Causes and Strategies for Plate Waste Management in the HoReCa Sector

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Abstract

Food waste in the HoReCa sector is a global phenomenon and has a negative worldwide impact. Despite that HoReCa units (restaurants, bars, cafeterias, pubs, canteens, etc) are large generators of food waste, they were given less theoretical consideration than other food waste generators. The objective of this article is to analyze the plate waste causes in HoReCa units and measures of how to reduce it. The work was carried out using an exploratory research method, being analyzed a number of WoS and Scopus publications to clarify the main causes of plate waste in the HoReCa units. At the same time, this paper summarizes the strategies to reduce of plate waste in the HoReCa areas. The advantages of knowing the causes of plate waste may be a target for interventions to reduce it.

Key words: HoReCa units, plate food waste, causes, management
J.E.L. classification: E30, J43, L66, M11, N50, O13, O15, Q13, Q17

1. Introduction

Due to its serious detrimental socio-economic (roughly a billion people around the world experiencing hunger and malnutrition and accounting for a global economic value of nearly 1000 billion dollars annually) and environmental (being responsible for 92% of the world's water footprint and for 20% of the world's greenhouse gas emissions) effects, the issue of food waste is becoming more widely recognized (Dolnicar *et al*, 2020, p.1; Parfitt *et al*, 2010, p. 3065; Seberini, 2020, p.5). Approximately 1.3 billion tons of the food produced for human use worldwide each year is lost or squandered, making it even harder the task of feeding the world's growing population, by 2050 being predicted that there will be nearly 10 billion people on the planet (Godfray *et al*, 2010, p.1; Papargyropoulou *et al*, 2019, p.1; Stoica *et al*, 2022, p.2). The use of food intended for human consumption and for non-human consumption (rerouting of food for animal consumption), or the disposal of edible food are all considered forms of food waste (FAO, 2014). While some scholars made a distinction between food loss (FL) and food waste (FW), by stating that the first one takes place at the beginning of the food supply chain (farm-level) and the second one occurs during final consumption (households and HoReCa sector), others are using both of them to describe the same phenomenon (Dhir *et al*, 2020, p.1). Throughout the many phases of the food supply chain (production, storage, processing, consumption) FW is produced. In about a third of cases, FW is created during consumption stage. The HoReCa industry has been recognized as one with a high potential for FW. This sector produces a significant quantity of waste, with FW accounting for approximately half of it. It is estimated that from 78% to 92% of FW is thought to be avoidable. Additionally, academics contend that there are three major categories of FW depending on the cultural setting, such as: (*i*) avoidable waste (meaning the edibility of food at a certain point which

turned into inedibility before the food gets disposed of), (*ii*) unavoidable waste (describing certain non-edible byproducts, e.g. eggshells), and (*iii*) waste that can be potentially avoidable (relating to specific wastes ingested occasionally, but not always, e.g. potato peels) (Betz *et al*, 2015, p.224; Bilska *et al*, 2022, p.1; Dhir *et al*, 2020, p.1; Dolnicar *et al*, 2020, p.2; Papargyropoulou *et al*, 2019, p.2).

Generally speaking, at the end of the 1990s, businesses in the hospitality industry gave less weight to sustainable FW management (Radwan *et al*, 2012, p.533; Radwan *et al*, 2012, p.534). Nowadays, it was found an increase in environmental consciousness owing to the explosion in the usage of ecolabels as a way of certification for a lot of units, a great part of them opting to become certified. On one hand, a large number of hotels and restaurants are implementing different FW reduction techniques. On the other hand, the current circumstance, however, is totally different, being also emphasized by the fact that in the following years, the HoReCa sector is anticipated to grow at considerable rates in various parts of the world with a big influence on FW levels (Pirani and Arafat, 2014, p.320). Typically, producing more waste results in a bigger environmental impact and more harm to the ecosystem. For instance, the average hotel guest is thought to produce up to 1 kilogram of FW daily, which equates to millions of tons of food wasted globally each year (Bohdanowicz, 2006). After farms and households, HoReCa generates the third-largest amount of FW in the EU-28 (Filimonau *et al*, 2020, p.4). For instance, FW accounts for 76% of the total Horeca Sector sector in EU-28 (9.3 million tonnes) in six important countries (Netherlands, Italy, Spain, Germany, United Kingdom, France) (Kretschmer *et al*, 2013). Around 75% of this waste is classified as avoidable, making this industry a top priority for reducing FW (Filimonau *et al*, 2020, p.4). Because efficient FW management necessitates a greater understanding of the volume and origin of the waste, it is crucial to understand the causes of waste and, as a result, researchers generally talked in-depth about how much food is wasted during phases like preparation, serving, and food consumption (Ai and Zheng, 2019, p.40; Dhir *et al*, 2020, p.2). In the consumption phase, plate food waste (PFW) is a category of FW produced in the HoReCa sector and refers to food that is served but not finished off on a plate. Taking into consideration that 12% of food provided is not consumed, PFW makes up nearly one-third of all FW in this sector (Dolnicar *et al*, 2020, p.1).

2. Theoretical background

According to recent estimates, one-third of food worldwide never makes it to a human stomach. Since the last ten years, policymakers, practitioners, and academics from a variety of academic fields have begun to view FW as a global problem. A recent analysis of FW globally reveals a divide between wealthy and underdeveloped nations. Therefore, in underdeveloped countries FL takes place mainly at the farm-level stage (FAO, 2011; Freedman and Brochado, 2010, p.1865), and, by contrast, final consumption stage makes the highest single contribution to FW in wealthy or developed countries (Stenmarck *et al*, 2016). FW in the hospitality sector is quickly becoming a major concern. In recent years, this sector's share of all FW has reached close to 12% (Tostivint *et al*, 2016). Additionally, hospitality waste has emerged as a significant problem for both developed and developing countries, owing to the rise in popularity of eating out, which is being fueled by rising wages and tourism (Wang et al, 2017, p.2).

The hospitality sector covers any establishments like hotels, bars, and restaurants that offer customers food, drink, or a place to sleep. Also, it features various significant sub-domains, like educational institutions, healthcare, staff catering (Pirani and Arafat, 2014, p.321; WRAP, 2013). In a wide sense, while hotels include lodging establishments and can be divided into luxury ones (five-star hotels), cheap hotels, bed & breakfasts, and also hostels, restaurants include units that serve various cuisines (e.g. Chinese, French, Italian cuisines) and also quick-service places that provide eat-in, as well as take-away food and leisure. Preschools, as well as elementary and secondary schools, facilities that offer tertiary education and universities are all part of educational institutions. The Healthcare System consists of hospitals and care facilities. Canteens and cafeterias for employees to eat in are examples of staff catering. Further, the hospitality industry can be split into two main divisions: commercial divisions (for-profit) and divisions based on social aspects (not-for-profit) (Dhir *et al*, 2020, p.2; WRAP, 2013). In the same way, Marthinsen *et al.* (2012) emphasized that hospitality consists of two sectors: one sector based on profits and the other sector based on

expenses. The profits sector establishments covered by the term "hospitality sector" include hotels, restaurants, cafeterias (which stand for HoReCa), as well as the catering industry (e.g. supermarkets) and canteens. On the other side, the expenses sector consists of units like hospitals, universities, schools, etc. where profit coming from hospitality services is not the primary goal. Moreover, medical and institutional facilities are categorized as institutional FW sources (Ai and Zheng, 2019, p.40; Ai and Zheng, 2019, p.41). Some believe that FW generation is the hospitality industry's most obvious environmental impact (Bohdanowicz, 2005, p.192). The majority of current research focuses on calculating the amount of FW produced by the HoReCa industry. For instance, in the US, one-third of FW is produced by restaurants (BSR, 2012) and about 50% of all waste generated by hotels is food-related (Dolnicar *et al*, 2020, p.2). Moving to the EU, the catering industry's contribution to FW is 14%. While numerous studies have explored aspects related to consumer behavior and FW in households (Vizzoto *et al*, 2021, p.1), unfortunately, consumers eating in out-of-home units have not received as much attention (Silvennoinen *et al*, 2015, p.140).

PFW (the food that individuals leave on their plates but don't consume) is the main source of waste in the HoReCa sector, being especially met within restaurants. Generally speaking, casual dining units produce more plate waste volume than fine dining ones (Dolnicar *et al*, 2020, p.2; McAdams *et al*, 2019, p.451; Vizzoto *et al*, 2021, p.2). Similarly, high-end restaurants produced the most waste per customer, followed by medium and low-end eateries (Aamir *et al*, 2018, p.600). Regarding restaurant size, parties and corporate banquets generated more PFW in large and medium-sized units, compared to working people that served meals in smaller units (Dhir *et al*, 2020, p.7). Despite this fact, few studies have looked at the drivers that make people more likely to throw away food when eating out and determined the grams of PFW produced by visitors to hotels and restaurants. Some investigations found that China customers produced 93 g of PFW per person for each dinner on average. In addition, the average daily FW per person was: 15.2 g at a breakfast buffet in a four-star hotel by the sea in Slovenia (Juvan *et al*, 2018, p.237; Juvan *et al*, 2021, p.2; Vizzoto *et al*, 2021, p.2) and 300 g, 100 g, and 400 g of food, respectively, at the breakfast, lunch, and dinner buffets at a five-star hotel in Malaysia (Papargyropoulou *et al*, 2016, p.332). No research has attempted to capture consumers' impressions regarding suggested measures to reduce PFW. By adopting measures, like reducing serving sizes and providing doggy bags for leftovers, unit managers have no way to guarantee that applying them won't anger customers (Vizzoto *et al*, 2021, p.2).

3. Research methodology

The approach adopted involved an exploratory study that was carried out by looking at the available literature. Literature review provides a foundation for the growth of knowledge, for which reason a large number of publications was analyzed (WoS, Scopus publications and specialized platforms or webpages like FAO, BSR, etc). The analysis of literature contributed to clarify the causes of PFW, as well as to identify scientifically proven measures of how to reduce it.

4. Findings

Researchers generally went into great depth about the food that is wasted during preparation, serving, and eating stages in the HoReCa industry. To identify associated reasons, overproduction, serving difficulties and PFW were taken into account (Sebbane and Costa, 2018, p.89). The main causes were the type of food offered, the method used in production, dinnerware size, employees' skill levels, the preference for pre-prepared over whole food products, the management capabilities regarding inventory and culture (Dhir *et al*, 2020, p. 5; Dhir *et al*, 2020, p. 6). Moving specifically towards restaurants, FW can occur due to the nature of the served dishes, ingredients used and opening hours (Principato *et al*, 2018, p.134). While an incorrect estimate of customers, a weak coordination between different functional areas (e.g. purchasing and preparation areas) and a strict rule against serving leftover food at the following meal are the main reasons for FW for buffet operations units (Pirani and Arafat, 2016, p.131; Silvennoinen *et al*, 2019, p.101), others reported wastes as a result of food deterioration and overproduction. In office canteens, PFW was primarily caused by taste perception (Dhir *et al*, 2020, p. 6). As PFW accounts for about one-third of the food

wasted in hospitality and tourism, this paper will focus on plate waste causes and measures of how to reduce it (Sustainable Restaurant Association, 2010).

4.1. Causes of PFW

Food left on the plate costs the hotel money and damages the environment. It does not make the meal more enjoyable. A small number of studies have pinpointed potential PFW causes or elements that are strongly linked to increased levels of plate waste (Dolnicar *et al*, 2020, p.1). Age, gender, income level, attitudinal, as well as geographic and cultural factors were discovered to have a potential effect or to be connected to the PFW causes. (Dhir *et al*, 2020, p. 7; Vizzoto *et al*, 2021, p.2). According to Hamerman *et al.* (2018), gender differences were not significant when it came to people's intention to leave leftovers. But the majority of research on how gender and age affect the amount of food wasted on plates reveals that women and younger customers are more predisposed than men and older customers to leave their dishes unfinished when dining out (Dhir *et al*, 2020, p. 7; Vizzoto *et al*, 2021, p.2). In contrast, some authors found that men have a greater tendency to generate PFW (Barr, 2007, p.465). This gender discrepancy regarding PFW levels is most likely explained by the fact that portions are bigger than the average woman's needs because the majority of foodservice units use portion sizes based on the average male's intake (Vizzoto *et al*, 2021, p.2). Regarding household income level and FW, it doesn't seem to be a direct connection between them (Koivupuro *et al*, 2012, p.189). However, while some authors stated that increased incomes result in more waste (Soma, 2019, p.384; Szabó-Bódi *et al*, 2018, p.633), others found that, on one side, people from lower social groups waste more food (Cox and Downing, 2007) and, on the other side, lower incomes people squander less because they cannot afford to throw away food (Ilakovac *et al*, 2020, p.237).

PFW is determined by the regularity with which certain people eat out. In this context, the same foodserving units are frequented by people who dine out, making it less likely that they will be startled by taste, unpredicted ingredients or dinnerware size. This leads to lower plate waste levels when people eat out more frequently. Moreover, PFW can occur because of the feeling of guilt and responsibility transfer. People frequently feel guilty about something they believe is their fault or they are responsible for, a lot of them considering themselves guilty when they waste food. The idea of responsibility transfer comes from consumers who eat out and blame that certain unit for their PFW claiming things like awful taste, excessive portions, etc (Vizzoto *et al*, 2021, p.2).

It was noted that country-specific variations in the factors driving FW, such as the number of people in a city, the size of a restaurant or various buffet elements and guest mix considerations suggested the likely influence of geographical and cultural distinctions (Dhir *et al*, 2020, p.7; Dolnicar *et al*, 2020, p.1). In the case of China, less populous locations were associated with higher PFW levels within larger restaurants or at business and social meetings, opposite to situations of private dining. Also, this study showed that foreigners were more likely than locals to leave meals in restaurants, wasting more food (Wang *et al*, 2017, p.6). When China and Western countries were compared for restaurant waste, it was discovered that it was almost identical to the Nordic average waste (Dhir *et al*, 2020, p.7). A study carried out on a Slovenian breakfast buffet revealed that, on one side, tourists from Austria produced substantially less PFW than those from Russia who generated the highest amount of wasted food on the plate per person. On the other side, opening additional areas where people can eat is possible to lead to an increase in PFW levels. The hotel typically offers two areas where customers can eat by themselves, but when their number increases, a third self-service section needs to be opened due to the peak season's increased occupancy of the dining room. This fact leads to a significant increase in PFW, possibly due to considering food abundance which can create a sense that the food is not a valuable commodity (Juvan *et al*, 2018, p.237). Regarding event catering, a study from the United Arab Emirates showed that standard buffet settings and a la carte lunches generated less plate waste than buffets with culinary demonstrations in real time and buffet-style lunches. Also, it was found that the overall portion of the dish that went uneaten in this trial ranged from 4 to 12 percent (Pirani and Arafat, 2016, p.137). According to Dolnicar and Juvan (2019), in a single setting (dining at the same hotel) were discovered to be 12 different causes that lead to PFW (Figure 1).

Figure no. 1. The causes of PFW

Source: (Dolnicar and Juvan, 2019)

Causes influencing PFW can be grouped in 5 categories. The first one refers to food quality and consists of foods displayed at the buffet that don't stay fresh, using low-cost ingredients and using of pre-prepared food products instead of meals cooked by the chef in the kitchen. Lack of ideas in combining some foods (bad food combinations), true difficulty in eating all edible parts of the food and using improper plates belong to the second category associated with paucity of knowledge regarding food. When speaking about less known foods and preparation methods, these 2 PFW causes mean familiarity absence. The last 2 categories consist of psychological factors, like overserving without awareness (because of fear of dread of not having enough to eat and going hungry and taking excessive food) and an attitude based on laziness (tough to eat/grueling foods and setting up of mini-buffets at the table. This diversity of PFW causes a challenge in obtaining accurate figures because all of these have a significant impact on FW during serving. However, one important advantage consists of the fact that each one of these causes may be a target for interventions meant to cut down on PFW (Dolnicar and Juvan, 2019, p.2; Dolnicar *et al*, 2020, p.1).

4.2. Strategies for PFW management

A recent area of research has focused on creating and testing experimental strategies to reduce HoReCa's sector negative environmental impact (Juvan *et al*, 2021, p.2). Accounting for a large percentage (34%) of the total food wastage in restaurants and having daily quantitative values per guest of 15g within breakfast buffets and 233g spread out over the day's meals in hotels, PFW management requires a set of reduction strategies (Dolnicar, 2020a, p.1; Filimonau *et al*, 2020, p.10). Some potential strategies designed to curb PFW can be classified into four categories: modifying choice architecture, strengthening social norms, shifting beliefs and enhancing enjoyment (Dolnicar, 2020b, p.3; Dolnicar, 2020b, p.4).

Reducing plate sizes and placing a table sign encouraging visitors to return to the buffet as frequently as they like are effective strategies to change choice architecture, as well as to leverage social norms (Juvan *et al*, 2021, p.2). Taking into consideration that beliefs are seen as being crucial for behavior change and the idea that people are influenced by those around them, these two strategies, when combined, prevent PFW by 20% in the case of the first, respectively 21% in the case of the second one, within hotel breakfast buffets (Dolnicar, 2020b, p.4; Dolnicar, 2020b, p.5; Kallbekken and Sælen, 2013, p.325). Both of them worked very well and while the reduction of plate sizes consisted of a 3 cm reduction and provided the advantage of lowering meal expenses for hotels while maintaining high levels of customer satisfaction, the use of a table sign stimulating guests to attend the buffet as often as they like, highlighted by explaining them that this is far preferable to consuming a large amount of food at once, contributed to a PFW cut from 48 kg to 34 kg per hotel, as well as per day (Juvan *et al*, 2021, p.2; Kallbekken and Sælen, 2013, p.326). On one side, the table sign strategy (based on social norms) demanded cognitive processing from visitors. On the other

side, the plate size reduction strategy (based on changes in choice architecture) was an infrastructure modification and didn't need any cognitive processing. Even if visitors were free to visit the buffet as frequently as they liked and they could generate as much FW on plates as they wanted, these strategies have been successful in the hotel setting (Dolnicar *et al*, 2020, p.2). In addition, strategies based on awareness programs by offering social cues have received a lot of attention from researchers in order to reduce PFW. When the proper message is conveyed to the groups who leave more food on their plates, for example, awareness efforts (e.g. provided by posters) are more likely to be effective. There are numerous examples documented in the literature when this strategy was successful, despite the fact that it is still unable to form a firm judgment about its efficacy (Dhir *et al*, 2020, p.7; Vizzoto *et al*, 2021, p.2). For various establishments, these strategies had varying degrees of effectiveness. In the case of restaurants, smaller plates were more successful than awareness programs provided by posters, as well as in the context of all-you-can-eat buffet units, leading to a decrease in plate waste by 30% (Dhir *et al*, 2020, p.7; Ravandi and Jovanovic, 2019, p.556). Within an university dining facility and a canteen, PFW was reduced by 15% as a result of using print messages that are functionally persuasive like: "Don't Waste Food", "Ask for the proper amount of food!" or "All Taste No Waste" (Cozzio *et al*, 2021, p.3211). Moreover, there was a shift in students' beliefs around FW done by written prompts using messages that highlight the social norm in behavioral contexts, such as: "Dining works hard to reduce waste. You can too" (Ellison *et al*, 2019, p.280). It could be the first step toward changing behavior and making the transition to sustainable consumer behavior. By using functional appeals (which put the emphasis on a logical information process), consumers become sensitives, leading to a change in their behavior regarding both favorable effects of desirable behavior (e.g. saving leftovers) and negative effects of undesirable behavior (e.g. PFW) (Cozzio *et al*, 2021, p.3210; Cozzio *et al*, 2021, p.3211).

In an experiment aimed primarily at families, increasing enjoyment was employed as a strategy for PFW reduction. By introducing stamps and gifts, FW produced by families at a dinner buffet was decreased by 34% (Juvan *et al*, 2020, p.2). Every time there was no plate waste in a day, the waiter stamped the booklet for each family, for that day. A certificate and a gift (e.g. a ball, a phone case) were given to the family at check-out if they were successful in obtaining one stamp for every day they stayed in that unit (Dolnicar *et al*, 2020, p.3). Additionally, the game boosted kids' holiday happiness while promoting a typical parental message among travelers from central Europe: food shouldn't be wasted (Juvan *et al*, 2021, p.2) Stamp collection booklet and the prizes families received for the entire booklet completion, have increased their enjoyment of their trip. This fact is a strong argument in favor of the great utility of this strategy in order to manage PFW (Dolnicar *et al*, 2020, p.3). Similarly, giving out complimentary chocolate at the end of the meal to staff members who did not leave plate waste behind was successful in minimizing PFW by 60% within a staff canteen (Windrum, 2014).

Industry organizations and experts give a variety of suggestions in addition to these scientifically validated strategies (Juvan *et al*, 2021, p.2). Focusing on the internal operations of hospitality companies can be found a reduction of portion sizes or a menu designed for kids, as well as providing take-home and doggy containers (Cozzio *et al*, 2021, p.3210; Vizzoto *et al*, 2021, p.3). According to Freedman and Brochado (2010), a decrease from 88 g to 44 g in the portion sizes of French fry in a university cafeteria resulted in a reduction in PFW by 86%. In order to manage edible waste, leftovers could be put in containers for takeout at home or to be donated. Especially when dining out, it is rarely an easy choice. The overall effect of many benefits and constraints that influence the associated consumer behavior is to take leftovers home in doggy bags (Mirosa *et al*, 2018, p.565). The challenges associated with doggy bags comes from customers' embarrassment (social stigma) when they request or accept these type of bags. To prevent a bad customer experience, managers didn't ask their table employees to provide this option (Vizzoto *et al*, 2021, p.3). On one hand, customers in situational circumstances, like dining with someone they wish to impress, can deny taking leftovers because doing this could be seen as going against social norms. On the other hand, social norms such as environmental concerns or the idea that food is suitable for consumption could encourage them to use take-home containers (Hamerman *et al*, 2018, p.95). Vizzoto *et al* (2021) found that most customers agree to take home unconsumed plate food and only 27% of them avoid asking for a doggy bag, in a study conducted in Italy. In addition to being consumed by the guests, leftovers fit for consumption may also be redistributed among the employees or donated to a charitable organization,

and leftovers that inappropriate for human eating can be composted for feeding animals (Dhir *et al*, 2020, p.8; Okumus, 2020, p.295).

Typically, due to enhanced consumers' anonymity and their perception of food abundance, all-you-can-eat buffet-style establishments encourage an increase in food waste (Cozzio *et al*, 2021, p.3209). Interventions like providing a la carte meals, creating menus that feature popular foods, educating customers on how to consume novel foods, serving tasting plates, reducing the excessive variety of meals, lowering the sense of plenty of food, as well as educating customers about the harm that PFW causes to the environment can be useful in PFW reduction (Juvan *et al*, 2021, p.2; PATA, 2018). For instance, educating diners at a university canteen resulted in a 25% reduction in plate waste (Dolnicar *et al*, 2020, p.2). Moreover, because it is difficult to balance the food supply and demand, the staff typically overcooks, which usually results in leftovers. An excellent way to avoid wasting these leftovers consists of utilizing digital platforms called Last-Minute Markets. The foodservice establishment can benefit from them by providing a deal on surpluses after working time. This results in a FW cut and a rise in profits. Nowadays, most businesses employ several delivery apps (Vizzoto et al, 2021, p.3).

5. Conclusions

Although HoReCa sector generates a significant amount of food waste, it received less attention than other food waste generators (farms and households). The plate food waste is an important source of food waste, accounting for one-third of the total food waste in this industry. Attitudinal, geographical and cultural factors, as well as factors regarding age, gender and level of income can have a possible impact or can be related to the causes of plate food waste. On one hand, there are causes coming from foodservice unit management, like low food quality, lack of experience in preparing and combining some foods or using too large plates and, on the other hand, there are causes related to consumers' behaviors, including overserving by taking too much food (possibly due to the fear of going hungry) and laziness attitudes such as leaving tough to eat foods on the plate or setting up of mini-buffets at the table. In order to reduce the plate food waste, some strategies were specially developed, like reducing plate size, encouraging guests to visit the buffet as often as they like, using persuasive messages to enhance customer awareness, introducing stamps and gifts, providing take-home and doggy containers, reducing the excessive variety of meals and the sense of plenty of food or serving tasting plates. These methods were scientifically proven to lower plate food waste.

6. References

- Aamir, M., Ahmad, H., Javaid, Q., Hasan, S.M., 2018. Waste not, want not: a case study on food waste in restaurants of Lahore, Pakistan. *Journal of Food Products Marketing*, 24, pp. 591-610. https://doi.org/10.1080/10454446.2018.1472695
- Ai, N., Zheng, J., 2019. Community-based food waste modeling and planning framework for urban regions. *Journal of Agriculture, Food Systems, and Community Development*, 9 (1), pp. 39-58. https://doi.org/10.5304/jafscd.2019.091.009
- Barr, S., 2007. Factors influencing environmental attitudes and behaviors: a uk case study of household waste management. *Environment and Behavior*, 39 (4), pp. 435-473. https://doi.org/10.1177/0013916505283421
- Betz, A., Buchli, J., G€obel, C., Müller, C., 2015. Food waste in the Swiss food service industry e magnitude and potential for reduction. *Waste Management*, 35, pp. 218-226. https://doi.org/10.1016/j.wasman.2014.09.015
- Bilska, B., Tomaszewska, M., Kołozyn-Krajewska, D., 2022. The Management of Meals in Food Service Establishments in the Context of Food Waste—Results of Focus Group Interviews with Employees and Owners. *Sustainability*, 14, 9258. https://doi.org/10.3390/su14159258
- Bohdanowicz, P., 2005. European hoteliers' environmental attitudes: greening the business. *Cornell Hotel and Restaurant Administration Quarterly*, 46(2), pp. 188-204. https://doi.org/10.1177/0010880404273891
- Bohdanowicz, P., 2006. Responsible resource management in hotels – attitudes, indicators, tools and strategies. [online] Available at:

<http://www.diva-portal.org/smash/get/diva2:10873/FULLTEXT01.pdfPaulina> [Accessed 20 November 2022].

- BSR, 2012. Food waste study – tier 1 assessment. [online] Available at: <https://www.foodwastealliance.org/wp content/uploads/2020/05/FWRA_BSR_Tier1_FINAL.pdf> [Accessed 21 November 2022].
- Cox, J., Downing, P., 2007. Food behaviour consumer research: quantitative phase [online] Available at:< https://wrap.org.uk/sites/default/files/2020-12/Food-behaviour-consumer-research-quantitative-phase.pdf > [Accessed 21 November 2022].
- Cozzio, C., Tokarchuk, O., Maurer, O., 2021. Minimising plate waste at hotel breakfast buffets: an experimental approach through persuasive messages. *British Food Journal*, 123(9), pp. 3208-3227. https://doi.org/10.1108/BFJ-02-2021-0114
- Dhir, A., Talwar, S., Kaur, P., Malibari, A., 2020. Food waste in hospitality and food services: A systematic literature review and framework development approach. *Journal of Cleaner Production*, 270, 122861. https://doi.org/10.1016/j.jclepro.2020.122861
- Dolnicar, S., Juvan, E., 2019. Drivers of plate waste: A mini theory of action based on staff observations (research note). *Annals of Tourism Research*, 78, 102731.
- Dolnicar, S., 2020a. Eat up! Prevention of plate waste in tourism and hospitality: a perspective paper. *Tourism Review*. https://doi.org/10.31235/osf.io/5jfzd
- Dolnicar, S., 2020b. Designing for more environmentally friendly tourism. *Annals of Tourism Research*, 84, 102933. https://doi.org/10.1016/j.annals.2020.102933
- Dolnicar, S., Juvan, E., Grün, B., 2020. Reducing the plate waste of families at hotel buffets – A quasi-experimental field study. *Tourism Management*, 80, 104103. https://doi.org/10.1016/j.tourman.2020.104103
- Ellison, B., Savchenko, O., Nikolaus, C.J. and Duff, B.R., 2019. "Every plate counts: evaluation of a food waste reduction campaign in a university dining hall". *Resources, Conservation and Recycling*, 144, pp. 276-284. https://doi.org/10.1016/j.resconrec.2019.01.046
- FAO, 2011. Global food losses and food waste. Extent, causes and prevention. [online] Available at:< https://www.fao.org/3/i2697e/i2697e.pdf > [Accessed 21 November 2022].
- FAO, 2014. Global Initiative on Food Losses and Waste Reduction. [online] Available at:< https://www.fao.org/3/i4068e/i4068e.pdf > [Accessed 21 November 2022].
- Filimonau, V., Todorova, E., Mzembe, A., Sauer, L., Yankholmes, A., 2020. A comparative study of food waste management in full service restaurants of the United Kingdom and the Netherlands. *Journal of Cleaner Production,* 258, 120775. https://doi.org/10.1016/j.jclepro.2020.120775
- Freedman, M.R., Brochado, C., 2010. Reducing portion size reduces food intake and plate waste. *Obesity*, 18(9), pp. 1864-1866. https://doi.org/10.1038/oby.2009.480
- Godfray, H.C.J., Beddington, J.R., Crute, I. R., Haddad, L., Lawrence, D., Muir, J.F., Pretty, J., Robinson, S., Thomas, S.M., Toulimn, C., 2010. Food Security: The Challenge of Feeding 9 Billion People. *Science*, 327(5967), pp. 812-818. https://doi.org/10.1126/science.1185383
- Hamerman, E.J., Rudell, F., Martins, C.M., 2018. Factors that predict taking restaurant leftovers: strategies for reducing food waste. *Journal of Consumer Behaviour*, 17(1), pp. 94-104. https://doi.org/10.1002/cb.1700
- Ilakovac, B., Voca, N., Pezo, L., Cerjak, M., 2020. Quantification and determination of household food waste and its relation to sociodemographic characteristics in croatia. *Waste Management*. 102, pp. 231-240. https://doi.org/10.1016/j.wasman.2019.10.042
- Juvan, E., Grün, B., Dolnicar, S., 2018. Biting off more than they can chew: Food waste at hotel breakfast buffets. *Journal of Travel Research*, 57(2), pp. 232-242. https://doi.org/10.1177/0047287516688321
- Juvan, E., Grün, B., Baruca, P.Z., Dolnicar, S., 2021. Drivers of plate waste at buffets: A comprehensive conceptual model based on observational data and staff insights. *Annals of Tourism Research Empirical Insights*, 2(1). https://doi.org/10.1016/j.annale.2021.100010
- Kallbekken, S., Sælen, H., 2013. 'Nudging' hotel guests to reduce food waste as a win–win environmental measure. *Economics Letters*, 119, pp. 325-327. https://doi.org/10.1016/j.econlet.2013.03.019
- Koivupuro, H.K., Hartikainen, H., Silvennoinen, K., Katajajuuri, J.M., Heikintalo, N., Reinikainen, A., Jalkanen, L., 2012. Influence of socio-demographical, behavioural and attitudinal factors on the amount of avoidable food waste generated in finnish households. *International Journal of Consumer Studies,* 36(2), pp. 183-191. https://doi.org/10.1111/j.1470-6431.2011.01080.x

- Kretschmer, B., Smith, C., Watkins, E., Allen, B., Buckwell, A., Desbarats, J., Kieve, D., 2013. Recycling agricultural, forestry & food wastes and residues for sustainable bioenergy and biomaterials, *Technology Options for Feeding 10 Billion People*. [online] Available at:< https://www.europarl.europa.eu/RegData/etudes/etudes/join/2013/513513/IPOL-JOIN_ET(2013)513513_EN.pdf> [Accessed 23 November 2022].
- Okumus, B., 2020. How do hotels manage food waste? evidence from hotels in Orlando, Florida. *Journal of Hospitality Marketing & Management*. 29(3), pp. 291-309. https://doi.org/10.1080/19368623.2019.1618775
- Marthinsen, J., Sundt, P., Kaysen, O., Kirkevaag, K., 2012. *Prevention of Food Waste in Restaurants, Hotels, Canteens and Catering.* [online] Available at:< http://norden.diva-portal.org/smash/get/diva2:701203/FULLTEXT01.pdf> [Accessed 21 November 2022].
- McAdams, B., von Massow, M., Gallant, M., Hayhoe, M.-A., 2019. A cross industry evaluation of food waste in restaurants field study. *Journal of Foodservice Business Research*, pp. 449-466. https://doi.org/10.1080/15378020.2019.1637220
- Mirosa, M., Liu, Y., Mirosa, R., 2018. Consumers behaviors and attitudes toward doggy bags: identifying barriers and benefits to promoting behavior change. *Journal of Food Products Marketing*, 24(5), pp. 563-590. https://doi.org/10.1080/10454446.2018.1472699
- Papargyropoulou, E., Wright, N., Lozano, R., Steinberger, J., Padfield, R., Ujang, Z., 2016. Conceptual framework for the study of food waste generation and prevention in the hospitality sector. *Waste Management*, 49, pp. 326-336. https://doi.org/10.1016/j.wasman.2016.01.017
- Papargyropoulou, E., Steinberger, J.K., Wright, N., Lozano, R., Padfield, R., Ujang, Z., 2019. Patterns and Causes of Food Waste in the Hospitality and Food Service Sector: Food Waste Prevention Insights from Malaysia. *Sustainability*, 11(21), 6016. https://doi.org/10.3390/su11216016
- Parfitt, J., Barthel, M., Macnaughton, S., 2010. Food Waste within Food Supply Chains: Quantification and Potential for Change to 2050. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 365, pp. 3065-3081. https://doi.org/10.1098/rstb.2010.0126
- PATA, 2018. *Building an Understanding For Food Excess in Tourism*. [online] Available at:< https://www.oneplanetnetwork.org/sites/default/files/from-crm/buffet_2019_final.pdf> [Accessed 21 November 2022].
- Pirani, S.I., Arafat H.A., 2014. Solid waste management in the hospitality industry: A review. *Journal of Environmental Management*, 146, pp. 320-336. https://doi.org/10.1016/j.jenvman.2014.07.038
- Pirani, S.I., Arafat, H.A., 2016. Reduction of food waste generation in the hospitality industry. *Journal of Cleaner Production*, 132, pp. 129-145. https://doi.org/10.1016/j.jclepro.2015.07.146
- Principato, L., Pratesi, C.A., Secondi, L., 2018. Towards zero waste: an exploratory study on restaurant managers. *International Journal of Hospitality Management*, 74, pp. 130-137. https://doi.org/10.1016/j.ijhm.2018.02.022
- Radwan, H.R.I., Jones, E., Minoli, D., 2012. Solid waste management in small hotels: a comparison of green and non-green small hotels in Wales. *Journal of Sustainable Tourism*, 20(4), pp. 533-550. https://doi.org/10.1080/09669582.2011.621539
- Ravandi, B., Jovanovic, N., 2019. Impact of plate size on food waste: agent-based simulation of food consumption. *Resources, Conservation and Recycling*, 149, pp. 550-565. https://doi.org/10.1016/j.resconrec.2019.05.033
- Sebbane, M., Costa, S., 2018. Food leftovers in workplace cafeterias: an exploratory analysis of stated behavior and actual behavior. *Resources, Conservation and Recycling*, 136, pp. 88-94. https://doi.org/10.1016/j.resconrec.2018.04.015
- Seberini, A., 2020. Economic, social and environmental world impacts of food waste on society and Zero waste as a global approach to their elimination. *SHS Web of Conferences*, 74, 03010. https://doi.org/10.1051/shsconf/20207403010
- Silvennoinen, K., Heikkilä, L., Katajajuuri, J.M., Reinikainen, A., 2015. Food waste volume and origin: case studies in the finnish food service sector. *Waste Management*, 46, pp. 140-145. https://doi.org/10.1016/j.wasman.2015.09.010
- Silvennoinen, K., Nisonen, S., Pietiläinen, O., 2019. Food waste case study and monitoring developing in Finnish food services. *Waste Management*, 97, pp. 97-104. https://doi.org/10.1016/j.wasman.2019.07.028
- Soma, T., 2019. Space to waste: the influence of income and retail choice on household food consumption and food waste in indonesia. *International Planning Studies*, 25(4), pp. 372-392. https://doi.org/10.1080/13563475.2019.1626222

- Stenmarck, Å., Jensen, C., Quested, T., Moates, G., 2016. *Estimates of European food waste levels*. [online] Available at: <https://www.researchgate.net/publication/301216380_Estimates_of_European_food_waste_levels> [Accessed 23 November 2022].
- Stoica D., Micu A.E., Stoica M., 2022. The Impact of Economic Drivers on Food Loss Management. *Ovidius University Annals. Economic Sciences Series*, 1, pp. 753-761.
- Sustainable Restaurant Association, 2010. *Too good to waste: Restaurant food waste survey report (2010).* [online] Available at:< https://docplayer.net/29065730-Too-good-to-waste-welcome-sustainable-restaurant-association-restaurant-food-waste-survey-report-2010.html > [Accessed 24 November 2022].
- Szabó-Bódi, B., Kasza, G., Szakos, D., 2018. Assessment of household food waste in hungary. *British Food Journal*, 120(3), pp. 625-638. https://doi.org/10.1108/BFJ-04-2017-0255
- Tostivint, C., Ostergren, K., Quested, T., Soethoudt, H., Stenmarck, A., Svanes, E., O'Connor, C., 2016. *Food Waste Quantification Manual to Monitor Food Waste Amounts and Progression.* [online] Available at: <https://www.eu-fusions.org/phocadownload/Publications/FUSIONS%20Food%20Waste%20Quantification%20Manual.pdf> [Accessed 22 November 2022].
- Vizzoto, F., Tessitore, S., Testa, F., Iraldo, F., 2021. Plate waste in foodservice outlets: Revealing customer profiles and their support for potentially contentious measures to reduce it in Italy. *Resources, Conservation and Recycling*, 174, 105771. https://doi.org/10.1016/j.resconrec.2021.105771
- Wang, L., Liu, G., Liu, X., Liu, Y., Gao, J., Zhou, B., Gao, S., Cheng, S., 2017. The weight of unfinished plate: a survey based characterization of restaurant food waste in Chinese cities. *Waste Management*, 66(3). https://doi.org/10.1016/j.wasman.2017.04.007
- Windrum, E., 2014. *Intercon cuts food waste among employees with new campaign*. [online] Available at:< https://dohanews.co/qatar-organizations-responding-countrys-high-food-waste/> [Accessed 29 November 2022].
- WRAP, 2013. *Overview of Waste in the UK Hospitality and Food Service Sector*. [online] Available at: <https://wrap.org.uk/sites/default/files/2020-10/WRAP-Overview%20of%20Waste%20in%20the%20UK%20Hospitality%20and%20Food%20Service%20Sector%20FINAL.pdf> [Accessed 30 November 2022].