**The determinants of consumer engagement in restaurant food waste mitigation in**

**Poland: an exploratory study**

**Abstract**

The growing magnitude of restaurant food waste undermines the environmental sustainability of the global sector of food service provision. The challenge of restaurant food waste is of particular concern for transitional and developing economies where food consumption out of home is becoming increasingly popular. In these markets, a large share of restaurant food waste comes from customer plates, which highlights changes to consumer behaviour as an important mitigation opportunity. Little is however known about how these behavioural changes can be activated and subsequently reinforced. This study explores the prerequisites of consumer involvement in mitigating restaurant food waste in Poland, a transitional economy in East-Central Europe. It tests the role of such prerequisites of pro-environmental consumer behaviour as public environmental knowledge, environmental concern, anticipated regret and pro-environmental behaviour at home in shaping positive customer attitudes towards the need to mitigate restaurant food waste with a subsequent trigger of behavioural intentions to engage in mitigation. The study offers policy and management recommendations on how these behavioural intentions can be reinforced.

**Keywords**

Food waste, restaurant, mitigation, environmental knowledge, consumer attitudes, pro-environmental behaviour, Poland

**Highlights**

- Deals with the growing societal challenge of food wastage in restaurants

- Studies an emerging market of out-of-home food consumption in East-Central Europe

- Reveals the determinants of consumer engagement in restaurant food waste mitigation

- Discloses the policy and management opportunities to enhance this engagement

# 1. Introduction

Restaurant food waste represents an issue of growing political, corporate and public concern (Giorgi 2013). It leads to the under-utilisation of natural resources, degrades the environment, diminishes business profitability and accelerates poverty (Hu *et al.* 2016; Pirani and Arafat 2016; Wang *et al.* 2017). Due to these long-term detrimental, socio-economic and environmental, implications, restaurant food waste has been increasingly portrayed in the media as a crime against the planet and humanity with repeated calls for its urgent mitigation (Cassidy 2018).

The mitigation of restaurant food waste is an important managerial task (Principato *et al.* 2018) and its fulfilment requires sustained scholarly support. Scholarly research is necessary to assist managers in establishing the magnitude and revealing the drivers of restaurant food waste (Filimonau and de Coteau 2019). It is further required to catalogue effective approaches to mitigation, drawing upon 'good business' practices and case studies from the different consumption markets and restaurant sub-sectors (Papargyropoulou *et al.* 2016). Last but not least, scholarly research should unveil the determinants of effective mitigation and inform policy-makers and industry professionals about how these determinants could be capitalised upon (Filimonau *et al.* 2019).

Despite the explicit advantages of scholarly research on restaurant food waste, its scope remains limited (Papargyropoulou *et al.* 2016). Extant studies have focused on developed countries while most transitional economies have been excluded from analysis (Filimonau and de Coteau 2019). This is a major shortcoming as the challenge of restaurant food waste is truly universal (Stenmarck *et al.* 2016). The developed countries are characterised by mature markets of out-of-home food consumption with excessive wastage (Christ and Burritt 2017). Such markets are rapidly emerging in the transitional economies and the phenomenon of

restaurant food waste is growing here accordingly, thus calling for its in-depth research (Pirani and Arafat 2016; Wang *et al.* 2017; Wen *et al.* 2015).

Irresponsible consumer behaviour represents one of the key drivers of restaurant food waste (Sakaguchi *et al.* 2018), highlighting the importance of engaging customers in its mitigation (Kallbekken and Sælen 2013). For consumer engagement to succeed, it is necessary to establish the determinants of voluntary, pro-environmental changes in consumer behaviour that may lead to reduced food wastage, and then to stimulate these determinants accordingly (Stöckli *et al.* 2018a). This topic is however under-studied and little is known about how pro-environmental consumer behaviour can be triggered and subsequently reinforced to mitigate restaurant food waste in different consumption contexts (Papargyropoulou *et al.* 2016).

This study contributes to knowledge by exploring the determinants of consumer engagement in the mitigation of restaurant food waste in Poland. Although the prerequisites of pro-environmental consumer behaviour in a generic context of household consumption have long been established, their validity has never been tested in the context of dining out. This pinpoints an important knowledge gap given the growing significance of restaurant food waste as a global societal challenge. To develop effective solutions towards this challenge, this study attempts to test how/if the known prerequisites of pro-environmental consumer behaviour can be applied to predict the extent to which consumers in Poland can be engaged in the mitigation of restaurant food waste. Knowledge of the prerequisites will aid Polish restaurateurs and policy-makers in the design of approaches to food waste management underpinned by changes to consumer behaviour. The geographical focus of this study on Poland is deliberate because it represents a significant, yet rapidly developing, market of out-of-home food consumption in East-Central Europe where restaurant food waste holds significant societal and environmental implications.

## 2. Literature review

### 2.1. Restaurant food waste and the related research agenda

The challenge of restaurant food waste was first recognised in the 1980s (Kirk 1995) with seminal contributions made to its initial understanding by Collison and Colwill (1986) and Cummings (1992). The research has then stagnated for almost three decades, and it was not until 2014 that the topic has regained scholarly interest (Filimonau and de Coteau 2019). Despite the 'fresh' research outlook on restaurant food waste as a major societal challenge, it remains under-examined (Papargyropoulou *et al.* 2016), especially when compared to the other contexts in which food wastage occurs, such as households (Evans 2011; Katajajuuri *et al.* 2014; Parizeau *et al.* 2015) and grocery retail (Eriksson *et al.* 2012; Filimonau and Gherbin 2017; Lebersorger and Schneider 2014), whose scholarly agenda is much more established.

Extant studies on restaurant food waste have attempted to establish its magnitude (see, for example, Betz *et al.* 2015; Eriksson *et al.* 2017; 2018), identify the key drivers (see, for instance, Derqui and Fernandez 2017; Juvan *et al.* 2018; Silvennoinen *et al.* 2015) and reveal the main approaches to mitigation (see, for example, Falasconi *et al.* 2015; Marthinsen *et al.* 2012; Sirieix *et al.* 2017). The need for more research on all of the above aspects of restaurant food waste has been acknowledged as the scholarly findings produced to date are insufficient to build a comprehensive picture of this phenomenon (Filimonau and de Coteau 2019). The comprehensive outlook is difficult to obtain because the restaurant sector is complex and diverse, consisting of numerous sub-sectors that target different consumer markets, each with specific operational and organisational characteristics that can affect the scale and influence the scope of food waste generation (Christ and Burritt 2017). For example, in fine dining restaurants, because of high quality standards and/or pure aesthetics reasons, substantial wastage occurs during food preparation (Charlebois *et al.* 2015) while, in

casual dining restaurants, significant wastage is produced by consumers (Juvan *et al.* 2018). Further, the geography of food consumption markets plays a role as the consumer cultural backgrounds, including their religious beliefs, and/or particular eating habits can determine the magnitude of food waste generation in restaurants. For example, excessive amounts of food are often ordered during formal dining out occasions in China, with subsequent wastage occurring on a regular basis, as this is an indispensable element of many national cultures in Asia showcasing respect of the host towards the guest (Wang *et al.* 2017).

A critical issue within the research agenda on restaurant food waste is the lack of accurate, quantitative assessments of the main food waste streams (Filimonau and de Coteau 2019). Extant figures are often based on the case studies of specific restaurants, being not necessarily sector-representative, which is, in part, due to the complexity of the national restaurant sectors, as highlighted above, but also because of the convenience sampling techniques employed for primary data collection. The lack of accurate, sector-representative assessments hampers understanding of the key drivers of restaurant food waste (Papargyropoulou *et al.* 2016). Wastage in restaurants occurs during food preparation, which embraces all operational processes and procedures attributed to food transportation, handling, storage, and cooking (Heikkilä *et al.* 2016); it further arises from consumer plates (Juvan *et al.* 2018). The precise contribution of each of these processes and procedures to restaurant food wastage remains unknown which is due to the lack of accurate and easily generalisable assessments of its magnitude, as discussed above. It is believed that consumers waste at least a third of restaurant food (WRAP 2013), but this figure may have significant market variations depending on such factors as the restaurant business models in use (i.e. a la carte versus buffet), the nature of dining out occasions (i.e. a large function versus a romantic dinner for two) and the (cooking, plating and serving) skills of kitchen and waiting staff, among others.

Poor understanding of the drivers of restaurant food waste hinders the design of effective mitigation approaches (Ferreira *et al.* 2013). These approaches can be divided into those related to the optimisation of food (supply chain) logistics and refinement of the kitchen processes (for example, working with suppliers to ensure timely, on-demand only, food deliveries and training staff to avoid wastage in cooking), those concerned with the redistribution of unsold food (for instance, donating excess food to the people in need and/or to the restaurant staff), and those attributed to the facilitation of changes in consumer behaviour (for example, enhancing consumer awareness of food wastage in restaurants and engaging them in mitigation). The major approaches to mitigating restaurant food waste alongside the examples of 'good business' practices in their adoption from around the world have been reviewed in Filimonau and de Coteau (2019), Papargyropoulou *et al.* (2016) and Pirani and Arafat (2016).

There is no universal portfolio of mitigation approaches that restaurants could adopt to reduce food wastage as the ultimate success of mitigation will depend on managerial knowledge of the consumption market in question (so-called external factors) and resource availability within their own enterprise (so-called internal factors or in-house competencies) (Martin-Rios *et al.* 2018). It is however recognised that voluntary changes in consumer behaviour hold a large mitigation potential, regardless of the consumption market of interest, and these changes should therefore be facilitated, whenever possible (Ge *et al.* 2018; Hamerman *et al.* 2018; Stöckli *et al.* 2018b). This emphasises the need to understand the determinants of more responsible, pro-environmental, consumer behaviour in the context of out-of-home food consumption in order to capitalise upon these determinants in pursuit of the food waste mitigation goals. These determinants are discussed next.

2.2. *The determinants of pro-environmental consumer behaviour to reduce restaurant food waste*

Consumer behaviour represents a major obstacle towards the sustainable development of the global tourism and hospitality industries (Becken 2007). Existing research into the drivers and consequences of (ir)responsible consumer behaviour in tourism and hospitality has highlighted the important role of voluntary behavioural changes in enabling the industry's progress towards the goal of environmental sustainability (Mair 2009). These are particularly effective when combined with technological improvements and financial (dis)incentives (Filimonau and Hogstrom 2017).

Existing research has shown that pro-environmental consumer behaviour in tourism and hospitality is difficult to predict as it represents a highly complex, multidimensional, product of the careful evaluation of numerous, internal and external, factors which consumers undertake prior to exerting actual consumption patterns that are better for the environment (Ramkissoon *et al.* 2012). For example, it has been shown that consumer awareness of the environmental impacts of flying and public concerns over climate change do not always prompt rejection of air travel because other factors, such as price, time availability and comfort, play a role in consumer routine choice of leisure transportation (Alcock *et al.* 2017; Hares *et al.* 2010; McKercher *et al.* 2009). Consumers exercise pro-environmental behaviour only if, psychologically or emotionally, they assign a (much) high(er) value of importance to the environmental implications of their travel compared to the other factors of relevance, such as travel cost, travel group structure and/or travel time budget (Juvan and Dolnicar 2017). The situations in which these other travel factors do not interfere consumer choice are however rare because leisure travel is increasingly dominated by inflexible structures in terms of time (for example, the role of school holidays in travel patterns) and cost (for instance, the role of fixed travel budgets in family travel), thus highlighting an important inhibitor of pro-environmental consumer behaviour in this particular consumption context (Hergesell and Dickinger 2013).

The research into the determinants of pro-environmental consumer behaviour in restaurants is less established than in tourism, but growing (Gao *et al.* 2016), with studies increasingly looking into the issues of 'green' restaurant patronage among consumers (Hanks and Mattila 2016; Hu *et al.* 2010; Jang *et al.* 2011), consumer knowledge of and attitudes to the adoption by restaurants of corporate social responsibility (CSR) strategies (Lee and Heo 2009; Xu 2014; Zhang 2014), and measuring customer willingness-to-pay for 'greener' and/or more responsible practices of food service provision ( Dewald *et al.* 2014; Dutta *et al.* 2008; Namkung and Jang 2017). Past research has established that, similar to tourism, pro-environmental consumer behaviour in the context of out-of-home food consumption is difficult to predict as numerous, not always environment-related, factors affect food consumption choices (Jang *et al.* 2011). Such factors as personal taste, the nature of a dining out occasion and the cost of food, among others, determine the patterns of restaurant food consumption and these patterns are not always environmentally-benign (Lorenz and Langen 2018). For example, Filimonau *et al.* (2017) have shown that, despite high levels of environmental awareness and environmental concern among restaurants guests, they often reject more climate-friendly dishes due to personal taste preferences. Importantly, limited research has considered the determinants of pro-environmental consumer behaviour in the context of restaurant food waste generation (Juvan *et al.* 2018) which is alarming given the growing magnitude of this major societal challenge and the essential role of consumers within.

The lack of research on the determinants of pro-environmental consumer behaviour in the context of restaurant food waste mitigation hampers the design of 'nudging' interventions encouraging restaurant guests to waste less food (Stöckli *et al.* 2018a; Kallbekken and Sælen 2013; Whitehair *et al.* 2013). The review of such interventions (Stöckli *et al.* 2018b) demonstrates they are small in number and do not always succeed empirically. More studies

should be designed to understand the factors that contribute to the (un)sustainable patterns of restaurant food consumption in order to inhibit their occurrence, while concurrently reinforcing those factors that can trigger more (economically and socially) responsible and environmentally-benign consumer food choices.

Models have been developed to aid in understanding of the determinants of pro-environmental consumer behaviour in the context of out-of-home food consumption (Ajzen 2015). These models are underpinned by theories of planned behaviour (TPB) and reasoned action (TRA) that highlight the role of such variables as public (pro-environmental) attitudes, public (environmental) concern, emotions and subjective norms, and public perception of behavioural control in shaping (pro-environmental) consumer behaviour (Han 2015; Han *et al.* 2015; Teng *et al.* 2015). Some of the models have further incorporated public environmental knowledge as another predictor of pro-environmental consumer behaviour. Environmental knowledge describes the extent to which consumers exert their awareness of the environmental implications of their own consumption choices (Powell and Ham 2008). Together with public environmental concern (Dunlap *et al.* 2000) explaining the degree to which consumers feel worried about the environmental implications of their consumption practices (Stern and Dietz 1994) and the related, positive or negative, emotions stirred (Kim *et al.* 2013), environmental knowledge can trigger pro-environmental consumer attitudes (Chen and Peng 2012). Pro-environmental consumer attitudes explain the state of consumers' mind-set in which they evaluate, favourably or unfavourably, the contribution of their own consumption choices to the environmental degradation (Chen and Tung 2014). Pro-environmental attitudes prompt consumers to behave in a particular manner, thus informing their pro-environmental behavioural intentions (Jang *et al.* 2011), such as consumers' willingness to pay more for the 'greener' food practices adopted by restaurants and/or their desire to reduce food wastage when dining out.

Although the conceptual rigour of the models of pro-environmental consumer behaviour has been acknowledged and their validity has been empirically tested in the tourism and hospitality settings (Namkung and Jang 2017), more research has been called for to refine these models with a view of identifying other, consumption market-specific, variables that can potentially affect pro-environmental consumer choices (Anable *et al.* 2006), including the context of out-of-home food consumption (Juvan and Dolnicar, 2017) and, especially, in terms of food waste mitigation (Juvan *et al.* 2018). Research should more accurately establish the drivers of pro-environmental consumer behaviour in the different consumption markets and examine the variables explaining the complexity of emotional elaborations that consumers undergo when transiting from environmental knowledge and environmental concern to pro-environmental attitudes, then to pro-environmental behavioural intentions, and then to actual pro-environmental behaviour (Laroche *et al.* 2001; Mostafa 2007; Schubert *et al.* 2010). This study responds to this call for research by examining the determinants of consumer engagement in restaurant food waste mitigation in the context of an emerging consumption market of Poland. This consumption context is discussed next.

2.3. *The market of out-of-home food consumption in Poland and the challenge of restaurant food waste within*

The market of out-of-home food consumption in Poland is rapidly developing in terms of its size, structure, ownership patterns, quantity and quality of the product offer. The development began in the 1990s when the country transited from the centrally planned economy towards free market (Głuchowski *et al.* 2017). One of the main consequences of this transition was the growth of the services industries in Poland, especially of the sector of food service provision (Kwiatkowska and Levytska 2007). This growth was attributed to the rise in income levels of Polish consumers and to the major societal lifestyle changes, such as increased public interest in healthy eating and/or in food nutrition and the rise of single-

person households with subsequent more frequent consumption of food out of home, among others (Levytska and Kowrygo 2007).

The food service provision sector in Poland was further transformed, qualitatively and quantitatively, after the country accessed the European Union in 2004. Post-accession, the sector has been experiencing an average growth rate of circa 3.5% per annum (Kwiatkowska and Levytska 2007) which is due to increased international tourism, risen foreign investments, arrival of new, franchise-based, business models, better availability of (cooking and customer service skills) training and aggressive marketing techniques borrowed from the out-of-home food consumption markets of the 'established' EU members, among others (Milewska *et al.* 2017). According to Kwiatkowska and Levyska (2007), the EU access enabled the sector of food service provision in Poland to become the largest in East-Central Europe, the trend which has persisted to date.

Nowadays, the sector of out-of-home food consumption in Poland shares many features of the national sectors of other EU countries in terms of its structure and the overall standards of (food and service) quality. In 2017, the sector was represented by 71056 catering enterprises, with most (over 98%) being private, which is an almost ten-fold increase compared to its size in 1950 (Rynek Gastronomiczny w Polsce 2018). Importantly, this number represents only those food service operators that have reported to employ 9+ staff, meaning the actual size of the sector is likely to be substantially larger as many catering ventures represent so-called 'micro' enterprises that employ fewer than ten people. In terms of structure, the sector is dominated by small catering businesses (mostly represented by takeaways) that account for circa 35% of the total market, alongside (fast food and casual dining) restaurants (approximately 30% of the market), and bars (circa 30% of the market) (Rynek Gastronomiczny w Polsce 2018). The rest of the sector (approximately 5%) is made up by work and school canteens (Rynek Gastronomiczny w Polsce 2018). Food service

operators in Poland cater for a large consumer base – in 2016, a record share of customers (54% of the total population) claimed to be eating out on a regular basis (Rynek Gastronomiczny w Polsce 2017). The average frequency of consuming food out of home in Poland equates to 3.7 times per month (Rynek Gastronomiczny w Polsce 2017).

The major political and socio-economic transformations in Poland within the last decade have had considerable environmental implications. For example, the liberalisation of the food consumption market and improved household access to food has led to excessive food wastage. Poland ranks seventh in the EU in terms of the wasted food per capita (Marszałek 2018), and it is estimated that Polish households waste as much as a third of the food they purchase (Kaczorowska and Kowrygo 2016). Further, the expansion of the out-of-home food consumption market in Poland has accelerated food waste generation in restaurants. Although no exact figures are available to accurately quantify the scale of this challenge, it is estimated that approximately 25% of the food procured by food service providers in Poland gets wasted with this wastage accounting for 2-6% of their operational budget (E-hotelarz 2016). These figures are substantially higher that the EU average, where the sector of food service provision is estimated to generate 12% of the total amount of food waste across the EU economy (FUSIONS 2016) with a share of 2% which this wastage holds in the annual sectoral turnover (SRA 2010). This demonstrates the important role played by restaurant food waste in undermining the environmental sustainability of the Polish economy as a whole and in diminishing the long-term business profitability of its specific catering businesses, thus emphasising the need for more research in support of mitigation interventions.

*2.4. Research aim and the baseline research model*

The aim of this study is to identify the determinants of consumer engagement to mitigate restaurant food waste in Poland by establishing the relationship between such

important prerequisites of consumer pro-environmental behavioural intentions as environmental knowledge (which includes public knowledge of generic environmental issues but also subject-specific knowledge of the societal challenge of restaurant food waste), environmental concern, anticipated regret, pro-environmental attitudes and pro-environmental behaviour at home (Figure 1). These pre-requisites have been drawn from the literature with a view to test their validity in a new consumption context, i.e. restaurant food waste and its mitigation in Poland. The research design adopted to fulfil this study's aim is explained next.

[Insert Figure 1 here]

## 3. Research design

The study adopted the quantitative survey tool for primary data collection which is to achieve better generalisability and representativeness of results. The survey questionnaire was developed based on a number of topics related to the determinants of effective consumer engagement in the mitigation of restaurant food waste that emerged from the literature. The questionnaire was first developed in English, as this was the language of the literature review, with its subsequent translation in Polish. During translation, a number of semantic issues had to be solved which was due to the linguistic specificity of the Polish language when it came to the day-to-day use of (hospitality and sustainability) subject-specific terms. For example, the English term 'dining out' could not be translated in Polish directly and, hence, it was substituted with a similar term which, if translated back to English, read as *'visiting a restaurant/cafe/pub/bar with the purpose of eating a meal'*. The term used in the Polish translation did not therefore embrace occasions of visiting restaurants with the purpose of casual consumption of alcoholic beverages. Neither did it include out-of-home food consumption in the form of eating breakfast and/or lunch in a work or school canteen.

Consumption of food in a work or school canteen is not considered a proper 'dining out' occasion by the Poles due to its routine nature.

To ensure the best quality of translation and to guarantee no meaning was lost when adjusting the project's core terminology to fit the Polish context, as per above, a back-translation technique was applied as recommended by Brislin (1970). Back translating involved two bilingual academics providing feedback on the original and final versions of the questionnaire. Additionally, the questionnaire was piloted in a group of five respondents, representing different socio-economic profiles of consumers of catering services in Poland. Following their feedback, further minor modifications were made to the text of the questionnaire for clarity.

Primary data were collected via a self-completion, but researcher-observed, public survey in May-September 2018 using a non-probability sampling strategy on a 'next-to-pass' basis. The survey was administered in popular public places in Krakow where the respondents were approached with a request to fill in a questionnaire. Krakow was selected for primary data collection because it is one of the largest cities in Poland characterised by a well-developed sector of food service provision which caters for significant numbers of international tourists and domestic consumers (Kurek and Pawlusinski 2009). The following criteria were applied to recruit willing survey participants: permanent residents of Poland aged 16 and above who consumed food out of home at least once a week. The 'once per week' frequency of dining out was employed as a main screening criteria to ensure the survey targeted only those Polish residents who dined out regularly given that the average frequency of consuming food out of home in Poland in 2017 was equal to 3.7 times per month (Rynek Gastronomiczny w Polsce 2017). In the case of families, only one family member was invited to partake in the survey.

The response rate was high (circa 90%) compared to previous research conducted on the topic of sustainable consumption in the tourism and hospitality contexts in Poland (see, for example, Dickinson *et al.* 2013; Filimonau *et al.* 2018; 2019). This could in part be attributed to the relative novelty of the topic of restaurant food waste which attracted significant interest from the public during the survey. The resultant sample (n=454, Table 1) was similar to the Polish population in terms of its key socio-demographic characteristics as reported in the annual record of population statistics by Poland's Central Statistical Office (2018). The only noticeable discrepancy between the survey sample and national population's statistics was recorded in the number of survey respondents who were University degree holders. These represented 63.7% of the survey sample (Table 1) while the national figure in 2018 was 26.4% (Central Statistical Office 2018). This discrepancy can be attributed to the fact that primary data collection took place in Krakow which is a major University hub in Poland. The representatives of so-called 'middle class', i.e. wealthy and educated people, are traditionally considered to be prime consumers of food in the out-of-home settings, which partially explains and justifies the prevalence of (more) educated respondents in the survey sample.

[Insert Table 1 here]

The questionnaire consisted of various blocks containing the different variables included in the baseline model. The introductory block asked the respondents about their dining out habits (frequency of eating out and the regular types of catering establishments visited). The following seven blocks gauged the respondent opinion towards specific topics. The environmental concern block used twelve items from Dunlap's *et al.* (2000) well-established 'New Ecological Paradigm' (NEP) scale. This scale covered a number of dimensions that reflected an individual's public concern for the environment (Erdogan 2009). Three items from the original NEP scale were excluded which is for the purpose of

simplifying the questionnaire and because of low individual factor loadings of these items as reported in previous empirical research (Dunlap *et al.* 2000; Erdogan 2008; Mostafa 2007). Next, the environmental knowledge block used the five items from Mostafa (2007). This scale included items that captured the respondents' degree of knowledge regarding five environmental aspects, such as purchase of environmental products, recycling, purchase of waste-reducing packaging, environmental symbols/labels literacy and environmental issues. The scale of pro-environmental behaviour at home was captured in the block consisting of the six items from Laroche *et al.* (2001) and Schubert *et al.* (2010). The block testing the effect of consumer knowledge of the issue of restaurant food waste comprised ten items. This scale measured the respondent's self-perception of their knowledge of the different aspects of the food waste challenge (magnitude, drivers and environmental repercussions) in the restaurant settings and was based on Schlegelmilch *et al.* (1996). Given the absence of established, validated measurement scales to study the determinants of pro-environmental consumer behaviour in restaurant food waste mitigation, the next two blocks testing the effect of: 1) anticipated consumer emotions (regret) towards wasting food when dining out; and 2) consumer attitudes towards the issue of restaurant food waste and the need for its mitigation; were designed on the basis of the four items from the scale of Kim *et al.* (2013) and the five items from the scale of Schlegelmilch *et al.* (1996), respectively, but adapted to fit the context of out-of-home food consumption and the challenge of food waste generation within. The block on behavioural intentions towards restaurant food waste mitigation encapsulated the five items extracted from Barver *et al.* (2009), Hu *et al.* (2010) and Lu *et al.* (2015) with the subsequent adaptation to fit the context of this study. The final block collected socio-demographic data. The items in all blocks aside from the introductory and the final ones were operationalised using a 5-point Likert scale. Next section describes how the primary data collected were analysed.

## 4. Data analysis

### 4.1. *Preliminary Exploratory Factor Analysis (EFA)*

In order to identify the dimensions underlying the different variables included in this study, a preliminary principal component analysis was undertaken. Varimax rotation was applied to delineate the factors behind consumer environmental concern, general environmental knowledge, pro-environmental behaviour at home, restaurant food waste specific knowledge, attitudes to restaurant food waste and the need for its mitigation, behavioural intentions to mitigate restaurant food waste and anticipated regret. The analysis revealed acceptable values for the Kaiser-Meyer-Olkin (KMO) measures and the Bartlett's Test of sphericity, thus supporting the factorability of the correlation matrix. In addition, all variables were shown to be uni-dimensional, except for consumer environmental concern and restaurant food waste specific knowledge.

As regards to the environmental concern scale, as expected, the rotated solutions (Table 2) confirmed the presence of four factors. This is coherent with the original Dunlap *et al.* (2000)'s dimensionality of this variable. The first factor, balance of nature (BAL), refers to public perception of the nature's fragility and the anthropogenic role in environmental damage. The second factor, anti-anthropocentrism (ANAN), explains the notion that nature does not exist to serve humans but holds an inherent, universal value. The third factor, limits to growth (LIM), examines public views on that the world's natural resources cannot forever sustain uncontrolled anthropogenic development. Finally, the rejection of exemptionalism (REJEX) factor tests the idea that humans, unlike other animal species, are exempt from the constraints of nature (Dunlap and Catton 1994).

[Insert Table 2 here]

As for consumer knowledge of the issue of restaurant food waste, the items composing this scale loaded onto two different factors (Table 3). The first factor referred to consumer awareness of the magnitude of food waste generation in restaurants and was named accordingly, i.e. Knowledge of the Restaurants Food Waste Issue (KRFWI). The second factor covered the four items related to consumer knowledge of the approaches to the mitigation of restaurant food waste and was therefore named as Knowledge of the Approaches to Managing Food Waste in Restaurants (KAMFWR). Two items were deleted at this stage because of their low factorial loadings across the two rotated factors.

[Insert Table 3 here]

### 4.2. *The Partial Least Squares (PLS) analysis*

In order to explore the influence of consumer environmental concern, generic environmental knowledge, pro-environmental behaviour at home, restaurant food waste specific knowledge and anticipated emotions on consumer attitudes and behavioural intentions to mitigate restaurant food waste, a structural equation model with Partial Least Squares (PLS) was applied. PLS is a distribution-independent technique widely used in social sciences to estimate complex, multi-dimensional models (Reinartz *et al.* 2009); it is a causal-predictive approach that prioritizes prediction in the estimation of structural models in order to provide causal explanations among the studied variables (Hair *et al.* 2019). PLS is considered appropriate for structural equation modeling in the situations of high complexity and reduced theoretical support and development; it is thus best suited for exploratory purposes and at early stages of theoretical development (Hair *et al.* 2019), for example when an attempt is made to identify the new potential causal relationships and/or when the measurement instruments are insufficiently mature (Roldan and Sánchez-Franco 2012). Given the exploratory nature of this project which makes an initial examination of the

determinants of consumer behavioural intentions to mitigate restaurant food waste, PLS represents an adequate research tool to reach this study's aim.

The first step of PLS involves examining the measurement model. For this process, the multi-dimensional variables environmental concern and knowledge of restaurant food waste were considered as reflective second-order higher constructs. As PLS does not directly estimate second-order constructs, the two-step approximation method developed by Wetzels *et al.* (2009) was employed in order to create these constructs. In line with this procedure, in an initial estimation, the dimensions of environmental concern and knowledge of restaurant food waste were included in the model as the first-order constructs. Then, this first estimation provided the latent variable scores for the first-order factors to be used in the subsequent estimation of the second-order factor model.

The reliability and convergent and discriminant validity of all first-order constructs were assessed in the first-step estimation. Considering that reliability for exploratory research should be a minimum of 0.60 (Hair *et al.* 2019), all items with factorial loadings below this threshold were removed from the model. This prompted the removal of one item from the LIM first-order factor, one item from the attitude scale, one item from the anticipated emotions variable, one item from the pro-environmental behaviour at home variable and one item from the KAMFWR first-order factor. Once these items were removed and the model was re-estimated, the results of the final measurement model revealed that all latent variables were internally consistent since the composite reliability indexes (CRI) were above the suggested benchmark of 0.7 (Nunnally and Bernstein 1994). The constructs also presented convergent validity with the average variance extracted (AVE) values above 0.5 (Fornell and Larcker 1981). The first-order dimensions of the NEP scale also presented composite reliability and convergent validity across the Balance (CR=0.868; AVE=0.622), Anti-Anthropocentrism (CR=0.770; AVE=0.532), Limits (CR=0.769; AVE=0.663) and Rejection

(CR=0.848; AVE=0.737) dimensions. Finally, the existence of discriminant validity was verified through the use of the Fornell and Larcker criterion (Fornell and Larcker 1981) and the heterotrait-monotrait (HTMT) ratio correlations method as proposed by Henseler *et al.* (2015).

Estimation of the initial first-order model provided latent variable scores to be employed in estimating the second-order model (Table 4). Again, the indicators presented individual reliability since all factor loadings exceeded the recommended threshold of 0.6 for exploratory analysis, including the second-order constructs. The factorial loadings of the (originally first-order) constructs environmental concern and knowledge of restaurant food waste on the second-order constructs were above 0.6 and presented adequate composite reliability (CR) values. The AVE values were above the accepted threshold with the exception of the environmental concern construct which was very close to 0.5. Discriminant validity was again verified by applying the Fornell and Larcker (1981) criterion and the HTMT method, as per above (Table 5).

[Insert Table 4 here]

[Insert Table 5 here]

Once the measurement model was verified to be satisfactory, the second step of the PLS analysis was to assess the structural model. This involved the estimation of the significance of the path coefficients and the examination of the coefficient of determination ($R^2$) and the blindfolding-based cross validated redundancy ($Q^2$). Before assessing the structural relationships, collinearity was examined in order to discard potential bias in the regression results. This analysis showed that all Variance Inflation Factor (VIF) values for the outer constructs were below 2.52, thus being inferior to the critical threshold of 3 (Becker *et al.* 2015). As for the explained variance of the endogenous constructs, as shown in Table 6, the model had sufficient exploratory power with $R^2$ ranging from 0.166 to 0.548. As for the

model's predictive accuracy, the positive $Q^2$ values indicated that, for each specific endogenous construct, there was sufficient predictive accuracy of the structural model. Once the model's explanatory and predictive power was confirmed, the next step involved the assessment of statistical significance and relevance of the path coefficients. To this end, a bootstrapping procedure (Hair *et al.* 2011), with 5.000 subsamples, was applied. Table 6 presents the outcome of the resultant structural model.

[Insert Table 6 here]

### 4.3. *Interpretation of results*

The results of the structural model (Figure 2) confirmed that both environmental concern (β=0.096; t=2.245) and environmental knowledge (β=0.479; t=12.291) positively influenced pro-environmental behaviour at home. The reduced incidence of environmental concern on this variable and the large effect of environmental knowledge could potentially indicate that knowledge was the prime mediator of this relationship. Therefore, more environmentally concerned individuals would more explicitly exhibit pro-environmental behaviour at home because they were more literate and/or better informed about the detrimental effect of the global environmental change. Similarly, both environmental concern (β=0.337; t=6.553) and environmental knowledge (β=0.170; t=3.358) proved to directly predict consumer knowledge of the restaurant food waste challenge. This suggests that consumers with better knowledge of restaurant food waste were also more knowledgeable about other, more common, environmental issues, such as climate change and pollution. The analysis also revealed that the consumers who were more committed to reduce their environmental footprint at home had more positive attitudes towards the need to reduce food wastage when dining out (β=0.202; t=3.958) as well as towards the restaurants managing their food waste pro-actively. Pro-environmental behaviour at home further correlated well

with pro-environmental behavioural intentions of consumers to engage in the mitigation of restaurant food waste ($\beta$=0.162; t=4.286)

[Insert Figure 2 here]

Next, consumer knowledge on restaurant food waste was able to explain positive consumer attitudes towards the need for its mitigation ($\beta$=0.429; t=10.526) and exerted positive behavioural intentions to engage in this mitigation when eating out, but also to patronise the restaurants pro-actively involved in food waste management ($\beta$=0.199; t=5.101). As expected, pro-environmental attitudes preceded pro-environmental behavioural intentions ($\beta$=0.449; t=10.809), thus suggesting that pro-environmental attitudes mediated the influence of environmental knowledge and pro-environmental behaviour at home in the behavioural intentions of consumers to reduce food waste when dining out. Finally, the findings indicated that anticipated emotions, specifically regret, played a significant role in predicting pro-environmental behavioural intentions ($\beta$=0.142; t=3.533). The extent of customer regret about the negative environmental footprint of restaurant food wastage and their own consumption choices in its generation predicted the likelihood of their engagement in mitigation but also their patronage of those restaurants practising pro-active food waste management.

Regarding the control variables, i.e. age and the level of education, three relationships were found to be statistically significant. First, age negatively affected consumer attitudes towards restaurant food waste mitigation ($\beta$=-0.071; t=1.732) implying that younger consumers would be more willing to develop favourable evaluations of the restaurants practicing pro-active food waste management. Second, age positively correlated with pro-environmental behaviour at home ($\beta$=0.166; t=4.359) suggesting that the older individuals would be more likely to implement environmentally-benign consumption practices in their day-to-day lives. Finally, the level of education significantly explained pro-environmental

attitudes ($\beta$=0.105; t=2.519) showcasing that more educated individuals would be more likely to exert pro-environmental attitudes and to engage in pro-environmental behaviour at home, but also when consuming food in restaurants.

## 5. Discussion

The study revealed that effective consumer engagement in the mitigation of restaurant food waste in Poland is underpinned by high levels of public environmental knowledge and environmental concern as these play an important mediating role in pro-environmental behaviour of Polish consumers at home, but also in their willingness to behave more environmentally-benign when dining out. Public environmental knowledge and environmental concern represent long-established drivers of more responsible and environmentally-friendly consumption choices in day-to-day, household-related, activities (Gifford and Nilsson 2014; Kaiser *et al.* 1999; Tilikidou 2007), but also specifically in the context of the tourism and hospitality industries (Hedlund 2011; Lee and Moscardo 2005; Tzschentke *et al.* 2008). The unique contribution of this study is in that it showcased the role of these factors in predicting consumer knowledge of restaurant food waste, something that previous research has not addressed despite the growing significance of this major societal challenge. This finding suggests that, to reinforce consumer awareness of restaurant food waste in Poland, it is important to first educate the public about the (more common) environmental repercussions of irresponsible consumption as related to food but also to other, equally scarce, natural resources, such as energy and water. Such (more generic) environmental education can subsequently build the high(er) levels of more specialised consumer knowledge on such particular environmental challenges as restaurant food waste. Such a spill-over effect from more generic environmental knowledge to more specific knowledge of a particular environmental issue is an interesting finding as it shows that, in order to trigger voluntary behavioural change towards restaurant food waste mitigation

among Polish consumers, it is first necessary to earn consumer preparedness to change their behaviour for the sake of mitigation of other, more generic, environmental problems, such as climate change and excessive water use. This further indicates that enabling voluntary mitigation actions towards a single environment issue, such as restaurant food waste, is pointless and that the efforts to facilitate pro-environmental behavioural change should rather target a range of environmental problems, thus having a better coverage and, subsequently, holding a better mitigation effect.

The study demonstrated strong correlation between pro-environmental behaviour at home and positive consumer attitudes towards the mitigation of restaurant food waste. This suggests that Polish consumers are prepared to extend the scope of their household environmental commitment towards the realm of out-of-home food consumption. This is an interesting finding given that mixed evidence exists as to whether there is a clear relationship between pro-environmental consumer behaviour at home and pro-environmental consumer behaviour in the external, tourism and hospitality related, consumption contexts. While some studies have shown this relationship to be weak, especially in the context of holiday travel (see, for example, Barr *et al.* 2010; Mehmetoglu 2010; Pereira *et al.* 2012), there is increasing evidence that, at least in the context of food service provision, consumers may be more prepared to sacrifice personal comfort and convenience in order to save the environment (see, for instance, Hu *et al.* 2010; Jang *et al.* 2015; Namkung and Jang 2013). In part, this can be attributed to the fact that dining out represents a less rare (or more frequent) occasion than holidaying, suggesting a higher probability for consumers to exert pro-environmental behaviour when consuming food out-of-home, rather than when travelling on vacation. This study provides further empirical evidence to this viewpoint which comes from an emerging market of out-of-home food consumption.

The study confirmed the validity of the TPB- and TRA-based models aiming to predict pro-environmental consumer behaviour in the tourism and hospitality industries as it found strong linkages between consumer pro-environmental attitudes and their pro-environmental behavioural intentions to reduce food waste in restaurants. This finding suggests that, in the Polish context, educating the public on the environmental repercussions of their consumption choices and raising public environmental awareness represents a cornerstone in building strong pro-environmental attitudes among consumers with a subsequently higher probability of active consumer engagement in the mitigation of major environmental issues, including food wastage in restaurants. This is in line with the literature which established this correlation in other geographical markets of out-of-home food consumption, but not specifically in the context of restaurant food waste (Jang *et al.* 2015; Neff *et al.* 2015; Shin *et al.* 2017).

The study revealed that Polish consumers with better environmental (including restaurant food waste specific) knowledge, higher levels of environmental concern and more established pro-environmental behaviour at home are more likely to patronise restaurants that practice pro-active food waste management. This is in line with other studies dealing with the drivers of the 'green' restaurant patronage in different geographical markets (DiPietro *et al.* 2013; Hu *et al.* 2010; Jang *et al.* 2011). This finding suggests that Polish restaurateurs should aim to engage in food waste mitigation as a means of building customer loyalty, especially among the consumers exemplifying high environmental commitment. As the study shown, these consumers have higher levels of education and, in most cases, higher levels of income. This implies that pro-active engagement of Polish restaurateurs in food waste management will also have the benefit of sustained revenue generation via improved customer loyalty.

Emotions, particularly anticipated consumer regret of the wasted food, were found to play an important role in the behavioural intentions of the Poles to engage in the mitigation of

restaurant food wastage. This is in line with Han *et al.* (2016), Han *et al.* (2017) and Kim *et al.* (2013) who arrived at similar conclusions when looking at the more generic context of pro-environmental behaviour in the tourism and hospitality industries, but also with Lorenz *et al.* (2016), Mirosa *et al.* (2018) and Sirieix *et al.* (2018) who examined the role of consumer regret in the specific context of restaurant food waste generation. This finding offers scope for the design of effective social marketing campaigns (Line *et al.* 2016) that should aim to trigger customer regret of the restaurant food being wasted and to showcase the numerous detrimental, socio-economic and environmental, implications of this wastage. Such campaigns will not only reinforce the feeling of customer regret, thus contributing to pro-environmental behavioural intentions, but also strengthen environmental awareness of Polish consumers which, in turn, correlates directly with pro-environmental attitudes and pro-environmental behavioural intentions to reduce restaurant food waste, as established above. For better consumer appeal, the social marketing campaigns run by restaurateurs can exhibit the images of extreme environmental degradation as well as urban and rural poverty as examples of the detrimental repercussions of food wastage in restaurants. This idea builds upon the concept of consumer guilt in driving (more) ethical consumption choices (Gregory-Smith *et al.* 2013) which suggests that marketers' appeal to negative consumer emotions may in fact trigger (societally and environmentally) positive behavioural response. Consumer emotions can be stirred by appealing to the societal paradox of food 'scarcity in abundance' which highlights the role of restaurant food waste in building food poverty (Porpino *et al.* 2015). The national government can take the lead in the design of such marketing campaigns and facilitate their broadcasting on the media, while restaurateurs can take advantage of in-house displays and menu presentations. Menus represent a powerful tool of managing (generic as well as more environmentally-responsible) consumer choice (Filimonau and

Krivcova 2017) and can therefore be utilised to address the challenge of restaurant food wastage in Poland via improved consumer engagement in its mitigation.

Age and education were found to influence the extent to which Polish consumers were prepared to engage in the mitigation of restaurant food waste. Lower levels of preparedness of the older demographics to mitigate food wastage in restaurants can be partially explained by the infrequent patterns of their food consumption in the out-of-home settings (CBOS 2014). For this category of Polish customers, due to their low income, dining out represents a rare occasion to relax and 'switch off' which is known to negatively affect the level of consumer engagement in environmental conservation in the tourism and hospitality industries (Hergesell and Dickinger 2013). In contrast, the younger demographics of Polish consumers showcase a clear desire to reduce food waste when eating out, thus signalling local restaurateurs the need for them to engage in the mitigation in order to catch the loyalty of this large, and yet growing, consumer market. This finding is in line with Jang *et al.* (2011) and Wang *et al.* (2018) who pinpointed the high(er) levels of environmental awareness, pro-environmental attitudes and pro-environmental behavioural intentions that are attributed to the younger generation of consumers of tourism and hospitality services.

Lastly, it is important to note that, given the exploratory nature of this study, choosing the prerequisites that could accurately explain the extent of consumer engagement in restaurant food waste mitigation in Poland was a difficult task to fulfil. The prerequisites that had been pre-tested and validated in past research were selected (i.e. environmental knowledge, environmental concern and pro-environmental behaviour at home) for examination in this study. Some of these pre-requisites did not work as expected, thus suggesting that the determinants of consumer behaviour towards mitigation of restaurant food waste differ from the determinants of consumer behaviour in other consumption contexts. This highlights the need for more in-depth investigation of the determinants of consumer

engagement in restaurant food waste mitigation, in Poland as well as in other consumption markets, preferably with the development, testing and validation of dedicated measurement scales. For example, such factors as national culture, including religion (Filimonau *et al.* 2018), ethical values, including morality (Renko *et al.* 2011), and history of the country, including the important societal role played by the diversity of ethnic cuisines in Poland (Jochnowitz 1998), may represent the important prerequisites whose role in consumer engagement in restaurant food waste mitigation should be examined more closely in order to design measurement scales that are more accurate and better represent the local (food) consumption context. This important task should be addressed in future research.

## 6.      Conclusions

This study has uncovered the determinants of consumer engagement in the mitigation of restaurant food waste in Poland, a rapidly emerging market of out-of-home food consumption in East-Central Europe. By considering the known prerequisites of pro-environmental consumer behaviour as established in past research, the study has tested their applicability to the new consumption context, i.e. restaurants and food waste generated within, and the new consumption market, i.e. Poland. The study has shown the important role played by such prerequisites as public environmental knowledge (concerning general environmental issues but also the specific environmental challenge of restaurant food waste), environmental concern and emotions (especially anticipated regret attributed to the negative repercussions of wasting food in restaurants) and pro-environmental behaviour at home in defining positive attitudes of Polish consumers towards the need to mitigate restaurant food waste and towards the restaurants that undertake pro-active work in this direction. The study has further revealed how all these prerequisites could prompt Polish consumers to more pro-actively aid Polish restaurateurs in the mitigation of food waste.

By disclosing the determinants of more active customer engagement in the mitigation of restaurant food waste in Poland, this study provided policy-makers and industry professionals with the scope to capitalise upon these determinants. This capitalisation can be achieved through the design of public awareness raising campaigns as well as social marketing and sustainability campaigns. The former can reinforce the appeal of public environmental knowledge and environmental concern as a pre-cursor of effective mitigation of food wastage in restaurants, while the latter can trigger consumer emotions, i.e. anticipated regret, which represents another important driver of pro-environmental attitudes and subsequent positive behavioural intentions in the realm of minimising restaurant food waste.

The study has revealed a number of promising research avenues. Future research should aim to examine the views of restaurant managers in Poland on the feasibility of designing and administering the social marketing campaigns that are required for more active consumer engagement in food waste mitigation. Opinions of Polish policy-makers on this topic should also be sought as the industry efforts alone will not be sufficient to create a long-lasting impact on environmental knowledge and environmental concern of consumers. Next, future research should explore the generational influence on the willingness of Polish consumers to reduce food waste when dining out. As this study shown, the younger generation of Polish consumers is prepared to engage in the mitigation of restaurant food waste but it is important to understand how this preparedness can better be reinforced and sustained by restaurateurs. Likewise, it is crucial to shed light on the drivers of restaurant food waste reduction among the older categories of Polish consumers. While they are not currently prepared to pro-actively engage in the mitigation, future research could look into the obstacles of consumer engagement within this generation. This is to identify the most appropriate means to eliminate the occurrence of such obstacles. Further, the effect of national culture on waste generating behaviour could be explored in more detail given the long-standing eating

traditions and habits in Poland can influence food consumption patterns at home and when dining out. Next, the growing magnitude of the global food waste challenge prompts a fundamental research question about how the known mechanisms of (food) consumption in tourism can affect the amounts of food waste generated in restaurants, especially in the context of emerging markets. Lastly, given the phenomenon of restaurant food waste is likely to be exacerbating in other developing and transitional countries with their growing markets of out-of-home food consumption, future research should examine how domestic and non-domestic, such as international tourists, consumers in these markers could engage in the mitigation, identifying the barriers to and revealing the opportunities for their active engagement.

## References

Ajzen, I., 2015. Consumer attitudes and behavior: the theory of planned behavior applied to food consumption decisions. *Rivista di Economia Agraria*, Anno LXX, n. 2, 121-138.

Alcock, I., White, M.P., Taylor, T., *et al.,* 2017. 'Green' on the ground but not in the air: Pro-environmental attitudes are related to household behaviours but not discretionary air travel. *Global Environmental Change,* 42, 136-147.

Anable, J., Lane, B., and Kelay, T., 2006. *An evidence base review of public attitudes to climate change and transport behaviour.* UK's Department of Transport, London, July 2006.

Barr, S., Shaw, G., Coles, T., and Prillwitz, J., 2010. 'A holiday is a holiday': practicing sustainability, home and away. *Journal of Transport Geography,* 18(3), 474-481.

Barver, N., Taylor, D.C., and Strick, S., 2009. Environmental Knowledge and Attitudes: Influencing the Purchase Decisions of Wine Consumers. *International CHRIE Conference-Refereed Track*, 16.

Becken, S., 2007. Tourists' Perception of International Air Travel's Impact on the Global Climate and Potential Climate Change Policies. *Journal of Sustainable Tourism,* 15(4), 351-368.

Becker, J.M., Ringle, C.M., Sarstedt, M., and Völckner, F., 2015. How collinearity affects mixture regression results. *Marketing Letters*, 26(4), 643-659.

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.

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

Cassidy, A., 2018. Could this startup shame restaurants into wasting less food? *The Guardian,* 15 May 2018.

CBOS–Centrum Badań Opinii Społecznej [Center for Public Opinion Research], 2014. *Zachowania żywieniowe Polaków, Komunikat z badań CBOS [Nutritional behaviours of the Poles, Statement from CBOS research]*. CBOS, 15, Warszawa.

Central Statistical Office, 2018. *Demographic Yearbook of Poland 2018*. Warszawa, 2018. Available from: https://stat.gov.pl/en/topics/statistical-yearbooks/statistical-yearbooks/demographic-yearbook-of-poland-2018,3,12.html [Accessed 27 September 2019].

Charlebois, S., Creedy, A.; and Massow, M.V., 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.

Chen, A., and Peng, N., 2012. Green hotel knowledge and tourists'staying behavior. *Annals of Tourism Research*, 39(4), 2203-2219.

Chen, M-F., and Tung, P.J., 2014. Developing an extended Theory of Planned Behavior model to predict consumers' intention to visit green hotels. *International Journal of Hospitality Management,* 36, 221-230.

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.

Collison, R., and Colwill, J., 1986. The analysis of food waste results and related attributes of restaurants and public houses. *Journal of Foodservice Systems*, 4(1), 17-30.

Cummings, L.E., 1992. Hospitality solid waste minimization: a global frame. *International Journal of Hospitality Management*, 11(3), 255-267.

Derqui, B., and Fernandez, V., 2017. The opportunity of tracking food waste in school canteens: Guidelines for self-assessment. *Waste Management,* 69, 431-44.

Dewald, B., Bruin, B.J., and Jang, Y.J., 2014. US consumer attitudes towards "green" restaurants. *Anatolia,* 25(2), 171-180.

Dickinson, J.E., Robbins, D., Filimonau, V., Hares, A., and Mika, M, 2013. Awareness of tourism impacts on climate change and the implications for travel practice: A Polish perspective. *Journal of Travel Research,* 52(4), 506-519.

DiPietro, R., Yang, C., and Charles, P., 2013. Green practices in upscale foodservice operations: Customer perceptions and purchase intentions. *International Journal of Contemporary Hospitality Management*, 25(5), 779-796.

Dunlap, R.E., and Catton, W.R., 1994. Struggling with human exemptionalism: The rise, decline and revitalization of environmental sociology. *The American Sociologist,* 25(1), 5-30.

Dunlap, R.E., van Liere, K.D., Mertig, A.G., and Jones, R.E., 2000. Measuring endorsement of the New Ecological Paradigm: a revised NEP scale. *Journal of Social Issues,* 56(3), 425-442.

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.

E-hotelarz, 2016. *Grupa Orbis zredukuje ilość odpadów żywnościowych o kilkadziesiąt procent [The Orbis Group will reduce the amount of food waste by several dozen percent]*. E-Hotelarz, 2016. Available from https://www.e-hotelarz.pl/mht/?p=42701&cookies=rodo [Accessed 17 January 2019].

Erdoğan, N., 2009. Testing the new ecological paradigm scale: Turkish case. *African Journal of Agricultural Research*, 4(10), 1023-1031.

Eriksson, M., Strid, I., and Hansson, P-A., 2012. Food losses in six Swedish retail stores: wastage of fruit and vegetables in relation to quantities delivered. *Resources, Conservation and Recycling*, 68, 14-20.

Eriksson, M., Osowski, C.P., 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., Osowski, C.P., Björkman, J., Hansson, E., Malefors, C., Eriksson, E., and Ghosh, R., 2018. The tree structure-a general framework for food waste quantification in food services. *Resources, Conservation and Recycling*, 130, 140-151.

Evans, D., 2011. Blaming the consumer–once again: the social and material contexts of everyday food waste practices in some English households. *Critical Public Health,* 21(4), 429-440.

Falasconi, L., Vittuari, M., Politano, A., and Segre, A., 2015. Food Waste in School Catering: An Italian Case Study. *Sustainability,* 7(11), 14745-14760.

Ferreira, M., Martins, M.L., and Rocha, A., 2013. Food waste as an index of foodservice quality. *British Food Journal,* 115(11), 1628-1637.

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 Gherbin, A., 2017. An exploratory study of food waste management practices in the UK grocery retail sector. *Journal of Cleaner Production,* 167, 1184-1194.

Filimonau, V., and Hogstrom, M., 2017. The attitudes of UK tourists to the use of biofuels in civil aviation: An exploratory study. *Journal of Air Transport Management,* 63, 84-94.

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

Filimonau, V., Lemmer, C., Marshall, D., and Bejjani, G., 2017. 'Nudging' as an architect of more responsible consumer choice in food service provision: The role of restaurant menu design. *Journal of Cleaner Production,* 144, 161-170.

Filimonau, V., Matute, J., Durydiwka, M., Faracik, R., Mika, M., and Zajadacz, A., 2018. The determinants of more responsible restaurant food choice in Poland. *Journal of Sustainable Tourism,* 26(8), 1398-1416.

Filimonau, V., Matute, J., Mika, M., and Faracik, R., 2019. National culture as a driver of pro-environmental attitudes and behavioural intentions in tourism. *Journal of Sustainable Tourism,* forthcoming, DOI: https://doi.org/10.1080/09669582.2018.1511722.

Fornell, C., and Larcker, D.F., 1981. Structural equation models with unobservable variables and measurement error: Algebra and statistics. *Journal of Marketing Research*, 382-388.

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].

Gao, Y., Mattila, A.S., and Lee, S., 2016. A meta-analysis of behavioral intentions for environment-friendly initiatives in hospitality research. *International Journal of Hospitality Management*, 54, 107-115.

Ge, L., Almanza, B., Behnke, C., and Tang, C., 2018. Will reduced portion size compromise restaurant customer's value perception? *International Journal of Hospitality Management*, 70, 130-138.

Gifford, R., and Nilsson, A., 2014. Personal and social factors that influence pro-environmental concern and behaviour: A review. *International Journal of Psychology,* 49(3), 141-157.

Giorgi, S., 2013. *Understanding out of home consumer food waste*. Banbury: WRAP.

Głuchowski A., Rasińska E., and Czarniecka-Skubina E., 2017. *Handel Wewnętrzny [Internal Trade]*. Report II, 4(369), SGGW, Warszawa, pp. 118-133.

Gregory-Smith, D., Smith, A., and Winklhofer, H., 2013. Emotions and dissonance in 'ethical' consumption choices. *Journal of Marketing Management,* 29(11-12), 1201-1223.

Hair, J.F., Babin, B.J., and Anderson, R.E., 2019. *Multivariate data analysis.* Cengage Learning, Hampshire, USA.

Hair, J.F., Ringle, C.M., and Sarstedt, M., 2011. PLS-SEM: Indeed a silver bullet. *Journal of Marketing theory and Practice*, 19(2), 139-152.

Hamerman, E.J., Rudell, F., and Martins, C.M., 2018. Factors that predict taking restaurant leftovers: Strategies for reducing food waste. *Journal of Consumer Behaviour,* 17, 94-104.

Han, H., 2015. Travelers' pro-environmental behavior in a green lodging context: Converging value-belief-norm theory and the theory of planned behaviour. *Tourism Management,* 47, 164-177.

Han, H., Jae, M., and Hwang, J., 2016. Cruise travelers' environmentally responsible decision-making: An integrative framework of goal-directed behavior and norm activation process. *International Journal of Hospitality Management,* 53, 94-105.

Han, H., Hwang, J., and Lee, M.J., 2017. The value–belief–emotion–norm model: investigating customers' eco-friendly behaviour. *Journal of Travel & Tourism Marketing,* 34(5), 590-607.

Han, H., Hwang, J., Kim, J., and Jung, H., 2015. Guests' pro-environmental decision-making process: Broadening the norm activation framework in a lodging context. *International Journal of Hospitality Management,* 47, 96-107.

Hanks, L., and Mattila, A.S., 2016. Consumer response to organic food in restaurants: A serial mediation analysis. *Journal of Foodservice Business Research,* 19(1), 109-121.

Hares, A., Dickinson, J., and Wilkes, K., 2010. Climate change and the air travel decisions of UK tourists. *Journal of Transport Geography*, 18, 466–473.

Hedlund, T., 2011. The impact of values, environmental concern, and willingness to accept economic sacrifices to protect the environment on tourists' intentions to buy ecologically sustainable tourism alternatives. *Tourism and Hospitality Research,* 11(4), 278-288.

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.

Henseler, J., Ringle, C.M., and Sarstedt, M., 2015. A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, *43*(1), 115-135.

Hergesell, A., and Dickinger, A., 2013. Environmentally friendly holiday transport mode choices among students: the role of price, time and convenience. *Journal of Sustainable Tourism,* 21(4), 596-613.

Hu, M-L., Horng, J-S., Teng, C-C., and Chou, S-F., 2016. A criteria model of restaurant energy conservation and carbon reduction in Taiwan. *Journal of Sustainable Tourism*, 21(5), 765-779.

Hu, H-H., Parsa, H.G., and Self, J., 2010. The Dynamics of Green Restaurant Patronage. *Cornell Hospitality Quarterly,* 51(3), 344-362.

Jang, S.Y., Chung, J.Y., and Kim, Y.G., 2015. Effects of Environmentally Friendly Perceptions on Customers' Intentions to Visit Environmentally Friendly Restaurants: An Extended Theory of Planned Behavior. *Asia Pacific Journal of Tourism Research,* 20(6), 599-618.

Jang, Y.J., Kim, W.G., and Bonn, M.A., 2011. Generation Y consumers' selection attributes and behavioral intentions concerning green restaurants. *International Journal of Hospitality Management,* 30(4), 803-811.

Jang, Y.J., Kim, W.G., and Lee, H.Y.., 2015. Coffee shop consumers' emotional attachment and loyalty to green stores: The moderating role of green consciousness. *International Journal of Hospitality Management,* 44, 146-156.

Jochnowitz, E., 1998. Flavors of Memory: Jewish Food as Culinary Tourism in Poland. *Southern Folklore,* 55(3), 224.

Juvan, E., and Dolnicar, S., 2017. Drivers of pro-environmental tourist behaviours are not universal. *Journal of Cleaner Production,* 166, 879-890.

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.

Kaczorowska J., and Kowrygo B., 2016, *Konsumencka gotowość do realizacji zrównoważonego wzorca spożycia żywności [Consumer's readiness to adopt a sustainable pattern of food intake]*. SGGW, Warszawa, 114, 33-44.

Kaiser, F.G., Wolfing, S., and Fuhrer, U., 1999. Environmental attitude and ecological behaviour. *Journal of Environmental Psychology,* 19(1), 1-19.

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.

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.

Kim, Y.J., Njite, D., and Hancer, M., 2013. Anticipated emotion in consumers' intentions to select eco-friendly restaurants: Augmenting the theory of planned behaviour. *International Journal of Hospitality Management,* 34, 255-262.

Kirk, D., 1995. Environmental management in hotels. *International Journal of Contemporary Hospitality Management*, 7(6), 3-8.

Kwiatkowska E., and Levytska G., 2007. *Stan i kierunki rozwoju polskiego rynku usług gastronomicznych [Status and directions of development of the Polish market of gastronomic services]*. SGGW, Warszawa, 63, pp. 135-145.

Kurek, W., and Pawlusinski, R., 2009. International tourism in Małopolskie Województwo: the present situation and prospects for development. *Tourism*, 19, 1-2.

Laroche, M., Bergeron, J., and Barbaro-Forleo, G., 2001. Targeting consumers who are willing to pay more for environmentally friendly products. *Journal of Consumer Marketing*, 18(6), 503-520.

Lebersorger, S., and Schneider, F., 2014. Food loss rates at the food retail, influencing factors and reasons as a basis for waste prevention measures. *Waste Management,* 34(11), 1911-1919.

Lee, W.H., and Moscardo, G., 2005. Understanding the Impact of Ecotourism Resort

Experiences on Tourists' Environmental Attitudes and Behavioural Intentions. *Journal of Sustainable Tourism,* 13(6), 546-565.

Lee, S., and Heo, C.Y., 2009. Corporate social responsibility and customer satisfaction among US publicly traded hotels and restaurants. *International Journal of Hospitality Management,* 28(4), 635-637.

Levytska G., and Kowrygo B., 2007. *Znaczenie usług gastronomicznych w żywieniu ludności w Polsce [The role of gastronomic services in human nutrition in Poland].* Roczniki PZH [Yearbooks of PZH], 2007, 1.

Line, N.D., Hanks, L., and Zhang, L., 2016. Sustainability communication: The effect of message construals on consumers' attitudes towards green restaurants. *International Journal of Hospitality Management,* 57, 143-151.

Lorenz, B.A.S., and Langen, N., 2018. Determinants of how individuals choose, eat and waste: Providing common ground to enhance sustainable food consumption out-of-home. *International Journal of Consumer Studies,* 42(1), 35-75.

Lorenz, B.A.S., Langen, N., Hartmann, M., and Klink-Lehmann, J., 2018. Decomposing attitudes towards food leftovers: Implications for general attitude, intention and behavior. *British Food Journal*, 120(11),.2498-2509.

Lu, L-C., Chang, H-H., and Chang, A., 2015. Consumer Personality and Green Buying Intention: The Mediate Role of Consumer Ethical Beliefs. *Journal of Business Ethics,* 127(1), 205-219.

McKercher, B., Prideauz, B., Cheung, C., and Law, R., 2009. Achieving voluntary reductions in the carbon footprint of tourism and climate change. *Journal of Sustainable Tourism,* 18(3), 297-317.

Mair, J., 2011. Exploring air travellers' voluntary carbon-offsetting behaviour. *Journal of Sustainable Tourism,* 19(2), 215-230.

Marszałek A., 2018. Czy możliwe jest przezwyciężenie problemu marnotrawstwa żywności? [Is it possible to overcome the problem of food waste?]. *Nierówności Społeczne a Wzrost Gospodarczy [Social Inequalities and Economic Growth]*, 54(2), 474-485. DOI: 10.15584/nsawg.2018.2.35

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.

Mehmetoglu, M., 2010. Factors Influencing the Willingness to Behave Environmentally Friendly at Home and Holiday Settings. *Scandinavian Journal of Hospitality and Tourism,* 10(4), 430-447.

Milewska M., Prączko A., and Stasiak A., 2017. *Podstawy gastronomii. Od żywności do turystyki kulinarnej [The foundations of gastronomy. From food to culinary tourism]*. PWE, Warszawa.

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.

Mostafa, M.M., 2007. Gender differences in Egyptian consumers' green purchase behaviour: the effects of environmental knowledge, concern and attitude. *International Journal of Consumer Studies,* 31(3), 220-229.

Namkung, Y., and Jang, S, 2013. Effects of restaurant green practices on brand equity formation: Do green practices really matter? *International Journal of Hospitality Management,* 33, 85-95.

Namkung, Y., and Jang, S, 2017. Are Consumers Willing to Pay more for Green Practices at Restaurants? *Journal of Hospitality and Tourism Research,* 41(3), 329-356.

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.

Nunnally, J.C., and Bernstein, I. H., 1994. *Psychometric Theory (McGraw-Hill Series in Psychology), 3rd volume*. New York: McGraw-Hill.

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.

Parizeau, K., Massow, M.V., and Martin, R. 2015. Household-level dynamics of food waste production and related beliefs, attitudes, and behaviours in Guelph, Ontario. *Waste Management*, 35, 207-217.

Pereira, E.M.V., Mykletun, R.J., and Hippolyte, C., 2012. Sustainability, daily practices and vacation purchasing: are they related? *Tourism Review*, 67(4), 40-54.

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

Porpino, G., Parente, J., and Wansink, B., 2015. Food waste paradox: antecedents of food disposal in low income households. *International Journal of Consumer Studies,* 39(6), 619-629.

Powell, R.B., and Ham, S.H., 2008. Can Ecotourism Interpretation Really Lead to Pro-Conservation Knowledge, Attitudes and Behaviour? Evidence from the Galapagos Islands. *Journal of Sustainable Tourism,* 16(4), 467-489.

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.

Ramkissoon, H., Weiler, B., and Smith, L.D.G., 2012. Place attachment and pro-environmental behaviour in national parks: the development of a conceptual framework. *Journal of Sustainable Tourism,* 20(2), 257-276.

Reinartz, W., Haenlein, M., and Henseler, J. 2009. An empirical comparison of the efficacy of covariance-based and variance-based SEM. *International Journal of Research in Marketing*, 26(4), 332-344.

Renko, S., Vignali, C., and Żakowska-Biemans, S., 2011. Polish consumer food choices and beliefs about organic food. *British Food Journal*, 113(1), 122-137.

Roldan, J.L., and Sánchez-Franco, M.J., 2012. Variance-Based Structural Equation Modeling: Guidelines for Using Partial Least Squares in Information Systems Research. In: Mora, M., Gelman, O., Steenkamp, A.L., and Raisinghani, M. (eds.), *Research Methodologies, Innovations and Philosophies in Software Systems Engineering and Information Systems*. IG Global, Hershey, pp. 193-221.

Rynek Gastronomiczny w Polsce 2017 [Gastronomic market in Poland in 2017]*, 2017. Rynek Gastronomiczny w Polsce 2017 [Gastronomic market in Poland in 2017]*. Kudosz, M. (ed.)*.* BROG B2B, Warszawa.

Rynek Gastronomiczny w Polsce 2018 [Gastronomic market in Poland in 2018]*, 2018. Rynek Gastronomiczny w Polsce 2018 [Gastronomic market in Poland in 2017]*. Kaszuba, M. (ed.)*.* BROG B2B, Warszawa.

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.

Schlegelmilch, B.B., Bohlen, G.M., and Diamantopoulos, A., 1996. The link between green purchasing decisions and measures of environmental consciousness. *European Journal of Marketing*, 30(5), 35-55.

Schubert, F., Kandampully, J., Solnet, D., and Kralj, A., 2010. Exploring Consumer Perceptions of Green Restaurants in the US. *Tourism & Hospitality Research,* 10(4), 286-300.

Shin, Y.H., Im, J., Jung, S.E., and Severt, K., 2017. Consumers' Willingness to Patronize Locally Sourced Restaurants: The Impact of Environmental Concern, Environmental Knowledge, and Ecological Behavior. *Journal of Hospitality Marketing and Management,* 26(6), 644-658.

Silvennoinen, K., Heikkila, L., Katajajuuri, J-M., 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.

Stenmarck, Å., Jensen, C., Quested, T., and Moates, G., 2016. *Estimates of European food waste levels*. Stockholm: European Commission.

Stern, P.C., and Dietz, T., 1994. The Value Basis of Environmental Concern. *Journal of Social Issues,* 50(3), 65-84.

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.

Teng, Y-M., Wu, K-S., and Liu, H-H., 2015. Integrating Altruism and the Theory of Planned Behavior to Predict Patronage Intention of a Green Hotel. *Journal of Hospitality & Tourism Research,* 39(3), 299-315.

Tilikidou, I., 2007. The effects of knowledge and attitudes upon Greeks' pro-environmental purchasing behaviour. *Corporate Social Responsibility and Environmental Management,* 14(3), 121-134.

Tzschentke, N., Kirk, D., and Lynch, P., 2008. Going green: Decisional factors in small hospitality operations. *International Journal of Hospitality Management*, 27(1), 126-133.

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.

Wang, J., Wang, S., Xue, H., Wang, Y., and Li, J., 2018. Green image and consumers' word-of-mouth intention in the green hotel industry: The moderating effect of Millennials. *Journal of Cleaner Production,* 181, 426-436.

Wetzels, M., Odekerken-Schroder, G., and van Oppen, C., 2009. Using PLS path modeling for assessing hierarchical construct models: guidelines and empirical illustration. *Management Information Systems Quarterly,* 33(1), 177-195.

Wen, Z., Wang, Y., and De Clercq, D., 2015. Performance evaluation model of a pilot food waste collection system in Suzhou City, China. *Journal of Environmental Management*, 154, 201-207.

Whitehair, K.J., Shanklin, C.W., and Brannon, L.A., 2013. Written messages improve edible food waste behaviors in a university dining facility. *Journal of the Academy of Nutrition and Dietetics*, 113(1), 63-69.

WRAP-Waste and Resources Action Programme, 2013. *Overview of waste in the UK hospitality and food service sector.* WRAP. HFS001-006, Oxon.

Xu, Y., 2014. Understanding CSR from the perspective of Chinese diners: the case of McDonald's. *International Journal of Contemporary Hospitality Management*, 26(6), 1002-1020.

Zhang, L., 2014. How effective are your CSR messages? The moderating role of processing fluency and construal level. *International Journal of Hospitality Management,* 41, 56-62.

Table 1. Sample characteristics

| Gender | | Frequency of dining out | |
|---|---|---|---|
| Male | 49.3% | Very often | 15% |
| Female | 50.7% | Often | 37% |
| | | Sometimes | 30.8% |
| | | Rarely | 17.2% |
| **Level of education** | | **Personal Salary** | |
| Primary School | 5.3% | | |
| Secondary School | 23.8% | Lower than the country average Higher | 42.8% |
| Vocational School | 5.7% | than the country average | 32% |
| High School | 63.7% | Prefer not to say | 25.2% |
| Other | 1.5% | | |
| **Age** | | **Occupation** | |
| 16-24 | 24.4% | Retired | 4.2% |
| 25-34 | 28.9% | Student | 24.2% |
| 34-44 | 25.3% | Unemployed | 2.6% |
| 45-54 | 13.7% | Full-Time employed | 61.7% |
| 55-64 | 4.8% | Part-Time employed | 7.3% |
| 65+ | 2.9% | | |

Table 2. EFA for the Environmental Concern Scale

| Items | Items factorial loadings | | | |
|---|---|---|---|---|
| | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
| **Factor 1. Balance of nature (BAL)** | | | | |
| When humans interfere with nature, this often results in disastrous consequences | .750 | | | |
| The balance of nature is very delicate and can be easily upset | .791 | | | |
| Humans are severely abusing the environment | .783 | | | |
| If things continue on their present course, we will soon experience a major ecological catastrophe | .715 | | | |
| **Factor 2. Anti-Anthropocentrism (ANAN)** | | | | |
| Humans have the right to modify the natural environment to suit their needs | | .664 | | |
| Plants and animals have as much rights as humans to exit | | .684 | | |
| Humans were meant to rule over the rest of the nature | | .787 | | |
| **Factor 3. Limits to growth (LIM)** | | | | |
| We are approaching the limit of the number of people the Earth can support | | | .784 | |
| This planet has plenty of natural resources, we just need to know how to develop them | | | .578 | |

| | | | | |
|---|---|---|---|---|
| The Earth is like a spaceship which has only limited room and resources on-board | | | .639 | |
| **Factor 4. Rejection of exemptionalism (REJEX)** | | | | |
| Human ingenuity will ensure that we do not make the earth inhabitable | | | | .700 |
| Humans will eventually learn enough about how nature works to be able to control it | | | | .844 |
| KMO = 0.804; Bartlett sphericity test = 1176.903 (Sig. <0.000); Total Explained Variance = 62.39% | | | | |

Table 3. EFA for the Knowledge on Restaurant Food Waste scale

| Items | Items factorial loadings | |
|---|---|---|
| | Factor 1 | Factor 2 |
| **Factor 1. Knowledge of Restaurants Food Waste Issue (KRFWI)** | | |
| I am aware / I know that cooking a restaurant meal generates a lot of food waste | .801 | |
| I am aware / I know that food wastage from consumer plates is substantial | .813 | |
| I am aware / I know that restaurant buffets generate excessive amounts of food waste | .833 | |
| I am aware / I know that all-inclusive / 'eat as much as you can' restaurant business models generate a lot of food waste | .577 | |
| **Factor 2. Knowledge of the Approaches to Managing Food Waste in Restaurants (KAMFWR)** | | |
| I am aware / I know that local food is better for the environment in terms of wastage | | .727 |
| I am aware / I know that bringing food from long distance to cook in a restaurant increases the probability of food waste occurrence | | .707 |
| I am aware / I know that donating unsold meals to the people in need is growing in popularity with restaurants around the world | | .625 |
| I am aware / I know that food waste reduction leads to significant financial savings for restaurant managers | | .555 |
| KMO = 0.811; Bartlett sphericity test = 965.71 (Sig. <0.000); Total Explained Variance = 51.2% | | |

Table 4. Results of the final measurement model.

| Construct | Indicator | Standardized Loading | Composite Reliability Index (CRI) | Average Variance Extracted (AVE) |
|---|---|---|---|---|
| Environmental Concern (EC) | BAL | 0.725* | 0.781 | 0.472 |
| | ANAN | 0.707* | | |
| | LIM | 0.673* | | |
| | REJEX | 0.640* | | |
| Environmental Knowledge (EK) | EK1 | 0.798* | 0.895 | 0.630 |
| | EK2 | 0.799* | | |
| | EK3 | 0.834* | | |
| | EK4 | 0.765* | | |
| | EK5 | 0.771* | | |
| Pro-Environmental Behaviour at Home (PEBH) | PEBH1 | 0.724* | 0.850 | 0.532 |
| | PEBH2 | 0.799* | | |
| | PEBH3 | 0.670* | | |
| | PEBH5 | 0.735* | | |
| | PEBH6 | 0.714* | | |
| Knowledge on Restaurant Food Waste (KRFW) | KRFWI | 0.877* | 0.815 | 0.688 |
| | KAMFWR | 0.780* | | |
| Anticipated Regret (AR) | AR1 | 0.906* | 0.838 | 0.638 |
| | AR2 | 0.630* | | |
| | AR4 | 0.835* | | |
| Attitudes towards Restaurant Food Waste (ATT) | ATT1 | 0.821* | 0.855 | 0.598 |
| | ATT2 | 0.803* | | |
| | ATT4 | 0.810* | | |
| | ATT5 | 0.760* | | |
| | | 0.645* | | |

| | | | | |
|---|---|---|---|---|
| **Behavioral Intentions towards Restaurant Food Waste Reduction (INT)** | *INT1* | 0.878* | | |
| | *INT2* | 0.816* | | |
| | *INT3* | 0.759* | 0.901 | 0.648 |
| | *INT4* | 0.703* | | |
| | *INT5* | 0.856* | | |

*Note:* * = p<0.01.

Table 5. Discriminant validity of the final measurement model.

| Construct | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-----------|------|------|------|------|------|------|------|
| **1. EC** | 0.687 | 0.357 | 0.350 | 0.628 | 0.275 | 0.345 | 0.454 |
| **2. EK** | 0.257 | 0.794 | 0.614 | 0.355 | 0.347 | 0.270 | 0.399 |
| **3. PEBH** | 0.250 | 0.524 | 0.729 | 0.396 | 0.497 | 0.403 | 0.517 |
| **4. KRFW** | 0.369 | 0.252 | 0.277 | 0.830 | 0.670 | 0.722 | 0.738 |
| **5. AR** | 0.189 | 0.286 | 0.393 | 0.429 | 0.799 | 0.552 | 0.583 |
| **6. ATT** | 0.242 | 0.224 | 0.317 | 0.484 | 0.431 | 0.773 | 0.797 |
| **7. INT** | 0.335 | 0.343 | 0.427 | 0.524 | 0.482 | 0.662 | 0.805 |

*Note 1*: Figures in the diagonal present the AVE values. Below the diagonal figures represent the constructs' squared correlations. Above the diagonal values represent the HTMT-ratios.

*Note 2*: See Table 1.

Table 6. Results of the structural model

| Relationships | β | t-value |
|---|---|---|
| Environmental Concern → Pro-Environmental Behavior | 0.096** | 2.245 |
| Environmental Concern → Knowledge Rest. Food Waste | 0.337* | 6.553 |
| Environmental Knowledge → Pro-Environmental Behavior | 0.479* | 12.291 |
| Environmental Knowledge → Knowledge Rest. Food Waste | 0.170* | 3.358 |
| Pro-Environmental Behavior → Attitudes | 0.202* | 3.958 |
| Knowledge Rest. Food Waste → Knowledge Rest. Food Waste | 0.429* | 10.526 |
| Pro-Environmental Behavior → Knowledge Rest. Food Waste | 0.162* | 4.286 |
| Knowledge Rest. Food Waste → Behavioral Intentions | 0.199* | 5.101 |
| Anticipate Regret → Behavioral Intentions | 0.142* | 3.533 |
| Attitudes → Behavioral Intentions | 0.449* | 10.809 |
| **Socio-demographic relationships** | | |
| Age → Pro-Environmental Behavior | 0.166* | 4.359 |
| Age → Knowledge Rest. Food Waste | -0.017 | 0.395 |
| Age → Attitudes | -0.071*** | 1.732 |
| Age → Behavioral Intentions | 0.042 | 1.390 |
| Level of Education → Pro-Environmental Behavior | 0.027 | 0.625 |
| Level of Education → Knowledge Rest. Food Waste | -0.022 | 0.500 |
| Level of Education → Attitudes | 0.105** | 2.519 |
| Level of Education → Behavioral Intentions | 0.036 | 0.981 |
| $R^2$ (PEBH) = 32%; $R^2$ (KRFW) = 16.6% ; $R^2$ (ATT) = 28.3%; $R^2$ (INT) = 54.8% <br><br> $Q^2$ (PEBH) = 0.145; $Q^2$ (KRFW) = 0.099 ; $Q^2$ (ATT) = 0.146; $Q^2$ (INT) = 0.306 | | |

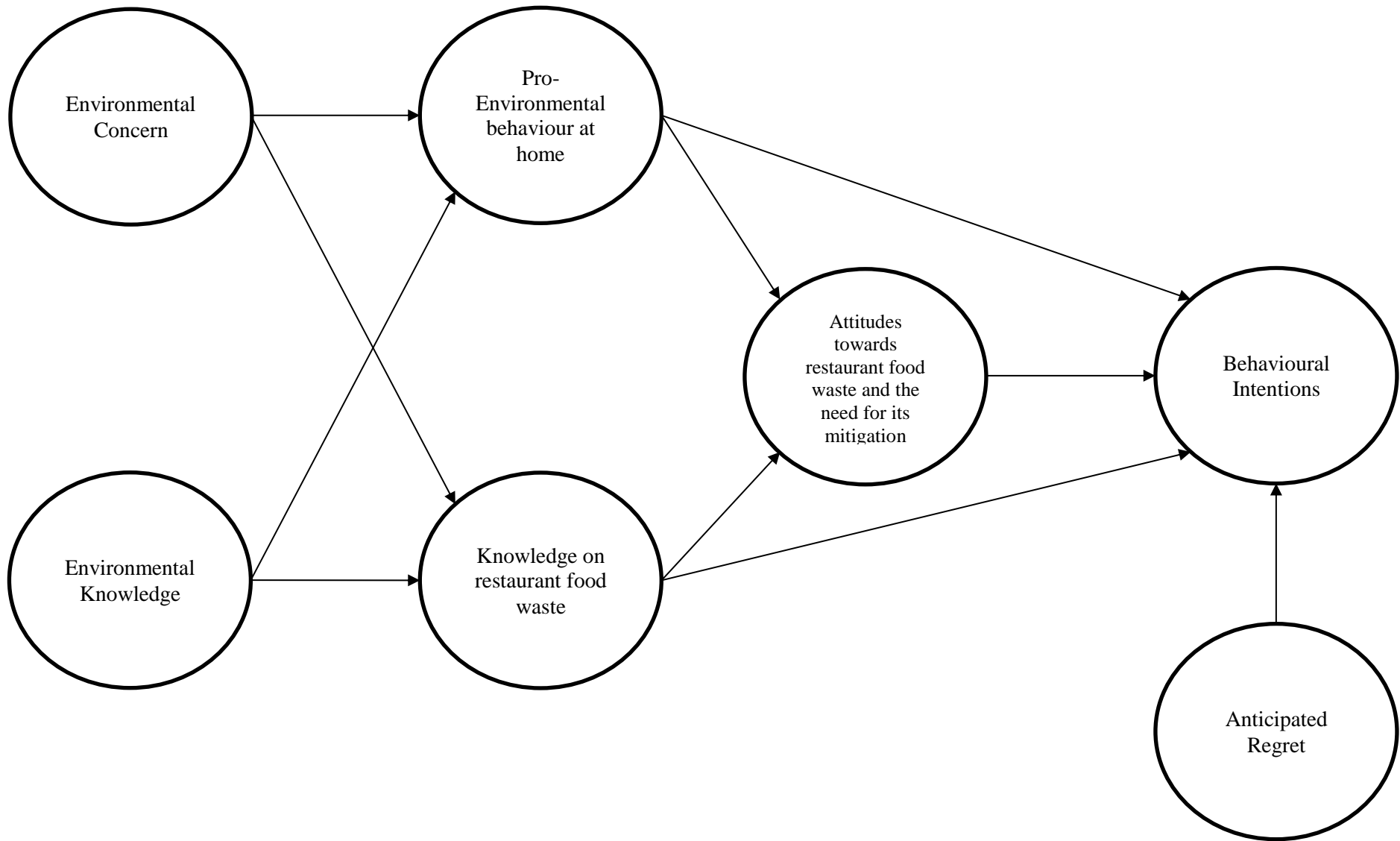*Note 1:* See Table 1.

*Note 2:* * = p<0.01; ** = p<0.05; *** = p<0.10.

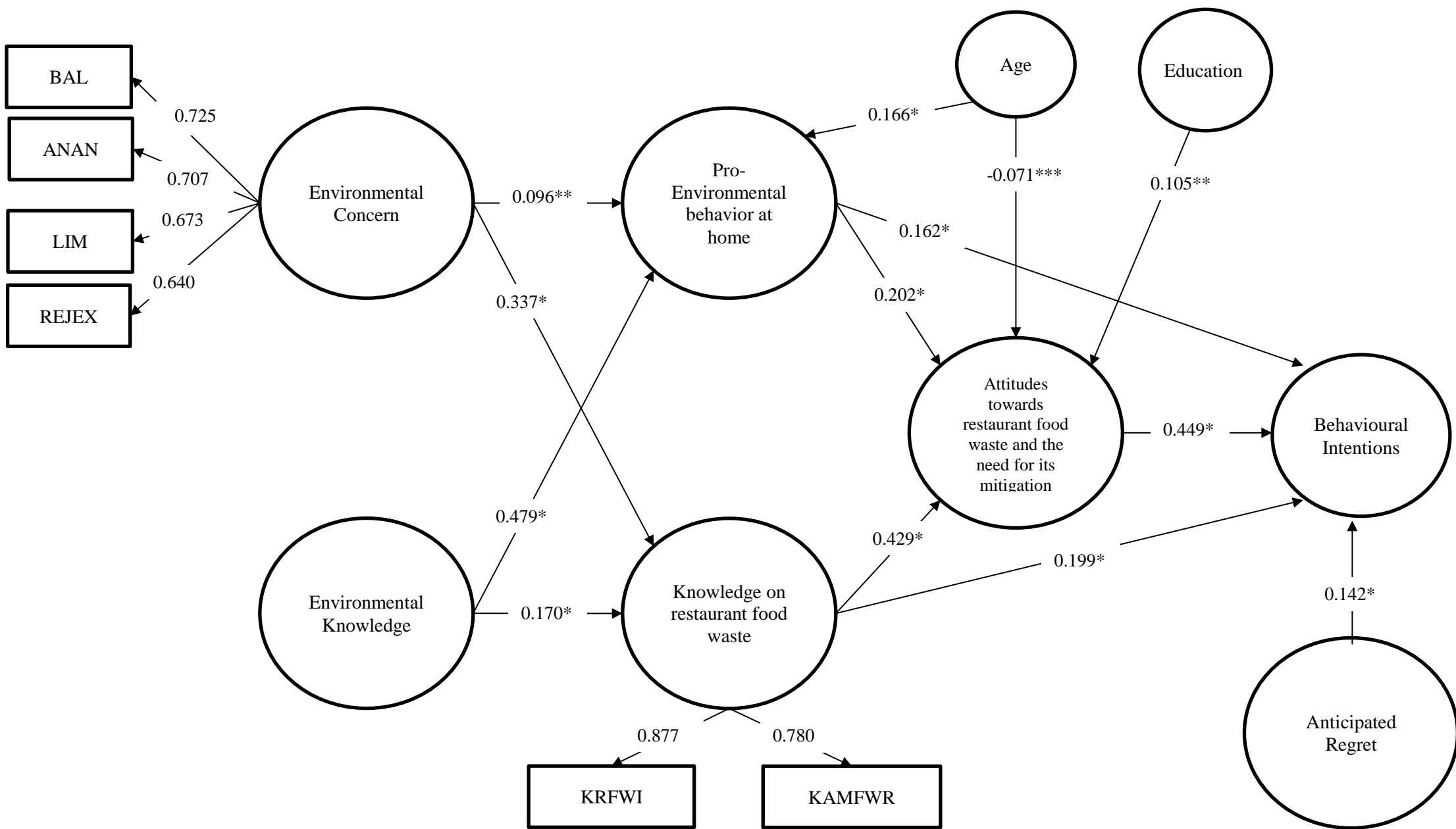Figure 1. Baseline research model adopted in this study

Figure 2. Results of the structural model. *Note* * = p<0.01; ** = p<0.05; *** = p<0.10.