

From Farm to Fork: Addressing Food Waste in Households

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Abstract: With the rising environmental awareness, the issue of food waste is drawing considerable attention from civil society, scholars, industry practitioners and policymakers alike. Addressing food waste is crucial, as it incurs a variety of social, health, economic and environmental costs, including greenhouse gas emissions, soil degradation and the depletion of natural resources. The objective of this study is to analyze processes in food waste management to gain insight into factors influencing consumer behaviour, attitudes, and practices regarding consumption and food waste and loss prevention in the supply chain. This requires the analysis of decision making methods and waste reduction strategies and approaches, particularly for households. The goal is to emphasize the importance of raising consumer awareness and sense of individual responsibility, especially given the recent surge in collective community intentions to live more sustainably. However, translating these intentions into tangible actions is uncertain and filled with socio-economic complexities. Reports indicate that, households are responsible for approximately half of all food waste generated. Therefore, it's important to review the literature on barriers and triggers related to behaviour patterns and variations in food related lifestyle dimensions, to determine the factors that might influence food handling and food waste knowledge. Targeting households presents a promising starting point for future interventions, highlighting actions that may influence the current food consumption model to reduce the amount of food wasted. The methodological approach was structured into three steps. First, a literature review was conducted to gather insights and identify factors and interconnections between consumer behaviour and food waste. Second, related drivers and triggers were analysed. Lastly, the findings were summarized to highlight gaps and opportunities for improving attitudes towards food waste prevention.

Keywords: Consumer behaviour, Food waste, Sustainable consumption, EU Green Deal, Farm to Fork

1. Introduction

Integrating sustainable food management practices, including minimizing food waste requires a multidisciplinary and collaborative approach (Kim et al., 2019; Schanes et al., 2018; Simões et al., 2022). Targeted policies across the agri-food sector and adequate governance are essential to address the systemic nature of food waste and loss related challenges (EU, 2020). Complementary to policy initiatives, enforcing existing legislation and regulation tools, as those prescribed by the EU Green Deal of Innovation and the Farm to Fork. These policies are designed to manage human and animal welfare, and protect the planet while promoting the adoption of green innovation strategies in support of sustainable long-term growth (Adamowicz, 2022). According to Siedschlag et al. (2022) targeted policy measures work to incentivize small and medium sized enterprises (SMEs) and, ultimately benefits end-users.

The EU recognizes that a transition to a more sustainable food system reshapes the economic landscape, thus the interaction patterns between food producers and consumers are underpinned by the Commission's regulatory system (EU, 2020). That is due to food production, processing, distribution and disposal being large contributors to greenhouse gas emissions, overexploitation of environmental resources (Canali et al., 2017; Cheng et al., 2023); ecosystem degradation (Birner, 2018; Štreimikienė et al., 2022) and biodiversity loss (EU, 2019). In response, the EU provides technical and financial assistance through existing instruments such as the European Agricultural Fund for Rural Development (EAFRT), EIT Food and European Interreg Projects among others, offering funding programs with national and regional reach.

As outlined in the Green Deal strategy, the EU's commitment to innovation is closely intertwined with its ambition to achieve climate neutrality by 2050 (EU, 2021; Kowalska et al., 2022). They drive change and mitigate risks while actively engaging citizens in fostering social innovation (Kowalska et al., 2022); and promote economic modernization guided by the SDGs framework (Birner, 2018). To support these transitions and transformations, the EU's strategy incorporates regular impact assessments. These assessments, informed by public consultations and the evaluation of environmental, social and economic impacts, analyze the effects on innovation and ensure that policy decisions are in alignment with the EU's goals (EU, 2020). This framework promotes policy coherence, embedding circular economy principles and outlining sustainable responsibilities and action across all food-related policies, to ensure resilience in the food supply chain (Chiaraluce et al., 2023; EU, 2020). It aims to establish sustainable standards the norm for food products in the EU market, benefiting both operators and consumers alike. For instance, this framework supports the integration of sustainable practices in the food industry through certifications and labelling (EU, 2020). These mechanisms aim to ensure vertical and horizontal policy integration in a "multilevel reinforcement" (Kreienkamp et al., 2022, p. 734) of best practices and coordination between industry

actors – consumers, producers, processors and policymakers (Sgroi & Marino, 2022), while creating feedback mechanisms within an interdisciplinary governance system (Conti et al., 2021; Oliver et al., 2018)

Active participation and collaboration among all stakeholders in the food supply chain is highly desirable (Fami et al., 2019) for promoting food waste reduction behaviours and consumption of environmentally-friendly food products (Secondi et al., 2015). It requires engaging with a broad range of partners, including farmers, food manufacturers, retailers, local authorities, community groups, and individuals (Secondi et al., 2015). Developing information sharing networks and creating partnerships are key to promoting behaviours to reduce food waste and facilitate the adoption of best practices at the individual and contextual levels (Secondi et al., 2015). Additionally, increasing consumer awareness of sustainable food consumption is vital (Canto et al., 2021).

2. Theoretical Insights into Food Waste and Consumer Behaviour

This section explores the characteristics of consumer behaviour and attitudes related to food waste, consumption decisions, and their role in accelerating the transition towards a sustainable food systems (Bedeau et al., 2021).

2.1 Food Waste

With the global population expected to grow from 8 billion to 9.7 billion by 2050, and 10.4 billion in 2100 (UN, 2022), policymakers worldwide are developing strategies in anticipation of predictable challenges, to ensure the integrity of social sustainable development (Bartelings & Philippidis, 2024). The United Nations's Sustainable Development Goals (SDGs) for 2030 provides a roadmap for sustainable progress, with the food system playing a key role (WHO, 2024). The UN is faced with a dual challenge, of feeding half a billion undernourished people while improving the diets of 2.8 billion overweight and obese adult individuals, as well as, millions of children and adolescents (WHO, 2024). Malnutrition in various forms, and diet related diseases remain a global cause of mortality, consequently, maintaining a sustainable food system is vital in this transformation from a human health perspective (Bartelings & Philippidis, 2024; Lindgren et al., 2018). Yet, access to nutritious food must not be at the expense of environmental, economic and social issues (Lindgren et al., 2018)

Meanwhile, the food system is responsible for approximately 30% of greenhouse gas emissions driving biodiversity losses (EC, 2021). It is estimated that as much as 40% of food produced is wasted or lost along the supply chain (WWF, 2021). Based on this evidence, the UN Sustainable Development Goal 12.3 targets a 50% reduction in per capita global food waste at the retail and consumer levels, along with minimizing food losses through production and supply chains caused by inefficiencies by 2030. According to Gustavsson et al. (2011, p. 1) and Thompson et al. (2020) "one third of all food produced globally is lost or wasted" amounting to 1.3 billion tons of food wasted annually. Yet, the FAO et al. (2023) estimate that approximately 8,9% (783 million) of the world's population suffered from hunger, while 2.4 billion people faced moderate or severe food insecurity in 2022, with 2.4 billion lacking regular access to sufficient and nutritious food (SDG indicator 2.1.2). On average, European consumers discard 123 kgs of food annually (Barone et al., 2019; Kunszabó et al., 2022) estimated at 88 million tonnes per year (EU, 2018). These percentages underscore the magnitude of this problem and its implications for resource utilization and environmental sustainability (Barone et al., 2019).

Thus EU policy roadmap for a more sustainable food system (EU, 2020), aims to achieve several goals including, "medium-term behavioural adjustments in consumption patterns" leading to social and economic impact (Bartelings & Philippidis, 2024, p. 568). It anticipates that household savings resulting from reductions in food waste can be spent elsewhere, either by purchasing the same food products (direct effect) or on other goods and services (indirect effect) (Bartelings & Philippidis, 2024). This phenomenon, known as the "rebound effect" (Albizzati et al., 2022; Bartelings & Philippidis, 2024), influences circular efforts, especially in terms of waste collection, resulting in financial benefits for businesses and consumers while having a positive impact on the environment (Aktas et al., 2018). Based on these insights, the importance of the bioeconomy cannot be underestimated (EU, 2012).

To achieve its targets, the EU has implemented legislation mandating member states adopt methodologies for measuring food waste, as well as, introduce food waste prevention programs, in order to monitor and report food waste levels (EU, 2018). As stakeholders in the agri-food sector search for new product solutions and applications, the integration of well designed food policy interventions and recommendations for sustainable food consumption becomes fundamental (Falasconi et al., 2019; Mokrane et al., 2023). They underscore the importance of sustainable food management practices from the farm to the table, food waste reduction initiatives, and underscore the need for the implementation of preventative measures, thereby strengthening networks in food waste management (Mokrane et al., 2023). The food system affects the pillars of the sustainable development environment, economic and social goals (Aktas et al., 2018; Aureli et al., 2021; Fiore et al., 2017). In wealthier countries such as EU member states, households are a target group, partly because, according to Gustavsson et al. (2011) households generate

the largest volume of food waste compared to other actors in the food supply chain (Beretta et al., 2017; FAO et al., 2023).

2.2 Consumer Behaviour

From the Theory of Planned Behaviour (TPB) perspective, household food waste is examined alongside behavioural patterns in the context of social and psychological determinants over time (Ajzen, 2015; Thompson et al., 2020). This theoretical lens offers useful insights by exploring how perceived behavioural control (PBC), attitude, and social norms influence waste generation (Thompson et al., 2020). The TPB by (Ajzen, 2015) proposes that the decision process is the result of an intentional action to perform a specific behaviour. It is shaped by attitudes, norms and beliefs relevant to that behaviour (Ajzen, 2015). While, Quested et al. (2013) and Block et al. (2016) argue that food waste arises as the result of multiple interconnected behaviour variables. Other studies have empirically examined socio-demographic behaviour drivers and values, which include concern for the environment (Diaz-Ruiz et al., 2018; Setti et al., 2016); and concluded that consumers often face conflicting motivations that impact their efforts to reduce household food waste (Setti et al., 2016). To this effect, Setti et al. (2016, p. 694) state that food choices are rooted in “judgements, such as emotions, habits, and values, thus raising the cognitive dissonance between motivation and behaviour (intention-behaviour gap)” .

From an economic perspective, Pocol et al. (2023) identified five consumer groups based on waste behaviour, namely conservative, self-indulgent, indifferent, consumerist, and eco-responsible; while Di Talia et al. (2019) examined household income levels to categorize consumer types, classifying them into three groups: unaware, unaware but not wasteful and aware. Within socio-demographic and economic aspects, other factors to be taken into consideration are geographical aspects, food prices, typical purchasing habits and cultural influences (Aureli et al., 2021). Understanding and addressing food waste at the household level, involves recognizing its association with diverse behavioural aspects, such as, with social, norms, culture, demographics, family structure, among many other factors, that influence and drive change in consumer habits. Thus, identifying and comprehending these behaviours is essential for effective strategies aimed at preventing food waste generation (Abeliotis et al., 2016). It is specially critical to encourage shifts in consumer behaviour for preventing food waste and loss across various stages of the supply chain.

To reduce the impact of their effect, the literature suggests that specific behaviours contribute to consumer food waste including buying or preparing too much food, incorrect storage methods, confusion over “best before” and “use by date” dates, lack of planning, impulse buying and lifestyle (Muresan, Harun, Andreica, et al., 2022). Marketing strategies, in combination with a lack of education and information about products, can inadvertently encourage food waste, even when items are still suitable for consumption (Muriana, 2017). This is often cause by labels like “use by date” or “sell by date” (Muriana, 2017) or the appearance of food (Chinie et al., 2021). Addressing these issues by improving consumer awareness and reducing biases related to food aesthetics or expiry dates could better align consumer choices with their intentions (de Visser-Amundson et al., 2023). This approach can significantly impact food waste management, as products often deemed waste due to visible imperfections or near expiry dates may still have inherent value (de Visser-Amundson et al., 2023). The complexity of food choices is further influenced by factors such as health concerns, taste preferences, budget, household structure, and cultural attitudes (Muresan, Harun, Brata, et al., 2022).

3. Methodology

This qualitative research study synthesizes existing literature to explore how consumer behaviour, attitudes and practices influence food waste and loss prevention at the household level. The analysis involved a thematic data extracted from scholarly articles, reports and other relevant sources. The key objective included identifying effective behaviour related and causes of food waste, food management strategies, and barriers and triggers to their implementation. The study aims to highlight insights that can inform policies and interventions to promote sustainable practices in food consumption and waste reduction.

To explore the interconnection between consumer behaviour and food waste, VOSviewer (van Eck & Waltman, 2014) was applied to perform a bibliometric analysis to examine the literature. SCOPUS and Web of Science (WoS) databases were used to select the articles following a search criteria that included the following keyword combination: “food waste” AND “consumer behaviour” OR “consumer behavior” AND “soci*” (for societal factors) (Figure 2). Limitations were set to peer reviewed journal articles; language: english; country: European countries; and discipline. Subsequently, Nvivo was used to code the articles in order to identify, and categorize interconnecting themes. VOSviewer identified distinct topics and perspectives on the subject by keyword search. The keyword examination revealed three clusters (figure 1 – green, red, blue). Words such as food waste, consumer behaviour,

consumer attitude, are some of the words that stand out to characterise this topic. The result indicates connections between the term “food waste” to “consumer behaviour” while at the same time illustrates the relationship between key subtopics.

The methodology was designed to address the following key question and subquestions (Bedeau et al., 2021):

- Q: 1. How do consumer behaviour, attitudes and practices impact food waste and loss prevention, particularly at the household level? 1.a) What methods and societal practices in food management for reducing waste exist? What are the triggers and barriers? 1.b) How can communication strategies be optimized into tangible actions to raise consumer awareness? Can policy measures and community engagement alone help?

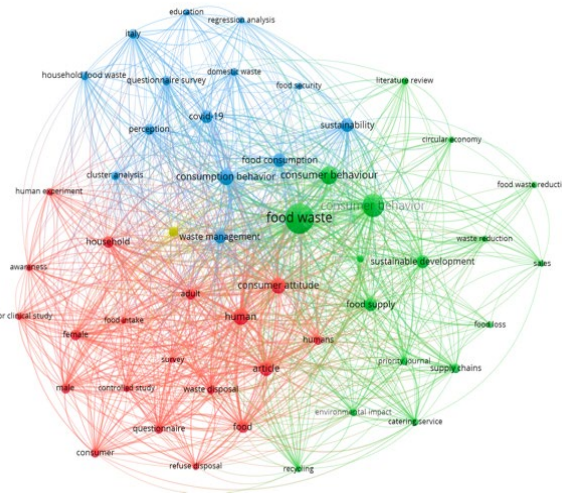


Figure 1: Keyword examination

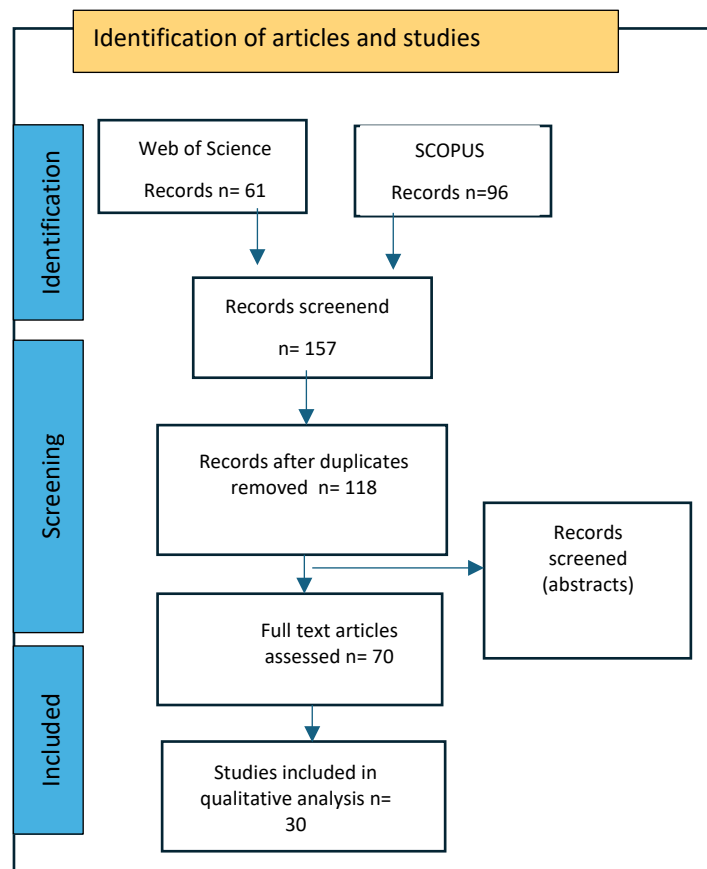


Figure 2: Identification of articles and studies

4. Findings and Discussion

This study highlights the need to primarily synthesize existing literature in order to design consumer behaviour strategies that are tailored to households. The goal was to gain a deeper understanding in the interplay between consumer behaviour, attitudes, and practices; and emphasize the role of mechanisms, referred to as “enablers” (Bedeau et al., 2021) in facilitating effective solutions. Where sustainable food consumption is concerned, attitudes towards how food is handled vary depending on the unique characteristics and contexts between countries and communities. Thus, to effectively tap into their transformative potential, it is important to take local knowledge and practices into account, and how these relate to food consumption, food waste potential (Bedeau et al., 2021) and preventative solutions.

The literature clearly shows a direct connection between food waste and socio-psychological factors, and it identifies the drivers and barriers that influence sustainable consumption (Özkaya et al., 2021) such as financial capacity, planning habits, attitudes, motivation, and family structure (Aktas et al., 2018). Motivation factors include “nutrition, health, consciousness, social identity, concern for farmers, ethical concerns, food security, perceived availability, store reputation, and animal welfare concerns among the factors that influence” (Özkaya et al., 2021, p. 5). Recently, a key motivator has become the preference for purchasing and consuming sustainable produce i.e. organic. Consumer food waste levels are also impacted by lifestyle factors including cooking practices, meal planning habits, price sensitivity, social aspects of meals, and concerns about food safety (Aschemann-Witzel et al., 2018). Conversely, barriers to reducing food waste include “high prices, time limit, access, lack of information, trust in labelling, limited marketing communication and unawareness of environmental impact” (Özkaya et al., 2021, p. 5).

To address these challenges, Aschemann-Witzel et al. (2018) advocate targeted marketing strategies and policies designed aimed at specific consumer groups to reduce food waste effectively. Their analysis reveals the role and importance of communication in shaping consumer perceptions of upcycled foods, raising consumer awareness, and encouraging sustainable consumption habits. Key interventions to boost awareness include product labelling, social media, educational programs, community campaigns and all types of print (Morone & Imbert, 2020).

Additionally, research by Amicarelli et al. (2022), Ankiel and Samotyja (2020), Aschemann-Witzel et al. (2020) and Falasconi et al. (2019) indicate that consumers often have low perception and lack awareness about the extent of food waste and its impact, a major barrier in sustainability efforts.

As the urgency to shift towards a circular economy and the demand for sustainable food systems intensifies, scholars illustrate the potential for converting food resources that would go to waste into products with value that can drive consumer demand (de Visser-Amundson et al., 2023). They further suggest that a higher degree of product transformation can attract consumers, with product design shaping consumer preferences. Achieving this requires innovation across the production value chain (BMZ, 2021; de Visser-Amundson et al., 2023; EU, 2018). To that effect, the EU promotes initiatives such as food donations, alternative uses in animal feed and applications in fashion, construction and energy. It is also funding projects like the Interreg CEFoodCycle Project (EU, 2022) to cut food waste and CO₂ emissions. Overall, valuable insights are presented into how individual characteristics impact consumption behaviour (Cela et al., 2024).

5. Conclusion

Addressing food waste and behaviours associated with efforts towards prevention habits is a priority topic on the agenda of policymakers and society in general. Implementing practices to reduce food waste and loss holds potential to reshape the food system from the farm to the table (Castillo-Díaz et al., 2023; EU, 2012). Consequently, a thorough understanding of consumer behaviour, in particular household typology, is essential in order to develop measures that can bring about lasting improvement (Abeliotis et al., 2016). Despite the potential benefits, the uptake of waste prevention practices continues to be a challenge due to consumer perception.

Food waste management is increasingly prioritized in waste management strategies (Abeliotis et al., 2016), thus, understanding the characteristic of food waste behaviours, aids with prevention campaigns, identifying target groups, determining appropriate engagement channels, and the design of communications materials (Abeliotis et al., 2016). This approach requires a systemic and transdisciplinary collaborative approach, along with increased consumer awareness, skills and competencies to drive the transformation process (Canto et al., 2021; Stirnimann & Zizka, 2022). To effectively implement these strategies, the role of the university, as a key ecosystem player, becomes pivotal in bridging the gap between awareness, responsibility and action. This research explores how universities can fulfill this role by developing tailored educational programs and community campaigns that impart

critical knowledge about food waste, and empowers individuals with the skills and competencies necessary to engage in sustainable practices.

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