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## Article

# Could assortment rationalisation help reduce food waste in grocery stores?

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# COULD ASSORTMENT RATIONALISATION HELP REDUCE FOOD WASTE IN GROCERY STORES?

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## Abstract

Nowadays, sustainable development and waste management are the topics on which academia is focusing. The size of the retail assortment plays a crucial role in influencing the levels of food waste in grocery stores. Additionally, the analysis of retail food waste highlights that the planning of assortment sizes is essential for reducing waste, particularly in products with expiration or best-before dates, such as fresh fruit and vegetables, where a few products contribute significantly to overall waste. This work aims to explore assortment rationalisation as a way to prevent food waste from perishable products in retail grocery stores and, therefore, improve the sustainability generated by food retail chains in developed countries.

Although many articles analyse the relationship between retail store operations and food waste prevention, to our knowledge, there is little research that explicitly focuses on assortment. From the review of the specialised literature, few studies have been detected on the effects of the grocery store assortment on food waste. This paper attempts to fill part of this research gap, by focusing on establishing a link between assortment rationalisation and food waste in grocery retail stores through a review of the scientific literature on proactive food waste prevention strategies, presenting an opportunity for future research in this emerging research area, and providing practical advice to retail chains concerned about sustainability. In conclusion, this study serves as an initial approach to this topic and is a useful starting point for future research in this area. Our primary contribution lies in highlighting a certain scarcity of studies on the retailer's assortment as a proactive food waste prevention strategy.

**Keywords:** assortment rationalisation, assortment reduction, assortment size, retail food waste, retail food waste prevention strategies, grocery stores, sustainability

**JEL Classification:** M14, M21, M31

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**Introduction**

Food waste involves not only the economic costs of unconsumed food, but also the social costs of food that could have fed more than two billion people, potentially mitigating global hunger (FAO, 2021). Additionally, it encompasses the environmental costs from wasted natural resources used in food production – 30% of cultivated land and 20% of freshwater – along with the energy and environmental damage resulting in 8% of greenhouse gas emissions (UNEP, 2024). Given its significant adverse economic, environmental, and social impacts, food waste represents a pressing sustainability challenge that requires immediate attention (Marchetti et al., 2024).

In 2015, the United Nations General Assembly established 2030 Agenda for Sustainable Development, which contains 17 Sustainable Development Goals (SDGs) and 169 specific targets aimed at combating poverty, addressing climate change, and fostering global prosperity by 2030. Among these, SDG 12 (Responsible Consumption and Production) specifically targets reducing food waste (12.3), aiming to “halve per capita global food waste at retail and consumer levels and reduce food losses along the production and supply chains, including post-harvest losses”. Achieving this target positively impacts five other SDGs: SDG 2 (Zero Hunger), SDG 11 (Sustainable Cities and Communities), SDG 13 (Climate Action), SDG 15 (Life on Land), and SDG 17 (Partnerships for the Goals).

In 2022, approximately 1.05 billion tons of food waste were generated predominantly by households, accounting for 60% of the total, followed by 28% from food services, and 12% from the retail sector (UNEP, 2024). FUSIONS, a major EU-funded research project, reported that around 88 million tons of food (173 kilograms per person) are wasted annually in the EU, constituting 20% of the total food produced (Stenmarck et al., 2016). In developed countries, households contribute the most to food waste, accounting for 53% in Europe (Eurostat, 2023). Although the retail sector is not the largest contributor, the opportunity to reduce food waste is significant, as 13% of global food waste occurs at this stage (Forbes et al., 2021). As concerns over sustainability and resource efficiency grow, the retail sector is increasingly called upon to implement innovative practices that reduce food waste.

European large retailers, located in the middle of the food supply chain and characterised by high market concentration, have considerable market power to affect change and reduce food waste throughout the supply chain (Zhang et al., 2022). Retail food waste results from issues such as deteriorated packaging, expiration date guidelines, surplus buying, and rigorous quality and visual standards (Calvo-Porrall et al., 2017). So, they can promote sustainable practices such as redesigning packaging to extend shelf life (Calvo-Porrall et al., 2017), reducing carbon footprints (Marrucci et al., 2020), implementing reverse logistics (Guarnieri et al., 2021), launching health-conscious and environmentally sustainable products (Aschemann-Witzel, 2021), eliminating promotions that lead to household over-purchasing (Heydari et al., 2020), and raising awareness throughout the supply chain (Calvo-Porrall et al., 2017).

The EU has significantly incentivised retailers through funding and programmes like FUSIONS, focusing on sustainable practices to address food loss and waste (FLW). Solutions include welfare policies, technological innovation, logistics, and awareness-raising, with a clear focus on food preservation and waste prevention (Al-Obadi et al., 2022).

Food waste is a growing concern affecting retailers' reputations and impacting brands (Cochran et al., 2018). Among the private initiatives to combat retail food waste are: committing to innovation, establishing prevention and efficiency practices to maximise resource utilisation throughout the food chain, maximising the use of surplus produced at various stages of the value chain (redistribution, reuse, and recycling), including the establishment of permanent agreements and collaboration protocols with food banks and other social entities, and raising social awareness and educational campaigns about the need to reduce food waste.

Consequently, sustainable development and waste management have become focal topics in academic research. Several studies indicate that factors such as the range of product assortment, pricing strategies, package dimensions, and operational inefficiencies are pivotal contributors to food waste within retail environments (Cuffey et al., 2023). The main contributors include inaccurate sales forecasting, inappropriate quality control, incentives that contributes to household over-purchasing, poor handling of fresh and perishable products, and overstocking (Teller et al., 2018; Buisman et al., 2019; Marchetti et al., 2024).

The abundance of assortment, while catering to consumer desires for choice and freshness, can lead to high food waste levels (Broekmeulen and van Donselaar, 2014). Retail assortment size significantly impacts sustainability, influencing environmental impact through the reduction of resources in transportation and packaging, economic efficiency through the reduction of operational and storage costs, and social well-being through the promotion of a responsible and sustainable assortment.

Therefore, effective overstock management and assortment rationalisation, such as tailoring their assortment to meet the preferences and needs of their local customers to the extent of developing private labels (PLs), removing low-demand products, and delisting items, can significantly reduce food waste, promoting a circular economy, and enhancing sustainability and operational efficiency in food retail chains.

This paper explores assortment rationalisation as a strategy to reduce food waste in grocery stores, enhancing the sustainability of food retail chains. The remainder of the paper is structured as follows. The next section provides the scientific literature review. The second section describes the research methodology applied. The third section discusses the results of articles focused on the size of the retail assortment as a food waste prevention strategy. Finally, in the conclusions, we synthesise the results, discuss their managerial implications, and provide suggestions for further research.

## **1. Review of the scientific literature**

Category assortment is a key driver of a store's image and success (Campo et al., 2004; Dekimpe et al., 2011). According to Roederkerk et al. (2013), assortment represents a critical component of a retailer's marketing strategy "that differentiates a retailer from its competitors and has a very strong influence on retail sales. Retailers face the challenge of determining the assortment that maximises category profitability".

In general, an assortment typically comprises the quantity and diversity of products within a given category (Gajanan et al., 2007). The variety of products in a retailer's inventory is generally quantified by the number of stock-keeping units (SKUs) (Alfaro and Corbett, 2003). Retailers often organise these SKUs into broader groups known as categories, and

further subdivide these into subcategories (Rooderkerk et al., 2013), grouping SKUs with similar attributes. Assortment breadth is defined as the number of lines that make up a product portfolio, while assortment depth refers to the number of distinct products included within a line. Retailers universally confront the critical strategic decision of balancing assortment breadth against depth.

The wide range of category products (i.e., assortment breadth/width) in different formats within each category leading to too many references (assortment size/depth), and the consequent cannibalisation of demand among them, implies that the end consumers have more choice alternatives but, on the contrary, a lower product turnover that generates overstock. A balance between three factors is necessary for assortment design given fixed store space and budgetary resources (Anupindi et al., 2015; Kök et al., 2015): (1) the number of distinct categories offered by the retailer, which relates to assortment breadth and the challenge of allocating space across categories; and (2) the quantity of SKUs within each category, pertaining to assortment depth and the intra-category space allocation issue, and (3) how much to stock of each SKU (inventory).

### 1.1. The retail problem

Alves et al. (2021) provide a comprehensive explanation of the retail problem: “To optimise store profits, retailers must satisfy their customers. If consumers leave because they cannot find their preferred brand or product, this represents lost revenue”. Retailers often aim to maximise the inventory on their shelves to align with consumer preferences, often leading to an excess supply and overstock of food products. Therefore, they used to over-order food items, as partially filled shelves are typically perceived as indicative of ineffective management and fail to satisfy consumers that generally prefer shelves that are fully stocked, which drives retailers to maintain a higher inventory level (Zhang et al., 2022). According to Frisk (2023): “For most retailers, there is an ongoing tension between operations and sales. Sales wants to add more SKUs to offer a greater variety of products, compete more effectively, and capture market share. Operations wants to sell existing stock, keep SKUs lean to reduce storage costs, and avoid obsolescence”.

In contrast with this practice, the Food Recovery Hierarchy, which was developed by the United States Environmental Protection Agency (EPA) in 2017 and recommended by various international organisations for the reduction and utilisation of food surpluses, prioritises actions that organisations can take to prevent the generation of food waste, minimising the risk of unsold products that could become food waste (Ciligot, 2023).

Thus, the academic literature has taken on the challenge of researching retail assortment management (Rooderkerk et al., 2013). The mainstream has focused on the influence of assortment reduction on consumer purchasing behaviour and product category sales (i.e., Drèze et al., 1994; Broniarczyk et al., 1998; Boatwright and Nunes, 2001; Borle et al., 2005; Sloot et al. 2006). Currently, a new line of research is emerging focusing on selecting the ‘right’ assortment to minimise or prevent retail food waste.

### 1.2. Traditional academic stream ‘more choice is better’

A broad product assortment offers several significant advantages to consumers (Broniarczyk et al., 1998; Kahn, 1998; Hoch et al., 1999). Firstly, Anupindi et al. (2015) highlight that the heterogeneity in needs and preferences among consumers forces retailers “to recognise that

wider assortments help their business by catering to the needs of multiple consumer segments, as well as by offering variety to variety-seeking consumers” (Kahn, 1998; Hoch et al., 1999; Iyengar and Lepper, 2000; Chernev, 2003). Secondly, individual consumers often pursue variety within and across consumption occasions due to factors such as satiation, curiosity, or changing needs (Kahn, 1998). Following Gourville and Soman (2005), a retailer that broadens its product range is likely to enhance its market share in comparison to those that do not.

Grocery retailers often prioritise availability, high accessibility on the shelf, and large variety to increase customer satisfaction due to consumer demand for quality and variety, over other considerations driven by intense competition within the sector and the critical need to generate sales (Smith, 2015; Riesenegger and Hübner, 2022). On the contrary, when customers show a high rate of substitution between references within the product category, the notion ‘more choice is better’ loses importance (Kök et al., 2015).

Therefore, retailers expand their assortments to align with customer expectations for a diverse range of products, ensuring that consumers have access to a wide range of choices (Kök et al., 2015; Canali et al., 2017). This creates a dilemma for retailers, who must balance the need to enhance store appeal by offering extensive assortments and maintaining high inventory levels, against the necessity of minimising the environmental, social, and financial repercussions associated with overstock (Teller et al., 2018).

### **1.3. Limits to the value of variety**

Gourville and Soman (2005) highlight that “research on consumer decision-making and rational choice has long viewed variety as good for consumers, manufacturers, and retailers”. However, Anupindi et al. (2015) maintain that there are inherent constraints on the benefits of variety, insomuch as introducing products with only minor differences provides minimal substantive variety to consumers and incurs additional operational costs.

A significant drawback to these assumed benefits is the risk of confusion or frustration derived from excessive assortments (Huffman and Kahn, 1998; Lehmann, 1998). As Huffman and Kahn (1998) note, “large assortment strategies can backfire if the complexity causes information overload such that a customer feels overwhelmed and dissatisfied, or chooses not to make a choice at all”. According to Ko et al. (2017), when consumers are faced with excessive amounts of items, “having an optimal rather than simply a large assortment is critical for retailers”. Broniarczyk and Hoyer (2009) found that “large assortment increase choice difficulty, increase negative affect and regret, and decrease likelihood of product purchase”. These findings highlight the potential adverse effects of product assortment on consumer choice, a phenomenon commonly referred to as “overchoice”.

Furthermore, research indicates that an increase in variety can result in choice deferral (Tversky and Shafir, 1992; Dhar, 1997; Iyengar and Lepper, 2000; Boatwright and Nunes, 2001; Chernev, 2003, 2011). In summary, when increasing the assortment for a brand or a category, the increased cognitive load a consumer faces may result in choice deferral and hence lower profits (Gourville and Soman, 2005).

Moreover, retailers can reduce assortments without affecting the perceived variety, insomuch as breadth and depth manipulation affects consumer perception of the variety (Piris, 2013).

Research conducted in grocery contexts has shown that reducing the number of low-selling SKUs within product categories does not negatively impact the consumer perception of variety (Broniarczyk et al., 1998; Sloot et al., 2006). The concept of choice overload may have strengthened the confidence of traditional retailers, leading them to believe that they could enhance their success by ‘offering less’ (Chernev, 2011). Considering this advantage at the store level, Gourville and Soman (2005) conclude that “researchers have begun looking at ways to increase or to maintain consumers’ perceptions of store variety while simultaneously reducing the actual assortment size”.

According to Cochran et al. (2018), growth in assortment, meanwhile, adds significant costs, but does not add proportionally to revenues. Evidence of “choice overload” at the store level is provided empirically by Boatwright and Nunes (2001). In their study, the overall sales of an online grocer increased by an average of 11%, even though the assortment was reduced by 20% to 80% in 42 different product categories. Gourville and Soman (2005) point out that these results support the conclusions of Dhar (1997) and Iyengar and Lepper (2000) and indicate that the grocery store did not benefit from the initially extensive assortments.

Rooderkerk et al. (2013) summarise that: “Larger assortments increase the costs for the retailer because of increased handling and administrative costs. In addition, consumers incur in higher search costs”. Furthermore, increasing assortment does not always mean increasing profits, and reducing assortment does not always mean less profits (Alves et al., 2021). In order to prevent these negative consequences, retailers should choose to limit the assortment size (Rooderkerk et al., 2013).

#### 1.4. Wasteful assortments

The upward trajectory of the total number of SKUs marketed in the United States persisted, with estimates suggesting a 30% increase between 2000 and 2009 (Hermsdorf et al., 2017). On the contrary, Gázquez-Abad et al. (2017) emphasise that “whereas in 2006 and 2007 retailers added more products than they delisted or removed from their shelves, for the first time in years retailers delisted more products in 2008 than they added. Retailers delisted 9.1% of their products that year, while adding only 8.2% of new products”.

As Velarde, Sales Manager Analytics at NielsenIQ, suggests (Food Retail & Shoppers, 2021): “Over the years, a significant number of brands and products have emerged in the market, driven by competition among manufacturers to satisfy consumers’ appetite for new varieties, products, and experiences. However, for both manufacturers and retailers, more is not always better. In fact, it can be quite the opposite, as manufacturers end up investing in the production and shelf space for products that do not add value. This erodes their profit margins and increases the likelihood of stockouts”.

Recent studies emphasise that some assortments have become excessive (e.g., Teller et al., 2018; Riesenegger and Hübner, 2022). Riesenegger et al. (2023) stated that in these cases: “reducing the variety significantly decreases food waste levels without a significant impact on sales”. Since the assortments have become excessive nowadays, the problem of selecting the right references is even more important (Rooderkerk et al., 2013). Thus, according to Riesenegger and Hübner (2022), large and unsatisfactory “assortments are problematic in terms of food waste (Teller et al., 2018), particularly for product groups with short shelf lives”. The assortment of ultra-fresh or highly perishable food products, such as bread and

bread products, fresh fruits and vegetables, and meat products, plays an important role since these categories are the largest contributors to food waste in retail (Eriksson, 2012; Cicatiello et al., 2016; Kliugaite and Kruopiene, 2018).

Empirical findings in the marketing literature provide strong support for the idea that more (great variety) is not necessarily better because can actually decrease consumer sales (Schwartz, 2004; DeKimpe et al., 2011; Gázquez-Abad et al., 2017) and reducing assortments can prove to be beneficial for retailers (Food Marketing Institute, 1993; Anupindi et al., 2015). However, Broekmuelen and van Donselaar (2014) warn that “the improvement potential to reduce waste and increase product freshness is different per retail chain, per store, and per product category”.

In Spain, for instance, categories such as beer, pastries, and liquid milk concentrate their sales on very few products and this results in a vast number of references occupying shelf space while selling less than desired (Food Retail & Shoppers, 2021). Some Spanish companies already have plans in place that, although not specifically designed to curb food waste, were implemented to enhance process and operational efficiency (MAPA, 2020). This approach not only curtails waste, but also boosts efficiency in operations and strengthens sustainability efforts.

Thus, it seems imperative to streamline a product assortment that has continuously expanded in recent years. SKU rationalisation has emerged as a critical focus for leading global retailers (Gázquez-Abad et al., 2017). However, there has been a limited focus on rationalising assortments of perishable foods or products with short shelf lives as a strategy to prevent or mitigate food waste.

### 1.5. Assortment rationalisation as a retail food waste prevention strategy

The growing competition within the food retail sector has compelled retailers to concentrate closely on ensuring that they offer the ‘right’ assortment to meet consumer demands (Gázquez-Abad et al., 2017). According to Fields (2006): “From the retailer’s point of view, SKU rationalisation should result in the highest satisfaction and maximum shopping basket across the breadth of its customers. A proactive SKU rationalisation exercise not only introduces the opportunity to eliminate competitive items, but also can enhance the overall vitality of the category”.

Assortment rationalisation refers to the practice of reducing or simplifying the variety of products offered in a store by decreasing the number of SKUs. Its primary objectives are to streamline the product offering, improve operational efficiency, reduce costs, and focus resources on products that truly add value and have high demand, thereby minimising overall waste and specifically retail food waste. Retailers have to decide which references to keep, remove, or add to the store’s assortment.

This strategy involves analysing the performance of each SKU to make decisions about reducing assortments and eliminating redundant, low-turnover, low-performance (low-profit-margin), or non-essential references (for the store’s main value proposition), thus simplifying assortment management. For example, Tesco implemented an assortment rationalisation strategy in 2015-2016, reducing its product range by 30%. This allowed Tesco to concentrate its resources on the most popular and profitable products, improving inventory



management, reducing storage costs, and decreasing waste from products that did not sell quickly (Ruddick and Anderson, 2015).

As the size of the assortment increases, the associated costs in the retail store also increase correspondingly (Hoch et al., 1999; Gázquez-Abad et al., 2017). According to Food Retail & Shoppers (2021), complementary studies by Bain & Company demonstrate that a reduction of 10% to 20% in SKUs can result in savings of up to 10% in production costs, 10% in supply chain costs, 10% in inventory, and an optimisation of up to 5% in raw materials and packaging costs.

So, Malinowski et al. (2021) conclude: “While there are ample benefits associated with SKU rationalisation, such as lower production and transportation costs, as well as inventory simplifications, a reduced portfolio has clear implications on a business's incoming demand”. Reducing retail assortment size can significantly impact food waste reduction (Riesenegger and Hübner, 2022). In fact, numerous grocery retailers, traditionally focused on offering a wide variety of products, are actively working to reduce the size of their assortments while enhancing efficiency, thereby challenging the conventional axiom that ‘more choice is better’ with empirical evidence (Argouslidis et al., 2018).

By limiting product offerings, retailers can better allocate resources like storage space, energy, packaging, and transportation, focusing on high-demand items and minimising overstock and potential food waste. This strategy enhances resource efficiency and reduces the environmental footprint of retail operations. A more streamlined assortment also allows retailers to prioritise product quality and sustainability, encouraging durability and circularity. By emphasising long-lasting, easily repairable products, this approach optimises shelf space, reduces overstock risk, and aligns with circular economy principles by extending product lifespans and conserving resources.

Ruiz-Real et al. (2019) note that retail assortment rationalisation typically emphasises optimising product variety, category sales, and profitability through strategic assortment reductions. This process involves carefully selecting products to enhance profitability and minimise excess inventory (Coronado-Hernández et al., 2020; Corsten et al., 2018), while also considering the broader effects on product categories and subcategories (Malinowski et al., 2021). However, overly aggressive reductions can risk alienating customers who value variety, making it essential to balance assortment size with consumer expectations. Thus, retail assortment rationalisation is increasingly recognised as a key strategy for reducing food waste, especially concerning perishable products.

## **2. Research methodology**

The literature review carried out is a mix between systematic and structured search. First of all, we follow the steps of a systematic literature review (SLR) to guarantee a thorough and unbiased collection of pertinent literature, which, in turn, facilitates the analysis and synthesis of information (Tranfield et al., 2003; Denyer and Tranfield, 2009). The first step in an SLR is to define the research question (Table no.1), in our case: What is the impact of assortment rationalisation on food waste in grocery retail stores?

Table no. 1. Systematic literature review protocol

<b>Statement of the Research Problem</b>	From the review of the specialised literature, scarce studies have been detected on the impact of retail assortment rationalisation on food waste.	<b>Inclusion Criteria</b>	<p>Peer-reviewed journal articles in Scopus and WoS that include a relationship between retail assortment size and food waste and that meet the following criteria:</p> <ul style="list-style-type: none"> <li>• Document type: Only final full-text articles.</li> <li>• English language only.</li> <li>• Subject areas: ‘Environmental Sciences’, ‘Business, Management and Accounting’, ‘Economics, Econometrics and Finance’ and ‘Social Sciences’.</li> <li>• Scope: retail food waste (supply side).</li> <li>• ‘Brick-and-mortar’ grocery stores.</li> <li>• Common product categories in a grocery store.</li> </ul>
<b>Objectives of the Systematic Review</b>	This study, through a SLR, aims to synthesise the existing academic literature on the scope ‘proactive food waste prevention, particularly fresh food, through assortment rationalisation in retail grocery stores.		
<b>Strategy to identify relevant studies</b>	Final articles published in scientific journals included in Scopus and the Web of Science that contain a study on the effects of the size of the retail assortment on food waste.		
<b>Database Selection</b>	Scopus Web of Science (WoS)	<b>Exclusion Criteria</b>	<p>Journal articles in Scopus and WoS that do not meet the following criteria:</p> <ul style="list-style-type: none"> <li>• Document type: No full-text articles or peer reviewed.</li> <li>• Articles were not written in English.</li> <li>• Books and book chapters, congress proceedings, and communications and thesis.</li> <li>• Food loss.</li> <li>• Household food waste (demand side).</li> <li>• Online grocery or e-commerce.</li> <li>• Other product categories different from the common ones in a grocery store.</li> <li>• Articles that do not have the “assortment size-food waste relationship” as the main topic.</li> </ul>
<b>Search terms</b>	<p>Scopus: To be found in the title, abstract, or key words.</p> <p>WoS: Topic (Search for title, abstract, and author keywords).</p> <p>“assortment” AND “sustainability”</p>		

Next, we have established clear inclusion and exclusion criteria to maintain the defined scope, systematically filtering the results in successive stages (Seuring et al., 2005), as outlined in table no. 2.

Table no. 2. Database search process and research refinement

<b>WoS Assortment (Topic) and sustainability (Topic) → 183 documents</b>	1. Database: WoS Core Collection → 127 documents.
	2. Collection: Social Sciences Citation Index (SSCI) → 37 documents.
	3. Document type: Articles (excluding books, proceedings papers, etc.) → 34 documents.
	4. Language: English → 34 documents.
	5. Research area: Business Economics and Environmental Sciences Ecology and Social Sciences Other Topics → 26 documents.
	6. Papers that establish a relationship between retailer assortment size and food waste or sustainability → 4 documents.

	7. Papers establishing a causal relationship between the size of the retail assortment and food waste or sustainability → 2 documents.
<b>Scopus</b> Assortment (Article Title, Abstract, Keywords) and Sustainability (Article Title, Abstract, Keywords) → 177 documents	1. Subject area: Environmental Sciences + Business, Accounting and Management + Social Sciences + Economics, Econometrics and Finance → 107 documents.
	2. Document type: Final articles (excluding books, proceedings papers, etc.) → 70 documents.
	3. Source type: Journal → 68 documents.
	4. Language: English → 64 documents.
	5. Papers that establish a relationship between retailer assortment size and food waste or sustainability → 3 documents.
	6. Papers establishing a causal relationship between the size of the retail assortment and food waste or sustainability → 2 documents.

Due to the small number of documents found, we decided to expand the search to verify that we had not left out seminal or significant articles for the topic discussed, due to the selection of the keywords following additional steps of a structured literature review. Following the methodology outlined by Riesenegger et al. (2023), we initially screened (backward search), and the articles cited by these selected articles (forward search) of the reference sections of the selected articles to identify further matching work, and finally we complemented the literature review with results from manual searches in leading journals in the field, such as Sustainability. Subsequently, we conducted a detailed review of the abstracts and identified one additional paper that matches the scope and research questions. In total, our search resulted in three articles.

### 3. Results and discussion

Despite the growing public recognition of its negative socioeconomic and environmental implications, the issue of food waste in the retail sector has been under researched. In addition to a small number of studies, the focus has been on food waste volume, causes and solutions at different stages of the retail chain, particularly in grocery retail (e.g., Mena et al., 2011; Stenmarck et al., 2016; Filimonau and Gherbin, 2017; de Moraes et al., 2020; Huang et al., 2021; Akkaş and Gaur, 2022).

According to Riesenegger et al. (2023): “there has been a shift of topics toward food waste prevention in grocery stores (Gruber et al., 2016; Filimonau and Gherbin, 2017)”. Almost all articles that promote food waste reduction practices are exploratory studies and use qualitative methodologies in different countries and product categories: structured literature review (Riesenegger et al., 2023), meta-analysis (Cicatiello et al., 2017), and in-depth interviews with grocery managers (Filimonau and Gherbin, 2017; Hermsdorf et al., 2017; Górska-Warsewicz et al., 2018; Kliugaite and Kruopiene, 2018; Yang et al., 2023). Previous studies discuss the impact of retail operations planning – demand forecasting, assortment planning, service level optimisation, and inventory replenishment management – on reducing food waste (Riesenegger and Hübner, 2022). According to Riesenegger et al. (2023), “even though research on assortment planning is generally well advanced, to date there is no paper that explicitly refers to food waste or uses any term related to food waste within the model” approach. Additionally, extensive literature on assortment and shelf space planning often addresses inventory management strategies that penalise excess stock, though these strategies are not always explicitly framed within the context of food waste (e.g., Hübner and Kuhn, 2012; Kök et al., 2015). Despite recent advancements in this field of research, no study has

yet systematically organised the existing literature with a focused emphasis on retail assortment size as a contributor to food waste reduction. From the review of the specialised literature, few studies have been detected on the effects of the size of the grocery retail assortment on food waste (Table no. 3).

**Table no. 3. Literature on proactive food waste prevention in retail stores by assortment size rationalisation**

Study	Objectives and methodology	Findings
Richards and Hamilton (2022)	Explores causes of expiry (loss) in retail beverage (beer) inventory management. Modelling and analysis of statistical and economic significance of loss drivers.	Competitive pricing, case sets, and assortment size impact supply chain loss. Salesforce discretion in inventory management can significantly reduce inventory loss. Detailed tracking can provide insight to limit inventory loss.
Riesenegger and Hübner (2022)	Explores options for reducing food waste through enhanced store operations planning in grocery bakery retailers. Exploratory qualitative research: Content analysis of 7 case studies. Primary sources of data collection: face-to-face interviews with owners, managing directors, and section heads. Qualitative text analysis method was used for data analysis.	Identify six fields of action to reduce food waste for ultra-fresh products, particularly enhance operational planning with tailored demand forecasts and assortment sizes. Formulate 15 propositions to guide grocery retailers in proactive food waste reduction.
Riesenegger et al. (2023)	Exploratory qualitative research: this study presents the first systematic literature review focused on analytical and modelling approaches for mitigating food waste within retail store operations.	Introduce a common classification scheme for the literature in this domain. Identify key retail planning areas that intersect in reducing food waste, specifically focusing on assortment management and shelf space allocation.

Furthermore, Argouslidis et al. (2018) pointed out two strategies to avoid the negative consequences of delisting. First, implementing changes gradually rather than abruptly in hedonic categories, and avoiding the delisting of SKUs from leading brands within a category, can help manage the perceived reduction in consumer choice. Second, with increased shelf space for PLs or best-selling NBs and communicating, at the same time, a high-quality PL range, grocers can improve the currently unfavourable attitude of consumers to such items and find more flexibility to reduce the NB variety.

The literature on retail assortment size (e.g., Kök et al., 2015; Sethuraman et al., 2022) had not analysed the options for reducing food waste via assortment size until the study by Riesenegger and Hübner (2022). Riesenegger et al. (2023) identify “three planning areas relevant for food waste prevention in grocery stores from an operations management perspective: (1) assortment and shelf space planning, (2) replenishment policy, and (3) dynamic pricing policies”. Riesenegger and Hüber (2022) classify grocery store strategies to reduce food waste into two approaches. First, reactive strategies in retail are used to manage overstock, such as inventory liquidation or promotion ‘close to the end of shelf life’, discounted prices for unsold prepared foods near their expiration, donations to food banks or shelters, reprocessing, or disposal for animal feeding. Huang et al. (2021) show that reactive

food waste management strategies dominate retail practice; indeed, the main strategy is food donation (Kliaugaite and Kruopiene, 2018). Second, proactive strategies in retail should be the primary focus on preventing surplus food from arising initially, rather than merely managing the subsequent waste valorisation. Among all of them, the size of the retail assortment seems to play a crucial role in influencing food waste levels (Richards and Hamilton, 2022; Riesenegger and Hüber, 2022; Riesenegger et al., 2023).

Many articles mentioned the impact of the size of the retail assortment on food waste by influencing the availability of the product and customer choice, leading to potential waste (Oishi, 2022; Richards and Hamilton, 2022; Riesenegger and Hübner, 2022; Riesenegger et al., 2023; Yang et al., 2023). Most of them support that larger inventories or broader assortment with varying characteristics (e.g., the differing dynamics between slow-moving and fast-moving goods) can simultaneously heighten the risk of both overstocks and shortages, given the constraints of shelf space, leading to higher waste (Kliaugaite and Kruopiene, 2018; Teller et al., 2018) since managing these items is more challenging, particularly due to factors such as reduced forecast accuracy for long-tail products (Mena et al., 2011).

### Conclusions

Despite the growing public recognition of its negative socioeconomic and environmental implications, the issue of food waste in the retail sector has been under researched. In recent years, academic research has increasingly focused on strategies for mitigating food waste within grocery retail environments, but almost all articles leading food waste reduction practices are exploratory studies and use qualitative methodologies in different countries and product categories (Cicatiello et al., 2017; Filimonau and Gherbin, 2017; Hermsdorf et al., 2017; Górska-Warsewicz et al., 2018; Kliaugaite and Kruopiene, 2018; Riesenegger et al., 2023).

Notwithstanding recent progress in this research area, no work has yet systematised published pioneer work investigating how grocery retailers develop proactive food waste prevention practices through assortment size rationalisation. From the review of the specialised literature, scant research has been identified concerning the impact of grocery store assortment size on food waste. Thus, this is an emerging area of research and a good proof of this is that there are very few studies on this topic. The existing literature on retail assortment size has not yet examined the potential for reducing food waste through modifications in assortment size until the seminal paper of Riesenegger and Hübner (2022). The same authors classify the retail assortment size rationalisation as a proactive strategy to prevent food waste. Although many articles mentioned the impact of retail assortment size on food waste by influencing product availability and customer choice, leading to potential waste (Oishi, 2022; Richards and Hamilton, 2022; Riesenegger and Hübner, 2022; Riesenegger et al., 2023; Yang et al., 2023), none of them assessed this effect. Most of them assumed the hypothesis that if the retail assortment size is reduced, food waste will be correspondingly reduced.

This paper represents a comprehensive literature review focused on strategies for mitigating food waste in retail settings through the rationalisation of assortment size. Therefore, this paper contributes to the sustainability of grocery retailers by proactively reducing food waste in grocery stores. In the previous results section, we discussed many ways to carry out an assortment size rationalisation and consequently prevent grocery retailer food waste without

negative consequences on sales, store choice, etc. Due to consumer choice overload, grocery retailers could reduce their assortment size to cutback significantly food waste, and in doing so, that these assortment reductions do not negatively affect the consumers' perceived variety through several strategies such as (Argouslidis et al., 2018): 1) a gradual implementation of hedonic categories, 2) delisting low-selling SKUs, and 3) increasing shelf space to PLs (or best-selling NBs) and communicating at the same time a high-quality PL.

This review is limited to common product categories sold in brick-and-mortar grocery retail stores, neglecting other retail sectors and product categories, that limits its generalisation and prevents its application to alternative channels, including online or omnichannel grocery retailers. In conclusion, this study serves as an initial approach to this topic and is a useful starting point for future research in this area. Our primary contribution lies in highlighting a certain scarcity of studies on the size of the retailer's assortment as a proactive food waste prevention strategy.

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