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Drivers of divergent industry and consumer food waste behaviors: The case of reclosable and resealable packaging

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ABSTRACT

Optimizing packaging to align with consumers' food management needs can improve packaging's potential to reduce household food waste, important for a sustainable food system. This paper provides actionable insights to support the food/beverage–packaging industry, policymakers, and researchers to better understand the factors impeding industry implementation of packaging aligned to consumer needs and the potential flow-on effects on household food waste. To facilitate understanding, a consumer-industry grounded model is presented based in the Australian context, developed through qualitative research using the Gioia method to examine reclosable/resealable packaging, food storage, and household food waste.

The results indicate that divergent packaging priorities and needs in industry and consumers impede food waste reduction. Industry concerns for business viability mean prioritizing features to sell products, hence consumer needs are secondary. Consumer needs are framed by individual task goals for managing food storage and the availability of supporting resources, including appropriate packaging. Suggestions to help align consumer and industry priorities include increased industry–consumer communication to better help industry understand consumer needs and validating product-packaging with consumers.

1. Introduction

The United Nations Sustainable Development Goals (SDG) 12.3 calls for global action to halve food loss and waste (FLW) by 2030, as part of a global shift toward sustainable production and consumption (SDG 12) for a sustainable future (Champions 12.3, 2020). With seven years left until the target deadline of 2030, there is an urgency to scale-up action. The food system is responsible for a significant amount of land, water, and energy usage, as well as contributing to one-third of global greenhouse gas (GHG) emissions (Crippa et al., 2021). FLW contributes half of the global GHG emissions from food systems, of which 35.5% can be attributed food waste (FW) at the consumer stage (Zhu et al., 2023) — including household food waste (HFW) which is the focus of this study. FW refers to food discarded during the retail to consumption stages of the food supply chain (Parfitt et al., 2010; UNEP, 2021). At an annual 570 million tonnes, HFW currently accounts for over half of all FW produced globally (UNEP, 2021), so reducing HFW can help lessen the potential climate change impacts of GHG emissions on the food system (Vermeulen et al., 2012; Zhu et al., 2023). Potential climate change impacts on food prices, food quality and food safety are likely to negatively affect consumers (Vermeulen et al., 2012). Therefore, greater action against HFW can deliver significant progress toward SDG 12.3 and help improve the overall sustainability of global food systems, important to support increased food security and environmental outcomes for current and future generations (FAO, 2022).

Packaging plays an important role to reduce FW through the supply chain and in households (Verghese et al., 2015). Within this context, there is an opportunity to improve packaging's potential to reduce HFW through improved alignment of packaging functions with consumers' needs as part of a sustainable food system (Sundqvist-Andberg and Åkerman, 2021; Wikström et al., 2018; Williams et al., 2020). In order to do so, relevant information on specific packaging functions in relation to HFW is needed but there is currently paucity of such studies. The majority of packaging related HFW studies are general HFW studies where packaging is mentioned but not the main focus (Brennan et al., 2020; Chan, 2022b). Moreover, to suggest packaging solutions that the industry is willing to implement, information on industry's willingness to adopt packaging functions aimed at reducing HFW is needed. However, related studies have mainly focused on active and intelligent packaging (Cammarelle et al., 2021) or industry's general willingness to implement FW reducing packaging (Ryder et al., 2021). Hence an opportunity for more research to help collect this data (Sundqvist-Andberg and

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Åkerman, 2021; Wikström et al., 2018), which this present study contributes to. Therefore, through the case of reclosable and resealable packaging, this study identifies key factors affecting consumers' food and beverage packaging needs in an Australian context and contributes actionable insights on key barriers impeding food/beverage–packaging industry implementation of packaging aligned to these needs, to reduce HFW. Note that when referring to 'HFW' or 'food' in this study, this includes both food and beverages unless specified. Similarly, when referring to packaging, this includes packaging for food and beverages unless specified.

1.1. Packaging's role to help reduce household food waste

Food and beverage packaging is an integral part of the modern food/beverage industry. Over 99% of food/beverages sold in industrialized nations rely on packaging to protect, preserve, contain, and facilitate the transport of food from farm to consumer, positively affecting product profitability by reducing FW (Restuccia et al., 2010; Verghese et al., 2015). Given packaging's importance, there is increasing interest among food/beverage–packaging industry actors and researchers in packaging's role to reduce HFW, with continued efforts to improve its efficacy (Chan, 2022a). Hence an opportunity for industry to modify packaging design processes to include FW considerations.

Industry actors can also increase packaging's potential to reduce HFW by identifying and addressing HFW drivers (Wikström et al., 2018). HFW drivers include social norms and attitudes, food management routines (shopping, storing, preparing), and packaging (see Oláh et al., 2022; Principato et al., 2021). These drivers often intertwine with consumers' daily lives, making HFW complex to understand and challenging to fully address (Quested et al., 2013). One element of this complexity is that the suitability of packaging functions to fulfill consumer needs can impact HFW (Wikström et al., 2019; Williams et al., 2020). A Swedish study attributed 20–25% of HFW to packaging functions unaligned with consumer needs (Williams et al., 2012), hence an opportunity for this present study to identify specific consumer needs in connection to packaging functions. Identified packaging drivers for HFW include food/beverages spoiled in packages containing more than needed, safety concerns affected by expiry dates, and quality concerns affected by lack of resealability (Dobernig and Schanes, 2019; Hebrok and Heidenstrøm, 2019; Williams et al., 2020). Furthermore, consumer perceptions that packaging is unsustainable can encourage actions that drive HFW (Langley et al., 2021; Plumb et al., 2013). However, this consumer perception is a paradox as packaging systems that reduce FW can produce a lower environmental impact than FW (Heller et al., 2018; Verghese et al., 2014). Sustainable packaging is multi-faceted and includes balancing material and FW impacts (Verghese et al., 2012). HFW and packaging can therefore be described as a 'wicked problem'; acknowledging this can foster meaningful discussion on ways to improve HFW management through packaging modifications (Närvänen et al., 2020). Thus, a holistic approach involving multiple actors could help address this problem, which this study has sought to take by combining consumer and industry views.

1.1.1. Reclosable and resealable packaging

This study focuses on consumer and industry perspectives on reclosable and resealable packaging intended to assist household food/beverage storage and reduce HFW, to help understand how these perspectives interplay. Reclosable and resealable packaging refers to packaging with in-built closure functionality to help consumers store food/beverages in the original packaging after opening, where resealable packaging features tighter fitting closures than reclosable (Scott and Butler, 2006). While this implies that resealable packaging — as opposed to reclosable — provides a more complete barrier against the outside atmosphere by reducing exposure to oxygen, moisture, and odors to improve the protection of food or beverage it contains (Scott and Butler, 2006), both reclosable and resealable packaging can assist consumers to reduce HFW. Hence, when reporting and discussing the results of this study, the joint term 'reclosable/resealable' is used unless it is important to make the distinction.

This study builds on a suggestion by Hebrok and Heidenstrøm (2019) that packaging can play a more central role in minimizing HFW during household food/beverage storage, by redesigning it to align with how consumers handle these products. Storage practices significantly influence HFW behaviors; packaging can contribute to this (Brook Lyndhurst, 2011; Farr-Wharton et al., 2014; WRAP et al., 2017). For instance, a lack of reclosable/resealable functionality can drive HFW by negatively affecting consumer perception of product quality when food/beverages are stored in the original packaging (Williams et al., 2012, 2020). Greater availability of reclosable/resealable packaging for home storage of food/beverages is therefore suggested to help reduce HFW (Lindh et al., 2016; Williams et al., 2012). This present study thus identifies contexts in which consumers perceive reclosable/resealable packaging as useful for storing food/beverages to minimize HFW and ways industry can act on such insights.

1.2. Opportunity to combine industry and consumer perspectives on packaging

Studies have been conducted with the food/beverage–packaging industry in Australia (Francis et al., 2021; Ryder et al., 2021) and Italy (Cammarelle et al., 2021) to gauge industry perceptions of willingness to invest in packaging design to reduce FW. Up to 70–75% of participants in the studies expressed conditional willingness to redesign packaging to reduce FW, affected by factors including development costs, implementation constraints, and market risks (Ansah et al., 2018; Cammarelle et al., 2021; Francis et al., 2021). While these industry studies help to elucidate some of the barriers that affect packaging-innovation development, there is an opportunity to explore the joint role that consumers and industry play in maximizing packaging's potential to reduce HFW. Although the food/beverage–packaging industry in Australia purport to consult consumer research teams during packaging design and rely on consumer complaints to inform redesign (Ryder et al., 2021), there is little indication to suggest that industry actively engages consumers to test packaging usability in the context of reducing HFW. As such consumer needs and HFW data are relatively unknown to industry and impede the development of packaging innovations that respond to consumer behavior (Cammarelle et al., 2021; Ryder et al., 2021). This highlights an opportunity for consumer research to play a bigger role in product-packaging development, to help identify a greater number of packaging opportunities and increase the chance consumers are satisfied with the resultant product-packaging (Simms and Trott, 2010). Additional empirical studies can help in this regard, hence this present study directly engages consumers and industry for combined packaging usability and packaging development insights. The consumer–industry joint role in packaging development to reduce HFW is explored in this present study by feeding insights into HFW and consumer needs to industry, to discover how this may affect industry willingness to design packaging to reduce HFW and in turn, affect consumer ability to reduce HFW.

1.3. Aim of this study and key contributions

Focusing on reclosable/resealable packaging and household food/beverage storage, this research asks the question *what factors impede Australian food/beverage–packaging industry ability to implement features into packaging to help consumers minimize HFW?* To help identify these factors, semi-structured interviews were conducted with 20 consumers and 11 industry individuals in Australia, analyzed using the Gioia et al. (2013) method based on grounded theory. This study aimed to:

- Identify key factors affecting consumer perceptions of reclosable/resealable packaging's role in household food/beverage storage and preventing HFW.
- Identify contexts in which consumers perceive reclosable/resealable packaging to be useful.
- Identify key factors affecting food/beverage–packaging industry willingness to offer reclosable/resealable functionality on food/beverage product packaging.
- Identify key barriers impeding industry ability to meet consumer demands for packaging features/functions.

The in-depth nature of this qualitative study with purposively selected participants (Guest et al., 2013b) meant that rich data was gathered, producing insights into some of the reasons and contexts behind consumer and industry decisions for FW and packaging that can jointly affect packaging-related HFW. Rather than contribute to wider discussions around organizational behavior, consumer behavior, and decision-making — which could be explored in future research through the data — the aim when reporting this study is to provide actionable insights to support industry, policymakers, and researchers to increase their understanding of the underlying factors that impede industry to implement packaging aligned with consumer needs to help reduce HFW.

The study combines insights from the consumer and industry data to produce a model showing how their respective decision-making drivers interrelate. The model elucidates factors that can guide the decision-making processes tied to the specific contexts of individual consumers and companies. In doing so, this study highlights the complex task industry face to design packaging that both fulfills industry interests and sufficiently meets consumer needs.

This study makes two key contributions. First, it helps to increase understanding of any barriers that impede industry ability to meet consumer demands for packaging features/functions, through specific increased understanding of consumer behavior around resealable/reclosable packaging. Second, the study contributes new insights for packaging design to reduce HFW that highlights a need to consider the dynamics between consumers and industry.

2. Method

This study engaged consumers and the food/beverage–packaging industry in Australia to address the research aims outlined in the introduction (see section 1.3). Data were primarily collected through semi-structured interviews to facilitate researcher–participant conversations that delved deep into participant experiences, with additional pre-interview sensitization activities for the consumer participants, for rich data (Creswell and Creswell, 2018; Visser et al., 2005). The Gioia (2021) method guided a systematic and robust data analysis and theory building process.

2.1. Research participants

This study engaged 31 participants in Australia, consisting of 20 consumers recruited via a market research agency and 11 food/beverage–packaging industry individuals recruited through email and industry newsletters. Generating statistically representative findings was beyond the remit of a study based on semi-structured interviews, so this study aimed for depth via rich insights rather than breadth via representativeness (Knott et al., 2022). Therefore a purposive sampling strategy was used to select participants with ability to contribute meaningful insights (Guest et al., 2013b). The combined information power (Malterud et al., 2016) of these participants was sufficient to contribute new knowledge into consumer and industry decisions for FW and packaging for the purpose of building a substantive theory (Magnani and Gioia, 2023).

The participants were spread across a major Australian metropolitan area and adjacent regional areas. Eligible consumer participants were the primary food managers for their household as they are likely to make key food and beverage product storage decisions and interact with food/beverage packaging within this context. Consumer participants represented high-income households earning at least AUD$100,000pa with children aged <14 years because this demographic is among those who generate the most HFW in Australia (Borg et al., 2022; Karunasena et al., 2021); useful for research to improve HFW packaging solutions. Appendix A shows the consumer participant profile. Eligible industry participants were involved in the design/decision-making processes of packaging development in various roles. Appendix B shows the industry participant profile. To maintain participant privacy, codifications have been used to refer to individual participants, where 'C *number*' (i.e., 'C1') refers to consumer participants and 'IN *number*' (i.e., 'IN1') refers to industry participants.

Consumer participants were engaged between October–December 2021 through a sensitization activity worksheet and semi-structured interviews. Each received an AUD$75 gift voucher upon completion. Industry participants were interviewed between February–April 2022. This research was approved by the Human Research Ethics Committee of RMIT University.

2.1.1. Sensitization worksheet for the consumer participants

Before being interviewed, each consumer completed sensitization activities designed to encourage greater awareness of their own actions pertaining to the research topic so they would be primed to answer the interview questions with greater depth. Sensitization is used to generate deep insights to help design products that improve the chance that it will adequately suit the people who will use them (Visser et al., 2005). The approach was deemed important to this study as prior packaging related HFW studies show that consumers often do not recognize packaging's role in relation to their food related practices (Williams et al., 2012, 2020). This complicates investigating consumers' packaging decisions in relation to their food practices and potential effects on HFW. The approach has also been used in prior HFW studies to remove any feelings of guilt that consumers may feel when reporting details on the food they waste (Williams et al., 2020). In this study, sensitization was used to improve the richness of the data gathered by encouraging consumers to share their experiences more openly and in greater detail. The activities were presented to consumer participants as a worksheet. Through photos and written descriptions, participants reflected on the most and least useful aspects of food/beverage packaging and containers they used to store food/beverages. Hence, the sensitization worksheet assisted research for an increased understanding of what consumers need from packaging to help them store food and beverages in a way that minimizes HFW.

2.1.2. Semi-structured interviews with consumer and industry participants

Semi-structured interviews with the consumer and industry participants were conducted through videoconferencing. Interviews lasted between 45 and 150min, depending on the depth of the answers provided. Interviews were recorded with permission and transcribed, yielding 275 consumer and 223 industry transcript pages. Participants were asked open-ended questions from an interview guide developed for this study, based on best practice principles (Guest et al., 2013a). The questions were designed to facilitate in-depth engagement with participants' experiences, to gather in-depth and context-rich information relevant to the aims of this study (see section 1.3).

The consumer participants were asked about how they store food/beverages at home, the reasons behind storage decisions, and the role of reclosable/resealable packaging, in relation to their HFW. The photos and descriptions in the sensitization worksheet were used as interview prompts to encourage participants to reflect on their own experiences, to gather data focused on the participant's reality. The prompts also encouraged participants to demonstrate the frustrating and useful aspects of food/beverage product packaging and participants provided photos to highlight these packaging aspects, leading to rich data. The

industry participants were asked about the different stages of food/beverage packaging design, their role in this process, factors determining packaging feature decisions, role of reclosable/resealable packaging to reduce HFW, and consideration of consumer needs. For the latter, insights from the consumer interviews were used so the questions would directly reflect packaging needs communicated by consumers. This is why consumer participants were engaged before industry participants in this study. Each industry participant was shown reclosable/resealable packaging by their place of employment to help gather data focused on their reality, since the participant had either directly worked on these packaging or were familiar with them.

2.2. Data analysis and building a grounded model

The Gioia method (see Gioia, 2021) was used to systematically analyze the data and build a grounded model on how industry decision-making process on packaging features influence consumer ability to fulfil task goals. The Gioia method is a systematic qualitative research method based on grounded theory (Strauss and Corbin, 1997). It originated from the field of management as a way to analyze and present rigorous qualitative research (Gioia, 2019; Gioia et al., 2013; Langley and Ravasi, 2019) on organizational behavior (e.g.: Giudici et al., 2018; Glaser, 2017). Additionally in recent years, this method has been adopted for use in disciplines as diverse as sustainability (Weng et al., 2020) and pedagogy (Zaheer and Munir, 2020), providing precedence for the interdisciplinary use of this method in this present study. As such, it is a suitable method for this present study as the foci are on food/beverage–packaging industry packaging decisions to support reducing HFW and consumer decision-making around packaging.

In this present study, the Gioia method was chosen as a rigorous way to analyze the research data and present it in a manner that clearly shows the progression from data to theory/grounded model. Data analysis through the Gioia method involved separately coding the consumer/industry data from first-order concepts to aggregate dimensions. The resulting consumer and industry data structure is presented in Figs. 1 and 2. Appendix C and D show a table of representative data/quotes corresponding to the consumer and industry data structures. Theoretical insights from the analysis were used to build separate consumer and industry grounded models (see Figs. 3 and 4) and then combined to build a consumer–industry grounded model (see Fig. 5).

Various food/beverage–packaging industry actors participated in the study (see appendix B), but the data structure (see Fig. 2) and grounded model (see Fig. 5) highlight the role of food/beverage brands. Brands refer to retail brands' associated products rather than the companies owning these brands. Since brands — directly or by proxy — determine the product-packaging that consumers use and consumers associate packaging experiences with the brand (Underwood, 2003), brands provide a link between industry perspectives of packaging design and consumers' food/beverage packaging experiences, aligning with this study's aims.

Analysis began with opening coding through a fine grain reading (Strauss and Corbin, 1997) of the data. Data excerpts/quotes were compared across participants to identify distinct patterns, described using participants' words. The resulting in-vivo codes were compared to merge redundancies then collapsed into first-order concepts. Next, second-order themes were generated through axial coding by comparing

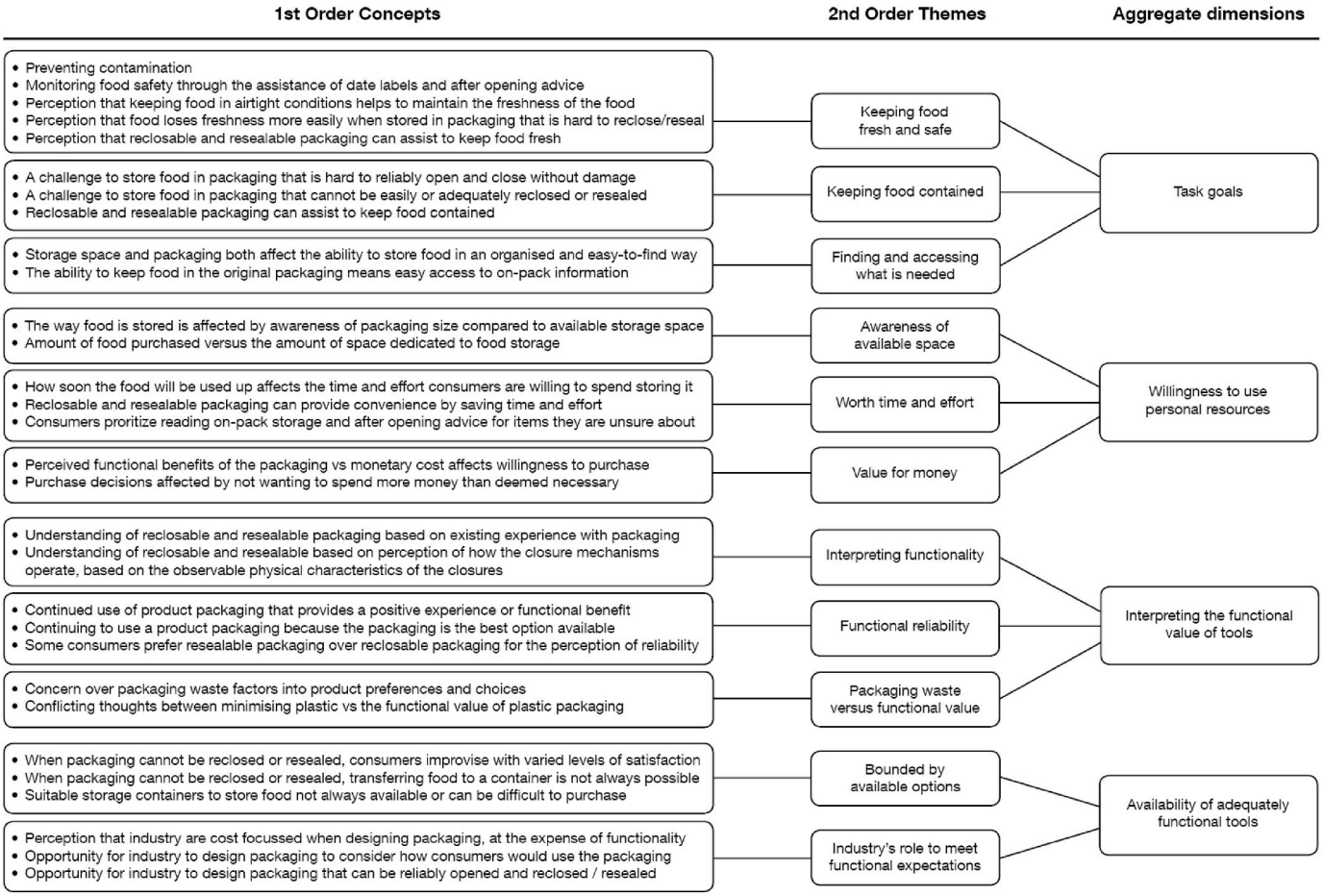

Fig. 1. Data structure generated from interviews with 20 consumer participants in Australia, for an understanding of consumers' packaging decisions for food/beverage storage at home and effects on household food/beverage waste — through the case of reclosable/resealable packaging.

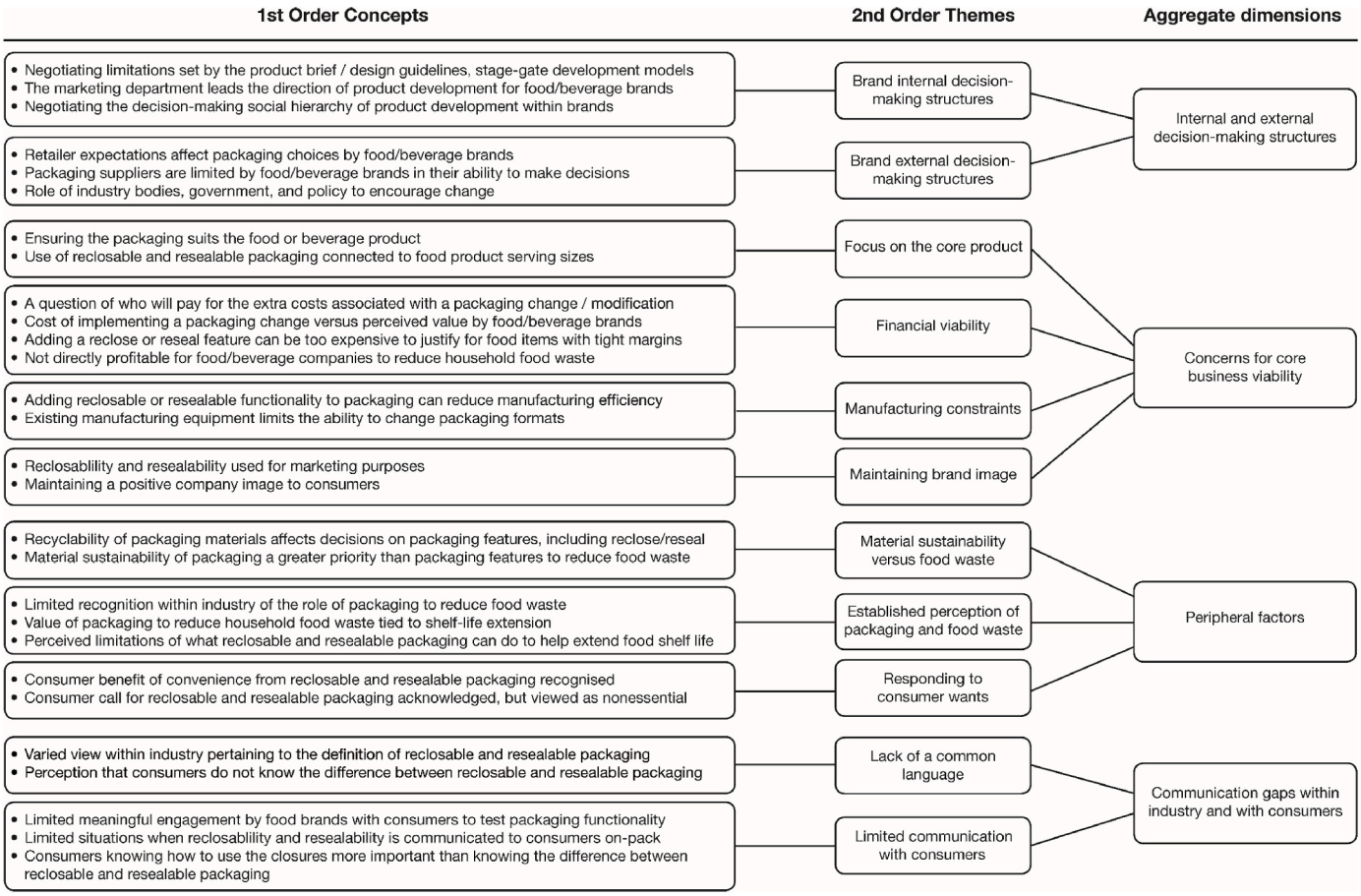

Fig. 2. Data structure generated from interviews with 11 food/beverage–packaging industry participants in Australia, for an understanding of industry packaging decisions and priorities to reduce household food/beverage waste — through the case of reclosable/resealable packaging.

and connecting first-order concepts to describe an abstracted concept with a theory-driven explanation (Gioia, 2021); writing theoretical memos (Strauss and Corbin, 1997) assisted. Aggregate dimensions were generated by comparing and grouping related second-order themes to describe further abstracted concepts. Using the Gioia method helped to ensure robust data analysis and that the emergent theory remained grounded in the data. These coding stages were repeated as the analysis was continuously scrutinized through constant comparison (Charmaz, 2006) for coherent connections both within and across each stage, contributing rigor to the process of analysis. The analysis subsequently evolved as a deeper understanding of the data manifested. The final step was to build the industry–consumer grounded model. Links between the aggregate dimensions informed separate consumer and industry models, which were combined.

3. Results

This section presents key aspects affecting consumer and industry packaging decisions as per the consumer and industry grounded models (see Figs. 3 and 4) developed during data analysis. The consumer model is presented in section 3.1 and the industry model is presented in section 3.2, each focusing on four key aspects.

3.1. Consumer decision-making for food storage in the context of household food waste

Consumer interactions with packaged food and beverages in the context of decision-making for food storage and effects on HFW is the focus of this section. A key purpose of collecting this consumer data is to inform industry considerations for consumer-needs-oriented packaging design to help consumers reduce HFW. Key insights from these data are distilled in Fig. 4, which shows a consumer decision-making process model for storing packaged food/beverages after opening the packaging. *Food storage task goals* (see section 3.1.1) represent ideal outcomes. These goals assist to frame consumer decisions and actions, but goal achievement is reliant on other factors determining if circumstances are conducive. This includes the *availability of adequately functional tools* (see section 3.1.3) suited to the task goals, where tools refer to storage implements — including containers and packaging — with suitable features. Not only are consumers limited by what tools they have at home and can purchase, consumers can only use/benefit from a tool when their *interpretation of the functional value* (see section 3.2.4) recognizes suitability for the task. Furthermore, what tools consumers use to store food/beverages is influenced by their *willingness to use personal resources* (see section 3.1.2), including the amount of money used to purchase tools, time/effort used to store food/beverages, and dedicated storage space. Consumer decision-making for food/beverage product storage therefore varies by context; the way these factors combine affect consumer ability to store these products in a way that fulfils task goals. The following subsections detail how these factors drive consumer demand for reclosable/resealable packaging to help fulfil task goals.

3.1.1. Food and beverage storage task goals

Consumers' food (and beverage) storage task goals — including keeping food/beverages contained, fresh and safe, with ease of finding and accessing the product and related information — represent ideal outcomes when consumers store food/beverages, therefore framing food/beverage storage decisions and perceptions of packaging's role.

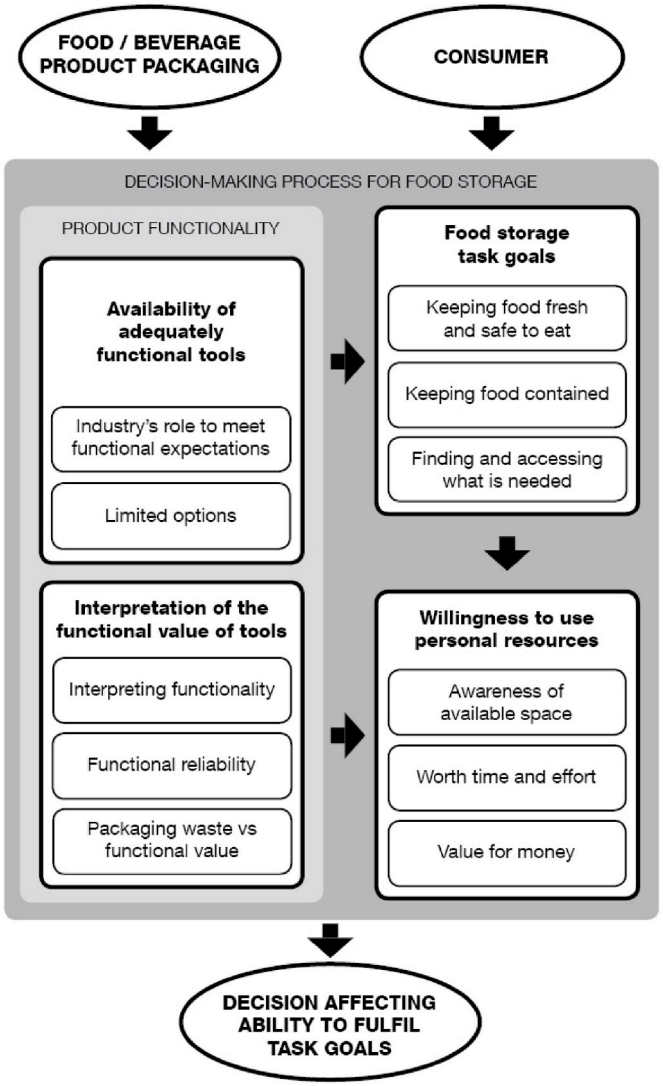

Fig. 3. Consumer decision-making process model for packaging's role in domestic food/beverage storage and effects on ability to fulfil task goals and reduce household food/beverage waste. Based on 20 consumer participants in Australia.

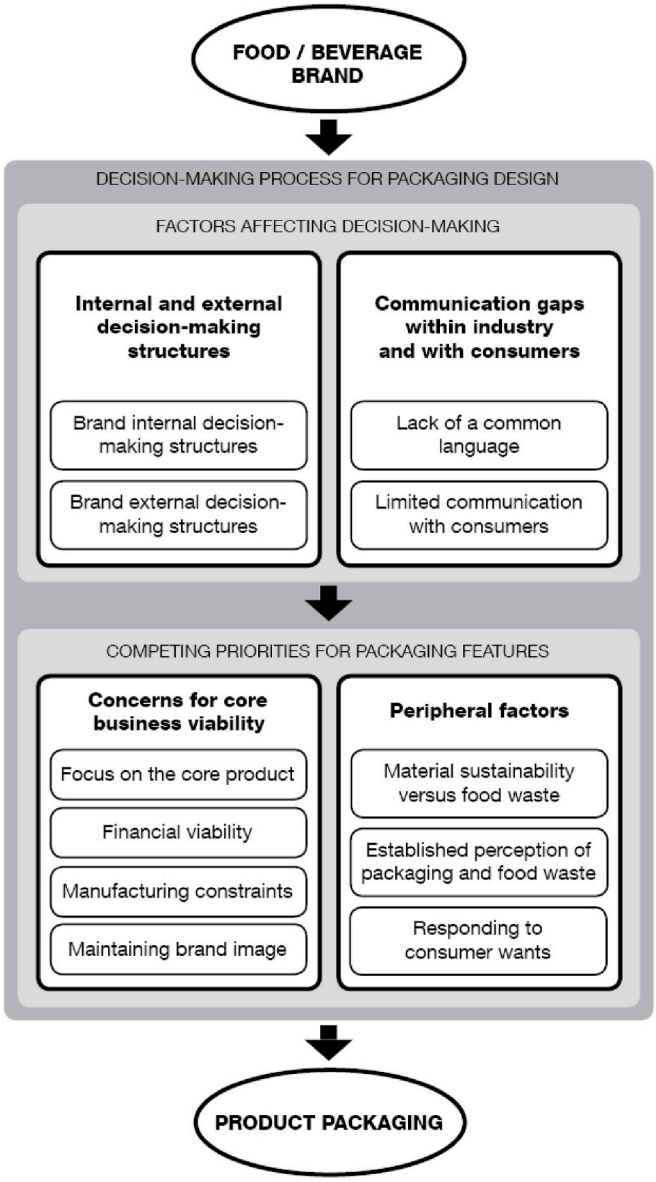

Fig. 4. Industry decision-making process model for food/beverage packaging features. Based on 11 food/beverage–packaging industry participants in Australia.

Consumers say that having unreliable or no reclosable/resealable packaging for some of the food/beverage products they buy can hinder these goals. Consumers find it challenging to keep food contained in packaging without built-in closures — including pasta/chips/nuts/frozen vegetables and biscuits in heat-sealed polymer-film bags and tray-in-sleeve packs — as the packaging "opens up more than you want" (C17) and "starts spilling … because you cannot close it" (C3). For similar reasons, consumers expressed frustration with unreliable closures on certain reclosable/resealable packaging formats. The tab closure of bag-in-box cereals/biscuits easily rips and sticker-closures on rice/sugar packaging "lose[s] its stickiness" (C18). Consequentially, consumers try to keep the packaging shut or transfer this food, compromising the fulfilment of one goal to meet another. When consumers use elastic bands or clips to shut packaging, "the moisture can still go in, [so] it doesn't stay fresh" (C16). Consumers say that consequently, they transfer the food into containers to "keep things fresher" (C14), "keep out pests and [prevent] spillage" (C10), but this is not always possible (see section 3.1.3) nor ideal for retaining on-pack information. On-pack information assists consumers to manage their food/beverages by enabling the product to be identified, providing access to ingredient/nutrition information for health reasons, date labels to assess food/beverage freshness/safety, and cooking instructions. Hence, some consumers try to store food in the original packaging whenever possible. Reliable reclosable/resealable packaging can assist, highlighting packaging's role to assist household food/beverage storage and management to prevent HFW. Consumers report they have fewer storage concerns for beverages, sauces, and condiments because they are usually packaged in reclosable or resealable packaging. This is opposed to consumers' storage concerns for pasta, chips, nuts, cereal, biscuits, and frozen vegetables, highlighting an opportunity for industry to consider implementing a greater number of reclosable/resealable packaging formats for these specific food categories. Wider availability of "sturdy and secure" (C8) closures for a greater variety of packaged food/beverages hold promise in supporting consumers to meet storage task goals.

3.1.2. Willingness to use personal resources

Consumer use of personal resources — including money, time, effort, and physical space — to store food/beverages varies by context, affecting fulfilment of task goals (see section 3.1.1) and perceptions of

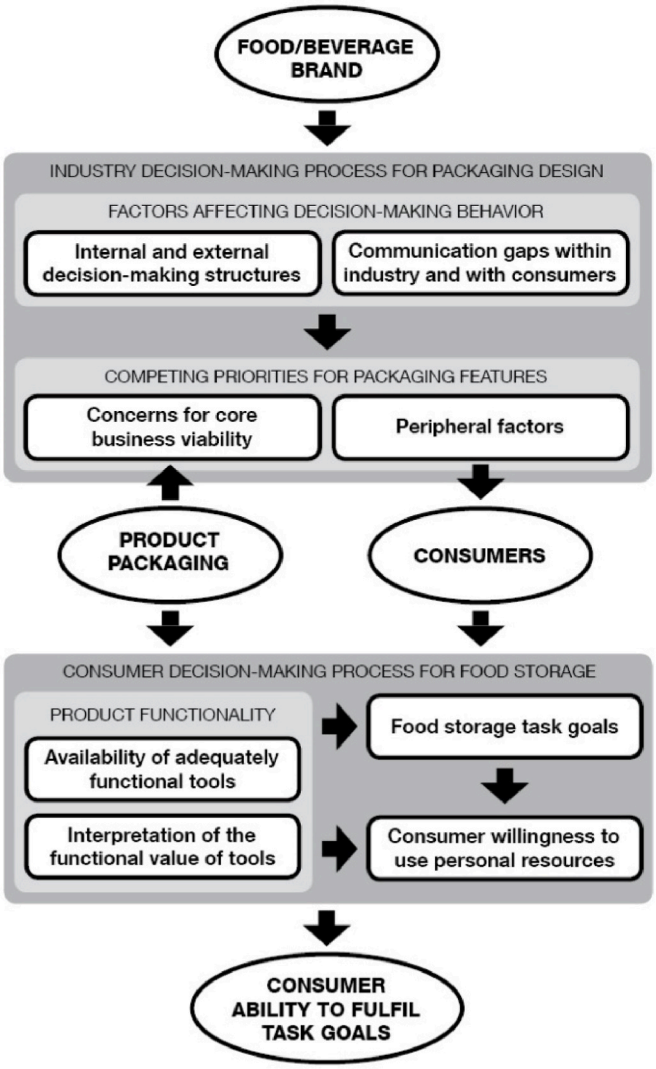

Fig. 5. Model of how industry decision-making processes on packaging features influence consumer ability to fulfill food/beverage storage task goals through packaging and reduce household food waste. Based on 11 food/beverage–packaging industry participants and 20 consumer participants in Australia.

packaging's role.

How consumers store packaged food/beverages is affected by their awareness of the number of items requiring storage and the space they occupy. Consumers who "have limited space" (C1) will sometimes remove the outer-box/container from foods in bag-in-box/container formats — including biscuits and cheese slices — to reduce "redundant space" (C8) as the inner-bag can be compressed. This frees storage space for other food/beverages but removes reclosability/resealability and can affect task goals. For opaque inner-bags including "silver foil package[s]" (C2), consumers say that the "organizing factor [is] very hard" (C2) as they can "forget what [food] is there and how long it'll remain fresh" (C2). This highlights the importance of industry understanding the limitations of different reclosable/resealable formats for different food and beverages within different storage contexts. Flexible pouch packaging with zipper closures can help consumers save space and maintain access to product information, therefore assisting food/beverage storage and organization.

Consumers adjust the time and effort they spend storing food and beverages "depend[ing] on how quickly [they] think the product will be used" (C6) and "whichever requires frequent access" (C2), affecting decisions to store products in the original packaging versus transferring. Quickly used and infrequently used/non-staple food and beverages preferably remain in the original packaging to minimize container-upkeep; reclosable/resealable packaging can assist. Space limitations is another factor: "If we were to put each [food] into their own containers then we would run out of space" (C1). On the other hand, consumers say they rarely need to transfer beverages, sauces, and condiments into separate containers for storage as these food/beverages usually come in reclosable/resealable packaging. Overall, this highlights reclosable/resealable packaging's role to support consumers' food/beverage storage needs.

Consumer perceptions of reclosable/resealable packaging's functional value (see section 3.1.4) and value-for-money affects willingness-to-purchase and therefore, use of such packaging. Consumers who see value in spending more money for reclosable/resealable packaging recognize benefits in the utility provided.

Greater consideration of the contexts affecting consumer willingness to use personal resources when storing food and beverages could inform packaging design to improve the chance it can adequately meet consumer needs.

3.1.3. Availability of adequately functional tools

Consumers' food/beverage storage decisions are bounded by the storage tools — including containers and packaging — they have at home/can purchase and recognize as useful (see section 3.1.3 and 3.1.4). Consumers sometimes prefer to store food/beverages in the original packaging. Their ability to do so, however, is impeded by perceived limited availability of suitable packaging — including reclosable/resealable packaging — and negative perceptions of industry's willingness to address this.

Consumers will sometimes transfer food into containers in the absence of reclosable/resealable packaging, but this is not always possible. Consumers may not own enough containers or be able to purchase suitable containers for all their foods: "If I keep putting [packaged] things in the containers, then I run out" (C5); "it's hard to find containers to fit [pasta]" (C11). This can drive HFW when consumers struggle to store food in the original package: "You can't reseal these packets … that [pasta] ended up falling out of its packet in the cupboard and I threw it in the bin" (C11). Hence an opportunity for industry to increase the availability of storage tools aligned to consumer needs and increase the acknowledgement of reclosable/resealable packaging's importance in this context.

Industry actors (especially food/beverage brands) can actively demonstrate their concern for consumers' food/beverage storage needs through wider availability of reclosable/resealable packaging with "more reliable seals" (C10): "The design has to have consumers in mind … Is it easy to open … without damaging the opening? Can you close it … so no insects … can crawl in? If they test it … they'll find out this is not working" (C16). Consumers can articulate their packaging issues and needs but they are skeptical that industry will act, perceiving that industry does not prioritize consumer needs: "They're … trying to get it out as cheaply as possible … once they sold the product, it's your problem" (C12). Hence an opportunity for industry to demonstrate to consumers their needs are acknowledged by increasing the availability of reclosable/resealable packaging aligned to these needs.

3.1.4. Interpretation of the functional value of tools

On-pack communication of packaging-feature functionality can assist consumers to identify packaging aligned to their needs by appealing to food/beverage storage goals and addressing sustainability concerns. Consumer interpretation of packaging's functional value as a food/beverage storage tool affects decisions to purchase and use; influenced by individual perceptions of packaging's ability to fulfil storage task goals/needs (see section 3.1.1) based on on-pack messages, packaging experiences and perceptions/values regarding packaging sustainability.

On-pack messaging can help consumers identify packaging with

functionality suited to their storage needs. When consumers see 'resealable for freshness' on packaging, some say they "assume that it's going to keep [the] product fresher for longer" (C13) and have purchased/used packaging on that basis. Consumers say they mainly noticed such messaging on zipper-seal packaging for cheese and bread wraps. This suggests an opportunity for industry to increase on-pack messaging for a wider range of products in different reclosable/resealable formats appealing to different storage goals for specific foods and beverages, so consumers can have heightened awareness of which packaging options might suit their specific needs.

Consumers say they prefer to repeat purchase and use food/beverages in packaging associated with functional value/benefits from previous experiences. This includes milk in screw-cap bottles and coffee in zipper-seal pouches for meeting key storage goals and reducing HFW. However, consumer perceptions of packaging sustainability also affect perceived functional value: "there's a balancing act … whether you waste food or … damage the environment" (C16). This suggests consumers perceive that packaging sustainability and packaging to reduce HFW are mutually exclusive when this is not always true. Hence an opportunity for industry to communicate on-pack to consumers the environmental impacts of HFW and packaging's potential to reduce it. Good food/beverage management — including storage — can help consumers reduce HFW (see section 1.1); packaging with appropriate features can assist when consumers recognize its functional value.

3.2. Industry decision-making for packaging features

Factors affecting organizational behavior related to decision-making for food/beverage packaging to reduce HFW is the focus of this section. Key insights from the industry data are distilled in Fig. 4, which shows how factors affecting industry decision-making determine the features included in food/beverage packaging. Actors within companies across industry contributed insights into how packaging decisions are made, but brands are highlighted because they design and produce packaging both directly and through proxy (see section 2.3).

Analysis shows that decision-makers within brands generally prioritize features supporting *concerns for core business viability* (3.2.2) over *peripheral factors* (3.2.3) to maintain business longevity. Brands' decisions can also be influenced by external stakeholders exerting regulatory and market-competition pressures. This affects the focus of the product-packaging specifications that packaging actors (packaging designers, technologists, and suppliers) are expected to follow as decision-executors when designing/supplying packaging for brands. Brand *internal and external decision-making structures* (3.2.1) therefore affect the decision-making agency of stakeholders involved in packaging design. The decisions are further impacted by *communication gaps within industry and with consumers* (3.2.4), driven by a divergent focus between decision-makers and decision-executors, lack of a common language to define packaging features within industry, and limited industry communication with consumers to test packaging usability. Altogether, these factors affect industry actor ability to implement packaging features conducive to reducing HFW. Further detail is provided in the immediate subsections.

3.2.1. Internal and external decision-making structures

The packaging design/development process involves "different stakeholders" (IN11) within and external to a brand, each with "a different voice" (IN11). Social-hierarchical structures within the food/beverage–packaging industry determine the decision-making influence of each voice, affecting stakeholder agency to make packaging decisions to help consumers reduce HFW.

The results of the data analysis indicate that brand marketers drive a key business focus of selling products (see section 3.2.1), possibly why they are considered key decision-makers while packaging actors are decision-executors. Focusing on "the ultimate product" (IN11), marketers commonly "lead the product and packaging" (IN8) design/development process by producing specifications and overseeing product-packaging testing. As packaging actors are expected to support this focus, they must "push quite hard" (IN8) to implement packaging considerations beyond specification, including HFW. They also "push to get involved" (IN11) in packaging testing, for relevance to consumer needs/usability. This suggests that a marketing-focused decision-making process within brands can limit industry implementation of packaging features to help consumers reduce HFW.

Higher-hierarchical external influences can limit the decision-making agency of actors (including marketing and packaging) working within and for brands. This includes the two major supermarkets that currently dominate the Australian market: "whatever obligations [they impose are] critical … for brands to follow" (IN10) as it affects business viability. Industry body and government guidelines/regulations also confine retailer decisions, so packaging actors suggest they can do more to encourage brands and retailers to prioritize packaging conducive to reducing HFW: "when regulations change … it becomes non-voluntary" (IN9). Packaging actors also mentioned the potential influence of direct consumer feedback to brands/retailers due to consumer purchase power, but the impact is debated (see section 3.2.3). Nonetheless, higher-hierarchical external influences impact brands' packaging decisions.

Dominant voices within the packaging decision-making hierarchy can influence brands' decisions by impacting how they approach considerations to core business viability. Hence, collective consumer, retailer, industry bodies, and government demand for more packaging to reduce HFW could help steer brands toward this direction.

3.2.2. Concerns for core business viability

Business viability is a key consideration by brands when deciding what packaging functions to use. This poses a challenge for wider adoption of reclosable/resealable functionality to help consumers minimize HFW. Insights into consumer demands for specific food/beverages from the consumer part of this study — including frozen vegetables, cereal, biscuits, and snacks — were presented to industry (see section 2.2). Industry expressed awareness of these demands, but brand concerns for core business viability frame packaging decisions, rendering consumer demands peripheral (see section 3.2.3): "the consumer wants it but [brands need] to see an increase in sales" (IN8). As brands prioritize packaging features that support a business focus on selling products, this can impede industry use of features to meet consumer demands and minimize HFW.

A business focus on selling products helps to explain the limited contexts in which brands prioritize reclosable/resealable packaging, despite industry acknowledgement that it is "[needed] on any item … beyond a single-use consumption" (IN7). Brands use reclosable/resealable packaging to help maintain brand image by encouraging consumers to "keep … reaching for a branded product" (IN10). Furthermore, the feature can "convey a premium feel" (IN10) where consumers "are willing to pay more" (IN6). Brands therefore prioritize packaging features that assist product sales.

Brand concerns for financial viability and manufacturing constraints also limit use of reclosable/resealable packaging: "It is … a more expensive exercise to both source the packaging and to fill and pack the packaging, [requiring] different machinery and capital investment" (IN1). Furthermore, industry perceives the food/beverage products for which consumers demand reclosability/resealability to be "such a low-cost business that [altering] the packaging format will either add costs or slow the machines" (IN7). Hence, financial risk to brands impedes industry implementation of packaging features to minimize HFW: "the cost of goods goes up, [brands are] not selling as much product" (IN7). "The more profit [brands] make, the better their companies become" (IN4), suggesting brands may perceive that addressing HFW challenges business viability.

3.2.3. Peripheral factors

Factors peripheral to the core business viability of brands are of secondary influence when brands make packaging decisions. Consequently, brands allocate comparatively fewer resources to integrating packaging features that meet peripheral factors. Brands must therefore choose which factors to prioritize. Industry responses suggest that material sustainability is prioritized over FW and consumer demands, impeding industry implementation of packaging to help consumers reduce HFW.

In recent years, the Australian food/beverage–packaging industry has been considering ways to balance the 2025 packaging targets on material sustainability and the 2030 FW target when designing packaging. However, industry participants claim that "the 2030 targets … [are] never captured in … the briefs … [and] … the conversation is focused on the 2025 targets because that's three years away" (IN7), suggesting that date-based prioritization is a reason for greater industry focus on material sustainability.

Limited industry recognition of packaging's role to reduce HFW beyond features that support shelf-life extension is a possible reason why FW and consumer demands are less prioritized. Brands prioritize business viability (see section 3.2.2), so industry focus is "[less] … from a food waste perspective but [for] … shelf-life" (IN11), to support product sales. Some industry participants questioned packaging's ability to adequately extend food/beverage product shelf-life in consumers' homes and therefore reduce HFW. Within this context, reclosability/resealability is perceived as unessential and "more for convenience" (IN10). Some industry participants claim that the low-cost food/beverage products consumers demand reclosability/resealability for are "designed to use an external after-purchase closing feature" (IN5). Others mentioned "an assumed and accepted culture of decanting and storage" (IN7). This suggests that industry relies on consumers to access secondary market solutions when packaging lacks reclosability/resealability.

Modifying industry perception that addressing consumer needs diverge from key priorities may lead to wider adoption of packaging functionality conducive to helping consumers minimize HFW.

3.2.4. Communication gaps within industry and with consumers

Lack of industry use of a common language to define packaging features — including reclosable/resealable — contributes to communication gaps within industry for their benefits and applications. Furthermore, limited meaningful consumer engagement for packaging-usability feedback can impede industry ability to implement features aligned to consumer needs. This potentially impacts industry use of reclosable/resealable packaging to help consumers reduce HFW.

Industry perspectives on whether reclosability/resealability are "two different concepts" (IN4) or not and how they varied differed, especially for resealability. 'Resealability' can represent a marketing-term for zip-seal packaging, greater closure security/airtightness than 'reclosability', or consumer attempts to restore peel-off factory-seal lidding film/foil. This lack of common language may hinder inter-industry communication on reclosability/resealability and amplify the different views packaging actors and brand marketers hold, hampering industry use of packaging features to reduce HFW within a marketing-driven packaging design/development/testing context (see section 3.2.1).

Industry appears to limit on-pack communication of reclosability/resealability to consumers due to "priorities" (IN4) (see section 3.2.2), perceiving that its presence is "obvious" (IN11) to consumers. However, packaging technologists and designers claim there is a lack of product-packaging testing to confirm whether consumers are aware of the features present, know how to use them, and if they align to needs. Testing focuses on "the marketing aspect" (IN1) and "not … enough from a packaging R&D side to truly understand the consumer" (IN11). Focus groups are purportedly used, but a limitation is that they provide "out of context" (IN7) information. Alternatively, ethnographic research assists industry to "see what actually happens" so can be an improved option. Yet "ethnographic research … is … still seen as … novel" (IN7), thus increased use by industry may help to improve consumer insight: "We went into people's homes … 9 out of 10 … didn't … know it had a reclose feature" (IN7). This highlights the importance of industry meaningfully engaging consumers for in-context feedback that considers how consumers physically interact with packaging, to confirm whether packaging features are being used as designed.

Since consumers suggest that reclosable/resealable packaging can assist them to prevent HFW, reducing inter-industry and industry–consumer communication gaps pertaining to reclosable/resealable packaging may improve packaging design/development/testing to reduce HFW.

4. Discussion

The interplay of factors affecting how industry decision-making on packaging features can influence consumer ability to fulfil task goals is the focus of this section. This interplay is represented in an industry–consumer model presented in Fig. 5, and represents the current situation reflected in the consumer and industry data. By juxtaposing the factors affecting consumer and industry priorities for packaging features, the model presents a syncretic yet abstracted view of the key barriers (or factors) to implementing packaging to reduce HFW. This visual map can help researchers, industry, and policymakers understand current conditions, to help suggest and make changes.

The industry–consumer model is presented (and titled in Fig. 5) so that the industry section is above (or before) the consumer section, to highlight how industry decisions and actions can affect what packaging solutions consumers have access to and therefore, consumer ability to minimize HFW through packaging. However, for consistency with this study's reporting order, the consumer aspect is discussed before the industry aspect. The consumer section (see section 3.1) of the model presents factors affecting consumer decision-making for packaging's role in domestic food/beverage storage. While some of these relate to consumers' individual contexts as part of their daily lives, there is an opportunity for industry to address consumers' packaging struggles and perceived lack of packaging that meets their needs. The industry section (see section 3.2) of the model presents factors affecting willingness and agency to implement packaging with functions aligned to consumer needs to help reduce HFW.

The industry–consumer model thus highlights a system-wide challenge to producing packaging that meets consumer and industry needs. Modifications made in one part of the system is likely to affect other parts of the system, a complexity that makes this challenge a 'wicked problem' (Närvänen et al., 2020). As noted in the introduction (see section 1.1), acknowledging this is essential for meaningful discussion on ways to improve how this 'wicked problem' is managed. This study does not purport to solve all these challenges. However, it offers another perspective to consider and suggests some solutions: the focus of the discussion subsections. The insights provided can inform a systems-wide approach (Lake et al., 2020) to help align food/beverage packaging production with consumer behavior through improved consideration of how the multiple factors shown in the industry–consumer model connect.

4.1. Opportunity for industry to take greater responsibility to help reduce household food waste

This study has revealed some of the key factors driving consumer and industry decisions and action pertaining to reclosable and resealable packaging. Therefore, the results can impact current and future food packaging design by industry that incorporates such functionality by highlighting what factors to address to encourage industry to take greater action to implement packaging to help reduce FW. Fundamentally, the industry-consumer model demonstrates how addressing HFW — especially packaging-related — is a system-wide challenge despite it

manifesting in households. Industry willingness to offer packaging suited to consumer needs is important to help reduce HFW. Hence this section discusses possible influences and effects of industry attitudes identified in this study as consistent with responsibility shift. Consumer responsibilization by industry to reduce HFW therefore impedes this (Welch et al., 2018). One instance is industry reliance on consumers using after-market products to fulfil storage needs (see section 3.2.3), partially driven by downplaying the necessity of reclosable/resealable packaging and to minimize packaging costs. Industry downplays the role of certain packaging (including reclosable/resealable) to reduce HFW by questioning its efficacy to extend food/beverage shelf-life in consumers' homes, based partially on a focus on product sales and as a cost-cutting measure (Ryder et al., 2021; Surucu-Balci and Tuna, 2022). However, consumer responses suggest that this role extends beyond shelf-life, thus an opportunity for industry to shift assumptions on ways packaging can reduce HFW.

To help industry shift assumptions, there is an opportunity to raise greater awareness about the benefits of reclosable/resealable packaging to reduce HFW (beyond shelf-life-extension) — including product containment and access to on-pack information — and why consumers perceive these benefits as essential. This could be assisted by improving industry–consumer communication which is further discussed in section 4.3. Furthermore, consumers are aware of the cost aspect and perceive industry to be dismissive of their packaging needs (see section 3.1.3). This potentially affects consumer perception of brand image, so it is significant for brands to address from the perspective of reputational risk as negative associations and experiences by consumers influence purchase intent (Curina et al., 2020; Roehrich et al., 2014). Global reports suggest that consumers are now less brand loyal (Smithers, 2019) and may switch to brands they perceive can more adequately meets their needs. Hence, industry diversion of responsibility to reduce HFW to consumers may backfire, especially for brands. This suggests greater action by industry to design/implement packaging aligned to consumer needs to help reduce HFW may be within brands' best interests. Industry and consumers sharing hybrid responsibility for reducing HFW is a way forward (Aschemann-Witzel et al., 2022), especially since consumer ability to reduce packaging-related HFW requires industry support. Marketing could transcend social-hierarchical barriers impeding industry implementation of packaging toward reducing HFW.

4.2. Marketing could transcend social-hierarchical barriers impeding industry implementation of packaging toward reducing household food waste

This study showed how social-hierarchical structures within and external to food/beverage brands support a business focus on selling more product (see section 3.2.1), impeding packaging-actor ability to more widely test and implement packaging with features to support consumers' needs and reduce HFW. Food/beverage brand and retailer profits relate to the amount of product sold rather than consumed (Aschemann-Witzel et al., 2016; Baker et al., 2009). Moreover, brand adherence to retailer demands can affect whether their products are stocked (Commonwealth of Australia, 2021; Devin and Richards, 2018). This may explain why the results of this current study suggests that brand marketers often lead the product-packaging design and testing with a focus on product sales, with packaging actors expected to support this focus. The results extends findings by extant studies that report on the high influence of brand marketers (compared to other packaging actors) within the packaging design decision-making process for sustainable packaging development (de Koeijer et al., 2017; Francis et al., 2021; ten Klooster and de Koeijer, 2016).

There is an opportunity for brand marketers and retailers to view packaging that supports consumer needs/reducing HFW as aligned with product sales, to help provide packaging actors greater agency to design and implement packaging that supports consumer needs and reduces HFW. This strategy may be amenable to brand marketers and retailers due to packaging's role as a marketing tool (Aschemann-Witzel et al., 2016; Rundh, 2005; Vernuccio et al., 2010); industry use of reclosability/resealability highlights this (see section 3.2.2). Consumer insights support the feasibility of this opportunity, as consumer perceptions and experiences of packaging functions within the context of task goals (see section 3.1.1) shape packaging satisfaction, affecting purchase intent. These task goals align to the packaging functions — "product protection", "preventing leakage", "declaration-of-contents", and "instructions" — which Löfgren and Witell (2005) describe as essential for consumer satisfaction and this present study suggests reclosability/resealability supports. Furthermore, an Australian study suggests that consumers are willing to pay a premium for packaging that extends food/beverage product shelf-life and facilitates easier storage (Brennan et al., 2022). That said, consumers' packaging purchasing behaviors are complex and depend on multiple factors including the perceived level of sustainability (Herrmann et al., 2022), benefits of the added features (Just and Goddard, 2023), and health concern impacts (De Canio, 2023) — also reflected in the consumer part of the industry–consumer model (see Fig. 3). Hence, it is acknowledged that consumers' positive intent to pay a higher price for value-added features does not necessarily reflect what consumers purchase in practice (Caruana et al., 2016; Wandosell et al., 2021). Regardless, a recent study supports that consumer intent to purchase sustainable packaging can positively translate into action (Gleim et al., 2023). Therefore, a wider availability of reclosable/resealable packaging represents a marketing opportunity for industry that aligns with product sales, whilst supporting consumers to more adequately manage food/beverage storage and reduce HFW (Lindh et al., 2016): a potential win-win situation.

4.3. Opportunity for industry to improve inter-industry and consumer communication

This study has demonstrated how actual and consumer-perceived lack of packaging with functions supporting consumer needs can drive HFW, incorporating industry–consumer insights to extend findings in related HFW literature (Wikström et al., 2019; Williams et al., 2020). Study insights suggest that an inter-industry language disconnect and a lack of meaningful industry–consumer communication/engagement compounds the missed opportunity to reduce HFW through packaging design. This presents opportunities for industry to develop an inter-industry common language, increase/modify consumer testing to identify consumer needs, increase their understanding of these consumer needs, and to increase on-pack communication of packaging functions to consumers.

Industry assumptions that consumer demand for packaging reclosability/resealability is based on convenience (see section 3.2.1) rather than task-goal-based needs is one aspect that may impede its availability. Consumer insights (see section 3.1) challenge this assumption by demonstrating how a lack of or unreliable resealability can drive HFW (Williams et al., 2012, 2020). Therefore, improved resealability across a wider range of food/beverages may afford consumers increased possibilities to reduce HFW through multiple functional benefits, including minimized spillage and extended product quality (Brennan et al., 2022; Lindh et al., 2016; Wikström et al., 2014). Even so, consumer ability to recognize packaging features and their functional benefits is essential to encourage purchase and use (INCPEN and WRAP, 2019; Steenis et al., 2018). Industry-actors involved in packaging design, development and implementation have deep knowledge about product-packaging so whatever packaging features are present and how they function will seem obvious, but less so for consumers without this same knowledge (Norman, 2002). Industry can thus prioritize on-pack communication of packaging functionality, aligning to suggestions within sustainable product development and innovation literature that an increase in industry communication of product/packaging benefits to consumers is needed to encourage increased product/packaging adoption and sustainable outcomes (Dörnyei et al., 2022; Kronthal-Sacco et al., 2019;

Surucu-Balci and Tuna, 2022; Wang and Su, 2022).

More generally, this study highlights the importance of industry reflecting upon and challenging assumptions of what factors are behind consumers' packaging demands. These assumptions can be addressed through increased consumer–packaging testing to identify consumer needs and improve packaging functionality. Yet industry indicate that while they sometimes use focus groups, they seldom use ethnography — let alone co-creation or participatory design — to understand how consumers use packaging and to identify usability issues, highlighting opportunities for meaningful industry–consumer engagement (Heiskanen et al., 2005) to confirm what is seemly obvious to consumers. Industry–consumer engagement should not be limited to the department or individuals who determine product-packaging specifications but broadened to packaging actors who design packaging. Packaging technologists and designers identified an opportunity improve packaging research and development to improve their understanding of consumer needs (see section 3.2.1), so are likely to act if given the opportunity. Encouraging increased communication between packaging actors and brand marketers along with increased inter-industry use of a common language for sustainable innovation — including packaging features to reduce HFW — may further assist by fostering increased collaborative action toward shared goals (Charter and Clark, 2007; Pålsson and Sandberg, 2022; Petala et al., 2010), for an increased chance of designing packaging that support consumers' needs and minimizes HFW.

4.4. Improving recognition of packaging that reduces food waste as sustainable

This study has highlighted a need for industry to improve their recognition of packaging that reduces FW as sustainable. If industry is willing to shift their existing perceptions and demonstrate this though increased implementation of packaging designed to reduce FW, this could improve the overall sustainability of the food system. Yet, industry and consumer responses suggest that packaging (material) sustainability and packaging to reduce HFW are perceived as competing priorities (see sections 3.2.3 and 3.1.4). This concern for packaging sustainability focused on material sustainability, where the direct polluting-effects of packaging — particularly plastic — was emphasized as important to reduce. As discussed in section 4.2, consumers' willingness to purchase packaging can affect industry wiliness to implement such packaging, and consumers' perceptions on packaging sustainability play a role. Consumer concern for packaging's material sustainability has been widely reported in FW and packaging literature in relation to perceived overpackaging (Brennan et al., 2020; Langley et al., 2021; Sundqvist-Andberg and Åkerman, 2021). Furthermore, in recent years there have been reports of increased consumer purchasing behavior of food in plastic packaging due to food safety concerns during the COVID-19 pandemic (Kitz et al., 2021; Leal Filho et al., 2021) and also, heightened pressure for industry to produce materially sustainable packaging (Chrysikopoulos, 2022; Smithers, 2022). Hence it is unsurprising that consumer and industry participants expressed concern for packaging's material sustainability in this present study.

Despite industry and consumer perceptions and concerns for packaging's material sustainability, a positive willingness by industry actors to use appropriate packaging systems is key to packaging's role to minimize FW through the supply chain and can reap net environmental benefits, so minimizing FW is an important facet of sustainable packaging (Heller et al., 2018; Sundqvist-Andberg and Åkerman, 2021). As few industry and consumer participants acknowledged this, there is an opportunity to continue educating both parties. This may help to increase consumer demand for sustainable packaging that considers FW and packaging waste, encouraging industry action. Food/beverage–packaging industry actors are reminded that FW and packaging waste are important to balance for a more sustainable food system (Grönman et al., 2013; Sundqvist-Andberg and Åkerman, 2021). Increased industry training and use of life-cycle analysis software or other environmental evaluation tools (see Frojan et al., 2023; Molina-Besch and Pålsson, 2020; Verghese et al., 2018) can assist brands and packaging actors to increase their awareness of FW's environmental costs and packaging's potential to reduce it. For instance, the environmental evaluation tools for food packaging developed by Molina-Besch and Pålsson (2020) and Frojan et al. (2023) includes FW as one of the evaluation criteria, supporting industry decision-making in regard to packaging materials, packaging features, and the development of product-packaging combinations that minimize total environmental impacts within the food supply and consumption chain.

Brand prioritization of material sustainability over packaging features to reduce HFW (see section 3.2.3) can be interpreted as addressing corporate social responsibility/managing reputational risk (Roehrich et al., 2014). Reputational risk is relevant to this study as it connects to 'maintaining brand image' under core business viability (see Fig. 4). Peer/consumer perception of inadequately addressing material sustainability represents a reputational risk to brands. Hence in addition to prioritizing action to meet the 2025 packaging targets, brands increasingly favor packaging materials and designs to show consumers their commitment to sustainability in response to rising consumer concern for sustainability (Smithers, 2019). Consumer concern for packaging sustainability can negatively affect their perceptions about packaging's value to reduce HFW (see section 3.1.4), documented in HFW and packaging literature (INCPEN and WRAP, 2019; Langley et al., 2021). This consumer perception is another possible reason why industry prioritizes material sustainability over packaging's value to reduce HFW, bolstering a need to educate consumers about packaging's multiple benefits. This presents an opportunity for industry to communicate these benefits on-pack to remind consumers in-store and at-home, to improve the chance consumers will purchase and use it — key for packaging solutions to have an actual impact to reduce HFW and improve the overall sustainability of the food system.

5. Conclusion

Packaging has many functions through the food supply chain and its potential to reduce HFW is only one dimension. The main conclusion of this study is that a key impediment to implementing packaging to help consumers reduce HFW is that consumer and industry packaging priorities diverge. This wicked problem highlights the challenge of designing packaging with features that satisfy both parties, especially since consumers and industry decisions are context driven. This study does not purport to solve this wicked problem, although the data presented can support further analyses. This includes scope for future research to gather more data on the contexts in which consumers find packaging features (beyond reclosable/resealable) useful to help reduce HFW, and research to explore the role of organizational hierarchy in packaging decision to help reduce FW — for an expanded view. More importantly, this study has demonstrated the value of combining industry and consumer perspectives to gain new insights into the complexities of designing appropriate packaging systems, highlighting the need to consider the dynamics between consumers and industry.

While the results of this study may not be generalizable to other populations and to other countries because of a smaller sample size that represents a limited population and focusses on the Australian context, the unique lived experiences that each participant shared through this research reflects the diversity and complexity in the way humans think and act. As such a benefit of this study is that it offers deep and rich research insights on some of the factors that can affect the packaging decisions and needs of food/beverage–packaging industry actors and consumers. Generalizability can be achieved through a combined qualitative-quantitative approach. The model generated from this qualitative study can act as a springboard for researchers to conduct additional quantitative research about these avenues (or factors), such as through a large-scale survey with statistical analyses, representing an

opportunity to extend this current study.

Prior consumer studies have highlighted an opportunity for industry to implement a greater number of reclosable/resealable packaging options to help consumers reduce HFW (Di Talia et al., 2019; Lockrey et al., 2020; Williams et al., 2012, 2020). This present study has added additional context through an increased understanding of the factors that drive consumer need for reclosable/resealable packaging to store food/beverages and importantly, also adds industry insights. As such, through an industry–consumer model, this study presents many significant avenues to help increase the understanding of consumer decision-making factors for packaging's role in household food/beverage management and effects on HFW within a wider recognition of the complex factors framing industry decision-making for packaging. While it was beyond this study's scope to discuss these avenues (or factors) in detail, greater awareness of these factors and how they interrelate are a gateway to assist researchers, industry, and policymakers to increase their understanding of the barriers impeding industry ability to implement packaging aligned to consumer needs to help reduce HFW — which can impact how sustainable packaging design strategies to reduce FW are recommended and implemented in the future.

A key contribution of this study is that it suggests actions for industry to increase the chance that consumers reduce HFW through packaging. For instance, increased industry communication with consumers is encouraged to foster greater understanding of the consumer decision-making factors identified in the model, to help industry to verify what food/beverages reclosable/resealable packaging would be most useful and in what contexts. It is hoped that researchers, industry, and policymakers will consider the suggestions offered in this study to reduce HFW through improved packaging, for a more sustainable food system.

CRediT authorship contribution statement

R.B.Y. Chan: The author confirms sole responsibility for the following, Conceptualization, study conception and design, data collection, analysis and interpretation of results, and manuscript preparation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Relevant data are included in the appendices in anonymized form. Raw data are not shared due to participant privacy.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jclepro.2023.137417.

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