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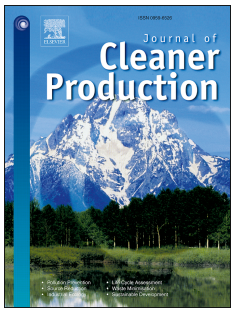

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A comparative study of food waste management in full service restaurants of the United Kingdom and the Netherlands

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Abstract

The EU-28's food service sector generates excessive amounts of food waste. This notwithstanding, no comparative, cross-national research has ever been undertaken to understand how food waste is managed in restaurants across the EU-28. This study contributes to knowledge by presenting a first attempt to conduct a comparative analysis of restaurant food waste management practices in the UK and the Netherlands. It finds that although restaurateurs in both countries use demand forecasting as a prime approach to prevent food waste, forecasting does not always work. When this happens, food waste management programmes such as repurposing excess foodstuffs, redistribution of surplus food and consumer choice architecture are mostly considered commercially unviable. To improve the effectiveness of food waste management in the food service sectors of the UK and the Netherlands it is necessary to ensure that food waste mitigation becomes a corporate target for restaurateurs and the progress towards its achievement is regularly monitored by top management. This corporate commitment should be facilitated by national policy-makers, but also by EU regulators, by raising consumer awareness of food waste, incentivising surplus food redistribution and enabling food waste recycling.

Keywords

Environmental impact

Food waste

Full service restaurant

Mitigation

Sustainable food practice

Highlights

- Food waste management practices in full service restaurants of the UK and the Netherlands are compared
- Demand forecasting, staff meal preparation and passive disposal are the dominant practices in both markets
- Good practices in food waste management are available in both markets but not widely used
- These are represented by the re-purpose of surplus ingredients, on-site food waste recycling, portion control and food-to-go boxes
- Determinants of (broader) cross-national application of these good practices are discussed

Introduction

The problem of food waste is receiving growing recognition due to its significant negative socio-economic and environmental impacts (Parfitt *et al.* 2010). Concurrently, the need to feed the increasing global population has become a major societal challenge as the associated rise in food demand depletes natural resources, pollutes the environment and exacerbates poverty (Godfray *et al.* 2010). This challenge can be at least partially addressed by reducing wastage generated throughout the global food supply chain (Alexander *et al.* 2017).

The sector of food service provision – our focal sector – is the third largest food waste generator in the EU-28, right after households and agriculture/food processing industries (Katsarova 2016). About 75% of this wastage is categorised as avoidable, thus showcasing food service/catering as a prime target for food waste reduction (Oliveira *et al.* 2016). This target becomes particularly relevant in light of the growing need for sustainable food practices outside home which will offer opportunities to reduce food wastage within the national sectors of food service provision in the EU-28 (FUSIONS 2016).

Due to the well-established markets of out-of-home food consumption, the sectors of food service provision in the 'older' EU member states waste disproportionally large amounts of food (Monier *et al.* 2010). For example, a combined contribution of the six 'older' EU members (UK, Germany, Italy, Spain, France and the Netherlands) to food service/catering waste is estimated as circa 9.3 million tonnes, or 76% of the EU-28's sectoral total (Kretschmer *et al.* 2013). The need to mitigate this excessive wastage has been politically recognised, with the European Commission assigning sector- and country-specific reduction targets in order to transit the EU-28 member states towards the Circular Economy and to fulfil the United Nations Sustainable Development goals (Katsarova 2016).

Meanwhile, restaurateurs are gradually recognising the business, as well as the moral, case of mitigating food waste (Martin-Rios *et al.* 2018). It is important to sustain this trend by providing empirical research demonstrating the benefits of food waste mitigation strategies to industry professionals (Filimonau and de Coteau 2019). Little systematic empirical work has, however, been undertaken to date on food waste management in the national sectors of food service provision in the EU-28 (Filimonau *et al.* 2019b). This hinders understanding of the most commercially viable approaches to food waste management with a subsequent lack of analysis of how these could be more broadly adopted across the sector, but also within the different markets of out-of-home food consumption (Pirani and Arafat 2016).

Based on above, the paper aims to answer the following research question(s): what approaches to food waste management are adopted by restaurateurs in the UK and the Netherlands, how are these approaches similar / different and what factors determine the (in)effectiveness of commercial adoption of these approaches in the two food consumption markets in question? The contribution of this paper is thus threefold. First, it extends our knowledge about sustainable food practices by demonstrating that the challenge of food waste management in restaurants is complex and multifaceted, and that a (more) holistic outlook is necessary to enable a better understanding of its drivers. Previous research has shown that restaurants waste substantial quantities of food in their kitchen (SRA 2010; Winnow 2018; WRAP 2013c) while this study revealed a significant proportion of food waste arising from customer plates, thus highlighting consumer behaviour as a prime mitigation target. Second, our study departs from previous research (Betz *et al.* 2015; Papargyropoulou *et al.* 2016; Principato *et al.* 2018) in that it enhances knowledge of the main factors that can enable or, in the opposite, deter effective mitigation of food waste in restaurants. Lastly, the study represents the first known attempt to undertake a comparative analysis of the challenge of food waste in two 'mature' markets of out-of-home food consumption in the EU-28, i.e. the

United Kingdom and the Netherlands. The choice of these two EU countries is driven by such factors as data availability and convenience but, most importantly, by the fact that their national sectors of food service provision account for excessive quantities of food waste. Kretschmer *et al.* (2013) estimate the UK to be the EU's largest producer of restaurant food waste and the Netherlands to be in the EU's top-6. By comparing the UK and the Netherlands, besides revealing the main drivers of food waste generation, establishing approaches to mitigation and uncovering the determinants of their successful implementation by restaurateurs, the study identifies best practices in the management of restaurant food waste and elaborates upon the feasibility of their broader adoption across the two consumption markets in question.

Background of studied markets

Restaurant food waste in the UK and the Netherlands

The UK

The market of out-of-home food consumption in the UK is well-established, yet rapidly developing (Mintel 2019). After a short decline in 2009 prompted by global financial recession, it has demonstrated a steady growth ever since, both in terms of its overall financial significance and the number of business ventures in operation. In 2017, there were over 86000 food service providers in the UK (Statista 2019), generating a market value of circa £74 billion in 2018 (Mintel 2019). It is anticipated that the market value of the sector will grow to £83 billion by 2023, or by 12%, driven by increased income and generational changes in consumer demand (Mintel 2019).

The steady growth of the UK market of out-of-home food consumption has triggered the challenge of food waste within the national sector of food service provision. WRAP

(2015) estimates that the sector generates circa 0.9 million tonnes of food waste per year, with 70% of wastage occurring in restaurants, 17% - in hotels and 13% - in leisure-related business ventures (WRAP 2013c). The figures provided by Kretschmer *et al.* (2013) pinpoint an even larger magnitude of food wastage in the UK sector of food service provision, i.e. 3 million tonnes, but offer no cross-sectoral disaggregation of the main contributors. According to WRAP (2013d), one complete meal out of six is wasted in the UK food service sector which equates to about 1.3 billion meals thrown away annually. As a result, SRA (2010) posits that an average UK restaurant wastes 21 tonnes of food every year. This wastage costs UK restaurateurs at least £0.7 billion per year, or almost £1 per meal, on average (WRAP 2013b). It is estimated that mitigating food waste could save UK food service providers up to £6000 a year which is a considerable figure for most small-to-medium-sized enterprises that prevail within the sector (SRA 2010).

Despite the substantial magnitude of the challenge of food waste in the UK sector of food service provision, the related agenda of academic research is under-developed, especially in terms of providing empirical evidence on the major drivers of wastage as well as the determinants of effective mitigation. Although these issues have been considered in the context of hospital contract catering (see Williams and Walton 2011 for a review), the sub-sector of restaurants has largely been excluded from analysis. The empirical work by Youngs et al. (1983) is dated while the study by Filimonau *et al.* (2019) focused on coffee shops that sit on the verge of food service and retail. Likewise, the work by Radwan *et al.* (2012) concentrated on hotels, thus highlighting food waste in UK restaurants as an academically under-examined domain.

The Netherlands

Similarly, the Dutch out-of-home food consumption market has witnessed substantial growth in recent years except for a slight dip in 2009 (Kouwenhoven *et al.* 2012). This growth is attributed to the prevalence of snacking among Millennials which is gradually eroding the traditional three meal-pattern a day. Residents here tend to eat at workplace, while traveling and in social outings with friends. According to the Geurts *et al.* (2017), out-of-home consumption accounted for 31.7% of the total food expenditure in the Netherlands. On its part, the FoodService Instituut Nederland (2017) reports out-of-home food consumption sales of US$11.8 billion or almost 90% of total foodservice sales in 2016.

There are over 20000 licensed restaurant operators in the Netherlands (Koninklijke Horeca Nederland 2019). In terms of annual sales, these generated US$4582 million in 2011 compared to US$5335 million in 2016. The increased sales are largely driven by positive outlook of the Dutch economy, the demographic changes and changes in lifestyles, and it is expected that this sub-sector will grow by 4% by 2021 (FoodService Instituut Nederland 2017).

With respect to food waste, the exact magnitude of its occurrence in the Dutch sector of food service remains unclear. While Kouwenhoven *et al.* (2012) estimate that Dutch restaurants discard about 51000 tonnes of food with a value of over €235 million, Kretschmer *et al.* (2013) suggest a significantly higher figure of 446000 tonnes of food waste generated in the Netherlands annually. Three main reasons have been identified for the high food waste here. Among the reasons, two are particularly relevant to this study: (1) food service businesses do not know how to prevent or reduce food waste; and (2) they lack awareness of the growing detrimental societal impact of restaurant food waste (Kouwenhoven *et al.* 2012).

Literature review

Food waste in food service provision

Due to the lack of empirical studies, the precise magnitude of food waste within the sector of food service provision is difficult to establish (Filimonau and de Coteau 2019). The paucity of research is largely attributed to the challenges of primary data collection and systematisation (Pirani and Arafat 2016). Defining food waste can be problematic, and there is often no clear differentiation, especially from the managerial viewpoint, between food 'waste' and food 'loss' (Okazaki *et al.* 2008). It may, therefore, be more appropriate to use the term 'wasted food' as it is more explicit in highlighting deliberate human action in its generation (Neff *et al.* 2015). Second, food service managers do not always possess the skills to identify, and then accurately quantify, the main food waste flows within their businesses and to characterise their occurrence (Sakaguchi *et al.* 2018). In many cases, the assessments of food waste in restaurants are restricted to rough managerial estimates, or even guestimates, of the volumes of wasted food, such as, for example, *the X number of the X volume garbage bins produced in a restaurant with a X period of time*, thus affecting data quality (Filimonau *et al.* 2019b). Third, besides the food waste data being of insufficient quantity and quality, managers of food service enterprises are often reluctant to share these data (Beretta *et al.* 2013). This is partially due to perceived commercial sensitivity of the topic of food waste, with the potential it holds to endanger business image and corporate reputation if the data on food wastage are released to the public, with consequent managerial unwillingness to discuss it with researchers (Hermsdorf *et al.* 2017). Lastly, the aggregation of primary data on food waste is challenging as the sector of food service provision is highly diverse, meaning that the data on the quantity and the character of wasted food from one restaurant may not represent the rest of the sector (Garrone *et al.* 2014). Further, there are significant variations across the geographical markets of out-of-home food consumption, suggesting that the data on food wastage from the restaurants in one country cannot be used to characterise the restaurants of the same category

in another country (Dutta *et al.* 2008). These challenges call for more empirical research on food waste as produced by the different types of restaurants in order to obtain (more) reliable, sector-representative figures (Papargyropoulou *et al.* 2016). This further necessitates comparative study on restaurant food waste, which could highlight important cross-national differences and similarities between consumption markets (Marthinsen *et al.* 2012). Such a systematic, comparative investigation will enable a better understanding of the market-specific drivers of food waste occurrence and aid in establishing the market-specific determinants of its effective mitigation (Filimonau and de Coteau 2019).

Drivers of food wastage

In the absence of accurate figures on restaurant food waste derived by academics, a number of industry reports have been produced to describe its occurrence. WRAP (2013b) suggests that food wastage in restaurants emerges from the three major sources, i.e. when preparing food (45%), from customer plates (34%), and due to in-transit and on-site spoilage (21%). SRA (2010) estimates that restaurants generate 65% of food waste in kitchens while customer plates and spoilage account for 30% and 5% of wastage, respectively. As effectively summarised by Winnow (2018), over 70% of food is wasted in food service provision before it even reaches customer plates, which is due to over-supply of foodstuffs, over-production of meals and human errors when handling and cooking food.

The relative share of food wastage across the different operational areas of a restaurant business can vary significantly depending, inter alia, on the category of food service establishment, but also on the type of occasions at which the food is consumed (SRA 2010). For example, fine dining restaurants may produce excessive wastage in cooking as the food served here has to be of the highest quality and aesthetic standards given a high price tag

attached (Charlebois *et al.* 2015). In contrast, fast food restaurants report substantial wastage arising from customer plates. This is due to highly standardised food preparation processes and serving procedures adopted herewith, but also because of irresponsible consumer behaviour which is often prompted by relative affordability of fast food (Katajajuuri *et al.* 2014). Likewise, food consumption at events and functions generates excessive wastage due to the need for people to socialise (Pirani and Arafat 2016). This is in contrast to so-called 'functional' occasions of out-of-home food consumption, such as eating out in work canteens, where food waste is less likely to occur due to a more utilitarian function of this meal type, i.e. to satisfy hunger (WRAP 2013d).

While the wastage attributed to spoilage in food service provision seems relatively low, i.e. 5-21%, depending on a source of estimates (SRA 2010; WRAP 2013b), it arguably represents the most challenging category of food waste to address from the managerial perspective (Filimonau and de Coteau 2019). Indeed, there is a direct relationship between food spoilage on the one hand and food storage and stock management on the other (Winnow 2018). For example, such operational procedures as ordering the 'right' amount of foodstuffs through accurate forecasting of consumer demand as well as regular stock rotation can significantly reduce food waste through spoilage (WRAP 2013a). While these operational procedures may seem straightforward, they are in fact the most difficult tasks for restaurant managers to fulfil, which is due to high seasonality and unpredictable nature of customer demand for food in the out-of-home settings (Papargyropoulou *et al.* 2016).

Food waste mitigation measures

For effective mitigation, extant literature suggests that restaurant managers should first identify the operational areas within their business ventures where most food is wasted, as

well as the main drivers, and then to routinely intervene into these areas aiming to reduce occurrence of this wastage (Filimonau and de Coteau 2019). Underpinned by the classical (food) waste management hierarchy, the interventions that restaurateurs may choose to adopt should prioritise prevention of food waste occurrence over passive disposal of wasted food (Papargyropoulou *et al.* 2016). Indeed, the foremost potential to minimise food wastage rests in accurate demand forecasting as it prevents over-supply of foodstuffs and over-production of meals with a subsequently reduced probability of spoilage (Filimonau *et al.* 2019b). While arguably being most effective, accurate demand forecasting is concurrently the most challenging mitigation opportunity to adopt in the context of out-of-home food consumption (Hu *et al.* 2004). In addition to high variations in consumer demand, as highlighted above, the success of such an intervention may depend on corporate policies, but also on the relationship a restaurant establishes with suppliers (Kasim and Ismail 2012). With respect to corporate policies, managers who are committed to reduce food waste involving storage and preparation are more likely to allocate a significant amount of resources for investments in sophisticated forecasting models (Filimonau and de Coteau 2019). Equally, establishing a good relationship with suppliers can be crucial in restaurants' drive towards food waste minimisation. Such a relationship can allow restaurant managers to order the 'right' quantities of food only when and if necessary (Derqui *et al.* 2016). Having good relationships with suppliers is of particular importance for independent, small-to-medium-sized, enterprises that constitute the largest portion of the national sectors of food service provision in the EU-28 (Eurostat 2019). This is due to their reduced bargaining power in comparison with large and chain-affiliated food service establishments (Filimonau *et al.* 2019b).

Inaccurate demand forecasting in restaurants leads to over-stocking of foodstuffs and/or over-production of meals (Papargyropoulou *et al.* 2016). The excess of foodstuffs should be repurposed while the surplus meals need to be redistributed to avoid wastage (Betz *et al.*

2015). There are a number of opportunities for restaurateurs to achieve this. First, any food surplus can be given to staff in the form of staff meals and/or as a reward (Filimonau *et al.* 2019b). Second, it can be reduced in price to facilitate quick sales while the redistribution of such discounted meals can be facilitated by smartphone technology (Filimonau and de Coteau 2019). Lastly, surplus food can be redistributed (donated) to charities that subsequently provide it to the people in need (Mourad 2016).

While these approaches have all been reported in the literature as practically viable, their ultimate success will depend on different organisational (internal) and institutional (external) factors that can have substantial cross-market variations (Filimonau and de Coteau 2019). For example, the effectiveness of food donations is determined by the legal landscape of the country where a restaurant operates (institutional factor), but also by managerial values and corporate vision adopted (organisational factor) (Filimonau *et al.* 2019b). While some EU-28 countries have already amended their legislation to streamline the redistribution of unsold food in grocery retail and food service, some countries are yet to implement such amendments (Thyberg and Tonjes 2016). Likewise, with respect to organisational factors, it is suggested that managerial values and corporate policies can have a major influence on how the surplus food can be utilised (Alexander and Smaje 2008). While some restaurants allow their managers to decide how/if to donate surplus food, some operate stringent corporate policies on, for example, health and safety, that prevent managers from engaging in food donations (Heikkilä *et al.* 2016). In addition, managers with strong moral norms and values can, at their discretion, allow their restaurants to donate surplus food to charities and homeless people (Irani *et al.* 2018).

To avoid food waste occurrence on customer plates, the principles of consumer choice architecture can be adopted by restaurateurs (Kallbekken and Sælen 2013). These can help to educate restaurant guests about the negative societal repercussions of food waste (Jagau and

Vyrastekova 2017). Restaurateurs can further appeal to customer moral norms in an attempt to trigger public regret of wasted food (Stöckli *et al.* 2018a). Next, managers can pro-actively reduce plate leftovers by offering customers the 'doggy bags' (Sirieix *et al.* 2017). Lastly, financial (dis)incentives can be applied by restaurateurs to 'nudge' more responsible behaviour (Dolnicar *et al.* 2019): for example, consumers can be charged for any plate leftovers or discounts can be provided to those guests who choose to order smaller portions (The Local 2016). Despite the significant potential held by the principles of consumer choice architecture to reduce wastage in the sector of food service provision, the related research agenda remains limited (Freedman and Brochado 2010). The prime reason for this is the reluctance of restaurateurs to experiment with nudging interventions in fear of possible 'backfire' effect from customers (Stöckli *et al.* 2018b).

If surplus food and/or food leftovers cannot be repurposed and/or redistributed, then they have to be disposed of. Although the classical (food) waste management hierarchy pinpoints disposal as the most reactive and, therefore, least preferred approach to food waste mitigation (Papargyropoulou *et al.* 2016), if organised properly, it can still minimise the complete loss of natural resources invested in food production. For example, wasted food can be recycled for material recovery via composting or anaerobic digestion (Kuczman *et al.* 2018). While food recycling is feasible in the sector of food service provision, its practical implementation is often constrained by the issues of space and aesthetics (Mbuligwe and Kassenga 2004). For example, food recycling bins can be bulky to store, which represents a major issue in the restaurants located in town centers where space is restricted; in addition, they can produce unpleasant odour.

The final, least desirable, approach to food waste management is passive disposal of wasted food (Pirani and Arafat 2016). Despite apparent simplicity, even this approach can be challenging to implement. This is because collections of commercial food waste can be poorly

organised (Thi *et al.* 2015) while the infrastructural and budgetary issues may prevent local authorities and private companies from collecting and disposing of food waste effectively (Sharholy *et al.* 2008).

In conclusion, it is important to note that existing studies on food waste management in the context of the sector of food service provision are gradually increasing in number (Filimonau and de Coteau 2019) which signifies growing political, public and academic concern of the alarming scale of this global societal challenge. In terms of research methodologies, existing studies employed the quantitative research paradigm (surveys and mass flow analysis) to quantify and characterise food waste in restaurants (Betz *et al.* 2015; Christ and Burritt 2017; Okazaki *et al.* 2008); concurrently, the qualitative methods of primary data collection (i.e. managerial and staff interviews) were utilised to examine managerial attitudes to food waste mitigation in restaurants and explore the effectiveness of specific mitigation approaches in use (Derqui *et al.* 2016; Goh and Jie 2019; Filimonau *et al.* 2019a). As this study focuses on managerial approaches to food waste mitigation in restaurants in the UK and the Netherlands, aiming to compare their effectiveness and identify good practices, it will thus take advantage of the qualitative research paradigm. The study's method is explained next.

Method

The study adopted a qualitative and descriptive case study approach (Yin 1989). This was considered the most appropriate approach given the exploratory and sensitive nature of the topic this project dealt with, i.e. restaurant food waste (Matthews and Ross 2014). The study is based on the experiences of restaurant managers in the UK and the Netherlands. It sheds light on the food waste management only in these two countries because of resource constraints for cross-national comparison of all 28 countries in the EU.

Managerial interviews represent a suitable tool for data collection as previous research has established that restaurant managers impose substantial influence on the amounts of wasted food in their establishments (Filimonau *et al.* 2019b) given the crucial role played in the design of kitchen processes and operational procedures (Heikkilä *et al.* 2016). Prior to interviews, a schedule was developed (Appendix 1). It focused on the participants' knowledge of and attitudes towards restaurant food waste and management practices adopted in-house to mitigate its occurrence. To ensure face and content validity, the schedule was based on previous research and tested on a handful of willing restaurant managers. The interviews in the UK were conducted in English while those in the Netherlands were conducted in both English and Dutch. Modifications to achieve content, textual and semantic equivalence were discussed among the bilingual peers (Chapman and Carter 1979).

Data were generated through a series of in-depth semi-structured interviews with managers of full service restaurants. For the purpose of this study, full service restaurants are defined as eating places where customers are seated and that operate with a full menu selection option. It excludes such commercial outlets as fast food restaurants, mobile food stands/kiosks and workplace cafeterias. The focus on full service restaurants was deliberate given they hold the largest share of the restaurant market in the UK and the Netherlands. The interviewees were purposely selected based on their experience and insights into the phenomenon under study (Lincoln and Guba 1985). The recruitment criteria applied to participating restaurants were as follows: full service restaurant which has been in operation under the current management team for at least one year; manager's readiness and willingness to speak about the challenge of food waste in their restaurant, including the availability of basic background data at hand, such as on quantity and character of food waste generated and its main drivers; manager's availability to partake in an interview and have this interview recorded by researchers for data analysis and interpretation.

The interviews were conducted in March-May 2018 in London and in January-February 2019 in Breda, a city in the southern part of the Netherlands. Thirty-one interviews lasting 30–60 minutes were recorded and later fully transcribed verbatim. Saturation of conceptual themes determined the sample size (Fusch and Ness 2015) which was reached with 16 interviews in the UK and 15 interviews in the Netherlands. In all cases, the interviewees were assured of confidentiality and anonymity in any written report or publications. Table 1 summarises participant profiles.

[Insert Table 1 here]

It is important to pinpoint the dominance of the independent restaurants in the Dutch sample and an almost equal distribution of the independent and chain-affiliated restaurants in the UK sample (Table 1). It was originally planned that this study would achieve samples of participants with a (more or less) equal representation of the independents and chain-affiliates. This is to ensure better consistency of the sample. However, when the study's interview schedule was tested with willing managers of the independent and chain-affiliated restaurants in the UK and the Netherlands, no significant variations in the approaches to food waste management adopted across the test sample were identified. Further, the test interviews included a number of questions to establish possible correlation between a restaurant's ownership model and its approaches to food waste management. The test interviews revealed no significant correlation and, hence, recruitment of restaurateurs for the main phase of the study only considered those enterprises that matched the recruitment criteria specified above. In the UK, willing restaurateurs were almost equally represented by both chain-affiliated and independent enterprises (which is in part due to London being more business vibrant and diverse market) while, in the Netherlands, these were represented by the independents only (which is partially because Breda is smaller and less vibrant in terms of business opportunities). Although some discrepancy in the approaches to food waste management

adopted in the independent and chain-affiliated restaurants in the UK was established in the main phase of the study (see the Findings and discussion section), this discrepancy was not significant.

The transcripts were analysed thematically. The authors read the transcripts to become familiar with the data and identified patterns of meanings of the participants' responses to the questions asked (Berg 2009). The responses were then collated under common themes, coded and labelled. Where disagreements were noted, researchers re-read the themes, referred back to the literature, discussed their differences and further refined the classifications until agreement was reached. Schutz's (1973) logical consistency and subjective interpretation postulates were applied throughout the entire process to ensure trustworthiness of the data. Exemplar excerpts from the transcripts of each of the themes are presented to support the findings.

As with any study, this one has limitations. First, the findings do not necessarily pertain to all restaurants and need to be interpreted with caution when applied to other types of restaurants such as quick-service restaurants where food is less consumed on the premises. Second, selection bias resulting from the recruitment of restaurant managers in London and Breda limits the transferability of the findings to other contexts. Third, resource and time constraints precluded cross-interviewing although the authors shared experiences during and after the interviews (Quilgars *et al.* 2009). The study's findings are presented next.

Findings and discussion

The magnitude of restaurant food waste and its key drivers

Magnitude

Even though most participants were aware of food wastage in their establishments they were unable to track or quantify it. Most reported gross visual observation of food waste by counting the number of waste bins set for collection by the local authorities and/or private collector. This result is not too surprising. The dearth of accurate assessments of food waste is a persistent issue across the restaurant sector which inhibits effective mitigation (Filimonau and de Coteau 2019; Papargyropoulou *et al.* 2016; Pirani and Arafat 2016). It stems from the lack of in-house training on how to measure food waste, but also arises due to the external provision of inadequate waste collection and disposal services (Sakaguchi *et al.* 2018) and the fact that municipal waste collections can be irregular (Manomaivibool 2015). Lastly, in the Dutch context, time was referenced as a main barrier towards monitoring the quantity and character of wasted food which is in line with the literature (Filimonau *et al.* 2019b).

Despite probing, the actual amount of food waste generated rarely resonated. Instead, most participants used words such as 'significant' and 'moderate' with the two fine dining restaurants in Netherlands reporting minimal food waste in their operations. Social desirability is one of many factors that may explain participants' comments describing the magnitude of food waste given the potentially negative implications that providing such estimate could to their businesses (Filimonau *et al.* 2019b).

Drivers

Two main drivers of food waste were repeatedly mentioned, i.e. customer plates (managers in both study areas place the blame squarely on consumers) and kitchen processes. This pair of findings is consistent with previous studies that noted losses during food preparation and the tendency of the industry professionals to shift responsibility towards customers for plate waste (Graham-Rowe *et al.* 2013; Principato *et al.* 2018; SRA 2010; WRAP 2013c). The data revealed that irresponsible consumer behaviour was in part driven by the cooking practices adopted by the studied restaurants and further exacerbated by the nature of their business

models. For example, some managers stated they employed larger menus to provide customers with a broad range of choices. This, however, involved ordering foodstuffs in bulk that were not always consumed. Periodic alterations to the choice menu initiated by the manager in response to changing market demands also contributed to wastage due to the disposal of unfinished stocks. Similar to findings reported in previous studies, portion size was repeatedly mentioned by participants as a facilitator of plate waste (Freedman and Brochado 2010; Wansink and van Ittersum 2013; Williamson *et al.* 2016). However, in the current study, it appeared participants appreciated the role of large portions in fostering customer satisfaction than its impact on food wastage. Interestingly, respondents serving buffets also commented on plate waste. They complained about the amount of edible waste left on customer plates. It can, however, be argued that restaurateurs are accountable for this wastage given that people choose larger food portions at buffet style restaurants in comparison to restaurants serving á la carte menus (Juvan *et al.* 2018):

> *'When I told him [chef] to reduce the portion prepared because of too much wastage, he said that he didn't want to lower the portion because he was afraid to disappoint the guests. Since the costs are quite low, he'd rather satisfy everyone and risk the food being thrown away. Our main goal is to make people happy. The choices we make are mostly based on this and not on the food we waste'* (NL3)

Some participants also thought that insufficient food ordering and cooking skills, poor communication between the kitchen and serving staff regarding customer orders, especially at busy times, were contributing factors to high plate waste. These comments

illuminate basic in-house operational procedures rather than irresponsible consumer behaviour in food waste generation. The lack of efficient interaction between back-of-house and front-of-house services coupled with inadequate employee training on how to cook, plate and serve food to avoid wastage are recognised causes of restaurant food waste (Goh and Jie 2019):

> *'Human mistakes can also cause food to be wasted. For example, we can order 10 kilos of a certain foodstuff or ingredient instead of 1 kilo. Sometimes, it happens in our restaurants that a waiter gets an order of certain food and the chef prepares something different or prepares the wrong quantities of food'* (NL2)

The explicit guest contribution to food waste was only identified in two situations. First, some managers blamed customers for pre-ordering meals, but then not showing. Second, and consistent with past research, participants believed high plate waste during major functions and/or events was due to their festive nature, where the need to socialise prevailed over environmental concerns and/or social norms (Wang *et al.* 2017). One participant stated:

> *'For me, I find that, when we have plated dinner service, when we have bookings, we keep plan of items we need to prep for the evening and there's little wastage. But when we have banquets, that's when people, they see the food and they take as much as they can, so even if they don't eat it they still fill their plate and they sit on it and talk, and they come back for seconds, there's a*

lot of food wastage and, of course, we have to prepare for that, so we'd have to make a lot more food than usual. So, definitely banquets is a big stress for us' (UK8)

The comment above highlights the importance of effective demand forecasting on food waste. The interviewees in both study areas felt that procurement strategies determined the amounts of food spoilage. This result is in line previous studies in which spoilage accounts for a noticeable share of restaurant food waste and occurs due to incorrect storage or overstocking, which is driven by erroneous demand predictions (SRA 2010; Winnow 2018; WRAP 2013c). Spoilage further relates to the problem of large menus, as discussed above, because these prompt managers to order excessive stock. Many restaurateurs in the UK (unlike in the Netherlands) stated that lack of careful planning of the amounts of food needed to be purchased and prepared in a given period resulted in large amounts of food wastage:

'The volume of restaurant business is not stable, it's fluctuating a lot, meaning you cannot control your stock, you don't know how much you're gonna prepare and you don't know how much you're gonna order. And then it becomes an issue "Ohh, you're short of this or you prepared too much of that…" So that's the biggest problem we are having because of unstable business volume' (UK9)

This situation not only calls for the adoption of more efficient demand forecasting techniques, but also emphasises the need to provide adequate in-house training on forecasting and procurement to operations managers and chefs (Filimonau and de Coteau 2019).

The need to comply with regulations on food safety by disposing foodstuffs that surpassed their 'use by' dates was mentioned by many managers in both the UK and the Netherlands as a driver of wastage. They believed that strict regulations did not only lead to disposal of food which could still be consumed, but also prevented donation of unsold food to the people in need, which will be discussed in the next section. Schneider (2013) argues that stringent food safety standards hinder the willingness of many restaurateurs to reuse excess food despite the dominant managerial perception of this food being safe to consume. The following quote is typical of participants' concerns:

> *'I think expiry dates are a marketing trick, I think most food can still be eaten a couple days after the date. That should be changed if you ask me because it puts pressure on us to throw away good food which can still be eaten'* (NL1)

Participants in both study areas recognised the need to minimise food wastage in their establishments as a means of reducing operational costs. Reputational gains were also mentioned as a benefit of food waste mitigation. Few respondents mentioned goals of environmental conservation as justification to prevent food wastage. This result is not surprising given the participants operate for profit. Previous research indicated that cost saving and corporate image building represent the main drivers of engaging in food waste mitigation among restaurateurs (Chan 2013). The mitigation approaches adopted by the participants are discussed next.

Mitigation approaches

Figure 1 summarises the approaches to food waste management adopted in restaurants in the UK and the Netherlands alongside a number of best practices whose adoption should be facilitated. It demonstrates the extant focus placed by managers in both samples on the prevention of on-site food waste occurrence via demand forecasting. In terms of management of kitchen processes, Figure 1 shows the restaurateurs have invested in effective food storage and handling. The passive disposal of food waste dominates across the board while, due to various reasons, managers tend to ignore the opportunities to repurpose excess ingredients, reduce plate waste and redistribute unsold food.

[Insert Figure 1 here]

Demand forecasting, pro-active work with suppliers, effective on-site storage

Effective food storage and handling was identified by all participants as a vehicle to prevent food waste. They emphasised the need to continuously maintain the 'cold chain' and provide adequate storage facilities (Girotto *et al.* 2015). Demand forecasting and maintaining good relationships with suppliers was also identified as critical actions towards food waste mitigation. In particular, The Dutch sample explained their arrangements with a small number of local food suppliers in order to build more responsive supply chains:

> *'We try to work with a small number of suppliers, to make it easier for ourselves. It can make a difference in a way that if they come only a couple times a week you might have to throw away things faster than when they come on a daily basis'* (NL4)

In line with findings from Murphy and Smith (2009), the study revealed that frequent food deliveries can facilitate menu planning and improve stock inventory management. This

was less the case in London though which can arguably reflect the challenges of food logistics in a metro-city (Kin *et al.* 2017). This notwithstanding, in the UK there was a strong primacy of managerial and chef proficiency in the supply chain management. The emphasis on relevant training for staff in negotiation skills to reduce food waste buttresses the suggestion by Filimonau and de Coteau (2019):

> *'We undertake regular trainings to ensure our employees know how to work with suppliers. Having a reliable and responsive supply chain is critical in preventing food waste occurrence. We know we can order as much food as we need, and we know this food will be delivered in a timely manner, meaning no scope for wastage…'* (UK12)

Repurpose

When accurate forecasting did not work, the sampled restaurants dealt with excess stock in a number of ways. Some managers pointed out that they regularly re-designed their menus to re-purpose spare ingredients. However, such practices appear to be best suited to independent restaurants that possess more freedom and flexibility in terms of menu (re-)design (Filimonau and Krivcova 2017). Chain-affiliated establishments are less likely to use this approach given their menus are more static and any changes to them may require approval from the brand owner. Further, to minimise wastage of food which was about to expire, many managers would regularly monitor the 'use by' dates in their foodstuff inventories and label those with the shortest shelf life to ensure they get used first:

'If we see something is going towards being wasted, we'll put it on the "specials" board so, for that night, it'll turn into the Special of the Evening and we'll tell waiters to push that particular dish so we get rid of it. Otherwise, we'll try to incorporate the different ingredients into other dishes, so just to get rid of that final product before we actually have to throw it away because it's good until that final point. And we also rely on the FIFO system, so that's first-in-first-out, so we just monitor, we date and we try not to open fresh containers unless we're going to use it all' (UK1)

Role of consumer behaviour

As plate waste rates were reported as a major issue, managers were asked to elaborate upon the approaches they adopted for its mitigation. A small number of participants stated that they offered their customers an opportunity to choose the size of portions they preferred. However, as discussed above, this approach was popular only with the independents while respondents from the chain affiliates spoke about their inability to deviate from standard portion sizes. Likewise, some independent Dutch restaurants chose to deliberately offer their guests portions that are small, but allowing seconds. This may be partially justified by the evidence that restaurant guests tend to opt for smaller portions due to health concerns (WRAP 2013d). The problem with such approach is that it may put off those customers who associate 'value for money' with large portions when eating out (Diliberti *et al.* 2004). In addition, such approach may reduce plate waste but increase kitchen waste as the food would still need to be prepared in anticipation of potential demand and could subsequently be discarded if the guests could not eat twice as much or more. Therefore, a more effective way may be to charge customers by weight of the food on the plate. Such practice has been adopted and proven effective in buffet style establishments:

'Although we use buffet here, we minimize food waste by allowing customers to get their own portions and pay by weight. We think paying by weight is a big influence keeping food waste to a minimum' (NL12)

In the hospitality industry, price disincentives represent a powerful tool to affect consumer behaviour. Yet, they should be used with caution given their potential to negatively impact customer loyalty (Nisa *et al.* 2017). Hence, restaurateurs may use 'softer' initiatives such as adopting consumer choice architecture tools (Jagau and Vyrastekova 2017) and communication with consumers to encourage voluntary behavioural changes (Graham-Rowe *et al.* 2013). Majority of Dutch managers stated that they proactively sensitized customers to the negative consequences of food wastage and the role consumer behaviour played in its prevention. They explained that they routinely monitored guests' feedback on the quality of food and the amount served. Further, some UK and Dutch restaurants set limits on the amount of food items customers could order at once. Great care should be taken not to upset customers with order limit as it may create a suspicion of restaurateurs downsizing their diners. Hence, when communicating the order limit to the guests, it is important to use only the 'right' language. For instance, messages should communicate information on the societal goal of environmental conservation and appeal to social norms and customer's self-esteem, rather than business profitability (Pearson and Perera 2018):

'We do steer guests towards ordering the standard portion size. We train staff to not encourage guests to order when they still have chips on the table. I also do that when people order too much, then I ask them: shall we start with two of

these dishes and then see if you like more after that? It is difficult, because people come here to spoil themselves' (NL10)

In addition, in the UK, some managers had tried, with limited success, offering customers takeout boxes or doggy bags to reduce plate waste. The reasons why these interventions did not work included the fact that some guests refused their leftover boxed because they felt embarrassed (Mirosa *et al.* 2018) and health regulations that prescribed restaurants to guarantee the safety of boxed food. For the latter reason, many managers felt it was an unnecessary hassle and so discarded the leftover food instead. A handful of those who provided the boxes pro-actively chose to sign a disclaimer:

'The customer is always welcome to have a take-away bag but, unfortunately, we no longer offer them pro-actively as we've had a few complaints in the past where the customers said that it looked cheap for them to be offered a to-go bag. But, yeah, if they ask for a take-away box, we will bring the box to the table and they can either put it in, which is best as they can see it's their food inside, or we'll do it then at the back for them but it's not ideal and we're best to provide a disclaimer…' (UK11)

Interestingly, some managers believed their national governments should do more by educating the public about the detrimental effect of irresponsible consumption in restaurants to avoid food wastage. At the same time, they largely failed to see their own role in changing the customer mind-set by, for example, insisting on the acceptance of doggy bags or

penalizing customers for food leftovers (Jagau and Vyrastekova 2017; Sirieix *et al.* 2017; Stöckli *et al.* 2018b).

Surplus food redistribution

This study supported the need for the re-distribution of edible surplus food. Managers in both study areas stated that any excess food was redirected towards staff meals. When queried about donating excess food, most participants said they did not provide such services to charities (UK) or foodbanks (Netherlands). Despite a significant interest in food donations, restaurateurs were deterred by stringent regulations on donating unsold food in the EU (Boeck *et al.* 2017). Managers in both study areas indicated these as a major consideration in their (un)willingness to donate unsold food to people in need and/or charities and food banks. The health and safety standards were described as being particularly rigid in both countries. Parini and Arafat (2014) suggest that these can be off-putting for restaurateurs because of the requirement to consider how long the food has been outside the 'cold chain' before donating it and to list all allergens on the packaging to prevent a reaction. In line with Filimonau *et al.* (2019b), this makes most establishments choose to reject food donations in fear of bad publicity:

> *'Donating is very difficult. I mean, what we'd like to do, really, is to give food to homeless people. But they [government] just make it so difficult for us to do that. It's awful, because by not following their rules you can get in trouble. It's much cheaper and easier for us to just dump the leftover food…We can't just go down the road and hand it out… Even if we hand it out, we've got to list all of the allergens and everything, you can't just give someone food and forget about it'* (UK6)

'We work with the Voedselbank where we donate our leftover food, but that is only when it's not bad. We got by the government regulations which state that we cannot just give anyhow. If the food has stayed for long time outside the cold chain, then we're not allowed to donate, and the Voedsel banks are not allowed to receive it either' (NL14)

The analysis showed that size and type of restaurants influenced food waste mitigation measures, which is in line with findings reported by Kasim (2009). Small and fine dining restaurants' managers who claimed to have minimal waste in their kitchens not only gave leftovers to staff and immediate family members, but also repurposed excess foodstuffs by creating completely new dishes, leaving limited room for donations:

'When we have something left over, we cannot serve anymore, we eat it ourselves… On Sundays my family eats fish sometimes because I do not want to throw it away. These are usually around 2-3 portions, so it's good for a family' (NL7)

On-site separation and recycling

Apparently, restaurants can separate and subsequently compost and/or recycle food waste after the options to reduce its occurrence and/or repurpose wasted food have been exhausted (Papargyropoulou *et al.* 2016). In the UK, participants routinely separated food waste in their properties. While those in the Netherlands can learn from the UK experience and vice versa on how to dispose of food waste, it is important to note the low adoption of food waste

management options such as composting and recycling among participants in both study areas. The low adoption of such initiatives was attributed to the limited provision of food waste recycling services by the local authorities and the lack of space for compositing systems as most restaurants operated in busy city centres. Notwithstanding, two restaurateurs reported what could be described as 'good practices' in this regard. One UK independent restaurant had a contract with a local farm to which it supplied most of its food leftovers. One Dutch restaurant worked with a local recycling company which collected their food waste with its subsequent conversion into biogas. The rare occurrence of such practices across the sector is well recognised (Kuczman *et al.* 2018) which highlights the need for policy interventions in support of managerial commitment to convert wasted food into valuable material (Principato *et al.* 2018). In addition to incentivising restaurateurs for the adoption of such food waste management practices, policy support is required to provide adequate recycling facilities for food waste locally, but also to ensure the quality of food waste collections. The irregularity and unreliability of the latter were reported as obstacles towards food waste recycling by a number of the UK and Dutch managers. Micro-scale anaerobic digestion may offer a potential solution to this issue given the pilots have shown its feasibility for deployment in urban areas (Walker *et al.* 2017).

Despite its reactive nature, binning food waste was the most prevalent practice among the managers as it was easy and cheap (Papargyropoulou *et al.* 2016). Its adoption was further justified by the absence of pressure from the local authorities with regard to pro-active management of food waste. Some managers admitted that passive disposal was wrong from the viewpoint of environmental conservation. However, from the perspective of business profitability, it was the least laborious and most cost-effective approach to adopt, which is line with findings of Filimonau *et al.* (2019b). For many restaurants in both the UK and the Netherlands, without adequate policy incentives to promote pro-active food waste

management on the ground, passive disposal is likely to retain its popularity in the foreseeable future:

> *'To be honest, we should do more about it [food waste]. We sort plastics, glass and paper, but we don't separate food waste. The reason for that is that it's just easier to throw everything in the same bin, it's more time-efficient. The company which collects the garbage also does not separate the waste, so it'd not make sense for us to do it. If they changed their system, we'd not have another option as to also separate our waste. That would be the best solution'* (NL11)

Summary

This study set to explore and compare approaches to food waste management in restaurants of the UK and the Netherlands. It revealed a number of similarities and differences in how restaurateurs in both markets tackle the growing societal challenge of food waste. These similarities and differences can be attributed to a number of political, legal, (wider) societal and cultural factors. In terms of the similarities, currently, both countries are the EU members and, subsequently, bound to operate under the same legal framework concerning food waste management, such as the EU Waste Legislation (European Commission 2019). Although this framework has been designed to promote prevention of food waste at each stage of the food supply chain, including restaurants, it does not necessarily reinforce prevention measures applied by specific (agricultural, food manufacturing, grocery retail and/or food service) businesses on the ground (FUSIONS 2016). This offers EU restaurateurs a scope of flexibility when selecting approaches to food waste management. As this study found, in the UK and the

Netherlands, restaurants tend to take advantage of those management approaches that are less laborious and most cost-effective from the business operational viewpoint. These are represented by passive disposal of food waste, preparation of staff meals out of surplus food ingredients and attempts to accurately forecast (food) demand (Figure 1). As for the differences in the approaches to food waste management (Figure 1), a (slightly) more popular use of portion control in restaurants in the Netherlands can be explained by the (wider) societal and cultural effects as Dutch consumers are deemed to possess high(er) levels of environmental (Eijgelaar *et al.* 2016) and health (Strijbos *et al.* 2016) awareness. Likewise, a (slightly) better feasibility of the food-to-go boxes identified for the UK market can be at least partially explained by the role of media that have consistently attempted at highlighting the important role of changes to customer behaviour in reducing the challenge of restaurant food waste (Young *et al.* 2017). By revealing these similarities and differences in the approaches to food waste management in restaurants of the UK and the Netherlands, this paper has provided a preliminary and exploratory analysis of the underpinning factors. This analysis can aid in the design of policies and management approaches to be adopted in the food service sectors of the UK and the Netherlands for more effective mitigation.

Conclusions

Responding to the calls for more comparative, cross-market research on the main societal challenge of food waste and its mitigation, this study facilitated understanding of the phenomenon of food waste and its management in full service restaurants in the UK and the Netherlands. By comparing the two markets, it demonstrated a substantial degree of similarity in how British and Dutch restaurateurs tackle the challenge of wasted food. More specifically, it showed that managers tend to employ the demand forecasting techniques and, when these do not work, rely upon passive waste disposal. The study showed limited managerial attempts

to repurpose excess ingredients, reduce plate waste, and/or engage in the redistribution of surplus food. A number of organisational and institutional factors were found to hinder the adoption of more proactive approaches to food waste management in the UK and the Netherlands.

The study highlighted a number of 'good business' practices in effective management of restaurant food waste whose application should be promoted across the two study areas. These practices include surplus food redistribution, offer of food-to-go boxes to restaurant customers, potion control and on-site food waste separation and recycling with subsequent local energy recovery and/or composting. For these practices to succeed, genuine corporate commitment to mitigate food waste is necessary. Once the restaurateurs have committed to integrate food waste management into their corporate agenda, measures are required for its practical implementation. Corporate commitment to mitigate food waste in restaurants should be supported with targeted policy interventions at the national, but also at the EU, level. These policy interventions should aim at raising consumer awareness of the environmental, social and economic impacts of wasted food in restaurants. This could in turn enable behavioural changes towards sustainable out-of-home food consumption practices particularly when it comes to reducing plate waste. Further, policy interventions are necessary to lessen the health and safety requirements on the surplus food that restaurateurs are willing to donate. This would in turn minimise the liability concerns that prevail within the sector. Instead, local authorities can provide tax incentives to those restaurants that donate food. Moreover, policy interventions are needed to encourage restaurants to separate food waste on their premises and then convert this waste into a valuable material. Lastly, policy in support of providing adequate facilities to recycle food waste in cities and ensuring reliable food waste collections are warranted.

Considering these sets of food waste management options raises a number of potential research opportunities. First, there is the need to investigate how restaurateurs in the UK and the Netherlands repurpose excess foodstuffs, implement plate waste reduction strategies and how they redistribute surplus food. For example, we know little about how the nudging interventions aimed at preventing plate waste apply in real-life settings and the feasibility of their rollout across the sector. Second, one ambiguous issue is how food waste management systems in restaurants relate to each other in the EU and non-EU countries. It would seem likely that similarities and/or differences in the approaches may exist while their underpinning reasons may be based on the variations in the national political contexts and patterns of out-of-home food consumption. Our comparative analysis has provided some clues about the type of 'good business' practices that fit with underlying restaurant characteristics. However, other types of public eateries have different restaurant concept. Are the same food waste management systems used across all full service restaurants or are different management options used in different restaurants? If the latter, then how do these different management systems related to each other in a consistent way and how do they impact each other? And finally, do different food waste mitigation measures in restaurants produce different outcomes if applied across the EU? These research questions warrant further investigation.

References

Alexander, C., and Smaje, C., 2008. Surplus retail food redistribution: An analysis of a third sector model. *Resources, Conservation & Recycling*, 52(11), 1290-1298.

Alexander, P., Brown, C., Arneth, A., Finnigan, J., Moran, D., Rounsevell, M.D.A., 2017. Losses, inefficiencies and waste in the global food system. *Agricultural Systems*, 153, 190-200.

Beretta, C., Stoessel, F., Baier, U., and Hellweg, S., 2013. Quantifying food losses and the potential for reduction in Switzerland. *Waste Management*, 33, 764-773.

Berg, B.L., 2009. *Qualitative research methods for the social science.* Boston, MA: Pearson Education.

Betz, A., Buchli, J., Goebel, C., and Muller, C., 2015. Food waste in the Swiss food service industry–Magnitude and potential for reduction. *Waste Management*, 35, 218-226.

Boeck, D.E., Jacxsens, L., Goubert, H., and Uyttendaele, M., 2017. Ensuring food safety in food donations: Case study of the Belgian donation/acceptation chain. *Food Research International*, 100(Part 2), 137-149.

Chan, E.S.W., 2013. Managing green marketing: Hong Kong hotel managers' perspective. *International Journal of Hospitality Management*, 34, 442-461.

Chapman, D.W., and Carter, J.F. 1979. Translation procedures for the cross-cultural use of measurement. *Educational Evaluation and Policy Analysis*, 1, 71–76.

Charlebois, S., Creedy, A., and von Massow, M., 2015. "Back of house"–focused study on food waste in fine dining: the case of Delish restaurants. *International Journal of Culture, Tourism and Hospitality Research*, 9(3), 278-291.

Christ, K.L., and Burritt, R., 2017. Material flow cost accounting for food waste in the restaurant industry. *British Food Journal,* 119(3), 600–612.

Derqui, B., Fayos, T., and Fernandez, V., 2016. Towards a More Sustainable Food Supply Chain: Opening up Invisible Waste in Food Service. *Sustainability,* 8(7), 693.

Diliberti, N., Bordi, P.L., Conklin, M.T., Roe, L.S., and Rolls, B.J., 2004. Increased Portion Size Leads to Increased Energy Intake in a Restaurant Meal. *Obesity,* 12(3), 562-568.

Dolnicar, S., Knezevic Cvelbar, L., and Grün, B., 2019. A Sharing-Based Approach to Enticing Tourists to Behave More Environmentally Friendly. *Journal of Travel Research,* 58(2), 241-252.

Dutta, K., Umashankar, V., Choi, G., and Parsa, H.G., 2008. A Comparative Study of Consumers' Green Practice Orientation in India and the United States: A Study from the Restaurant Industry. *Journal of Foodservice Business Research,* 11(3), 269-285.

Eijgelaar, E., Nawijn, J., Okuhn, L., and Dijkstra, L., 2016. Consumer attitudes and preferences on holiday carbon footprint information in the Netherlands. *Journal of Sustainable Tourism,* 24(3), 398-411.

European Commission, 2019. *EU actions against food waste.* Available from: https://ec.europa.eu/food/safety/food_waste/eu_actions_en [Accessed 01 October 2019].

Eurostat, 2019. *Tourism industries–employment.* Available from: https://ec.europa.eu/eurostat/statistics-explained/index.php/Tourism_industries_-_employment [Accessed 10 February 2019].

Filimonau, V., and de Coteau, D.A., 2019. Food waste management in hospitality operations: a critical review. *Tourism Management,* 71, 234-245.

Filimonau, V., and Krivcova, M., 2017. Restaurant menu design and more responsible consumer food choice: An exploratory study of managerial perceptions. *Journal of Cleaner Production*, 143, 516-527.

Filimonau, V., Fidan, H., Alexieva, I., Dragoev, S., Marinova, D.D., 2019a. Restaurant food waste and the determinants of its effective management in Bulgaria: an exploratory case study of restaurants in Plovdiv. *Tourism Management Perspectives,* in press.

Filimonau, V., Krivcova, M. and Pettit, F., 2019b. An exploratory study of managerial approaches to food waste mitigation in coffee shops. *International Journal of Hospitality Management*, 76, 48-57.

FoodService Instituut Nederland, 2017. *Netherlands: Food service- hotel restaurant Institutional: The Dutch food service report*. Wassenaar. The Netherlands: FoodService Instituut Nederland (FSIN).

Freedman, M.R., and Brochado, C., 2010. Reducing portion size reduces food intake and plate waste. *Obesity*, 18(9), 1864-1866.

Fusch, P.I., and Ness, L.R., 2015. Are we there yet? Data Saturation in Qualitative research. *The Qualitative Report*, 20(9), 1408-1416

FUSIONS, 2016. *Estimates of European food waste levels*. European Commission (FP7), 2016. Available from: http://www.eu-fusions.org/phocadownload/Publications/Estimates%20of%20European%20food%20waste%20levels.pdf [Accessed 24 January 2019].

Garrone, P., Melacini, M., and Perego, A., 2014. Opening the black box of food waste reduction. *Food Policy*, 46, 129-139.

Geurts, M., van Bakel, A.M, van Rossum, C.T.M., de Boer, E., and Ocké, M.C., 2017. Food consumption in the Netherlands and its determinants: *Background report to 'What's on our*

plate? Safe, healthy and sustainable diets in the Netherlands.' RIVM Report 2016-0195. Bilthoven, The Netherlands: National Institute for Public Health and the Environment.

Girotto, F., Alibardi, L., and Cossu, R., 2015. Food waste generation and industrial uses: A review. *Waste Management*, 45, 32-41.

Godfray, H.C.J, Beddington, J.R., Crute, I. R., Haddad, L., Lawrence, D., Muir, J.F., Pretty, J., Robinson, S., Thomas, S.M., and Toulimn, C., 2010. Food Security: The Challenge of Feeding 9 Billion People. *Science*, 327(5967), 812-818.

Goh, E., and Jie, F., 2019. To waste or not to waste: Exploring motivational factors of Generation Z hospitality employees towards food wastage in the hospitality industry. *International Journal of Hospitality Management*, 80, 126-135.

Graham-Rowe, E., Jessop, D.C., and Sparks, P., 2013. Identifying motivations and barriers to minimising household food waste. *Resources, Conservation and Recycling*, 84, 15-23.

Heikkilä, L., Reinikainen, A., Katajajuuri, J-M., Silvennoinen, K., and Hartikainen, H., 2016. Elements affecting food waste in the food service sector. *Waste Management*, 56, 446-453.

Hermsdorf, D., Rombach, M., and Bitsch, V., 2017. Food waste reduction practices in German food retail. *British Food Journal*, 119(12), 2532-2546.

Hu, C., Chen, M., McCain, S-L.C., 2004. Forecasting in Short-Term Planning and Management for a Casino Buffet Restaurant. *Journal of Travel & Tourism Marketing*, 16(2-3), 79-98.

Irani, Z., Sharif, A.M, Lee, H., Aktas, Topaloğlu, Z., van't Wout, T., Huda, S., 2018. Managing food security through food waste and loss-Small data to big data. *Computers and Operations Research*, 98, 367-383

Jagau, H.L., and Vyrastekova, J., 2017. Behavioral approach to food waste: an experiment. *British Food Journal*, 119(4), 882-894.

Juvan, E., Grun, B., and Dolnicar, S., 2018. Biting Off More Than They Can Chew: Food Waste at Hotel Breakfast Buffets. *Journal of Travel Research*, 57(2), 232-242.

Kallbekken, S., and Sælen, H., 2013. 'Nudging' hotel guests to reduce food waste as a win–win environmental measure. *Economics Letters*, 119(3), 325-327.

Kasim, A., 2009. Managerial attitudes towards environmental management among small and medium hotels in Kuala Lumpur. *Journal of Sustainable Tourism*, 17(6), 709-725

Kasim, A., and Ismail, A., 2012. Environmentally friendly practices among restaurants: drivers and barriers to change. *Journal of Sustainable Tourism*, 20(4), 551-570.

Katajajuuri, J-M., Silvennoinen, K., Hartikainen, H., Heikkilä, L. and Reinikainen, A., 2014. Food waste in the Finnish food chain. *Journal of Cleaner Production*, 73, 322-329.

Katsarova, I., 2016. *Tackling food waste. The EU's contribution to a global issue*. European Parliamentary Research Service, Briefing Paper, November 2016.

Kin, B., Verlinde, S., and Macharis, C., 2017. Sustainable urban freight transport in megacities in emerging markets. *Sustainable Cities and Society*, 32, 31-41.

Koninklijke Horeca Nederland 2019. *Over ons*. Available from: https://www.khn.nl/overkhn [Accessed 29 April 2019].

Kouwenhoven, G., Bulterman, S., and Reddy, V. 2012. Reducing food waste: An opportunity for the innovative catering entrepreneur. In M. van Gelderen and E. Masurel (eds.), *Entrepreneurship in context* (pp. 87-100). New York and Oxon: Routledge.

Kretschmer, B., Smith, C., Watkins, E., Allen, B., Buckwell, A., Desbarats, J., and Kieve, D., 2013. *Technology options for recycling agricultural, forestry and food wastes and residues*

for sustainable bioenergy and biomaterials. Report for the European Parliament, STOA, as part of the study 'Technology Options for Feeding 10 Billion People'. IEEP: London

Kuczman, O., Gueri, M.V.D., De Souza, S.N.M., *et al.*, 2018. Food waste anaerobic digestion of a popular restaurant in Southern Brazil. *Journal of Cleaner Production*, 196, 382-389.

Lincoln, Y.S., and Guba, E.G. 1985. *Naturalistic inquiry*. Beverly Hills, CA: Sage Publications.

Manomaivibool, P., 2015. Wasteful tourism in developing economy? a present situation and sustainable scenarios. *Resources, Conservation and Recycling*, 103, 69-76.

Marthinsen, J., Sundt, P., Kaysen, O., and Kirkevaag, K., 2012. *Prevention of food waste in restaurants, hotels, canteens and catering*. Nordic Council of Ministers, Copenhagen.

Martin-Rios, C., Demen-Meier, C., Gossling, S., and Cornuz, C., 2018. Food waste management innovations in the foodservice industry. *Waste Management*, 79, 196-206.

Matthews, B. and Ross, L., 2014. *Research Methods*. Harlow: Pearson

Mbuligwe, S.E., and Kassenga, G.R., 2004. Feasibility and strategies for anaerobic digestion of solid waste for energy production in Dar-es-Salaam city, Tanzania. *Resources, Conservation and Recycling*, 42(2), 183-203.

Mintel, 2019. *Eating out review-UK-September 2018.* Mintel, London.

Mirosa, M., Liu, Y., and Mirosa, R., 2018. Consumers' Behaviors and Attitudes towards Doggy Bags: Identifying Barriers and Benefits to Promoting Behavior Change. *Journal of Food Products Marketing*, 24(5), 563-590.

Monier, V., Shailendra, M., Escalon, V., O'Connor, C., Gibon, T., Anderson, G., Hortense, M., Reisinger, H., 2010. *Preparatory Study on Food Waste across EU 27*. European Commission (DG ENV) Directorate C-Industry. 2010. ISBN: 978-92-79-22138-5

Morse, J.M., 2000. Determining sample size. *Qualitative Health Research*, 10, 3–5.

Mourad, M., 2016. Recycling, recovering and preventing "food waste": competing solutions for food systems sustainability in the United States and France. *Journal of Cleaner Production*, 126, 461-477.

Murphy, J., and Smith, S., 2009. Chefs and suppliers: An exploratory look at supply chain issues in an upscale restaurant alliance. *International Journal of Hospitality Management*, 28(2), 212-220.

Neff, R.A., Spiker, M.L., and Truant, P.L., 2015. Wasted food: US consumers' reported awareness, attitudes, and behaviour. *PLOS One*, 10(6), 1-16.

Nisa, C., Varum, C., and Botelho, A., 2017. Promoting Sustainable Hotel Guest Behavior: A Systematic Review and Meta-Analysis. *Cornell Hospitality Quarterly*, 58(4), 354-363

Okazaki, W.K., Turn, S.Q., and Flachsbart, P.G., 2008. Characterization of food waste generators: a Hawaii case study. *Waste Management*, 28, 2483-2494.

Oliveira, B., de Moura, A.P., and Cuhna, L.M., 2016. Reducing Food Waste in the Food Service Sector as a Way to Promote Public Health and Environmental Sustainability. In: Filho, W.L., Azeiteiro, U.M., Alves, F. (Eds), *Climate Change and Health Book Subtitle: Improving Resilience and Reducing Risks*, Springer, Basel.

Papargyropoulou, E., Lozano, R., Steinberger, J. K., Wright, N., and Ujang, Z. B., 2014. The food waste hierarchy as a framework for the management of food surplus and food waste. *Journal of Cleaner Production*, 76,106-115.

Papargyropoulou, E., Wright, N., Lozano, R., Steinberger, J., Padfield, R., and Ujang, Z., 2016. Conceptual framework for the study of food waste generation and prevention in the hospitality sector. *Waste Management*, 49, 326-336.

Parfitt, J., Barthel, M., and Macnaughton, S., 2010. Food waste within food supply chains: quantification and potential for change to 2050. *Philosophical Transactions Royal Society B*, 365, 3065-3081.

Pearson, D., and Perera, A., 2018. Reducing Food Waste: A Practitioner Guide Identifying Requirements for an Integrated Social Marketing Communication Campaign. *Social Marketing Quarterly*, 24(1), 45-57.

Pirani, S., and Arafat, H.A., 2016. Reduction of food waste generation in the hospitality industry. *Journal of Cleaner Production*, 132, 129-145.

Principato, L., Pratesi, C.A., and Secondi, L., 2018. Towards Zero Waste: an Exploratory Study on Restaurant managers. *International Journal of Hospitality Management*, 74, 130-137.

Quilgars, D., Elsinga, M., Jones, A., Toussaint, H.R., and Naumanen, P. 2009. Inside qualitative, cross-national research- making methods transparent in a EU housing study. *International Journal of Social Science Research Methodology*, 12(1), 19-31.

Radwan, H.R.I., Jones, E., and 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), 533-550.

Sakaguchi, L., Pak, N., and Potts, M., 2018. Tackling the issue of food waste in restaurants: Options for measurement method, reduction and behavioral change. *Journal of Cleaner Production*, 180, 430-436.

Schneider, F., 2013. The evolution of food donation with respect to waste prevention. *Waste Management*, 33(3), 755-763.

Schutz, A. 1973. *Collected papers I: The problem of social reality*. In: A. Broderson, (ed.). The Hague, the Netherlands: Martinus Nijhoff.

Sharholy, M., Ahmad, K., Mahmood, G., and Trivedi, R.C., 2008. Municipal solid waste management in Indian cities–A review. *Waste Management,* 28(2), 459-467.

Sirieix, L., Lala, J., and Kocmanova, J., 2017. Understanding the antecedents of consumers' attitudes towards doggy bags in restaurants: Concern about food waste, culture, norms and emotions. *Journal of Retailing and Consumer Services,* 34, 153-158.

SRA-Sustainable Restaurant Association, 2010. *Too good to waste: restaurant food waste survey report.* SRA, London.

Statista, 2019. *Number of restaurants and mobile food service enterprises in the United Kingdom (UK) from 2008 to 2017*. Statista-The Statistics Portal, London.

Strijbos, C., Schluck, M., Bisschop, J., Bui, T., de Jong, I., van Leeuwen, M., von Tottleben, M., van Breda, S.G., 2016. Consumer awareness and credibility factors of health claims on innovative meat products in a cross-sectional population study in the Netherlands. *Food Quality and Preference*, 54, 13-22.

Stöckli, S., Dorn, M., and Liechti, S., 2018a. Normative prompts reduce consumer food waste in restaurants. *Waste Management*, 77, 532-536.

Stöckli, S., Niklaus, E., and Dorn, M., 2018b. Call for testing interventions to prevent consumer food waste. *Resources, Conservation and Recycling,* 136, 445-462.

The Local, 2016. The restaurants punishing guests for not finishing meals. Available from: https://www.thelocal.de/20160816/eat-up-or-pay-up-why-guests-are-charged-for-leftovers [Accessed 12 April 2019].

Thi, N.B.D., Kumar, G., Lin, C-Y., 2015. An overview of food waste management in developing countries: Current status and future perspective. *Journal of Environmental Management,* 157, 220-229.

Thyberg, K.L., and Tonjes, D.J., 2016. Drivers of food waste and their implications for sustainable policy development. *Resources, Conservation and Recycling*, 106, 110-123.

Walker, M., Theaker, H., Yaman, R., *et al.,* 2017. Assessment of micro-scale anaerobic digestion for management of urban organic waste: A case study in London, UK. *Waste Management,* 61, 258-268.

Wang, L., Liu, G., Liu, X., Gao, J., Zhou, B., Gao, S., and Cheng, S., 2017. The weight of unfinished plate: a survey based characterization of restaurant food waste in Chinese cities. *Waste Management,* 66, 3-12.

Wansink, B., and van Ittersum, K., 2013. Portion size me: Plate-size induced consumption norms and win-win solutions for reducing food intake and waste. *Journal of Experimental Psychology: Applied, 19*(4), 320-332.

Williams, P., and Walton, K., 2011. Plate waste in hospitals and strategies for change. *E-SPEN, the European e-Journal of Clinical Nutrition and Metabolism*, 6, e235-e241.

Williamson, S., Block, L.G., and Keller, P.A., 2016. Of Waste and Waists: The Effect of Plate Material on Food Consumption and Waste. *Journal of the Association for Consumer Research,* 1(1), 147-160.

Winnow, 2018. *Addressing food waste in the hospitality & foodservice sector. An overview of why and where food waste happens.* Winnow Solutions, 2018.

WRAP-Waste and Resources Action Programme, 2013a. *Overview of Waste in the UK Hospitality and Food Service Sector*. Oxon, UK

WRAP, 2013b. *Restaurants: Taking Action on Waste*. Oxon, UK

WRAP, 2013c. *The True Cost of Food Waste within Hospitality and Food Service*. Oxon, UK

WRAP, 2013d. *Understanding out of home consumer food waste*. Oxon, UK

WRAP, 2015. *Estimated of Food and Packaging Waste in the UK Grocery Retail and Hospitality Supply Chains*. Oxon, UK

Yin, R., 1989. *Case study research: Design and methods*. Sage Publications: Newbury Park.

Young, W., Russell, S.V., Robinson, C.A., and Barkemeyer, R., 2017. Can social media be a tool for reducing consumers' food waste? A behaviour change experiment by a UK retailer. *Resources, Conservation and Recycling*, 117(Part B), 195-203.

Youngs, A.J., Nobis, G., and Town, P., 1983. Food waste from hotels and restaurants in the UK. *Waste Management & Research*, 1, 295-308.

Table 1. Interview participants (n=31).

Code	Type[1]	Profile (Gender, Education level, Managerial position)	Industry experience
The United Kingdom			
UK1	Independent	Male, Hospitality Graduate, General Manager	10+ years
UK2	Chain-affiliated	Male, No hospitality degree, General Manager	2+ years
UK3	Independent	Male, No hospitality degree, General Manager	5+ years
UK4	Chain-affiliated	Female, Hospitality Graduate, Operations Manager	5+ years
UK5	Chain-affiliated	Female, Hospitality Graduate, General Manager	2+ years
UK6	Chain-affiliated	Male, No hospitality degree, Owner of the chain	2+ years
UK7	Independent	Male, No hospitality degree, General Manager	10+ years
UK8	Independent	Male, No hospitality degree, Operations Manager	3+ years
UK9	Independent	Male, No hospitality degree, Owner	20+ years
UK10	Independent	Male, No hospitality degree, Owner and Head Chef	10+ years
UK11	Chain-affiliated	Female, Hospitality Graduate, General Manager	5+ years
UK12	Chain-affiliated	Male, No hospitality degree, General Manager	2+ years
UK13	Chain-affiliated	Male, No hospitality degree, Operations Manager and Head Chef	10+ years
UK14	Chain-affiliated	Male, No hospitality degree, General Manager	10+ years
UK15	Independent	Female, No hospitality degree, General Manager	2+ years
UK16	Independent	Male, No hospitality degree, Operations Manager and Head Chef	5+ years

[1] Chain-affiliated restaurants are those that are obliged to follow the corporate agenda of the main brands as they operate on the basis of a franchise business model. International examples of such restaurants include Pizza Hut, Nando's and Zizzi. In contrast, independent restaurants are not bound to any contractual agreement with a corporate owner and have total freedom in how they operate.

The Netherlands			
NL1	Independent	Male, Hospitality Graduate, Chef	10+ years
NL2	Independent	Male, No hospitality degree, Owner/chef	10+ years
NL3	Independent	Male, No hospitality degree, Owner / Manager	2+ years
NL4	Independent	Female, No hospitality degree, Owner	9+ years
NL5	Independent	Female, No hospitality degree, Owner / Manager	23+ years
NL6	Independent	Female, No hospitality degree, Owner	10+ years
NL7	Independent	Male, No hospitality degree, Owner	25+ years
NL8	Independent	Male, Hospitality Graduate, Manager	5+ years
NL9	Independent	Male, No hospitality degree, Manager	8 years
NL10	Independent	Male, No hospitality degree, Manager	12 years
NL11	Independent	Male, No hospitality degree, Manager	1+ years
NL12	Independent	Male, Hospitality Graduate, Manager	6+ years
NL13	Independent	Male, Hospitality Graduate, Manager	13 years
NL14	Independent	Male, No hospitality degree, Manager	10+ years
NL15	Independent	Male, Hospitality Graduate, Manager	25+ years

	Demand forecasting and work with suppliers	**Storage and handling**	**Re-purpose excess ingredients**	**Reduce plate waste**			**Redistribute unsold food**			**Onsite separation and recycling**	**Passive disposal**
				Portion size control	*Pervasive communication*	*Food-to-go boxes*	*Staff meals*	*Donations*	*Online food distribution platforms*		
The UK											
The Netherlands											
'Good business' practices	Contracts with local suppliers to enable more 'responsive' supply chain	On-site electric and electronic equipment is regularly serviced to avoid breakdowns	Use of 'Day's or Chef's specials' on the menu	Charging buffets per weight Limiting the quantity of items ordered at once	Recommending customers to order less food at first but then allowing to order more if deemed necessary	Pro-active offer to take plate leftovers home	-	-	-	Contracts with local farms to compost food waste Contracts with companies producing biogas	-

Note: The colour indicates the extent of adoption of specific mitigation approaches.

	Adoption is considered commercially unviable
	Adoption is considered viable by the few restaurants (< 25% of the sample)
	Adoption is considered viable by some restaurants (25-50% of the sample)
	Adoption is considered viable by the majority of restaurants (>50% of the sample)

Figure 1. Approaches to food waste mitigation in restaurants

The authors declare no conflict of interest