‘Bin it and forget it!’: the challenges of food waste management in restaurants of a mid-sized Hungarian city

Abstract

Although research on food waste and its management in foodservices is gradually evolving in developed countries, it remains limited in transitional economies. This holds true for many EU-28 member states located in East-Central Europe, where no studies have assessed to date the magnitude of food waste occurring in foodservices, identified its key drivers and established the scope for minimisation. By interviewing 18 managers of foodservice businesses in a historical, mid-sized, city of Veszprem, this paper explores the phenomenon of food waste in the foodservice sector of Hungary, an EU-28 economy in transition. It provides a first benchmark of food waste generation in Hungarian foodservices. It also identifies institutional, contextual, locational, organisational and cultural factors that impede food waste prevention and mitigation. Drawing on international experience and best practices in food waste management, recommendations are made on how these factors should be addressed.

Keywords

Food waste

Restaurant

Prevention

Mitigation

Recycling

Sustainability

Highlights

- Provides a first benchmark of food waste generation in Hungarian foodservices
- Identifies barriers to more effective management of food waste
- Categorises these barriers into institutional, contextual, locational, organisational and cultural
- Drawing on international experience, suggests how these barriers can be addressed

1. Introduction

The global foodservice sector generates significant amounts of food waste (FW) (Huang *et al.* 2020). For example, foodservices of the EU-28 countries waste circa 11 million tonnes of food per year, or 12% of the region's total (FUSIONS 2016). US foodservices generate up to 24 million tonnes of FW annually, which equates to 40% of the country's total (ReFED 2018). Although the problem of FW is getting increasingly recognised politically (United Nations Sustainable Development Goals 2020), the 'blind spots' remain. These concern the drivers of FW occurrence in foodservices, approaches to FW prevention/mitigation and impediments to effective management (Vizzoto *et al.* 2020). This hampers the design of evidence-based policies in support of FW minimisation in the foodservice sector (Papargyropoulou *et al.* 2016). This further hinders the development of 'tried and tested' managerial measures for FW reduction (Pinto *et al.* 2018).

To date, research on FW and its management in foodservices has covered developed economies, such as USA (Sakaguchi *et al.* 2018), Switzerland (Betz *et al.* 2015) and Finland (Silvennoinen *et al.* 2015). Most developing and transitional countries, with a few notable exceptions (see Filimonau *et al.* 2019a; Kasavan *et al.* 2019; Papargyropoulou *et al.* 2019), have been excluded from analysis. This is a major drawback as the out-of-home food consumption markets in these countries are growing rapidly due to increasing demand for food from local customers (Wang *et al.* 2017) and tourists (Li *et al.* 2020). The rising demand generates excessive FW, which exacerbates environmental and socio-economic challenges already prevalent in many developing and transitional economies (Wang *et al.* 2018).

The above drawback is well reflected in FW research in foodservices of the EU-28 countries. Although the European Commission has committed to halve its per capita FW by 2030 (European Commission 2020), the lack of knowledge on how FW occurs within the specific

sectors of the EU-28's food supply chain impedes this ambition. FUSIONS (2016), a specialised project established to examine the phenomenon of FW in EU-28, has assessed the FW data as being of sufficient quality only in foodservices of eight EU-28 member states (Austria, Denmark, Finland, France, Germany, Ireland, Sweden and the UK). No FW data have been recorded for the foodservice sectors of ten EU-28 countries (Bulgaria, Cyprus, Hungary, Latvia, Malta, Poland, Portugal, Romania, Slovakia and Spain). Many of these latter countries are represented by so-called economies in transition whereby markets of out-of-home food consumption are rapidly developing.

This paper will shed light on the phenomenon of FW and its management in the foodservice sector of Hungary, an economy in transition in East-Central Europe. Hungary reported no FW data in its foodservice sector to FUSIONS (2016). To partially rectify this knowledge gap, the study explored the magnitude of FW occurrence, its drivers and approaches to minimisation within a sample of foodservice providers in a Hungarian city of Veszprem. Veszprem is a historical, mid-sized, city which has a well-established foodservice market catering for domestic guests and international tourists. The study provided, for the first time, a benchmark of FW occurrence in foodservices of Hungary and outlined the determinants of its effective management. It is hoped that the findings of this study can contribute to a better understanding of the phenomenon of FW in the foodservice sectors of other transitional economies of EU-28. It is also hoped that the findings of this study will prompt future scholarly investigation of FW in Hungarian foodservices, but also in other sectors of its national economy.

2. Literature review

2.1.Environmental impacts of foodservices

Foodservices have long played an important socio-economic role in modern societies by satisfying public demand for food in the out-of-home settings. However, it was not until recently that scholarly attention turned towards the assessment of environmental externalities of foodservice provision (Engström and Carlsson-Kanyama 2004). The environmental impacts of hotels have been studied in depth (Jones *et al.* 2014). The environmental effects of restaurants and cafeterias have been scholarly scrutinised to a much lesser degree. For example, a review of 58 academic papers on the environmental performance of hospitality organisations undertaken by Myung *et al.* (2012) revealed only six studies focusing on foodservices. Similarly, a more recent review by Chan and Hsu (2016) showed that about 60% of research on the environmental impacts of hospitality organisations was concerned with hotels.

The analytical scope of research on the environmental externalities of foodservice operations is limited. Higgins-Desbiolles *et al.* (2019) demonstrated that the bulk of past studies on 'sustainable restaurants' revolved around the following topics: (1) (general) managerial commitment to environmental conservation; (2) (general) consumer attitudes to the environmental innovations in restaurants; and (3) corporate environmental strategies adopted by specific foodservice providers. While such general management- and consumer-focused research is important, specialised studies are required to assess the magnitude of environmental impacts of foodservices (Filimonau *et al.* 2020c). This need emerges from a well-established business 'measurement-management' paradigm (Eriksson *et al.* 2019). This paradigm suggests that effective management of a problem is impossible without an understanding of its problem and drivers. Truly comprehensive research on the environmental impacts from foodservices should, therefore, aim at addressing the entire extent of the 'measurement-management' paradigm by (1) assessing the magnitude of an impact, (2) establishing its drivers and (3) evaluating approaches to its management.

To date, only fifteen studies have attempted to assess the magnitude of environmental externalities of foodservices, mostly energy use and water consumption (see Dai *et al.* 2020 for a review). This is insufficient to identify commonalities and establish trends in the environmental performance of foodservice providers (Filimonau *et al.* 2019a). More research is, therefore, needed to holistically analyse the environmental impacts of foodservices for effective mitigation (Li *et al.* 2019).

Similarly, the topic of FW, which represents, arguably, the main environmental impact of foodservice operations, has been under-researched (Pirani and Arafat 2014). Although the challenge of FW in restaurants was first scrutinised over three decades ago, it was only in the last few years when the related research agenda started evolving steadily (Filimonau and De Coteau 2019). This interest was largely sparked by popular media and news reports highlighting the disproportionate amounts of food wasted in foodservices in presence of hunger and malnutrition (see, for example, Stuart 2009).

The following can, at least partially, explain why scholarly research on FW and its management in foodservices is yet under-developed. Based on the authors' personal experiences, many scholars studying foodservice operations have majored in business (management) disciplines. These disciplines are primarily concerned with examining the social and business relationships of foodservice providers with the purpose of revenue maximisation. Although by minimising FW foodservices can reduce their operational costs (Christ and Burritt 2017), FW as an operational issue is not prioritised within the sector. Instead, FW is considered by many foodservice businesses the ‘necessary evil’ and rather ‘normal’ output of foodservice provision required to satisfy consumers, thus building their loyalty (Okumus *et al.* 2020). Whilst FW represents a

direct significant cost to any business, many foodservice operators are prepared to compromise on it in pursuit of corporate and personal targets (Filimonau *et al.* 2019b).

2.2.Managing FW in foodservices

2.2.1. The magnitude

Although FW in the global foodservice sector has long been estimated as significant (Parfitt *et al.* 2010), its precise magnitude is unknown. Foodservice providers do not diligently record the quantities of wasted foodstuffs (Filimonau *et al.* 2019b). This is due to a lack of managerial interest in FW as an operational challenge (Principato *et al.* 2018). This is also because of the impracticalities of measuring FW on the ground (Papargyropoulou *et al.* 2019). For example, quantifying FW and its major streams can be difficult, if not impossible, in the kitchen of a busy restaurant during the 'high' season.

Ex post, post-service, measurements of FW can be implemented to solve this problem. These require, however, continued managerial commitment and active employee engagement that are not always present (Goh and Jie 2019). Larger, chain-affiliated, foodservice businesses are more diligent in measuring their FW. This is because they tend to set strict(er) organisational goals of environmental conservation (Filimonau *et al.* 2020b). The bulk of the foodservice sector is, however, represented by small(er), independent and family-run, foodservice businesses (Camillieri 2018). Unless the owners of such businesses have committed to environmental conservation, they fail to invest in environmental innovations, such as FW measurement and management (Filimonau *et al.* 2020b).

The few available estimates of FW in the global foodservice sector come from regional and country-specific reports produced by various governmental bodies and industry associations, see, for example, ReFED (2018) for the USA and SRA (2010) and WRAP (2020) for the UK. These reports lack accuracy as their measurements are normally based on the method of self-reported FW assessment (WRAP 2015). This method has a well-established drawback of limited data reliability and can be affected by social desirability biases (Wang *et al.* 2017). Further, such reports normally reflect FW occurring in large(r), chain-affiliated, foodservice organisations (WRAP 2013). This is due to a more standardised and routine procedure of measuring FW adopted by such enterprises, as discussed earlier. The estimates of FW generated by the 'independents' are rare, which is a major shortcoming as these businesses dominate the global foodservice sector (Filimonau *et al.* 2020b).

Given the challenges of obtaining accurate FW estimates from foodservice providers, cross-sectoral generalisations are common (see, for example, Betz *et al.* 2015). Such generalisations should, however, be avoided as the foodservice sector is complex and diverse. For example, the patterns of FW in the limited service, often publicly-subsidised, contract catering enterprises differ significantly from those observed in the full-service, for-profit, restaurants. This is attributed to different values attached to the function/role of food in these foodservice establishments (Filimonau *et al.* 2020b). The FW figure from a workplace canteen should not, therefore, be used to describe the magnitude of FW in, say, casual dining restaurants.

The market location plays a role. For instance, restaurants in major metropolitan areas, such as Shanghai (Filimonau *et al.* 2020c), waste more food compared to 'provincial' restaurants (Wang *et al.* 2018) due to their busier services. Similarly, coastal foodservices in Turkey are

more wasteful compared to the foodservices located in the ‘hinterlands’. This is because they cater for the different categories of clientele with subsequent variations in the business models adopted, i.e. all-inclusive versus a la carte (Okumus *et al.* 2020).

What is clear from research is that the challenge of FW in foodservices is likely to be under-estimated and the relative contribution of the sector to global FW can be substantially higher than conventionally accepted (Filimonau and De Coteau 2019). Currently, foodservices generate the third largest amount of FW across the global food supply chain, right after households and food manufacturing industries (WRAP 2020). Importantly, this share is larger in developing and transitional economies (Wen *et al.* 2018).

2.2.2. The drivers

The drivers of FW in foodservices are manifold and can be divided into external and internal (Kasavan *et al.* 2019), institutional and organisational (Heikkilä *et al.* 2016), and business- and market-specific (Hennchen 2019). From the managerial perspective, FW occurs in the kitchen (Papargyropoulou *et al.* 2019) and on customer plates (Martin-Rios *et al.* 2018). It may further arise in transit when, for instance, the foodstuffs get damaged by suppliers due to inappropriate handling (Pinto *et al.* 2018).

FW occurs in the kitchen because of equipment problems (Filimonau *et al.* 2019a). It also arises due to spoilage driven by poor sanitation, inadequate storage and over-ordering (Papargyropoulou *et al.* 2019). Spoilage can also occur because of over-production (Garrone *et al.* 2014), but also due to the lack of cooking (Charlebois *et al.* 2015) and serving (Goh and Jie 2019) skills. Lastly, perceived business needs drive FW.

For example, high aesthetic standards of fine dining restaurants contribute significantly to wasting the foodstuffs (for example, irregularly shaped vegetables) that would otherwise be perfectly usable in other foodservice settings (Shao *et al.* 2020).

Customers waste food because of personal taste (Wang *et al.* 2018), portioning problems and over-ordering (Kallbekken and Sælen 2013). The social element of eating out also contributes to plate waste, with events and functions being among the most wasteful occasions of foodservice provision (Zhang *et al.* 2020). Hosts tend to over-order food to be seen as good providers or in order to gain/keep face (Block *et al.* 2016).

The estimates of how much FW is generated in the different stages of foodservice provision vary. While some studies pinpoint disproportionate FW occurring on customer plates (Filimonau *et al.* 2020b; Hennchen 2019; Jagau and Vyrastekova 2017), some highlight kitchens as the prime sources of FW (Goh and Jie 2019; Papargyropoulou *et al.* 2019; SRA 2010). The difference is attributed to the type of dining out occasions: for example, customers waste more food during self-service buffets (Pirani and Arafat 2014). It is further associated with a foodservice category. For instance, due to highly standardised cooking and plating procedures, fast food restaurants generate more FW on customer plates (Martin-Rios *et al.* 2018). Lastly, the season of business operations may play an important role. For example, higher FW in the kitchen is more likely to happen in the 'low' business season due to unpredictable demand and consequent over-production. In contrast, during the 'high', exceptionally busy, foodservice season most FW occurs on customer plates (Filimonau *et al.* 2019a). From the managerial perspective, it is critical to understand the main drivers of FW in foodservice operations and design appropriate approaches to prevent and mitigate its occurrence (Heikkilä *et al.* 2016).

2.2.3. Approaches to management

Given that FW represents a significant cost to a foodservice business (WRAP 2013), foodservice providers have adopted approaches to its management. To aid industry practitioners in managing FW, FW management hierarchies have been developed by academics (see, for example, Filimonau and De Coteau 2019; Papargyropoulou *et al.* 2014; WRAP 2016). These hierarchies aim to facilitate managerial understanding of one or another approach to FW management, involve the necessary stakeholders and assign the required resources accordingly.

In line with the FW management hierarchies, the approaches to FW management in foodservices can be categorised as prevention-, mitigation- and passive disposal-based (Filimonau and De Coteau 2019). The preventative approaches aim at minimising the probability of FW occurrence (Papargyropoulou *et al.* 2016). To this end, they are concerned with such measures as (1) quality assurance standards (to reduce food spoilage and FW in cooking) (McAdams *et al.* 2019); (2) accurate demand forecasting (to avoid the over-production of food) (Filimonau *et al.* 2020a); (3) portion size control (to reduce FW on customer plates) (Condrasky *et al.* 2007); (4) menu design (to avoid excessive inventories of food stock) (Filimonau *et al.* 2019b); and (5) pervasive communication/'nudging' (to engage customers in FW minimisation) (Dolnicar and Juvan 2019).

Research shows, however, that while many foodservice providers can apply one or another, or even a combination of such preventative measures, these may not always work (Filimonau *et al.* 2020b). Such factors as (1) seasonality of customer demand; (2) high guest expectations

of food quality and quantity; and (3) fear of competition (applies to the adoption of nudging interventions and portion size control), contribute to the generation of surplus food or excess food ingredients (Silvennoinen *et al.* 2015). This surplus, if not effectively utilised, goes to waste.

Mitigation approaches can be applied to minimise FW. First, any surplus food can be redistributed (Garrone *et al.* 2014). For example, in the case of excess food ingredients, these can be repurposed to prepare other dishes (Filimonau *et al.* 2020a). As for surplus meals, these can be sold at a discounted price by adopting digital solutions (Huang *et al.* 2020). These meals can also be given to staff and donated to charities (Filimonau *et al.* 2019a). Second, any food left on customer plates can be given to restaurant guests in take-away boxes (Sirieix *et al.* 2017). Research shows that many foodservice providers tend to combine various mitigation-based approaches in pursuit of FW minimisation (Hennchen 2019; Papargyropoulou *et al.* 2019; Pirani and Arafat 2014).

Passive waste disposal implies binning surplus food and any plate leftovers with a scope for composting or using these as animal feed, subject to regulatory and corporate permissions (Papargyropoulou *et al.* 2016). Research indicates that passive disposal prevails in foodservices by representing the most popular way of managing FW (Huang *et al.* 2020). The reasons for this popularity are manifold. First, the ownership model is a major factor to consider. While large(r), chain-affiliated, foodservice organisations have (better) resources to prevent and mitigate FW, smaller ‘independents’ cannot afford investing in environmental conservation due to the lack of such resources (Filimonau *et al.* 2019a).

Personal beliefs and values of restaurant managers also play a role (Principato *et al.* 2018). Managers assigning high importance to environmental conservation are more likely to save food from going to waste (Heikkilä *et al.* 2016). Such managers are, however, rare and most

tend to ‘go with the flow’ when managing FW, rather than experiment and innovate with various preventative and mitigation approaches (Martin-Rios *et al.* 2018).

Affordability and relative simplicity of FW disposal is another determinant (Filimonau and De Coteau 2019). Foodservice providers usually pay per volume of FW collected from their business premises, which is often cheap. Plus, collection of FW represents a rather fixed cost (for instance, £X/$X per a 50 liter garbage bin), which is different in the case of energy or water consumption. These are variable and clearly associated with business performance. For instance, higher occupancy brings about higher energy use, thus pinpointing the latter as a more relatable cost category for foodservice managers (Filimonau and Magklaropoulou 2020).

Lastly, the phenomenon of the neoliberal economy (Lawrence *et al.* 2013) hampers environmental innovations in foodservices. Governments of many, developed and transitional, countries expect foodservices to voluntarily invest in FW management (FUSIONS 2016). The industry is, however, satisfied with the current status quo because of the reasons highlighted above and awaits the government to explicitly (dis)incentivise FW minimisation. The industry also awaits signs from consumers signalling the need for them to stop wasting food (Kasavan *et al.* 2019). However, as most consumers do not recognise the scale of the FW problem (Filimonau *et al.* 2020a), they fail to put sufficient pressure on foodservice providers. Instead, customers expect the industry or the government to lead on FW prevention and mitigation. This becomes a vicious circle in which none of the stakeholders take any meaningful action to pro-actively manage FW in the foodservice sector. This results in disproportionate quantities of food being wasted.

2.3.The Hungarian context

The challenge of FW in Hungary is substantial but under-examined. Although research has attempted to understand the patterns of FW in Hungarian households (Kasza *et al.* 2020; Szabó-Bódi *et al.* 2018), no studies have shed light on the phenomenon of FW in the national foodservice sector. The FUSIONS (2016) project identified no FW data for the foodservice sector of Hungary and, therefore, was unable to provide an estimate of its magnitude. Likewise, although a more recent study by Bori (2018) suggests that circa 2 million tonnes of food is annually wasted in Hungary, it fails to establish the contribution of foodservices. Although the Hungarian market of out-of-home food consumption is large and rapidly developing, Bori (2018) only differentiates between FW in national food processing industries (62% of the total), households (21%) and trade and retail (17%). The lack of specialised knowledge on the patterns of FW occurrence in foodservices of Hungary and approaches to its management is a major research gap, which this study aims to, at least partially, fulfil.

3. Research design

To achieve the goal of this study, a qualitative and descriptive case study approach was adopted (Yin 1989). This approach suits projects aiming to study under-examined topics with a certain degree of sensitivity (Matthews and Ross 2014). Research shows that restaurant managers are reluctant to speak freely about the challenge of FW and its management (Filimonau *et al.* 2020c), especially in countries with emerging democratic governance (Filimonau *et al.* 2019a). This highlights the need to build trustworthy relationships with managers as key study informants. Trust can mitigate the negative effect of social desirability biases that can influence the quality of primary data collection on FW and

its management in the context of foodservices (Principato *et al.* 2018). The qualitative research paradigm and the descriptive case study approach have proven potential to, at least partially, overcome the issues of sensitivity and distrust (Matthews and Ross 2014).

Focus groups were considered but rejected due to the logistical difficulties in bringing together the diverse populations of restaurant managers. Managerial interviews were used instead as this was a popular research method in past studies on FW and its management in foodservices (see, for example, Kasavan *et al.* 2019; Principato *et al.* 2018; Vizzoto *et al.* 2020).

An interview schedule was developed grounding on a set of preliminary themes that emerged from literature review (see Appendix 1). These themes revolved around the topics of managerial knowledge of (1) environmental externalities of foodservice operations, especially FW; (2) magnitude of FW in the case studied businesses; (3) major drivers of FW; and (4) approaches adopted for FW management. The schedule was initially developed in English, i.e. the language of literature review, and translated in Hungarian using the back-translation technique (Brislin 1970). To ensure validity, the schedule was pre-tested with three foodservice managers.

Primary data were generated through in-depth semi-structured interviews with managers of foodservice businesses in Veszprem, a historical, mid-sized, city in Hungary. The choice of Veszprem was determined by three considerations. The first determinant was opportunistic as the study was undertaken within the framework of a large-scale EU-funded research project aiming to enhance the environmental sustainability within the broader Balaton region. Secondly, a mid-sized city of Veszprem was preferred to the capital of Hungary, Budapest, due to being a better representative of the bulk of the national foodservice market. As indicated in research conducted in the context of China (Filimonau *et al.* 2020c), Budapest, as a major metropolitan region, is likely to generate excessive FW given its popularity as a tourist

destination. This suggests that the primary data collected in Budapest is likely to be an over-estimate of actual FW generated across the national market of out-of-home food consumption in Hungary. Veszprem provides a more representative case study as its foodservice market resembles such in other provincial, non-metropolitan, areas of Hungary. Lastly, Veszprem has a well-established market of out-of-home food consumption, which caters for domestic guests and international tourists. There is an interesting pattern of seasonality in demand for its foodservices whereby tourism dominates in the summer while the locals provide the main clientele for the Veszprem's foodservice sector within the rest of calendar year. Again, this is in line with the patterns of out-of-home food consumption in other provincial cities of Hungary, except Budapest where tourism represents an all-year-round economic activity.

Interview participants were purposefully selected given their insights into the studied phenomenon (Lincoln and Guba 1985). Identical approach for primary data collection has been adopted in past studies on FW and its management in the foodservice sector (see, for instance, Filimonau *et al.* 2020c; Okumus *et al.* 2020; Papargyropoulou *et al.* 2019). To obtain a diversity of views and opinions, thus facilitating a holistic analysis, managers representing a broad range of foodservices operating for-profit (hotel restaurants, fine dining restaurants, casual dining restaurants, fast food restaurants and cafeteria) were invited to the interviews. Managers of non-for-profit, contract and publicly subsidised, foodservices such as, for example, workplace and school canteens, were excluded due to their substantially different business models.

The interviews were conducted in January-February 2020. Data saturation determined sample size which was reached with eighteen interviews. Data saturation occurs when the study participants' contributions are exhausted so that they become repetitive and have no further

information to provide (Saldana 2016). Normally, primary data reach saturation with 10-30 interviews (Thomson 2010 cited Marshall *et al.* 2013) and the current study falls into this recommended range. On average, the interviews lasted 30–60 minutes; they were digitally recorded and fully transcribed verbatim. Prior to interviewing, in order to build trust, thus striving for honesty and openness in responses, study participants were assured of complete confidentiality and anonymity. For exactly the same purposes, pseudonyms were used when describing the profiles of study respondents (Table 1).

[Insert Table 1 here]

Thematic analysis was applied to the interview transcripts. To this end, the interview material was first carefully read by the research team to ensure data familiarity and establish patterns of meanings (Berg 2009). These patterns were subsequently labelled, coded and assembled under the common themes following the technique proposed by Braun and Clarke (2006). Table 2 outlines the coding structure with major themes and codes. Following this, exemplar excerpts from the transcripts were sought for each theme to be provided as quotes in the process of this study's write-up in order to support its findings.

[Insert Table 2 here]

4. Findings and discussion

4.1.Environmental impacts of foodservices

Although the literature states that foodservices often fail to adequately recognise the environmental externalities of their operations (Jang *et al.* 2017), study participants were well aware of the environmental impacts of their businesses. In part, this could be attributed to high levels of education among managers in this sample (many were educated to a University degree level), but also to possible media effect. For example, the latter may have influenced popularity of plastic waste as a recurring code in the interviews (Table 2). This is because the issue of plastics in foodservices has been repeatedly featured in major (inter)national popular news (see, for example, BBC 2019). Energy was the second most popular code while the issue of FW, rather unexpectedly, came third (Table 2). This contradicts findings of Filimonau and Magklaropoulou (2020) who identified FW as the most widely recognised environmental impact of hospitality operations. Potentially, high managerial awareness of energy use as an environmental impact of foodservices can be explained by the relative 'tangibility' of its consumption. Indeed, energy use has a clear monetary value as demonstrated by the Marine's quote below. In contrast, FW was seen as an indirect, 'hidden', operational expense, which was partially covered by customers, or even as the operational necessity. The immediate availability and affordability of municipal FW collection services was mentioned as another reason for why the issue of FW was insufficiently recognised by restaurateurs. Lastly, perceived small magnitude of FW in the case studied foodservice businesses had an effect, as the next section explains:

> *'Energy use has a major impact and we try to reduce it as saving energy means saving money. For us, our electricity bill is 450,000 HUF [circa EURO 1300] a month. We have about 15-20 fridges that are old, so they consume a lot of power. Plus water which costs*

us around 40,000-70,000 HUF [circa EURO 115-200] a month which is also expensive, So, energy is always an important topic for us...' (Marine, medium-to-large sized casual dining restaurant)

4.2.Magnitude of FW

All study participants were initially requested to quantitatively estimate the amounts of food wasted in their foodservice businesses, per day or per week. Only one manager was able to provide figures. The rest of the sample failed to offer a precise assessment. This is in agreement with the literature, which has shown that foodservice managers do not keep accurate records of FW (Filimonau *et al.* 2019b). Simplistic, qualitative evaluations of FW, such as 'small', 'large' and 'manageable' are more popular with foodservice operators (Kasavan *et al.* 2019).

In line with this point, study participants were asked to qualitatively evaluate size of the FW problem in their businesses. The majority described FW as being small-to-medium in magnitude, but many evaluated it as being negligible (Table 2). This finding contradicts the literature, which has established substantial size of the FW challenge as perceived by foodservice managers in Italy (Principato *et al.* 2018), Malaysia (Papargyropoulou *et al.* 2019) and China (Filimonau *et al.* 2020c). It also confirms the point made by Vizzoto *et al.* (2020) who argue that, despite FW being a significant issue across the foodservice sector, many managers do not appreciate its true scale. Instead, managers tend to view FW as inevitable given the nature of foodservice business.

Moreover, at a closer look, the actual magnitude of FW in the case studied businesses may have been larger than qualitatively evaluated by study participants. The quote from Paulina below, who qualitatively described the challenge of FW in her foodservice business as 'minor',

suggests otherwise. This is especially true when a comparison is made with the FW figures obtained in other markets of out-of-home food consumption. Paulina assumes that, in low season, her small-to-medium sized restaurant wastes, on average, 100g of food per guest. This figure is, however, larger than FW recorded for foodservices in Sweden (75g per meal, Eriksson *et al.* 2017) and China (93g per guest, Wang *et al.* 2017). Further, assuming an average restaurant meal weighs 650g (WRAP 2013), but possibly less in the case of lunch dishes, Paulina's estimate signifies wastage of about 15%, which is far from insignificant:

> *'We don't measure food waste here but, I think, it's minor. We get a 50 liter bucket and it gets taken away twice a week. There're times when these buckets aren't full, but normally they are, so I'd say, it's roughly 100 liters per week in the low season. If we get about 100 guests a day, on average, this gives us, roughly, I'd say, 100 grams of food wasted per guest, if I calculated this correctly. It becomes three buckets in the summer when we cater for more people'* (Paulina, small-to-medium sized fast food restaurant)

The erroneous perception of the small magnitude of FW in the case studied foodservice businesses indicates critical issues. First, it shows a clear need for scholarly and commercial research to accurately quantify FW in various foodservice sub-sectors in Hungary in order to establish its benchmarks. Second, comparative, cross-sectoral, but also cross-market, studies are required to identify the discrepancy in the amounts of wasted food and establish the reasons for its occurrence. Changes to managerial perceptions of the FW problem as being 'minor' or 'negligible'

are critical for its effective management. Urgent interventions are, therefore, necessary to highlight the 'true' magnitude of the FW challenge in Hungarian foodservices, as per above, thus prompting its minimisation.

In terms of the main fractions of FW, these were represented by vegetables and bakery items (Table 2), which is in line with past studies (Gao *et al.* 2017). Low cost of these foodstuffs determined their excessive wastage. Interestingly, used cooking oil was repeatedly mentioned as FW given that foodservice operators in Veszprem receive money (90 HUF or EURO 0.25 per liter) for its disposal from private waste collection companies. This, again, showcases close association between managerial awareness of FW and the monetary 'value' factor, as discussed earlier.

4.3.Drivers of FW

Most study participants identified customer behaviour as a prime driver of FW (Table 2). This was mainly linked to the issues of personal taste and, to a lesser extent, portion size problems and dietary requirements, which is in line with the literature (Filimonau *et al.* 2020b). There is a well-established tendency among foodservice operators to shift responsibility for FW generation towards consumers (Sakaguchi *et al.* 2018). This may have been further evidenced in this study.

Over-cooking due to errors in demand forecasting was another significant driver of FW, which is confirmed in the literature (Pirani and Arafat 2014). Within this driver, seasonality was an important factor, especially given popularity of Veszprem as a tourist destination. As the quote below indicates, FW from overcooking mostly occurs in summer. This is when tourists come to the city and their numbers are difficult to anticipate. Although many tourists self-cater (Gretzel *et al.* 2019), some also eat out, thus contributing to FW generation in the foodservice

sector of Veszprem. In the ‘low’ season, most food is wasted during the evening service, which has an extensive ‘a la carte menu’, as opposed to lunch, when a fixed ‘lunch’ menu is operated. Long, a la carte service, menus have previously been established as drivers of kitchen FW (Filimonau *et al.* 2019a), which is further confirmed in the Hungarian context.

> *‘Lunch service doesn’t cause us a problem [with food waste] as we usually cater for the ‘regulars’ and we know, roughly, how many people come to us every day. It’s the a la carte, which we use in summer but also for our dinner service, that makes this demand [forecasting] difficult. You don’t know how many people will come in advance, so you tend to overcook. Of course, we’re trying to put up a menu that can prepare for these unexpected situations, and we aim to repurpose as many leftovers and extra stock as possible because wasting these wouldn’t be economically viable’* (Tim, small-to-medium sized casual dining restaurant).

The locational factor was further reflected in the lack of storage facilities as another driver of FW (Table 2). Most restaurants in Veszprem are situated in the city center featuring key tourist landmarks. Location in historical, often listed, buildings implies limited scope for business extension/modification due to difficulties in securing planning and building permissions (Giombini and Pinchi 2015). Thus, foodservice managers lack room to accommodate machinery to reduce FW, such as vacuum sealers and deep freezers, as discussed later.

4.4.Approaches to FW management

All study participants claimed to rely on passive disposal as the main approach to managing FW (Table 2). This was described by Paul below as a 'bin-and-forget' approach whose overall preference was determined by its operational simplicity. Literature highlights the prevalence of passive disposal in other markets of out-of-home consumption whereby similar reasons determine its popularity with foodservice managers (see, for example, Heikkilä *et al.* 2016 for Finland):

> *'Look, in our kitchen, we have a big plastic bucket. When it's full of food waste, we put it outside. We have a contract with a specialist company who takes this waste away. That's it, job done, bin it and forget about it. In the past, there was a way to give this food waste to local people. They'd come, collect it and give it to pigs or other animals. But this is forbidden now. So, we have to have this contract with a waste management company who manages all our food waste'* (Paul, medium-to-large sized fast food restaurant)

A unique finding of this study was in that many foodservices in Veszprem tended to vacuum fresh foodstuffs upon delivery and freeze any excess food ingredients for subsequent consumption to avoid their wastage (Table 2). As Boris explains below, modern technology enables foodservice operators to store foodstuffs for long(er) without any detriment to their quality. Literature provides no evidence of the use of this approach to FW management in restaurants of other out-of-home food consumption markets. This is probably because vacuuming and freezing should be applied with caution to avoid customer accusations in the food served being not fresh enough. This is not considered an issue by foodservice businesses in Veszprem because they offer affordable meals with low profit margins. Local consumers of foodservices in Veszprem

are likely to make certain compromises on quality/freshness of meals in pursuit of lower costs, especially when it comes to such 'functional' (Principato *et al.* 2018) occasions of eating out as lunches. As for tourists, these come and go and do not, therefore, represent repeat customers. This suggests that Veszprem restaurateurs can preserve excess food, sacrificing some quality while increasing profits:

> *'We use modern kitchen technology, such as the sous vide technology which is well-proven to reduce wastage. When it comes to fresh raw materials, such as meat and fish, when these arrive, they get immediately processed, obviously the necessary bones are cleaned, and then placed in a vacuum bag, which allows longer storage of the food. Since we started using this technology, we've dropped 50% of our food waste. It also provides good quality, so we don't get complaints from customers about the freshness of our food'*
> (Boris, small-to-medium sized casual dining restaurant)

Other popular approaches to FW management were less acceptable for Veszprem restaurateurs. Although foodservices can apply portion size control (McAdams *et al.* 2019), offer differently-sized portions to females and children and cook on demand (Silvennoinen *et al.* 2015), these did not work for most of study participants (Table 2). The prime reason was in the high competitiveness of the local out-of-home food consumption market, exacerbated by the locational factor. Indeed, due to its small, compact size, the city of Veszprem hosts most foodservice operators in close proximity to one another. These operators cater, except for the summer, to a well-established base of clientele represented, in majority, by local 'regulars', especially for lunch. This suggests that making any 'unconventional' decisions regarding the food offer/menu can

reduce the inflow of customers and, consequently, diminish profitability. As a result, local foodservice businesses tend to 'play it safe' by going 'along with the flow' and refrain from implementing such (perceived to be unconventional) interventions as, for example, cooking less food or preparing smaller portions.

Even the pro-active offer of take-away boxes for plate leftovers was considered potentially damaging. Given that take-away boxes may prompt anger among certain categories of consumers (Sirieix *et al.* 2017), local foodservices in Veszprem have to offer them with caution. This is because customer anger may cause dissatisfaction and bring about lost customer loyalty. This is in line with the literature (Condrasky *et al.* 2007), which has long established managerial reluctance to damage consumer experience as a prime reason for the limited adoption of preventative/pro-active approaches to FW management in foodservices. The dilemma which restaurateurs in Veszprem face is well-articulated by Marta below:

> *'We don't use portion size control because this dissatisfies people. Say, we give them smaller portions for the same price, they will be like, oh, 'what is this?', they will be a little bit angry, not angry, but like, oh, 'these guys, they want to cheat us, or, well, we'll go to their competitors'. I'm not an enemy to my own guests, so I don't want them to feel unhappy, so they no longer come to me. So, we don't do that [portion size control]. Happy customer, happy business, you know'* (Marta, small-to-medium sized hotel restaurant)

Given growing popularity of food rescue as an approach to mitigate FW occurrence in foodservices, a probe was made to understand the scope for its adoption in Hungary. Most study participants rejected the idea of rescuing excess food (Table 2) which was due to (1) the lack of charitable organisations in Hungary/Veszprem that could redistribute surplus food to people in need and (2) insufficient resources possessed by such organisations for surplus food collection and service. Lastly, (3) food safety concerns widespread among restaurant managers were another reason. This is in line with the literature which outlined identical impediments of food rescue in other markets of out-of-home food consumption (see Filimonau *et al.* 2019b for the UK):

> *'At the beginning, we tried to look for some food rescue organisations who could come and take any surplus food we had away. We'd happily give the surplus to them, but their condition was that we'd deliver it. We cannot provide a separate resource for this. We can pack the surplus up and leave it for collection, so we told them to come and get it every day. But they didn't make use of it, unfortunately, that's how it goes. So, we'd be prepared to donate unsold food, but we really need someone reliable who could rescue it, but unfortunately their system is not ready for this'* (Bernie, medium-to-large sized fast food restaurant)

4.5.Barriers to FW management

The last part of the interviews aimed at understanding the overarching barriers to effective management of FW in Hungarian foodservices. These barriers can be categorised as institutional, contextual, locational, organisational and cultural (Figure 1). To reduce these barriers, a joint, multi-stakeholder, effort is required. More specifically:

[Insert Figure 1 here]

The EU-28 and Hungarian institutions of power (i.e. the institutional barrier) should revise their current (inter)national food health and safety standards. This is to reduce foodservice business liability for food related diseases/food poisoning, thus promoting food rescue among restaurateurs. To encourage food redistribution, the non-governmental sector of Hungary should evolve. This can be incentivised by national policy-makers. For example, dedicated governmental grants should be provided to charitable organisations to aid in securing the necessary (physical and labour) capital. The UK experience of devising such governmental grants can be used as an example by the Hungarian institutions of power (GOV.UK 2020).

From the viewpoint of contextual impediments (Figure 1), regional authorities in Hungary should work closely with the national government to support charitable work of food rescue organisations. Investment in transparent, streamlined food supply chain is also necessary to ensure foodservices can access quality foodstuffs at affordable prices. Financial incentives can be provided to promote shorter food supply chains with their higher levels of stakeholder trust and engagement (Govindan 2018).

To reduce the locational barrier, local authorities in Veszprem should review their current urban planning policies and practices. This should be concerned with streamlining applications for planning permissions from the restaurateurs striving to conserve the environment. For

example, approvals for the adoption of on-site composting units can be simplified. Appropriate incentives, such as interest-free loans, can be provided to businesses willing to divert FW from landfill.

The locational impediment is also reflected in fierce market competition among local foodservice businesses in Veszprem. This competition inhibits application of environmental innovations within the foodservice sector of the city. It is argued that, given the relatively small size of the local food consumption market, foodservices in Veszprem should move away from competing with each other and start collaborating, or even coopeting (Bengtsson and Kock 2000). For example, in the high season, local foodservice operators can send any excess clientele to their 'sister' restaurants, thus avoiding over-production of food with subsequent wastage. They can further provide any surplus food to the foodservices that need it. A commission system can be developed to reward such customer/surplus food exchanges. This outlines the scope for business innovation and provides room for application of the 'sharing economy' model in the business-to-business settings.

The above can, at least partially, reduce the organisational barrier to FW management in foodservices (Figure 1). In the foremost, this concerns willingness of restaurateurs to invest in FW prevention and mitigation. This is in pursuit of the long(er)-term, environmental sustainability, rather than short(er)-term, business profitability, related, goals. Further, preparedness of foodservice businesses to innovate by adopting novel business models is critical for business longevity. The value of business innovation is well demonstrated by the on-going impact of online food distribution platforms on foodservices which has disrupted the traditional foodscapes of cities (Filimonau and De Coteau 2019).

Lastly, all barriers discussed above should be considered through the prism of consumer behaviour (Figure 1). International tourists from EU-28 countries and beyond, domestic tourists from Hungary and local residents of Veszprem all fail to recognise the challenge of FW in the

foodservice sector (the cultural impediment). This suggests that all measures designed to address this challenge in the Hungarian context can only succeed through active consumer engagement in FW management. It is argued that customers are unlikely to voluntarily change their behaviour overnight and start saving food when eating out. Their engagement in FW prevention and mitigation should be facilitated by national policy-makers via targeted educational campaigns. This should be supported by foodservice providers via the adoption of consumer (dis)incentivisation techniques, such as 'nudging' interventions (Filimonau *et al.* 2020a). There is growing evidence that such interventions can change consumer behaviour (Dolnicar and Juvan 2019). This highlights the need for their active adoption across the foodservice sector in Hungary.

5. Conclusions

This study shed light on the challenge of FW and its management in the foodservice sector of a transitional economy in Europe, Hungary. It provided the first benchmark of FW occurrence in foodservices of a mid-sized Hungarian city of Veszprem. The study demonstrated that limited managerial recognition of the FW problem hampered the adoption of preventative approaches to its minimisation. This was further exacerbated by the presence of institutional, contextual, locational, organisational and cultural factors that hindered effective FW management. Drawing on international experience and best practices, the study provided recommendations on how the effectiveness of FW prevention and mitigation in Hungarian foodservices can be improved.

As with any research, this study had limitations. Small sample size is one of the key drawbacks given its restricted generalisability. As the study was conducted prior to COVID-19, its results will have to be verified after the pandemic is over. COVID-19 has detrimentally affected the global foodservice sector, and one of these effects could be in changed FW dynamics.

The study outlined directions for future research. The case studies of restaurants in Veszprem, while offering an important initial perspective into the challenges and opportunities of FW management in Hungarian foodservices, lack the national representativeness. Future research should, therefore, conduct similar investigation in other localities in Hungary, most notably in its most developed market of out-of-home consumption, the capital city of Budapest. Second, as customer behaviour was identified as a key impediment to effective FW management, future studies should examine the drivers of irresponsible food choices among consumers of Hungarian foodservices. Given popularity of Veszprem/Hungary as a tourist destination, future research can undertake a comparative, cross-cultural, analysis, to identify drivers of FW generation by different socio-demographic and national customer groups. Lastly, voices of other stakeholders (policy-makers, local authorities and charitable organisations) in Hungary should be listened to. This is to provide a multi-stakeholder perspective on the barriers to effective management of FW in Hungarian foodservices and, accordingly, design effective solutions to reduce their occurrence.

Acknowledgements

This study was undertaken within the framework of the *Sustainable, intelligent and inclusive regional and city models* project (project nr. EFOP-3.6.2-16-2017-00017) co-funded by the Hungarian Government and the European Social Fund of the European Union.

References

BBC, 2019. Single-use plastic: takeaways challenged to use less. Available from: https://www.bbc.co.uk/news/uk-england-bristol-47403669 [Accessed 06 June 2020].

Bengtsson, M., and Kock, S., 2000. ”Coopetition” in Business Networks—to Cooperate and Compete Simultaneously. *Industrial Marketing Management*, 29(5), 411-426.

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

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

Block, L.G., Keller, P.A., Vallen, B., Williamson, S., Birau, M.M., Grinstein, A., *et al.*, 2016. The squander sequence: understanding food waste at each stage of the consumer decision-making process. *Journal of Public Policy & Marketing*, 35(2), 292-304.

Bori, P., 2018. *The state of food waste in Hungary*. *A report by the Agricultural Team of the Embassy of the Kingdom of the Netherlands in Budapest, Hungary,* August 2018.

Braun, V., and Clarke, V., 2006. Using Thematic Analysis in Psychology. *Qualitative Research in Psychology*, 3, 77-101.

Brislin, R.W. 1970. Back-Translation for Cross-Cultural Research. *Journal of Cross-Cultural Psychology*, 1**,** 185-216

Camillieri, M.A., 2018. Nurturing travel and tourism enterprises for economic growth and competitiveness. *Tourism and Hospitality Research*, 18(1), 123-127.

Chan, E.S.W., and Hsu, C.H.C., 2016. Environmental management research in hospitality. *International Journal of Contemporary Hospitality Management*, 28(5), 886-923.

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.

Condrasky, M., Ledikwe, J.H., Flood, J.E., and Rolls, B.J., 2007. Chefs' Opinions of Restaurant Portion Sizes. *Obesity*, 15(8), 2086-2094.

Dai, Y., Yang, Y., Lee, R., Fleischer, A.S., and Wemhoff, A.P., 2020. Life cycle environmental impacts of food away from home and mitigation strategies—a review. *Journal of Environmental Management*, 265, 110471.

Dolnicar, S., and Juvan, E., 2019. Drivers of Plate Waste. A Mini Theory of Action Based on Staff Observations. *Annals of Tourism Research*, 78, 102731.

Engström, R., and Carlsson-Kanyama, A., 2004. Food losses in food service institutions Examples from Sweden. *Food Policy*, 29(3), 203-213.

Eriksson, M., Osowski, P.C., Malefors, C., Björkman, J. and Eriksson, E., 2017. Quantification of food waste in public catering services–A case

study from a Swedish municipality. *Waste Management*, 61, 415-422.

Eriksson, M., Malefors, C., Callewaert, P., Hartikainen, H., Pietilainen, O., and Strid, I., 2019. What gets measured gets managed–or does it? Connection between food waste quantification and food waste reduction in the hospitality sector. *Resources, Conservation & Recycling*:*X*, 4, 100021.

European Commission, 2020. *EU actions against food waste.* Available from: https://ec.europa.eu/food/safety/food_waste/eu_actions_en [Accessed 01 June 2020].

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

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*, 32, 100577.

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.

Filimonau, V., and Magklaropoulou, A., 2020. Exploring the viability of a new 'pay-as-you-use' energy management model in budget hotels. *International Journal of Hospitality Management*, 89, 102538.

Filimonau, V., Matute, J., Kubal-Czerwinska, M., Krzesiwo, K., and Mika, M., 2020a. The determinants of consumer engagement in restaurant food waste mitigation in Poland: An exploratory study. *Journal of Cleaner Production*, 247, 119105.

Filimonau, V., Todorova, E., Mzembe, A., Sauer, L., and Yankholmes, A., 2020b. A comparative study of food waste management in full service restaurants of the United Kingdom and the Netherlands. *Journal of Cleaner Production*, 258, 120775.

Filimonau, V., Zhang, H., and Wang, L., 2020c. Food waste management in Shanghai full-service restaurants: a senior managers' perspective. *Journal of Cleaner Production*, 258, 120975.

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 01 June 2020].

Gao, L.W., Cheng, S.K., Xu, S.W., Li, Z.M., Liu, X.J., Zhang, D., Yu, W., Cao, X.C., Wang, L.E., Liu, Y., Wang, Y. and Qin, Q., 2017. Impacts of National Policy on Catering Food Waste in Urban China–A Case Study of Lhasa City. *Food and Nutrition in China*, 23(3), 44-48.

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

Giombini, M., and Pinchi, E.M., 2015. Energy Functional Retrofitting of Historic Residential Buildings: The Case Study of the Historic Center of Perugia. *Energy Procedia*, 82, 1009-1016.

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.

Govindan, K., 2018. Sustainable consumption and production in the food supply chain: A conceptual framework. *International Journal of Production Economics,* 195, 419-431.

GOV.UK, 2020. *Over £1m to fund food waste fight*. Available from: https://www.gov.uk/government/news/over-1m-to-fund-food-waste-fight [Accessed 12 June 2020].

Gretzel, U., Murphy, J., Pesonen, J., and Blanton, C., 2019. Food waste in tourist households: a perspective article. *Tourism Review*, 75(1), 235-238.

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

Hennchen, B., 2019. Knowing the Kitchen: Applying Practice Theory to Issues of Food Waste in the Food Service Sector. *Journal of Cleaner Production*, 225, 675-683.

Higgins-Desbiolles, F., Moskwa, E., and Wijesinghe, G., 2019. How sustainable is sustainable hospitality research? A review of sustainable restaurant literature from 1991 to 2015. *Current Issues in Tourism*, 22(13), 1551-1580.

Huang, C-H., Liu, S-M., and Hsu, N-Y., 2020. Understanding Global Food Surplus and Food Waste to Tackle Economic and Environmental Sustainability. *Sustainability*, 12, 2892.

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

Jang, Y.J., Zheng, T., and Bosselman, R., 2017. Top managers' environmental values, leadership, and stakeholder engagement in promoting environmental sustainability in the restaurant industry. *International Journal of Hospitality Management*, 63, 101-111.

Jones, P., Hillier, D., and Comfort, D., 2014. Sustainability in the global hotel industry. *International Journal of Contemporary Hospitality Management*, 26(1), 5-17.

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.

Kasavan, S., Mohamed, A.F., and Halim, S.A., 2019. Drivers of food waste generation: Case study of island-based hotels in Langkawi, Malaysia. *Waste Management*, 91, 72-79.

Kasza, G., Dorko, A., Kunszabo, A., and Szakos, D., 2020. Quantification of Household Food Waste in Hungary: A Replication Study Using the FUSIONS Methodology. *Sustainability*, 12(8), 3069.

Lawrence, G., Richards, C., Lyons, K., 2013. Food security in Australia in an era of neoliberalism, productivism and climate change. *Journal of Rural Studies*, 29, 30-39.

Li, Y., Wang, L., and Cheng, S., 2019. Spatiotemporal variability in urban HORECA food consumption and its ecological footprint in China. *Science of the Total Environment*, 687, 1232-1244.

Li, Y., Filimonau, V., Wang, L., and Cheng, S., 2020. Tourist food consumption and its arable land requirements in a popular tourist destination. *Resources, Conservation & Recycling*, 153, 104587.

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

Marshall, B., Cardon, P., Poddar, A., and Fontenot, R., 2013. Does sample size matter in qualitative research?: A review of qualitative interviews in IS research. *Journal of Computer Information Systems*, 54(1), 11–22.

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.

McAdams, B., von Massow, M., Gallant, M., and Hayhoe, M.A., 2019. A cross industry evaluation of food waste in restaurants. *Journal of Foodservice Business Research*, 22(5), 449-466.

Myung, E., McClaren, A., and Li, L., 2012. Environmentally related research in scholarly hospitality journals: Current status and future opportunities. *International Journal of Hospitality Management*, 31(4), 1264-1265.

Okumus, B., Taheri, B., Giritlioglu, I., and Gannon, M.J., 2020. Tackling food waste in all-inclusive resort hotels. *International Journal of Hospitality Management*, 88, 102543.

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.

Papargyropoulou, E., Steinberger, J., Wright, N., Lozano, R., Padfield, R., and Ujang, Z., 2019. Patterns and Causes of Food Waste in the Hospitality and Food Service Sector: Food Waste Prevention Insights from Malaysia. *Sustainability*, 11, 6016.

Parfitt, J., Barthel, M., and 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(1554), 3065-3081.

Pinto, S.R., Pinto, S.R.M., Melo, S.F.F., Campos, S.S., and Cordovil, C.M., 2018. A Simple Awareness Campaign to Promote Food Waste Reduction in a University Canteen. *Waste Management*, 76, 28-38.

Pirani, S., and Arafat, H., 2014. Solid waste management in the hospitality industry: A review. *Journal of Environmental Management*, 146, 320-336.

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

ReFED, 2018. *The Foodservice Food Waste Action Guide*. ReFED. Available from: https://www.refed.com/downloads/Foodservice_Guide_Web.pdf [Accessed 09 June 2020].

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.

Saldaña, J., 2016. *The Coding Manual for Qualitative Researchers* (3rd ed.). London: Sage Publications Ltd.

Shao, X., Jeong, E., Jang, S., and Xu, Y., 2020. Mr. Potato Head fights food waste: The effect of anthropomorphism in promoting ugly food. *International Journal of Hospitality Management,* 89, 102521.

Silvennoinen, K., Heikkilä, L., Katajajuuri, J., and Reinikainen, A., 2015. Food waste volume and origin: Case studies in the Finnish food service sector. *Waste Management*, 46, 140-145.

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.

Stuart, T., 2009. *Waste: Uncovering the global food scandal.* Penguin Books, London.

Szabó-Bódi, B., Kasza, G., and Szakos, D., 2018. Assessment of household food waste in Hungary. *British Food Journal*, 120(3), 625–638.

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

United Nations Sustainable Development Goals, 2020. *Goal 12: Ensure sustainable consumption and production patterns.* Available from: https://www.un.org/sustainabledevelopment/sustainable-consumption-production/ [Accessed 01 June 2020].

Vizzoto, F., Tessitore, S., Iraldo, F., and Testa, F., 2020. Passively concerned: Horeca managers' recognition of the importance of food waste hardly leads to the adoption of more strategies to reduce it. *Waste Management*, 107, 266-275.

Wang, L., Liu, G., Liu, X., Liu, Y., Gao, J., Zhou, B., Gao, S. and Cheng, S., 2017. The Weigh of Unfinished Plate: A Survey Based Characterization of Restaurant Food Waste in Chinese Cities. *Waste Management*, 66, 3-12.

Wang, L., Xue, L., Li, Y., Liu, X., Cheng, S., and Liu, G., 2018. Horeca Food Waste and Its Ecological Footprint in Lhasa, Tibet, China. *Resources, Conservation and Recycling*, 136, 1-8.

Wen, Z., Hu, S., Clercq, D., Beck, M, B., Zhang, H., Zhang, H., Fei, F. and Liu, J., 2018. Design, Implementation, and Evaluation of an Internet of Things (loT) Network System for Restaurant Food Waste Management. *Waste Management*, 73, 26-38.

WRAP-Waste and Resources Action Programme, 2013. *Final Report: The True Cost of Food Waste within Hospitality and Food Service.* WRAP Technical report, project code HFS001-015. WRAP, Banbury.

WRAP, 2015. *Food waste tracking sheet.* WRAP, Banbury. Available from: https://wrap.org.uk/sites/files/wrap/Food_Waste_Tracking_Sheet_v1.1_0_050115.pdf [Accessed 09 June 2020].

WRAP, 2016. *Estimates of Food surplus and waste arisings in the UK*. Banbury: WRAP.WRAP, 2020. *UK progress against Courtauld 2025 targets and UN Sustainable Development Goal 12.3*. January 2020, WRAP, Banbury. Available from: https://wrap.org.uk/sites/files/wrap/Progress_against_Courtauld_2025_targets_and_UN_SDG_123.pdf [Accessed 09 June 2020].

Zhang, X., Jeong, E-H., Olson, E.D., and Evans, G., 2020. Investigating the effect of message framing on event attendees' engagement with advertisement promoting food waste reduction practices. *International Journal of Hospitality Management*, 89, 102589.

Table 1. Study participants (n=18).

Pseudonym	**Gender**	**Age**	**Highest education level**	**Business type**	**Size** *Small-to-medium (up to 20 tables)* *Medium-to-large (20+ tables)*	**Types of meal service offered**
Marta	Female	In their 60s	University degree	Hotel restaurant	Small-to-medium	Breakfast and lunch
Tim	Male	In their 40s	University degree	Casual dining restaurant	Small-to-medium	Lunch-dinner
Paulina	Female	In their 30s	University degree	Fast food restaurant	Small-to-medium	Lunch-dinner
Simon	Male	In their 40s	University degree	Casual dining restaurant	Medium-to-large	Lunch-dinner
Victoria	Female	In their 40s	University degree	Casual dining restaurant	Medium-to-large	Lunch-dinner
Juliana	Female	In their 30s	University degree	Cafeteria	Small-to-medium	Breakfast, lunch, dinner
Sandra	Female	In their 60s	University degree	Hotel restaurant	Small-to-medium	Breakfast, lunch, dinner
Sean	Male	In their 40s	University degree	Fine dining restaurant	Medium-to-large	Lunch-dinner
Boris	Male	In their 50s	College degree	Casual dining restaurant	Small-to-medium	Lunch-dinner
Bernie	Female	In their 40s	University degree	Fast food restaurant	Medium-to-large	Lunch-dinner
Ben	Male	In their 50s	University degree	Hotel restaurant	Medium-to-large	Breakfast, lunch, dinner
Paul	Male	In their 40s	College degree	Fast food restaurant	Medium-to-large	Lunch-dinner
Thomas	Male	In their 50s	College degree	Casual dining restaurant	Small-to-medium	Lunch-dinner
Zachariah	Male	In their 40s	University degree	Casual dining restaurant/pub	Medium-to-large	Lunch-dinner
Jack	Male	In their 50s	University degree	Hotel restaurant	Medium-to-large	Lunch-dinner
Jane	Female	In their 40s	University degree	Fast food restaurant	Medium-to-large	Lunch-dinner
Greg	Male	In their 40s	University degree	Casual dining restaurant	Medium-to-large	Lunch-dinner
Marine	Female	In their 50s	University degree	Casual dining restaurant	Medium-to-large	Lunch-dinner

Table 2. Coding structure with themes and codes. The figures highlight the number and proportion of quotes assigned to each code. Red colour denotes the most popular codes (mentioned by >50% study participants).

Theme	Code	n	%
Environmental impacts	Plastic waste from food packaging and single use cutlery (including straws)	10 out of 18	56%
	Energy use	8 out of 18	44%
	Food waste	7 out of 18	39%
	Water use	5 out of 18	28%
	Other waste, i.e. paper and glass	4 out of 18	22%
Magnitude of food waste	Small-to-medium	10 out of 18	56%
	Small/Negligible	8 out of 18	44%
Food waste types	Vegetables (for salads and garnish)	11 out of 18	61%
	Bakery items	8 out of 18	44%
	Used cooking oil	7 out of 18	39%
	Meat	6 out of 18	33%
	Sauces	2 out of 18	11%
Food waste drivers	Customer plate leftovers	12 out of 18	67%
	Unpredictable demand, especially for dinner services, services on weekends and services in the summer >>> Leading to over-cooking	9 out of 18	50%
	Events and functions	4 out of 18	22%
	Insufficient food storage capacity / lack of food freezing facilities / lack of adequate packaging for food storage	4 out of 18	22%
	Foodstuffs of poor quality (or damaged in transit) provided by suppliers	1 out of 18	6%
	Dietary requirements of guests	1 out of 18	6%
Management approaches	Passive disposal for municipal collection	18 out of 18	100%
	Use of frozen food with longer storage time / Freezing food to keep it for longer / Sous vide and vacuuming methods for keeping surplus food and for food storage	10 out of 18	56%
	Experienced chefs and kitchen staff monitoring food stock and repurposing excess when and if required	7 out of 18	39%
	Portion size control	6 out of 18	33%
	Excess food given to staff	6 out of 18	33%
	Short menus, especially for lunch service	6 out of 18	33%
	Extended times of foodservice operations e.g. serving breakfast until 11.00, lunch until 16.00	5 out of 18	28%
	Cooking on demand	5 out of 18	28%
	Smaller portions for children and female guests	3 out of 18	17%
	Use of seasonal ingredients	3 out of 18	17%

	Donations to people in need	2 out of 18	11%
Barriers to more effective mitigation	Lack of consumer awareness/understanding >>> resultant lack of consumer engagement in food waste mitigation	12 out of 18	67%
	Food health and safety – relates to 1) food donations, 2) take away boxes, 3) food waste fed to animals, and 4) food waste used for onsite composting	11 out of 18	61%
	Urban planning restrictions (e.g. difficult to have modifications approved for historical, listed buildings)	9 out of 18	50%
	Lack of reliable suppliers	6 out of 18	33%
	Cost of take-away boxes (applies to plate leftovers)	4 out of 18	22%
	Lack of governmental incentives	3 out of 18	17%
	Lack of reliable food rescue organisations	3 out of 18	17%
	Fear of competition	2 out of 18	11%
	Fear of customer backfire (applies to portion size control and nudging interventions)	2 out of 18	11%