food quality, whereas ‘use by’ dates are an indication of food safety. One consumer talked about how their partner did not realise that the different types of date labels meant different things. This consumer said that although they had tried to tell their partner this, the partner would likely only trust such information from a government or expert source. Another consumer said they see “lots of people who would throw away food just because it’s one hour after the expiry date or because it’s not immediately perfect”, or because there’s “a tiny piece of mould that could easily be cut and the whole region around it could be cut and the rest of the pieces is perfectly good”. Misunderstanding date labels as giving information about food safety (rather than freshness) and risk perceptions are commonly acknowledged to lead to food waste [52-55].



3.6.2

Ignoring date labelling

Several consumers talked about how they deliberately ignored date labelling, often because they used other methods, such as paying attention to the material quality of the foods, to decide whether something was still good to eat. One consumer said they believed expiry dates were more for food companies to “protect themselves”, and instead of using date labels, this consumer will, for example, notice whether the texture of a donut is “as hard as a rock”. Another consumer also said they relied on their own sense of bakery products’ “freshness”, taking care to choose the “softest” baked goods at the store because they believe these are the freshest. Consumers specifically considered date labels when making decisions about purchasing dairy and eggs. Many also reported ignoring date labels or having ways to ‘test’ the safety of the food, regardless of whether the date label suggested this is a good idea. Interestingly, for some fresh products, consumers found ‘packed on’ dates useful, rather than ‘use by’ dates. They said these dates gave them an indication of the freshness of the product, which they valued highly.

3.7

Discrepancy between beliefs and practices

Many consumers believed that they did not produce much food waste themselves, though they recognised it as an issue that other people contributed to. As one consumer reflected:

“I can’t stand the idea of something as important as food being wasted. You know, but there’s a lot of labour and energy and resources that go into everything. Just throwing it away and destroying it seems awful.”

Others expressed strong beliefs about unnecessary packaging on fruit and vegetables, but photographs taken of their crisper drawers in the refrigerator revealed that they did indeed buy fruit and vegetables in packaging. For example, one consumer noted how their current household wasted little food compared to other households they had lived in in the past, and how they were now mostly concerned with the amount of packaging being wasted:



53%

of people self-reported that they 'never' or 'rarely' throw bakery items away

32%

of people do it 'sometimes'

"The situation I'm in now there's very little food waste but in living situations I've been before there's been lots of it. So now it's mainly the packaging, so buying stuff in the supermarket or when I do get meal deliveries it's always in plastic packaging."

This reflects how values towards waste are often linked – though not always neatly – to awareness of food waste as a problem and attitudes towards this problem. Consumers with a high environmental concern about food waste often self-report that they create less waste and take action toward reducing their levels of waste [38]. However, in places like Australia where overall awareness and concern for waste in general is high, these concerns do not necessarily lead towards actions that reduce food waste [22].

Several consumers said they specifically never disposed of bread because they could place it in the freezer instead. Others said they put bread into the compost when it needed to be disposed of, or that they fed bakery items to birds. The perceived lack of bread waste is perhaps related to this bakery item being a regularly used item, and one that therefore has established routines and strategies for use. In Victoria, previous bin audits have found that bakery items are a substantive component of food waste (16.3%) [56], but the majority of people self-reported that they 'never' or 'rarely' (53%) throw bakery items away and the bulk of the rest only do it 'sometimes' (32%) [22].

3.8

What counts as **waste**?

Consumers also varied in their categorisation of certain types of disposal as 'waste'. For instance, many identified placing something in the compost or feeding it to animals meant that food did not 'count' as waste (or counted less), though there were differences in these categorisations between more expensive foods such as meat and seafood, versus everyday foods (breads and generic fresh fruit and vegetables).





04

Recommendations

The insights that emerged from our research led to the following recommendations:



1. Visibility of food waste impact along the supply chain: Several consumers said they would like to see more communication and education around food waste. Part of this education could include information about how each part of the supply chain contributes to waste generation, highlighting the relative impacts of consumers to reinforce their important role in FLW reduction.



2. Engaging with household needs: Households' willingness - in practice, rather than only in theory - to engage with particular types of packaging might depend largely on what individuals think other members of their household would find suitable and relevant to their needs. This shapes potentially unique and diverse uses of the packaging and has implications for the design of packaging to prevent food waste that are adaptive to different priorities within and between households.



3. Deep and nuanced consumer research: Understanding the dynamic nature and shifts in household demographics, headcounts, and needs is key for companies aligning serving sizes of packaging and product combinations as a continual process over time.



4. Up-stream supply chain action: Waste in the home could also be mitigated by changes to other food supply stages, such as changing portion selling practices at the retail stage, or changing packaging design to reduce food waste in households. Specifically, food producers, manufacturers, and retailers need to ascertain how their packaging is actually used by consumers and ensure that the appropriate design features are included. This clearly links to the packaging criteria being developed in FFW CRC Save Food Packaging Design Criteria and Framework project. The importance of co-designed solutions and industry collaborations and adoption cannot be understated here.



5. Packaging function education: Consumers' understanding (or lack thereof) of the various functions of packaging suggests that efforts around consumer education on food waste should also aim to increase consumers' knowledge about these functions, especially those related to food waste. Such efforts might explain the protective functions of packaging, such as mechanical protection, chemical/physical protection, and resealability/sealing properties. Consumers should also be made aware of functions of packaging that facilitate handling, including being easy to open, grip, dose, and empty, packaging's processability, and correct quantity or serving sizes. Packaging can also communicate food safety and freshness information, expiry dates, storage options, best packaging use information, product usage information, information about portioning, and information on the sorting of household waste.



6. Food category education: Consumers' understanding (or lack thereof) of shelf life suggests consumer education should also aim to increase consumer's knowledge about how long various foods last, especially about how to store food correctly to make it last longer. This could include education around why particular packaging materials are used to assist in elongating shelf life, and how fresh food respire, ripens, and degrades.





7. Packaging product interaction: Packaging could also be used to communicate specifics on the characteristics of different products, including recommendations on how to store food, and why particular packaging is required for that product – for example, the difference in ripening rates for Continental and Lebanese cucumbers. This could expand the acceptance of certain packaging. Education around how fruit and vegetables respire and ripen and how packaging works to slow degradation and extend life is an important part of the conversation and communications that is required to shift mindsets.



8. Packaging vs food waste education: Examples from our research suggest that there is at least some awareness among consumers that calculating the impact of different types of packaging can be complex. This may represent an opportunity for further engagement for companies and governments looking to open a consumer conversation about packaging benefits to reduce food waste. Moreover, the food waste issue and related environmental, social, and economic impacts of food waste need to be communicated with consumers more explicitly. We therefore recommend further education of consumers on the role of packaging in food waste reduction and the relative environmental impact of such strategies compared to recycling.



9. Packaging design for home storage: The relationship between food, packaging and storage constraints (e.g. available pantry and fridge/freezer space) may be useful to consider as a way to assist consumers in reducing food waste when designing food packaging. This acknowledges practises such as decanting food into storage containers, the ideal storage space and conditions, and the trade-off between the price, quality, and durability of packaging.



10. More packaging, rather than less: Where the potential impact of the waste of those foods is quite high, some food products might require more packaging rather than less. This includes several products mentioned in our insights section, such as resealable features for bread or the mechanical protective packaging for cherry tomatoes.



11. Communication on packaging for optimal home storage: Our research suggests that on-pack information about storage might be missing on some products, or that consumers may not be aware of the information even though it is present. Packaging could include information about how to store a food product in the freezer – for instance, optimal storing temperature or the length of time a product can be frozen – which may help to both improve food quality and reduce food waste. It may be useful for food labelling to include clear information using effective graphics. Our research supports this premise and suggests that consumers might need to be educated about the presence of such information on food packaging.



12. Date label clarity and reform: Confusion about what date labels mean and consumers' food risk perceptions are important factors influencing consumer behaviour around date labels. A transformation of how governments and industry regulate and present date labels therefore seems necessary. Educating consumers about the meaning of the various label types would also address the various risk perceptions they hold.



13. Deploying packaging material benefits: Opportunities to modify packaging material to something that is recyclable or compostable would benefit food producers and brand owners. The recovery issue shows the importance for food producers and brand owners to have a good understanding of packaging materials and product characteristics, and the possible trade-offs of other packaging functions if materials are changed to

recyclable or compostable materials. The Australasian Recycling Label (ARL), “an on-pack labelling scheme that helps consumers understand how to recycle products correctly”, operated by the Australian Packaging Covenant Organisation is a national program that should be supported by food system stakeholders.



- 14. Communicating packaging material benefits:** If indeed non-recyclable or non-compostable materials are the best way to package a particular food, this needs to be clearly communicated to consumers. This is important, as consumers now hold a nuanced awareness and related behaviour around recycling. Whether correct or not, this awareness has elevated recycling as the major issue to the general population regarding sustainability.

These recommendations provide industry and government with formative advice to pursue actions that may better inform and enable consumers on how to reduce food waste in the home in relation to packaging. It is the intention of the research team to further develop these recommendations through industry and consumer engagement, through activities within the FFW CRC Reduce Program.



Acknowledgements

Associate Professor Karli Verghese, Dr Simon Lockrey and Professor Linda Brennan are Chief Investigators on the ‘Consumers Perception of the Role of Packaging in Minimising Food Waste’ (Project 1.2.2), which is funded by the Fight Food Waste Cooperative Research Centre, Sustainability Victoria, Woolworths and RMIT University. Additional RMIT 1.2.2 project investigators include Allister Hill, Sophie Langley, Caroline Francis, Maddison Ryder, and Tram Phan.

The Fight Food Waste Cooperative Research Centre activities are funded by the Australian Government’s Cooperative Research Centre Program. The CRC Program supports industry-led collaborations between industry, researchers and the community.

REFERENCES

1. Food and Agriculture Organisation, *The State of Food and Agriculture: Moving Forward on Food Loss and Waste Reduction*. 2019, Food and Agriculture Organisation, United Nations: Rome.
2. Devin, B. and C. Richards, *Food waste, power, and corporate social responsibility in the Australian food supply chain*. *Journal of Business Ethics*, 2018. **150**(1): p. 199-210.
3. Spang, E.S., et al., *Food Loss and Waste: Measurement, Drivers, and Solutions*. *Annual Review of Environment and Resources*, 2019. **44**.
4. Schanes, K., K. Dobernig, and B. Gözet, *Food waste matters - A systematic review of household food waste practices and their policy implications*. *Journal of Cleaner Production*, 2018. **182**(C): p. 978-991.
5. Wikström, F., et al., *The Importance of Packaging Functions for Food Waste of Different Products in Households*. *Sustainability*, 2019. **11**(9).
6. Wikström, F., et al., *The influence of packaging attributes on consumer behaviour in food-packaging life cycle assessment studies - A neglected topic*. *Journal of Cleaner Production*, 2014. **73**: p. 100-108.
7. Verghese, K., et al., *Packaging's Role in Minimizing Food Loss and Waste Across the Supply Chain*. *Packaging and Technology and Science*, 2015. **28**: p. 603-620.
8. Williams, H., et al., *Reasons for household food waste with special attention to packaging*. *Journal of Cleaner Production*, 2012. **24**: p. 141-148.
9. Brennan, L., et al., *The role of packaging in fighting food waste: A systematised review of consumer perceptions*. 2020: Manuscript Under Review for Publication. p. 31.
10. Pennanen, K., et al., *European Consumers' Perceptions of Time-Temperature Indicators in Food Packaging*. *Packaging Technology and Science*, 2015. **28**(4): p. 303-323.
11. Barska, A. and J. Wyrwa, *Consumer perception of active and intelligent food packaging*. *Zagadnienia Ekonomiki Rolnej*, 2016. **4**(349): p. 134-155.
12. ARCADIS, *National Food Waste Baseline: Final assessment report*. 2019: www.environment.gov.au. p. 101.
13. Quested, T.E., et al., *Spaghetti soup: The complex world of food waste behaviours*. *Resources, Conservation and Recycling*, 2013. **Oct 1**(79): p. 43-51.
14. Young, C.W., et al., *Sustainable Retailing - Influencing Consumer Behaviour on Food Waste*. *Business Strategy and the Environment*, 2018. **27**(1): p. 1-15.
15. Farr-Wharton, G., M. Foth, and J.H.-J. Choi. *Colour coding the fridge to reduce food waste*. in *Proceedings of the 24th Australian Computer-Human Interaction Conference*. 2012. ACM.
16. Holsteijn, F.v. and R. Kemna, *Minimizing food waste by improving storage conditions in household refrigeration*. *Resources, Conservation and Recycling*, 2018. **128**: p. 25-31.
17. Stancu, V., P. Haugaard, and L. Lähteenmäki, *Determinants of consumer food waste behaviour: Two routes to food waste*. *Appetite*, 2016. **96**: p. 7-17.
18. Szabó-Bódi, B., G. Kasza, and D. Szakos, *Assessment of household food waste in Hungary*. *British Food Journal*, 2018. **120**(3): p. 625-638.
19. Visschers, V.H.M., N. Wickli, and M. Siegrist, *Sorting out food waste behaviour: A survey on the motivators and barriers of self-reported amounts of food waste in households*. *Journal of Environmental Psychology*, 2016. **45**: p. 66-78.
20. Evans, D., *Blaming the consumer - once again: the social and material contexts of everyday food waste practices in some English households*. *Critical Public Health*, 2011. **21**(4): p. 429-440.
21. Evans, D., *Food Waste: Home consumption, material culture and everyday life*. 2014, London, UK; New York: Bloomsbury Publishing.
22. Sustainability Victoria, *Love Food Hate Waste Pre Campaign Community Research*. 2018, Sustainability Victoria; Victorian State Government: Melbourne, Victoria.
23. Lindh, H., et al., *Elucidating the Indirect Contributions of Packaging to Sustainable Development: A Terminology of Packaging Functions and Features*. *Packaging and Technology and Science*, 2016. **29**: p. 225-246.
24. Verghese, K., et al., *The greenhouse gas profile of a "Hungry Planet"; quantifying the impacts of the weekly food purchases including associated packaging and food waste of three families*, in *19th IAPRI World Conference on Packaging 2014: Responsible Packaging for a Global Market*. 2014.
25. Manfredi, M., et al., *Environmental assessment of antimicrobial coatings for packaged fresh milk*. *Journal of Cleaner Production*, 2015. **95**: p. 291-300.
26. Zhang, H., et al., *The effect of active packaging on minimizing food losses: Life cycle assessment (LCA) of essential oil component-enabled packaging for fresh beef*. *Packaging Technology and Science*, 2015. **28**(9): p. 761-774.
27. Møller, H., et al., *Food waste and date labelling: issues affecting the durability*. 2016: Nordic Council of Ministers.
28. Gutierrez, M.M., M. Meleddu, and A. Piga, *Food losses, shelf life extension and environmental impact of a packaged cheesecake: A life cycle assessment*. *Food Research International*, 2017. **91**: p. 124-132.
29. Wikström, F., et al., *Packaging Strategies That Save Food: A Research Agenda for 2030*. *Journal of Industrial Ecology*, 2018. **23**(3): p. 532-540.
30. Yildirim, S., et al., *Active packaging applications for food*. *Comprehensive*

- Reviews in Food Science and Food Safety, 2018. **17**(1): p. 165-199.
31. INCPEN and WRAP, *Key Findings Report: UK survey 2019 on citizens' attitudes & behaviours relating to food waste, packaging and plastic packaging*. 2019, WRAP: Banbury, UK. p. 14.
 32. Licciardello, F., *Packaging, blessing in disguise. Review on its diverse contribution to food sustainability*. Trends in Food Science & Technology, 2017. **65**: p. 32-39.
 33. Lewis, H., et al., *Food waste opportunities within the food wholesale and retail sectors*. 2017, Prepared for the NSW Environment Protection Authority by the Institute for Sustainable Futures at the University of Technology Sydney.
 34. Millen, D.R., *Rapid ethnography: Time deepening strategies for HCI field research*, in *Proceedings of the 3rd conference on Designing interactive systems: processes, practices, methods, and techniques*. 2000, Association for Computing Machinery: New York City, New York, USA. p. 280-286.
 35. Pink, S. and J. Morgan, *Short-term ethnography: Intense routes to knowing*. Symbolic Interaction, 2013. **36**(3): p. 351-361.
 36. Rosenbaum, M.S., M.L. Otolara, and G.C. Ramirez, *How to create a realistic customer journey map*. Business Horizons, 2017. **60**(1): p. 143-150.
 37. Temkin, B.D., A. McInnes, and R. Zinser, *Mapping The Customer Journey: Best Practices For Using An Important Customer Experience Tool*. 2010, Forrester Research Inc. p. 18.
 38. Diaz-Ruiz, R., M. Costa-Font, and J.M. Gil, *Moving ahead from food-related behaviours: an alternative approach to understand household food waste generation*. Journal of Cleaner Production, 2018. **172**: p. 1140-1151.
 39. Abdelradi, F., *Food waste behaviour at the household level: A conceptual framework*. Waste Management, 2018. **71**: p. 485-493.
 40. Farr-Wharton, G., M. Foth, and J.H.-J. Choi, *Identifying factors that promote consumer behaviours causing expired domestic food waste*. Journal of Consumer Behaviour, 2014. **13**(6): p. 393-402.
 41. Corrado, S., et al., *Modelling of food loss within life cycle assessment: From current practice towards a systematisation*. Journal of Cleaner Production, 2017. **140**: p. 847-859.
 42. Verghese, K., S. Lockrey, and H. Williams, *Final Report: Districts, Lifestyles and Avoiding Food Waste*. 2014, Banyule City Council: Melbourne, Australia. p. 51.
 43. Gale, T., *Food Packaging and Household Food Waste: What the Love Food Hate Waste campaign needs to know*. 2018, Sustainability Victoria: Melbourne, Victoria.
 44. Australian Packaging Institute, *2019 Australasian Packaging Innovation and Design Awards*. 2019, AIP.
 45. Dhall, R., S. Sharma, and B. Mahajan, *Effect of shrink wrap packaging*

- for maintaining quality of cucumber during storage*. Journal of Food Science and Technology, 2012. **49**(4): p. 495-499.
46. Porpino, G., J. Parente, and B. Wansink, *Food waste paradox: antecedents of food disposal in low income households*. International Journal of Consumer Studies, 2015. **39**(6): p. 619-629.
 47. Blanc, S., et al., *Use of Bio-Based Plastics in the Fruit Supply Chain: An Integrated Approach to Assess Environmental, Economic, and Social Sustainability*. Sustainability, 2019. **11**(9): p. 2475.
 48. Van den Oever, M., et al., *Bio-based and biodegradable plastics - Facts and Figures: Focus on food packaging in the Netherlands*. 2017, Wageningen Food & Biobased Research. p. 65.
 49. Molina-Besch, K., F. Wikström, and H. Williams, *The environmental impact of packaging in food supply chains—does life cycle assessment of food provide the full picture?* The International Journal of Life Cycle Assessment, 2019. **24**(1): p. 37-50.
 50. APCO, *Our Packaging Future Report: a collective impact framework to achieve the 2025 National Packaging Targets*. 2020, Australian Packaging Covenant Organisation: Melbourne, Victoria.
 51. Deloitte, *Finding the green in today's shoppers: Sustainability trends and new shopper insights*. 2009, Report to the Grocery Manufacturers Association (GMA).
 52. Wilson, N.L.W., et al., *Food waste: The role of date labels, package size, and product category*. Food Quality and Preference, 2017. **55**: p. 35-44.
 53. Ghinea, C. and O.A. Ghiuta, *Household food waste generation: young consumers behaviour, habits and attitudes*. International Journal of Environmental Science and Technology, 2019. **16**(5): p. 2185-2200.
 54. Principato, L., L. Secondi, and C.A. Pratesi, *Reducing food waste: An investigation on the behavior of Italian youths*. British Food Journal, 2015. **117**(2): p. 731-748.
 55. Thompson, B., et al., *The effect of date labels on willingness to consume dairy products: Implications for food waste reduction*. Waste Management, 2018. **78**: p. 124-134.
 56. EC Sustainable, *Victorian Statewide Garbage Bin Audits: Food, household chemicals and recycleables 2013*. 2014, Report for Sustainability Victoria. p. 62.
 57. Lockrey, S., Hill, A., Langley, S., Ryder, M., Francis, C., Brennan, L., Verghese, K and Fight Food Waste CRC (2020) *Consumer Perceptions and Understanding of Packaging: Journey Mapping*. Interim Industry Full Report. Adelaide. Australia

APPENDIX 1 Further journey mapping methodology

7.1

Structure and focus of journey mapping sessions

Given the time constraints of the journey mapping sub-project, it was acknowledged that it was unlikely that all journey stages for the allocated food waste categories were able to be mapped in sufficient detail in the one hour time allocated for each household interview. The mapping process was therefore split in half. One section in the guided discussion targeted the awareness, consideration, shopping, and purchase stages. The second section asked about awareness, retention/storage, use, and disposal stages (It must be noted that journey stages were numbered as relevant to sections in the discussion guide used – see also **Table 2** below).

As an example of the questions the consumers were asked, in relation to their allocated category, for the consideration stage, the following kinds of questions were asked in the guided discussion, using bakery as an example:

- What bakery items do you buy regularly? Who do you buy it for and on what occasions?
- How do you feel about wasting bakery items?
- Do you consider storage or have specific things you buy and then store bakery items in? Does storage have an impact on the wastage of bakery items?
- Do you plan ahead, and if so how/why, before shopping for bakery items? Who else is involved in that planning/decision making?
- What role does packaging play in the above process?

The discussion guide, as with much qualitative consumer research, was used as a broad guide only. The actual journey mapping process was intended to be (and was) more organic and conversational in nature.

7.2

Field work and breakdown of journey map sessions

As well as the consumer recruitment, the field data collection was conducted solely by the field agency Stable Research, who utilised one qualitative field researcher to conduct all the field work. Using the one qualitative researcher ensured a consistent approach. Consumers were recruited from concentrated geographic areas around in Melbourne, Victoria – East Melbourne, West Melbourne, South Melbourne, North Melbourne and Inner Melbourne – so that the qualitative researcher could use their own vehicle and quickly travel from one session at the respondents' homes to another.

Due to the qualitative researcher's scheduling commitments, an initial batch of 39 journey mapping sessions were recruited and booked for October and November 2019. Of those scheduled, there were two respondents that did not participate, so only 37 journey mapping sessions were conducted. It was decided to review the recorded session materials (mapping notes, audio, and images) over the coming months (including the Christmas/New Year break).

Once all the transcriptions of the session audio and other data (notes and images) were reviewed, it was agreed that there was sufficient coverage of categories and data to answer the core research question with confidence, so no further data collection was required. **Table 2** shows a breakdown of the completed and targeted number of journey map sessions for each food category and the assigned groups within.

TABLE 2

Food Category Groups & Journey Stages

Food waste category	Journey stages	Number of journey maps (final/aim)
Bakery	G1 - 3. Awareness, 4. Consideration, 5. Shopping & 6. Purchase	4/5
	G2 - 3. Awareness, 7. Retention/ Storage, 8. Use, 9. Disposal	3/5
	Bakery total	7/10
Dairy and eggs	G1 - 3. Awareness, 4. Consideration, 5. Shopping & 6. Purchase	4/5
	G2 - 3. Awareness, 7. Retention/ Storage, 8. Use, 9. Disposal	3/5
	Dairy and eggs total	7/10
Packaged and processed	G1 - 3. Awareness, 4. Consideration, 5. Shopping & 6. Purchase	5/10
	G2 - 3. Awareness, 7. Retention/ Storage, 8. Use, 9. Disposal	5/10
	Packaged and processed total	10/10
Fruit and vegetables (fresh)	G1 - 3. Awareness, 4. Consideration, 5. Shopping & 6. Purchase	3/5
	G2 - 3. Awareness, 7. Retention/ Storage, 8. Use, 9. Disposal	4/5
	Fruit and vegetables total	7/10
Meat and seafood (fresh/frozen)	G1 - 3. Awareness, 4. Consideration, 5. Shopping & 6. Purchase	3/5
	G2 - 3. Awareness, 7. Retention/ Storage, 8. Use, 9. Disposal	3/5
	Meat and seafood total	6/10
Total		37/50

The RMIT 1.2.2 project team kept in touch with Stable Research and the qualitative researcher during the time in field, making some adjustment to the flow of the discussion guide after the initial sessions. A key adjustment was reducing the focus on awareness of food waste, in relation to the category and in general, as the initial consumer conversations were somewhat dominated by this journey stage. After this change, the sessions flowed better and often all stages of the food waste category journey map were able to be covered within the allotted hour.

7.3

Analysis of data

The 1.2.2 project research assistants (RAs) managed the data analysis internally (over the period November 2019 to February 2020). They began by listening to the session audio and tidying up the transcripts automatically generated by the Otter artificial intelligence (AI) transcription service. The RAs then provided a summary synthesis of each transcript (as well as associated mapping notes and images created during the sessions). The RAs made sure that they tidied-up transcripts and summarised several sessions, assigned to a variety of food waste categories, so they had an intimate sense of the various categories being mapped. Several RAs and Chief Investigator Simon Lockrey produced further synthesis of each category that then fed into research findings.

APPENDIX 2 Collated respondent journey map summaries

FIGURE 2

Journey map for bakery items



FIGURE 3

Journey map for dairy and eggs

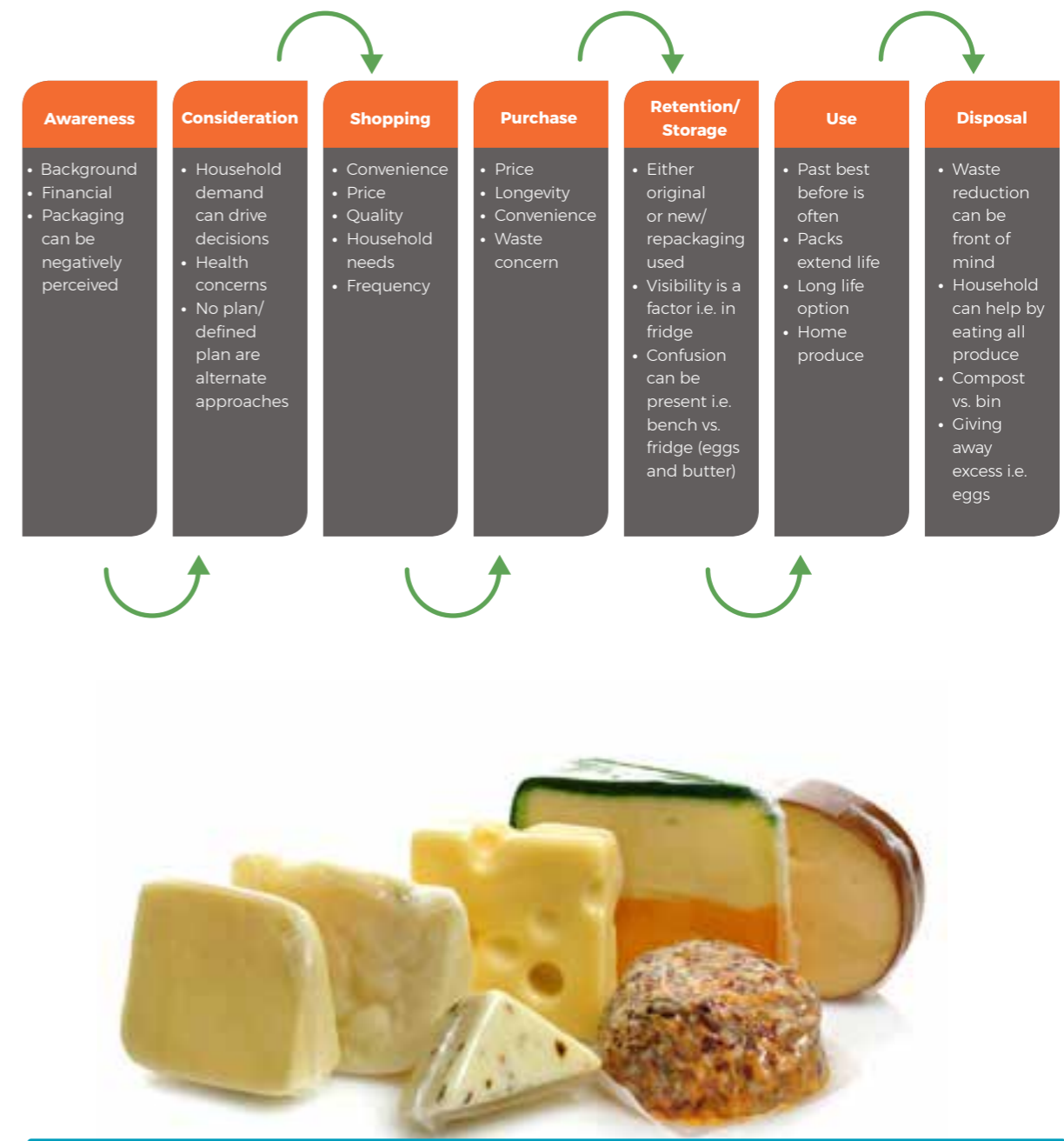


FIGURE 4

Journey map for packaged and processed foods

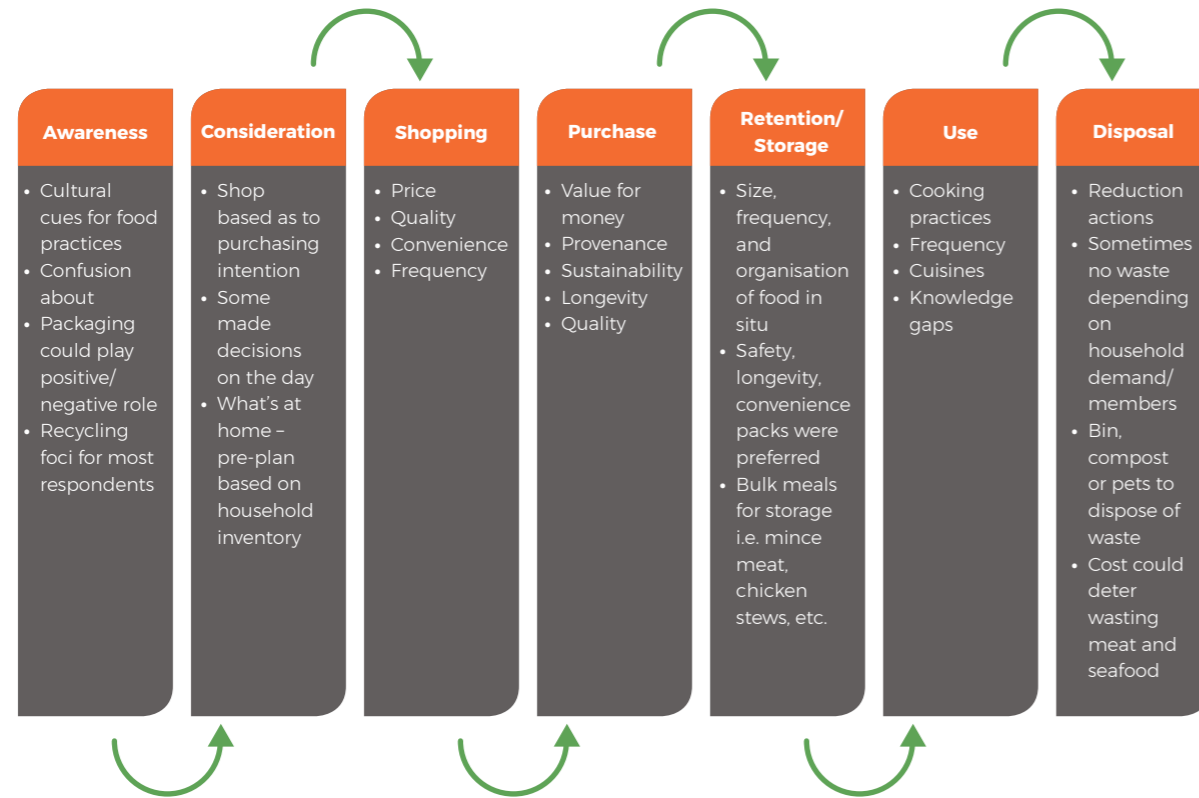


FIGURE 5

Journey map for fresh fruit and vegetables



FIGURE 6
Journey map for meat and seafood



About this project

Understanding the perception and use of packaging by consumers and how this plays a role in household food waste generation is an important first step in this project. With a greater understanding of how people appreciate and use packaging, along with the food waste they generate, we can design improved packaging and communications on food waste avoidance that will ultimately reduce food waste.

This project aims to understand consumer perceptions of the role of packaging in reducing food waste by:

- discovering target areas that will help drive packaging design decisions.
- discovering key consumer behaviours that may be adapted to reduce food waste.
- determining potential consumer responses to labelling and packaging alternatives in relation to food packaging.
- providing formative information for partners' new product development processes.
- designing packaging solutions to reduce food waste.
- designing more effective consumer education campaigns to reduce food waste.

The Project Partners are:



fightfoodwastecrc.com.au



FIGHT FOOD WASTE
Cooperative Research Centre
REDUCE - TRANSFORM - ENGAGE



Australian Government
Department of Industry, Science,
Energy and Resources

Business
Cooperative Research
Centres Program