

# Reducing waste of food left on plates

## Interventions based on means-end chain analysis of customers in foodservice sector

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### Abstract

**Purpose** – Social marketing and other types of targeted behaviour change interventions should appeal to an individual's personal values in order to improve their effectiveness. However, there is currently little understanding of what these values are in relation to food waste. The purpose of this paper is to identify the values underpinning the specific behaviour of plate waste created in a residential foodservice setting.

**Design/methodology/approach** – In semi-structured interviews ( $n = 50$ ) laddering techniques were used to identify links from behaviours through individual's rationalisation for that behaviour to their personal values. The aim of the questioning was to uncover underlying drivers that lead to plate waste as well as those barriers to reducing it.

**Findings** – The values identified as being most important are hedonism and self-direction. The specific aspects of these values for plate waste reduction interventions are not compromising on the individual's enjoyment of the meal and meeting their health goals. Effective interventions include pre-ordering meals, reducing food options provided, reducing plate size, removing food tray and finally, information campaigns to raise awareness.

**Originality/value** – The study provides insights into the personal values that influence behaviours resulting in plate waste. The study is the first to determine the links between this behaviour, rationalisations for that behaviour and personal values.

**Keywords** Behaviour change, Food waste, Foodservice, Leftovers

**Paper type** Research paper

### Introduction

As the impacts of climate change, peak oil and food insecurity become prevalent, food waste looks set to become one of the major environmental and social justice issues of the twenty-first century. Research has indicated that about one-fifth of the food delivered to foodservice institutions is lost (Engström and Carlsson-Kanyama, 2004). There is consensus in the literature on the definition of plate waste. This is expressed as the quantity of an edible portion of served food that is discarded (Buzby and Guthrie, 2002), or the fraction of food waste that represents the leftovers (Schneider, 2008). The existence of plate waste indicates that the food resource could be used more efficiently and improving this would enhance environmental sustainability (Singer and Smart, 1977).

Further, from a practical view, as a big impact may be achieved when addressing food waste in an institutional setting where there are many individuals dining in the same way, the foodservice sector has every reason to be at the forefront of efforts to reduce food losses along supply chains and food waste caused by individuals at point of consumption. Despite this, academic research on food waste that considers how the foodservice sector can effectively make meaningful reductions has been slow to emerge.



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A number of studies have focused on food waste generated in catering and public procurement practices (e.g. Sonnino and McWilliam, 2011) and in institutional kitchens (e.g. Goonan *et al.*, 2014). In terms of food waste-related literature in foodservice settings, the majority of this has focused on plate waste which makes sense given that plate waste is the single largest source of loss for food delivered to foodservice institutions. Plate waste research has primarily been conducted in two key settings: education and health. The key studies in each of these areas are now discussed in turn.

In the education sector there has been plate waste studies in both school and university settings. For example, Kim *et al.* (2000), An and Lee (2002) and Lee (2005) looked into plate waste in South Korean schools to determine the nutrient intake of lunches within the schools. Understanding the reasons why food was wasted and strategies to prevent this occurring in the future was not the focus of these works. Yoon and Kim (2012) did look into elementary school students' perceptions of food waste and factors affecting plate waste rates in school foodservice. They found that students who ate a balanced diet were less likely to waste food, students who were satisfied with the school foodservice were also less likely to create food waste than those who were unsatisfied, and students who recognised the need for nutrition education had a significantly lower amount of food waste than those who did not. Students' attitudes towards food waste were significantly negatively correlated with plate waste rates. The suggestions were made that nutrition education on portion size and that having a balanced diet would be beneficial in reducing the amount of food waste generated in Korean schools. Other plate waste studies in school foodservice settings include Jansen and Harper's (1978) study on the consumption and plate waste of menu items served in a national school lunch programme and Kirks and Wolff's (1985) study that compared methods for plate waste determinations. In a university context, Ferreira *et al.* (2013) studied food waste in a Portuguese University and found that approximately 200 g of food was wasted per individual per meal. Suggested intervention strategies given for this waste included: booking of meals, tray-free dining during lunch, analysing eating patterns for a potential forecasted meal and preparing food based off the appropriate forecast. Similar studies by Whitehair and Shanklin (2012) and Whitehair (2011) identified that written messages improved food waste behaviours in a university dining facility and that tray-free dining could also reduce food waste. In addition to the aforementioned written messages, booking of meals and tray-free dining interventions, others that have been touted in the literature as having the potential to reduce plate waste in foodservice dining facilities include, though not being limited to, rescheduling meal hours, tailoring serving sizes to an individual's appetite via self-service, improving quality and condition of food and providing nutrition education (Buzby and Guthrie, 2002).

In the health sector, a large number of plate waste studies have been conducted in hospital foodservice settings (see, e.g. Al-shoshan, 1992; Holdt *et al.*, 2006; Hong and Kirk, 2006; Kandiah *et al.*, 2006). Williams and Walton (2011) provide a summary review of the literature on the extent of plate waste in hospitals, methods for its measurement, causes and possible strategies to reduce plate waste. The fact that there has been more attention on hospital food waste compared to other foodservice settings is likely reflective of the fact that hospitals produce the large amounts of plate waste due to the clinical condition of the patients, food and menu issues (such as poor quality, inappropriate portion sizes and limited choice menu), service issues (including difficulty accessing food and complex ordering systems) and environmental factors (such as inappropriate meal times, interruptions and unpleasant ward surroundings)

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(Williams and Walton, 2011). While some of the identified strategies to reduce hospital patients' plate waste are context specific (as they address clinical issues, e.g. appetite stimulants, or service issues, e.g. feeding assistance), there are many of the plate waste reduction initiatives that are in fact very similar to those suggested for school and university settings (e.g. food and menu issues such as flexible portion sizes, increased choice and improved food quality).

Despite recognition of plate waste being a problem and identification of a gamut of possible reduction initiatives in the academic literature, the reality is that the amount of plate waste in foodservice continues to be a significant and concerning issue. While the abovementioned studies offer some insight into possible causes of plate waste in foodservice and suggest interventions to address these, few studies actually investigate the underlying motivations that lead customers to waste food and none of the studies investigate the more specific and concrete linkages between personal values and plate wasting behaviours. Without such an understanding, foodservice managers risk putting resources and efforts into designing unsuccessful plate waste reduction initiatives and interventions. We contend that what is specifically missing in the existing plate waste-related literature is an insight from a consumer behaviourist perspective into the decision making processes that underpin foodservice customer's plate waste behaviours. Providing an understanding of the cognitive reasons customers give as to why plate waste occurs will provide insights that can practicably be used by foodservice managers as a helpful basis for designing more successful interventions to reduce plate waste.

Thus the research presented in this paper contributes to the extant plate waste literature by providing a close examination of individual's motivations for either cleaning their plate, or for leaving food on it, in order to improve effectiveness of behaviour change initiatives. Motivations are an energising force that induces action (Pinder, 1998). In the context of this study, motivations relate to peoples' decisions about eating (or not) all the food on their plate; it involves how, when, and why people allocate effort to these activities. Ultimately, the aim of this study was to get foodservice customers to think about their motivations that lead to plate waste, thereby allowing the researchers to identify the underlying drivers and barriers. Understanding these motivations can facilitate recommendations to minimise the amount of food plate waste in order to achieve a more environmentally sustainable foodservice system.

Before detailing the specificities of method used in the study the following section introduces the theoretical approach used, namely, personal values and means-ends chains. Personal values are one approach that has been used to explore motivation and food choices (Anderson and Miroso, 2014; Arsil *et al.*, 2014; Zanoli and Naspetti, 2002). Values are defined as concepts or beliefs, related to desirable end states or behaviours. They guide selection or evaluation of behaviour and events, and are ordered by relative importance (Schwartz, 1992). Thus values are guiding principles regarding how individuals ought to behave; by definition they are fairly stable and, due to their link to behaviour, they offer good insights for social marketing and other promotional campaigns that foodservice managers might use for persuasion. Schwartz's theory of values is one of the most validated and popular approaches to investigate them. This theory is built on the idea that every individual holds ten primary motivational values types (achievement, hedonism, stimulation, self-direction, universalism, benevolence, conformity, tradition, security and power) which underlie their behaviour. As each individual may place a different weighting of importance on each value, this theory embraces the different actions that do emerge amongst individuals (Schwartz and Bilsky, 1990).

Previous research has confirmed values can provide reasons for an individual's food behaviour (Grunert and Juhl, 1995). While there are many studies linking food preference and choice with personal values, there is limited literature on values and how these influence food wastage. Although motives for reducing food waste have been reported in the literature to be save money, save the planet, save hungry people and to save guilt (Aschemann-Witzel *et al.*, 2015), to date exactly how these motives link to personal values has not been explored.

Means-ends approach to understanding behaviours is usually attributed to Kelly (1955) and was a fundamental idea in Rokeach's (1973) work on values. In this approach consumers carry out behaviour as a means to reach an objective or an end (Reynolds and Whitlark, 1995). The model gives a deep view into consumer perceptions, revealing the characteristics consumers judge as important in their choices. This information is fundamental in order to devise effective communication strategies. To operationalise means-end theory, Reynolds and Gutman (1988) developed the laddering technique. They define laddering as interviewing to develop an understanding of how consumers translate attributes of products into meaningful associations with respect to themselves. Thus means-end chain provides a structure that links consumers' knowledge about product attributes through their personal knowledge about consequences to their personal values (Sonne *et al.*, 2012). While the original means-end chain concept is based on the link between attribute-consequence and value, a variant of this concept has been applied to study consumers' motivations for doing, or not doing, certain behaviours. This variant focuses on the association between behaviour-rationalisation and value and allows the interviewers to identify the underlying drivers or barriers for behaviours. Behaviours studied to date using this adapted means-end chain concept includes healthier fast food consumption (Anderson and Miroso, 2014), wine consumption behaviours (Miroso and Tang, 2016) and energy saving behaviours in the home (Miroso *et al.*, 2013). When applying means-end chain thinking to the context of behaviours, it does not make sense to use the commonly used laddering terms "attributes" and "consequences" (Reynolds and Olson, 2001) to represent the first two levels of abstraction in the ladder as these specifically relate to product use and not behaviour. Thus the first two steps of the variant chain are alternatively referred to as "behaviour" and "rationalisation" (i.e. the behaviour-level responses and the rationalisation-level responses which are the immediate reasons identified for doing or not doing that particular behaviour).

## Methods

### *Data collection*

A total of 50 short semi-structured qualitative interviews were conducted with residents living full-time in a New Zealand university residential college in the South Island city of Dunedin. Participants ate meals in-house at an "all you can eat" dining facility. Participants had to be over the age of 18 to participate in the study. As a general rule of thumb for laddering interviews, it has been suggested that a minimum of 20 respondents should be included in any single subgroup (Saaka *et al.*, 2004). Data collection ceased after 50 interviews had taken place when it was clear saturation in the range of identified values had been achieved. This was seen as a sufficient sample size, particularly based on the homogenous nature of the population in question. This sample size also ensured that there were more than the suggested minimum 20 participants in each of the two subgroups (those participants that "did waste" and those that "didn't waste").

Participants were recruited for the study using an intercept method as they returned their finished plates after the meal. Using a randomised systematic intercept method participants were stopped regardless of whether or not they had any food left on their plate and asked whether they would be willing to participate in an interview. Of the 53 individuals approached only three declined to participate.

The interviews were audio recorded and photos were taken of the plate being returned to document food being wasted. Interviews varied in length ranging from 30 seconds to three minutes. Participants were thanked and offered a chocolate bar for their participation. Interviews were conducted during the main meal service in the evenings, between 5.30 and 6.30 p.m., over five days in the month of June. A summary of the procedure is presented in the interview protocol:

- Conduct interviews during the meal service, in the evenings, between 5.30 and 6.30 p.m. over five different days to try and obtain a representative picture of the amount of plate waste generally discarded over different stages of the eight week cycle.
- Recruit participants using a randomised systematic intercept method as they return their finished plates to the kitchen after the meal.
- If the student agrees to participate, thank them in advance for their time and led them into a small side room.
- After initial introductions, ask the participant to read the ethics information sheet and sign the consent form provided.
- Take a photo of their dirty plate.
- Briefly explain the laddering interview process.
- Start the recording on the handheld digital voice recording device.
- Ask: “Why have you (or have you not) eaten all of the food on your plate tonight?”
- Continuously probe participants (e.g. by asking them a series of “why?” questions). Aim to move the participants’ thinking to a higher level of abstraction eventually revealing the underlying values which influence their plate waste behaviours.
- Record the participants’ socio-demographic details (ethnicity and gender).
- Again thank participant and offer them a small chocolate bar for their participation.

Note: Throughout the process, pay particular attention to Reynolds and Gutman’s (1988) suggestions for conducting a value laddering interviewing: create a non-threatening environment; create a slight sense of vulnerability on the part of the interviewer; maintain control of the interview; create a sense of involvement and caring in the interview; and create a non-misleading interview environment.

Ethical approval for the project was obtained from the University Ethics Committee. Written informed consent was obtained from all participants. The interview guide, which was developed to structure the data collection process, was screened by a panel of experts (university staff) as well as reviewed by the catering manager at the research site.

#### *Laddering interviews*

A variant of the Reynolds and Olson (2001) laddering technique, developed to identify means-ends chains, was used to get participants to think critically about what their

motivations for eating, or not eating, all of the food on their plate. This allowed the interviewers to identify the underlying drivers and barriers for these behaviours. In this study, the predefined behaviour was leaving food, or not, on the plate. Participants were then probed as to “why” they behaved in that way. This normally uncovered some conscious rationalisation of the behaviour and this rationalisation was then probed as to why that is important to the individual. The underlying reasons, where a participant can genuinely articulate them, were then associated with their fundamental values.

The specific style of questioning was designed to reveal values through the natural flow of a conversational structure. This allowed participants to form their own categories and is known as a “soft” laddering technique (Grunert and Grunert, 1995). An example of a typical line of questioning and answers is as follows.

*I: interviewer, R: respondent*

I: Why did you not eat all of the lettuce on your plate tonight?

R: I didn't really feel like it because it didn't go with what I was eating.

I: Why “didn't it go” with what you were eating?

R: It was just plain lettuce and I had pasta, so it didn't really match.

I: So is it important to you for your foods to “match”.

R: Yeah, because if it's different foods that don't go together it's not that tempting.

I: Why is it important to you that your food is “tempting”?

R: It has to be tempting for me to want to eat it – eating should be pleasurable and we eat with our eyes so it has to look good as well as taste good. And not just the individual foods themselves but it's also about how they are presented together on the plate! That's what I didn't eat the lettuce tonight. It didn't go with the rest of the food on the plate.

### *Data analysis*

The researcher transcribed the digital recordings after all the interviews had been completed; this was done using the qualitative software programme NVIVO 9. An adapted Reynolds and Gutman (1988) framework was used to allocate the codes. The framework involved three levels of analysis: the behaviours, the rationalisation and the values. Responses at each level were categorised as follows:

- (1) behaviour level: responses were either “did waste” or “didn't waste”;
- (2) rationalisation level: responses were coded into one or more of the 13 categories defined by the researcher; and
- (3) value level: responses were coded using the ten primary motivational values (Schwartz, 1992).

The rationalisation-level responses were analysed using Braun and Clarke's (2006) thematic analysis approach. Familiarisation with data was undertaken before initial themes were generated and further developed throughout the coding process.

The definition provided by Schwartz (1992) for each of the values was used to conceptualise them in the context of the current study.

The relationships between levels of abstraction were analysed using the queries function in NVIVO and then exported to Microsoft Excel to create the implication matrix which showed how many times the behaviours, rationalisations and values lead to another behaviour, rationalisation or value. On the basis of this matrix, and using a cut-off level of 3, the aggregate ladders were formed summarising the reasons given for either wasting or not wasting food. Thus the ladders pictorially represent the

“behaviour – rationalisation – value” chains. Interpretation of this type of data assists in understanding consumers’ underlying motivations with respect to a given behaviour. Each chain represents a possible explanation of the behaviour undertaken.

**Results**

Of the 50 participants approximately half (48 per cent) did waste food. Further a slight majority were female (60 per cent) (Table I).

Based on visual inspection of the photographs of the plates, the main food items wasted were: sauces/condiments (wasted by 54 per cent of the participants who did waste); potatoes/rice/pasta (wasted by 46 per cent); vegetables (wasted by 33 per cent); salad/coleslaw/garnish (29 per cent); and meat/fish (25 per cent).

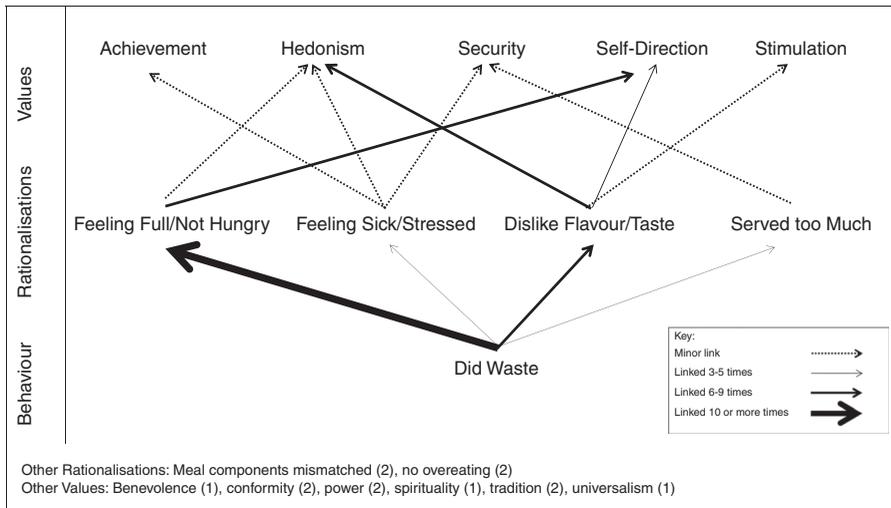
Ladders were constructed to highlight the links between the behaviours “did waste” and “didn’t waste”, the rationalisations stated for these particular behaviours and the underlying values. Tracing a pathway from the bottom to the top shows a single means-end chain (Reynolds and Gutman, 1988). Rationalisations and values that appear three or more times in the coding that were included in the hierarchical value maps and a boxed table of the rationalisations and values which have appeared at least once but no more than twice has been constructed to retain the unique stories of the research respondents. The thickness of the lines between the behaviours, rationalisation and values shows the strength of the link.

The information has been presented for the behaviours “did waste” (Figure 1) and “didn’t waste” (Figure 2).

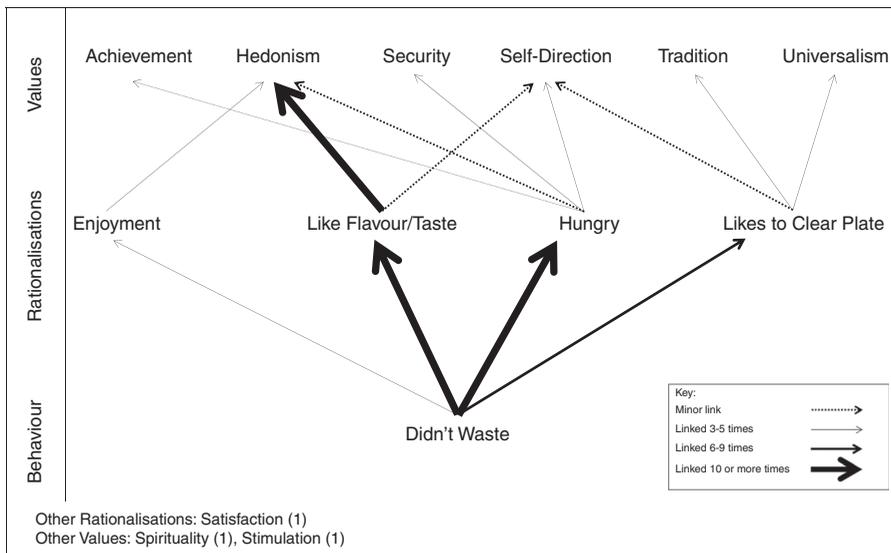
The dominant rationalisations for the behaviour “did waste” were “feeling full/not hungry” (14 links) and “dislike flavour/taste” (seven links), indicating that these were the main reason participants wasted food. For the behaviour “didn’t waste” there were three dominant rationalisations. These were “like flavour/taste” (11 links), “hungry”

Enjoyment	“I just didn’t really like the fish tonight, usually I would, but the fish just didn’t do it for me”
Feeling full or not being hungry	“Well I had quite a big lunch, it was quite a late lunch as well, so I just wasn’t that hungry”
Feeling sick or stressed	“I’m feeling a little stressed” ... “I have exams”
Flavour or taste – dislike	“I didn’t like the taste of the meat” ... “It was kind of a little bit bitter, and off putting”
Flavour or taste – like	“I enjoyed it all. It was really tasty” ... “Um, the flavour. Ah yeah I love olives”
Healthy option	[Talking about why participant ate all the tofu] “Because it’s high in protein. And as a vegan I don’t get much protein” ... “It’s very, very important” ... “So I have enough energy”
Hungry	“I was hungry because I have been studying hard so worked up an appetite”
Like to clear plate	“We come to the college, and they provide us with food that we pay for, I guess we should eat what we put on our plates”
Meal components mismatched	[Talking about lettuce] “I didn’t really feel like it because it didn’t go with what I was eating”
Not wanting to overeat	“I don’t want to over eat and get bloated so I just stopped myself”
Poor quality	[Talking about tomatoes] “They were a bit mushy today, I wasn’t really feeling them, there weren’t as good as normal”
Satisfaction	“Um it was good to have hot food after being out in the cold”
Served too much	[Talking about potatoes] “Um I got too many ... and I was kind of sick of them after a while”

**Table I.**  
List of rationalisations for plate waste behaviour with exemplar quotes for explanation



**Figure 1.** Hierarchy value map of values for “did waste” behaviour



**Figure 2.** Hierarchy value map of values for “didn't waste” behaviour

(11 links) and “likes to clear plate” (six links). A list of rationalisations for the plate waste behaviours with exemplar quotes is provided in Table II.

The top five most frequently identified values (Table III) are now explained.

*Hedonism*

This value type is the “pleasure or sensuous gratification for oneself” (Schwartz, 1992, p. 8). Within this dimension are pleasure and enjoying life, with the former being most relevant to our study. Of the values related to the various rationalisations, “hedonism” was found to be the most important in determining whether or not participants finishing their meals.

In the context of the behaviour “did waste”, the idea behind the hedonism value is that if participants were not enjoying their meal, or gaining pleasure from it, they were more inclined not to finish and this resulted in food wastage. This value was linked to the rationalisation “didn’t like flavour/taste”. For example, when asked why all of the food on the plate was not eaten, one of the participants, “I just didn’t really enjoy it. There were some hard bits through it which put me off”.

For the behaviour “didn’t waste”, hedonism is related to both the rationalisations “like flavour/taste” and “enjoyment”. When participants liked the flavour, they gained greater pleasure from the meal, and this meant they were less likely to waste the food, as they wanted to enhance their pleasure of the meal and finish it all. This is highlighted through the following quote: “I enjoyed what was in it, and there was nothing I didn’t really want to eat”.

These results highlight the importance of how the food tastes, and the associated pleasure customers gain from the eating experience. It is clear that enhanced taste and pleasure decreases customers’ plate waste because, as customers have greater enjoyment of their meal, they want to eat more. While on the other hand, an unpleasurable meal experience increases the level of waste, as customers do not want to eat their food. The implication of this is that any potential plate waste reduction intervention should not compromise on the taste of the food and the consequential pleasure customers derive from the eating experience.

*Self-direction*

This value type is “independent thought and action – choosing, creating and exploring” (Schwartz, 1992, p. 5). Self-direction was also found to be an important value in terms of plate waste. In the context of the study, self-direction is related to the idea of choosing one’s own goals, with the goal being health.

**Table II.**  
Profile of participants

Behaviour	Male (%)	Female (%)	New Zealand European (%)	Other European (%)	Asian (%)	Māori (%)	Total (%)
Did waste	16	32	36	4	6	2	48
Didn't waste	24	28	36	10	4	2	52

**Notes:** n = 50. All participants were living full-time in a New Zealand university residential college in the South Island city of Dunedin and were aged between 18 and 20

**Table III.**  
Value associated with behaviour

Value	Did waste <sup>a</sup>	Didn't waste <sup>a</sup>
Hedonism	14	15
Self-direction	15	10
Security	4	3
Achievement	3	3
Universalism	0	5
Tradition	0	5
Stimulation	3	0

**Note:** <sup>a</sup>Number of times coded during interviews

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In terms of the “did waste” behaviour, self-direction related to the rationalisation “feeling full/not hungry”. This was the idea that participants did not want to eat past being full, as they did not want to gain weight through over eating, or become uncomfortable with other issues such as indigestion or bloating. These factors lead to participants choosing not to finish food on their plate, and hence create waste. An example of this is illustrated by the quote “Why is it important for you to stop eating your meal if you’re not hungry?” (Interviewer). “Probably so I don’t overeat and then get indigestion or something later” (Participant).

For the “didn’t waste” behaviour, self-direction was also related to the rationalisation “hungry”. Participants indicated that they were “hungry” for certain foods that could help to enhance their brain function and ensure they did not become tired. This led to these participants eating all of the food on their plates, for example, one participant discussed how they ate lots of fish for the meal as it was seen to be good for brain health. They also believed consuming all the food on a plate would lead to remaining stress free.

These results indicate that health (in terms of feeling full and food with particular health properties such as brain function) is a factor that needs to be considered in the development of future foodservice plate reduction behaviour change techniques.

### *Security*

This value type is “Safety, harmony, and stability of society, of relationships, and of oneself” (Schwartz, 1992, p. 9). Security was found to be another important value related to not wasting food, and the rationalisation of being hungry. This was because participants wanted to eat a lot of food, so they had their security of knowing they had eaten enough to sustain themselves.

This desire to consume enough food to sustain oneself was one of the motivations, which led to food not being wasted. It is interesting to note that some participants also talked about another aspect of security as a reason why they did waste food. These participants felt like they needed to fill their plates to ensure that there was going to be enough food for them, before all of the food ran out, even if it meant taking more food than they could realistically eat.

### *Universalism*

This value type is “an understanding, appreciation, tolerance and protection for the welfare of all and for nature” (Schwartz, 1992, p. 12). Logically, this value always acted to promote “did not waste” behaviours. This was related to the rationalisation “likes to clear plate”. The following quote is typical of the types of explanations given by participants: “I think it’s a waste to have cooked something and just chuck it out; you’ve spent money on it and someone else could have eaten it so why chuck it out?” This indicates that individuals who care for others and the environment are less likely to waste food.

### *Tradition*

This value type is “respect, commitment, and acceptance of the customs and ideas that one’s own culture or religion imposes on the individual” (Schwartz, 1992, p. 10). The value tradition was related to the rationalisation “likes to clear plate”. For many individuals it became clear that finishing all the food on their plate was something they always had to do as children and it had become a deep-seated habit that followed them

into adulthood. The following quote exemplifies this thinking: "I've always been taught to eat everything on my plate".

The identification of values, which lead to the behaviours "did waste" and "didn't waste", and the rationalisations behind these behaviours, has provided insights into why plate waste is occurring. As previously stated, it is widely recognised that values are entrenched and difficult to change. Further most individuals are likely to adjust their behaviour to act more consistently with their values (Miroso *et al.*, 2013). Based on the results from this study it is clear "hedonism" and "self-direction" are the dominant values influencing whether or not food is wasted. This indicates that interventions embracing these values are likely to be more effective.

### **Discussion and implications**

The main contribution of this study is determination of the paths that link plate waste behaviours to individual's rationalisations for those behaviours and their personal values. More specifically, the results from this research show the different means-ends chains that link values to behaviours for both "did have plate waste" and "did not have plate waste" behaviours.

A range of personal values and associated rationalisations that guide individuals regarding the behaviours of wasting or not wasting food were identified. However, it is important to note that there are many instances where it becomes difficult to identify the underlying value for a specific behaviour. Different values can underlie the same behaviour; the same value can underlie different and opposing behaviours; and the same values can be connected to the same behaviours but for different reasons.

To be effective intervention strategies seeking to reduce plate waste need to support customer's values or, at the very least, not go against them. The values, which were found to be the most important for the behaviour "did waste" food were "hedonism" and "self-direction" whilst for "didn't waste" were also "hedonism", "self-direction" but different aspects of them, as well as "security", "tradition" and "universalism".

To produce meaningful practical implications the following discussion integrates insights gained from these empirical results with knowledge in behaviour change literature to derive a toolbox of specific plate waste reduction interventions for foodservice staff to implement in their own institutions.

The intervention strategies outlined below are all classified as "nudges". A "nudge" is an altering of "architecture" that alters consumer behaviour in a predictable way without forbidding options or significantly changing economic incentives (Thaler and Sunstein, 2008). "Nudges" guide and enable consumer choice and have been used in a previous plate waste study (Kallbekken and Sælen, 2013).

Pre-ordering food the night before is an intervention technique, which supports the "hedonism" value and aims to enhance the pleasure customers' gain from their meal experience. If customers were to pre-order their meal the night before, they would be guaranteed their preferred meal option. This strategy would ensure customers are receiving the food which they chose and links to the rationalisation "like flavour/taste" for not wasting food. There is a risk associated with this intervention that customer's preferences may change on a day-to-day basis, and therefore the food they felt like when ordered the day before may differ the next day, and conversely this could lead to increased levels of food waste.

Reducing options within an institution may reduce the amount of plate waste created (Miroso *et al.*, 2016). This method of intervention may allow the food providers to focus on the quality of the food, not the quantity/number of options available.

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This could enhance the pleasure of the meal (thus relating to the value “hedonism”), as more effort is put into fewer options and into ensuring the food is of a higher standard.

Due to variance in customer likes and dislikes, the pre-order and reducing options intervention methods should be accompanied by surveying customers’ preferences. This would help to determine which meals are going to be the most accepted and liked by customers. It could also enable customers to express their demands in regard to health needs, for example, their food preferences that support individual health goals.

Reducing plate size in foodservice setting is a technique, which has been looked into in previous studies. A study by Kallbekken and Sælen (2013) found that reducing plate size lead to a decrease in food waste by up to 20 per cent in a hotel foodservice environment. Smaller plates provide less room for food and research has found that when using larger plates the average customer consistently serves more than onto relatively smaller dinnerware (Van Ittersum and Wansink, 2012). Freedman and Brochado (2010) also found that increased plate size leads to increased portions and causes a larger amount of food to be wasted. Reducing plate size supports the rationalisation of feeling “too full/not hungry”, as customers are encouraged not to overeat and instead take less food. The method also appeals to the value “self-direction” as it becomes easier for customers to control the amount of food they are consuming, and not become bloated or gain weight, leading to achievement of their health goals. Caution must be taken, however, as reducing plate size does risk interfering with the ultimately important value “hedonism”. Focus group research in a university foodservice setting revealed the potential for some unhappy diners if smaller plates were introduced (Munro, 2012). Key causes of concern for the students included not having enough room for salad and having to wait in line or until the end of the dining service to get seconds if they were hungry. Although not directly linked to customer values, it is also noteworthy that there were causes of concern for staff as well including students’ overfilling their smaller plate and dirtying dining trays, and the use of more side plates which would result in increased costs in dishwashing time and cleaning products.

Removing option of tray service is a similar method to that of reducing the plate size, which can have an effect on total plate waste created. Studies by Whitehair (2011) and Hackes *et al.* (1997) both showed that removing trays reduced plate waste significantly, indicating that this method could be successful. To enhance this intervention a written message could be placed alongside the plates informing customers they are welcome to come back for more food once they have finished their first plate. This would support the customer’s values such as “security” in terms of knowing they will receive enough food to sustain themselves, as well as their “self-direction” in terms of ability to make their own choices, as customers still have the option to eat as much as they would like, but it encourages them to take a more realistic amount of food each time. A study by Kallbekken and Sælen (2013) found that a message encouraging hotel guests to come up for more food once they had finished their first plate reduced the amount of food waste by up to 20 per cent. Written messages alongside meal options have also been shown to be a successful technique, see for example, Whitehair and Shanklin (2012) reporting a reduction in food waste of around 15 per cent.

Food waste awareness campaign is one intervention technique which could be used to support the value “universalism”. This would inform customers of the scale of this issue and the damage caused to food security and environmental sustainability. This relates to the rationalisation “likes to clear plate”. This may lead to the customers feeling compassion towards the issue and stimulating the desire to help to protect the welfare of others and the environment. Engström and Carlsson-Kanyama (2004)

reported that running a food waste awareness campaign led to a 35 per cent reduction in plate waste. In addition Barr (2007) and Principato *et al.* (2015) found that individuals with a good knowledge of problems linked to food waste are more likely to avoid wastage. As well as this, individuals with high-environmental consciousness have been reported to waste less food (Williams *et al.*, 2012) further supporting the idea that an awareness campaign could have a large impact on reducing food waste. In addition to supporting the value “universalism”, food waste awareness campaigns could also tap into the value “security” by providing messages that are focused on the links between reducing food waste and the benefits to nutritional health. The health of individuals and the health of the planet are inextricably linked and the obesity caused by overconsumption of food, and its associated prevalence of junk food, thus represents a waste of food (Miroso *et al.*, 2017). Interestingly, Smil (2004) explicitly includes over-nutrition – the gap between the energy value of consumed food per capita and the energy value of food needed per capita – in his definitions of food waste. Scholars Blair and Sobal (2006) have defined the term “luxus consumption” to mean food waste and overconsumption leading to storage of body fat, health problems and excess resource utilisation. They estimate that 18 per cent of land and ocean hectares used to support the US diet is used to produce this luxus consumption. There are a number of pre-existing campaigns that link sustainability and health such as the global “EAT initiative” (<http://eatforum.org/>) which can be used as a precedent for how to integrate efforts in these two, often disparate, areas of concern.

While the above section has mapped the identified personal values underpinning plate waste behaviours onto existing initiatives (i.e. those discussed in the literature), the next logical step is the identification of new initiatives designed specifically with the identified linkages between personal values and behaviours in mind. For example, organising the service so that customers order (or line up for) the next course when they have finished eating a preceding course would be one way to stop those people who piled up food on their tray at the start of the meal, only to find they were unable to eat everything that they had taken. This initiative would allow those who are hungry to still eat more and those who are not to stop at the appropriate time without wasting food. A similar initiative that taps into the same value (self-direction) would be to provide nutritional information on the foods available at the point of service. Again, while this is available at some restaurants, provision of this information in college foodservices with buffet style menus is not common. Another idea is to increase variation in the meal proportions served (i.e. offer smaller cuts of meat) to better cater for students with different appetites. The importance of liking the food was very clear in the study results (with the dominance of the hedonism value). Perhaps offering customers a sample of the dish (e.g. on a teaspoon) before they are served a full size portion would be one way to avoid plate waste. If they do not like the taste, they could then just skip that menu item and just take the remainder of the meal offered (the vegetables, salad, breads, etc. from the buffet) to fill up on. The provision of a “doggy bag” (a container for leftover food to be taken away for later) could be investigated as a possible option.

Another interesting plate waste reduction initiative is a “pay for what you don’t eat” strategy. Recently used in the restaurant and café sector, the idea behind this initiative is that it will increase the likelihood of individuals clearing their plate becoming the norm. However, based on the results of this study, caution is advised before implementing this in a college foodservice dining setting given the stated importance of the pleasure that the customers’ derive from the eating experience. The potential stress that such a penalty system might cause risks compromising this pleasure.

The intervention techniques suggested above may change customers' behaviours surrounding food waste. It is clear that tradition was one of the key reasons a portion of the participants in the current study did not waste food, as they have grown up with the belief that they need to clear their plates. If consuming all food on a plate became the norm at a young age (e.g. as young adults living in a university residential hall), it could be further passed on to their children and have a large effect on the amount of plate waste created in future generations.

## Conclusion

There is a general consensus amongst consumers, governments and the private sector that food waste is both morally and economically outrageous. As such, food waste reduction is likely to be receiving more attention over coming decades as one of many environmental and health campaigns that seek to achieve positive social changes in society.

It is timely for the foodservice sector to become more engaged in food waste reduction initiatives. The potentially effective interventions identified based on the results of this study are those encourage customers to pre-order their meals, reduce the range of food options provided to customers, reduce the size of plates provided for servings and removing the tray that is used to carry servings to the table. In addition to these interventions that result in changes in the physical context there is the opportunity to provide additional information. This could be through campaigns that aim to raise awareness of the financial, environmental, food security and potential guilt associated with contributing to food waste by leaving uneaten food on the plate.

Research presented in this paper has identified those personal values which are important to food waste behaviours that the previously mentioned interventions are seeking to change. The specific values are "hedonism" such as food needs to taste good and be part of a pleasurable consumption experience, as well as "self-direction" where the food helps customers reach their health goals. Regardless of the intervention selected, or combination thereof, it will be more successful if it aligns with these values or, at the very least, does not go against them.

The implication of the research for foodservice staff is that behaviour change interventions should appeal to the targeted audience's personal values in order to improve their effectiveness. Practicably, this may involve some initial research prior to intervention development so that staff has an understanding of what the core values are for their customers so that they can select and shape the interventions accordingly. Getting buy-in from students on food waste issues will require that foodservice staff explain the reasons for their food waste reduction efforts in an appropriate way. Research repetitively shows that most people do feel guilty about wasting food (cf. WasteMINZ, 2015; where 89 per cent of the people surveyed agreed that wasting food felt wrong to them). As food waste advocate Stuart (2009) suggests, rather than feeling guilty about wasting food, people should feel empowered by the sense of responsibility, knowing that by making small adjustments in their everyday food habits, they can play a part in helping to improve the lives of people who are currently hungry. By communicating these sorts of messages, foodservice staff will be able to help motivate students to change their dietary habits. Collaborating with all stakeholders to develop innovative solutions to reducing food waste would appear to be a good way forward. A planning workshop, designed to bring management,

kitchen staff and foodservice customers together to brainstorm ideas for food waste reduction initiatives, is an obvious place to start.

It is important to remember that care should be taken when adapting the conclusions presented in this paper to other contexts. Hence there are opportunities to extend this research into different types of foodservice settings (such as schools and hospitals) and cultural contexts. Further research opportunities include application of this laddering research design to understand plate waste in diverse foodservice settings (such as those with different production and service styles). Another extension of this research would be to carry out suggested intervention(s) and measure the anticipated reductions in food waste. Further research exploring connections and conflicts with other issues (such as time constraints, social expectations and financial costs) may add further insights on the plate waste issue. Finally, longer more in-depth interviews could be conducted with similar student resident populations to explore the generalisability of the plate waste-related values and rationales identified in this study. Examining how these translate into other contexts (e.g. pro-environmental behaviours such as recycling) would be worthwhile.

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