

Rationalizing Assortment Size as a Way to Proactive Food Waste Prevention: A Literature Review

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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 size rationalization as a way to reduce food waste from perishable products in retail grocery stores and, therefore, improve the sustainability generated by food retail chains.

Although many articles analyze the relationship between retail store operations and food waste prevention, to our knowledge, there is little research that explicitly focuses on assortment size rationalization. From the review of the specialized literature, few studies have been detected on the effects of the size 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 rationalization 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 corporations 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 size of the retailer's assortment as a proactive food waste prevention strategy.

Keywords

Assortment size, Rationalization, Perishable products, Grocery, Retail, Food waste, Sustainability.

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Introduction

Food waste not only involves the economic costs of food that is not consumed, but also the social costs of food that could have been used to feed more than two billion people and potentially address global hunger (FAO, 2021). Additionally, it accounts for the environmental costs not only of the consumption of natural resources wasted in the production of food that is not consumed -30% of cultivated land and 20% of freshwater-, but also energy and its environmental damage -through 8% of greenhouse gas emissions- (UNEP, 2024). The high impact of food waste on the economy, society, and the environment places it among the challenges to be addressed in the 2030 Agenda for Sustainable Development. Food waste is closely related to at least five of the United Nations Sustainable Development Goals (SDGs). SDG 2 'Zero Hunger', SDG 13 'Climate Action', SDG 15 'Life on land' and SDG 17 'Partnerships to achieve goals', and in particular SDG 12 'Responsible Production and Consumption'. Mitigating food waste helps promote more responsible patterns of production and consumption. In fact, one third of the food produced ends up rotting in consumer and retail bins or spoils due to poor practices in transportation and harvesting (FAO, 2011). This is the reason why sustainable development and waste management are the topics on which academia is focusing today.

According to UNEP (2024), around 1.05 billion tons of food waste were generated in 2022, 60% of which came from households, 28% from food services and 12% from retail. Positioned in the middle of food supply chains, retailers have considerable market power to affect change and reduce food waste by promoting practices such as redesigning and improving their food product packaging to maintain food items fresh for as long as possible (Calvo-Porrall et al., 2016), reducing carbon footprint (Marrucci et al., 2020), reverse logistics (Guarnieri et al., 2021), launch new products regarding healthiness and environmental sustainability (Aschemann-Witzel, 2021), removing sales promotions such as 'buy one, get one free' or '3x2', which drives customers to make unnecessary purchases and increases household food waste (Heydari et al., 2020), etc. Al-Obadi et al. (2022) maintain that the ultimate way to reduce food waste is by saving food. From a retailer's perspective, prevention includes any measure to minimize food waste as long as the product can still be sold. Research indicates that assortment size, competitive pricing, package size, and inefficiency are significant determinants of food waste at the retail level (Cuffey et al., 2023).

The wide range of category products (assortment breadth/width) in different formats within each category leading to too many references (assortment size/depth), and the consequent cannibalization of demand among them, implies that the end consumers have more choice alternatives but, on the contrary, a lower product turnover that generates overstock. Retailers have to decide which references to keep, remove, or add to the store's assortment and how much shelf space is assigned to each item to ensure that the products offered are optimized to meet customers' needs and preferences while maximizing retailer revenues and profits (Hübner and Kuhn, 2012; Kök et al., 2015). Effectively managing overstock may involve retail strategies to prevent food waste based on assortment, also called assortment rationalization, such as tailoring their assortment to meet the preferences and needs of their local customers to the extent of developing their private labels (PLs) to offer products not available elsewhere or to compete with national brands (NBs) in the market offering better value for money, or even the removal of products that no longer have demand (low-selling references). Therefore, reducing the number of references or stockkeeping units (SKUs) in the retailer's portfolio, also called delisting items or brand discontinuation, can significantly reduce food waste and contribute to the circular economy by optimizing resources and promoting the reuse and circularity of products in the supply chain and product lifecycle, benefiting both the sustainability and operational efficiency of food retail chains.

This work aims to explore assortment size rationalization as a way to reduce food waste at brick-and-mortar grocery stores and, therefore, to improve the sustainability generated by food retail chains. The rest of the paper is structured as follows. The next section provide the scientific literature review. The second section describes the research methodology applied. The third section discuss the results of articles focused on the size of the retail assortment as a food waste prevention strategy. Finally, in the conclusions, we synthesize the results, discuss their managerial implications, and provide suggestions for further research.

1. Review of the scientific literature

Grocery retailers often prioritize availability, high accessibility on the shelf, and large variety to increase customer satisfaction due to consumer demand for quality and variety, over other aspects due to strong competition in this sector and the imperative of realizing sales (Riesenegger and Hübner, 2022). Furthermore, retailers expand assortments to meet customer expectations of a large variety of goods to have a large choice (Kök et al., 2015; Canali et al., 2017). This means that retailers face a trade-off between increasing the attractiveness of the store through larger assortments and high inventory, on the one hand, and minimizing the environmental, social and financial impacts of overstock, on the other (Teller et al., 2018). In terms of customer satisfaction, retailers prefer to maintain a large assortment of products.

But when consumers are faced with excessive amounts of items, having an optimal rather than simply a large assortment is critical for retailers (Ko et al., 2017) due to increased choice difficulty, increased negative affect and regret, and decreased likelihood of product purchase (Broniarczyk and Hoyer, 2009). Moreover, retailers can reduce assortments without affecting the perceived variety, insomuch as breadth and depth manipulation affects consumer perception of the variety (Piris, 2013). Studies in grocery settings have found that cutbacks in low-selling stockkeeping units (SKUs) of product categories do not adversely affect variety perception (Broniarczyk et al., 1998; Sloot et al., 2006). The choice overload proposition may have increased the confidence of traditional retailers that they could boost their success by 'offering less'.

Furthermore, Argouslidis et al. (2018) pointed out two strategies to avoid the negative consequences of delisting. First, a gradual (vs. abrupt) implementation in hedonic categories and the avoidance of delisting

SKUs of the leading brand of a category can regulate the perceived loss of freedom of 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 unfavorable attitude of consumers to such items and find more flexibility to reduce the NB variety. Consistent with this, the results of the Broekmeulen and van Donselaar (2019) model show that if low-performing products are delisted, food waste can be reduced significantly. In fact, many grocers that traditionally emphasize diversity have implemented drastic assortment reductions after calling for assortment efficiency and evidence that narrow assortments reduce the tyranny of shoppers' choice (Argouslidis et al., 2018). By limiting the number of products offered, retailers can optimize the use of resources such as storage space, energy, packaging materials, and transportation and focus on those with high turnover and demand, thus minimizing overstock and the possibility of obsolete or unsold products that can become food waste. This contributes to more efficient resource management and reduces the environmental carbon footprint of retail operations. Additionally, by offering a more limited selection of products, retailers can focus their resources on improving the quality and sustainability of the products they offer. Assortment reduction can encourage the reuse and circularity of products by focusing on offering durable and high-quality products that can have a longer lifespan and be easily repaired or refurbished. This promotes circular economy principles by extending the useful life of products and reducing the need for resources to manufacture new products.

Recent studies emphasize that some assortments have become excessive (e.g. Teller et al., 2018; Riesenegger and Hübner, 2022), and reducing the variety significantly decreases food waste levels without a significant impact on sales. Therefore, 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). However, little attention has been paid to the rationalization of the assortment of perishable food products as a way to prevent or mitigate food waste.

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 ensure an objective and in-depth gathering of relevant 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 (see Table no.1), in our case: "What is the impact of assortment rationalization on food waste in grocery retail stores?"

Table no. 1. Systematic Literature Review Protocol

| | | | |
|--|---|---------------------------|--|
| Statement of the Research Problem | From the review of the specialized literature, scarce studies have been detected on the impact of retail assortment rationalization on food waste. | Inclusion Criteria | 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: <ul style="list-style-type: none"> • Document type: Only final full-text articles. • English language only. • Subject areas: 'Environmental Sciences', 'Business, Management and Accounting', 'Economics, Econometrics and Finance' and 'Social Sciences'. • Scope: retail food waste (supply side). • 'Brick-and-mortar' grocery stores. • Common product categories in a grocery store. |
| Objectives of the Systematic Review | This study, through a SLR, aims to synthesize the existing academic literature on the scope 'proactive food waste prevention, particularly fresh food, through assortment rationalization in retail grocery stores. | | |
| Strategy to identify relevant studies | 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. | | |
| Database Selection | Scopus Web of Science (WoS) | Exclusion Criteria | Journal articles in Scopus and WoS that do not meet the following criteria: <ul style="list-style-type: none"> • Document type: No full-text articles or peer reviewed. • Articles were not written in English. |
| Search terms | Scopus: To be found in the title, abstract, or key words. | | |

| | | |
|--|--|---|
| | WoS: Topic (Search for title, abstract, and author keywords). "assortment" AND "sustainability" | <ul style="list-style-type: none"> • Books and book chapters, congress proceedings and communications and thesis. • Food loss. • Household food waste (demand side). • Online grocery or e-commerce. • Other product categories different to common ones in a grocery store. • Articles that do not have the "assortment size-food waste relationship" as the main topic. |
|--|--|---|

Source: Own elaboration

Next, we specified explicit inclusion and exclusion criteria that ensure the defined scope by sequentially screening the results (Seuring et al., 2005) as you can see in Table no. 2.

Table no. 2. Database search process and research refinement

| | |
|--|--|
| WoS Assortment (Topic) and sustainability (Topic) → 183 documents | 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. |
| Scopus 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. |

Source: Own elaboration.

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. In doing so, the reference sections of the selected articles were screened (backward search), and the articles cited by these selected articles (forward search) were examined to identify further matching work. 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 3 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).

In recent years, 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 forecasts, assortment selection, service levels, and 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. Furthermore, a rich literature on assortment and shelf space planning includes inventory decisions that penalize overstocks without clearly defining this as food waste (e.g., Hübner and Kuhn, 2012; Kök et al., 2015). Notwithstanding recent progress in this research area, no work has yet systematized published research with a clear focus on retail assortment size as a contributor to food waste reduction. From the review of the specialized 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 rationalization

| Study | Objectives and Methodology | Findings |
|-------------------------------|---|---|
| Richards and Hamilton (2022) | Explores causes of expiry (loss) in retail beverage (beer) inventory management. Modelling and analyzes 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 insights 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: First structured literature review of analytics and modeling methods dealing with food waste prevention in retail store operations. | Introduce a common classification scheme for the literature in this domain. Identify cross-cutting store-related planning areas to mitigate food waste: assortment and shelf space planning, replenishment policies, and dynamic pricing policies. |

Source: Own elaboration

The literature on retail assortment size (e.g. Kök et al., 2015; Sethuraman et al., 2022) had not analyzed 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 Hübner (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 (Kliugaite and Kruopiene, 2018). Second, proactive strategies in retail should be to prevent surplus food in the first place rather than just trying to manage waste valorization. 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 Hübner, 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., slow vs. fast-moving goods) increase the risk of overstocks and shortages at the same time, as shelf space becomes a scarce resource leading to higher waste (Kliugaite and Kruopiene, 2018; Teller et al., 2018) since larger product variety are more difficult to manage due to, e.g., lower forecast accuracy in long-tail items (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, there has been a shift in topics toward food waste prevention in grocery stores, but almost all articles leading food waste reduction practices are exploratory studies and use qualitative methodologies in different countries and product categories (Riesenegger et al., 2023; Cicatiello et al., 2017; Filimonau and Gherbin, 2017; Hermsdorf et al., 2017; Górska-Warsewicz et al., 2018; Kliugaite and Kruopiene, 2018).

Notwithstanding recent progress in this research area, no work has yet systematized published pioneer work investigating how grocery retailers develop proactive food waste prevention practices through assortment size rationalization. From the review of the specialized 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 literature on retail assortment size has not yet analyzed the options for reducing food waste via assortment size until the seminal paper of Riesenegger and Hübner (2022). The same authors classify the retail assortment size rationalization 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 contribute to the first structured literature review that deals with food waste prevention in a retail store through assortment size strategies. Therefore, this paper contributes to the sustainability of grocery retailers by proactively reducing food waste in grocery stores. In the previous results section, we discuss many ways to carry out an assortment size rationalization 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 on brick-and-mortar grocery retail stores, neglecting other retail sectors and product categories, that limits its generalization and prevents its application to other channels such as e-commerce grocery 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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