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Investigating chefs' behaviours on food waste: An extended theory of planned behaviour

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Abstract

The present work examined an extended theory of planned behaviour model, incorporating moral norms and food waste knowledge, to elucidate the antecedents of chefs' food waste reduction behaviour. Empirical data were collected *via* online self-report surveys from 281 chefs, and analysed using structural equation modelling. Results revealed that food waste knowledge significantly influenced food waste reduction behaviour and perceived behavioural control, while its impact on attitudes was statistically insignificant. Moral norms were found to have a significant positive effect on both attitude and behavioural intention. Furthermore, attitudes positively influenced behavioural intention, whereas subjective norms and perceived behavioural control did not significantly impact behavioural intention. The primary theoretical contribution of the present work lies in the application and validation of an extended theory of planned behaviour model within the context of chefs' food waste reduction efforts. These findings would provide valuable insights for developing effective strategies to enhance chefs' motivations for food waste reduction behaviour, and improve food waste reduction practices in the hospitality sector, thus contributing to practical applications and policy establishment in sustainable food management.

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Introduction

The activities of hospitality businesses generate significant waste, resulting in more food waste as this sector grows (Filimonau and De Coteau, 2019). These wastes create substantial ecological and economic impacts, and are produced at all food chain stages (Parfitt *et al.*, 2010; Okumus *et al*., 2020). The issue of food waste is increasingly being studied internationally, especially in the hospitality sector (Kallbekken and Sælen, 2013; Juvan *et al.*, 2018; Hennchen, 2019; Dolnicar and Juvan, 2019; Dhir *et al.*, 2020; Chawla *et al.*, 2020; Wang *et al*., 2021). Researchers have become interested in and examined technological solutions, plate size reduction, and takeaway containers to reduce food waste in the hospitality sector (Kallbekken and Sælen, 2013; Juvan *et al*., 2018; Dhir *et al.*, 2020). However, there are many challenges to implementing the suggested strategies by chefs. Chefs are uniquely positioned to navigate menu design, food preparation, and customer satisfaction, yet face various challenges in these interconnected areas (Goh and Jie, 2019; Filimonau *et al.*, 2020). Some challenges include managing complex supply chains with perishable ingredients (Filimonau and De Coteau, 2019), balancing portion sizes based on customer expectations (Dhir *et al.*, 2020), and predicting fluctuating demand. They also struggle to maintain product quality while integrating traditional culinary practices with innovative waste management (Charlebois *et al.*, 2015). The fast pace of professional kitchens, coupled with a lack of formal training in waste management, further complicates chefs' efforts to prioritise and implement effective food waste reduction (FWR) measures. Understanding these challenges is essential to supporting chefs' FWR efforts, and developing targeted strategies.

Contrarily, chefs' role in reducing waste has not received the same degree of attention until recent years (Chawla *et al.*, 2020). The human factor plays a critical role in implementing FWR measures. Although various technological and operational

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solutions have been proposed to reduce food waste in the hospitality sector, such as stock management, portion control tools, Wise UP on Waste, and Too Good To Go (Gould, 2016; Okumus *et al.*, 2020), these measures face limitations in practical implementation because factors such as inadequate staff training or resistance to change reduce the efficiency of technological solutions and strategies, and make them challenging to implement (Filimonau and De Coteau, 2019). Considering the critical role of increasing environmental awareness and consciousness of all stakeholders in FWR in the hospitality sector (Çetin and Süren, 2024), it is imperative to understand attitudes and behaviours towards FWR in this sector. However, the success of these initiatives largely depends on chefs in the hospitality sector, as they play a significant role in waste management, and are the primary decision-makers in culinary operations. Therefore, chefs' attitudes, skills, and behaviours are likely to influence the implementation and success of FWR strategies significantly. For example, chefs' creativity in menu planning and ability to reuse ingredients can dramatically reduce food waste (Charlebois *et al.*, 2015; Goh and Jie, 2019). Additionally, chefs' leadership and influence over kitchen staff might help create a culture of food waste across the business.

Food waste is generated at different stages in hospitality businesses. Preparation, cooking, storage, service, and consumption stages contribute significantly to food waste generation in regular hospitality businesses. Besides, the California Environmental Protection Agency in 2013 claimed that nearly all waste in the food service industry occurred during (1) planning, (2) storage, and (3) product processing/food preparation stages (Okumus *et al.*, 2020). Signifying the end of the supply chain in developed countries, the preparation stage accounts for the highest food waste percentage (FAO, 2011). For this reason, chefs are considered vital in FWR during menu planning, purchasing, storage, preparation, food safety, cooking, and storage stages. Additionally, a comprehensive understanding of chefs' food waste behaviours (FWBs) might assist in FWR since they are at the forefront of the war against food waste.

The theory of planned behaviour (TPB) is frequently employed to understand the reasons behind individuals' behaviour. Individuals' intentions to perform behaviour are shaped by their perceived behavioural control (PBC) over the behaviour (Ajzen, 1991). The TPB mainly posits that subjective norms (SNs), PBC, and attitude influence an individual's intention, which translates into behaviour. The literature supports the predictive utility of the TPB model (Armitage and Conner, 2001; McEachan *et al.*, 2011). However, some studies argue that adding additional variables to the basic model will increase its predictive ability (Ajzen, 1991; Davies *et al.*, 2002; Kaiser, 2006; Bortoleto *et al.*, 2012) because the TPB adopts a rational approach to explaining an individual's behaviour, and evaluating the benefits and harms of any behaviour before performing it (Manstead, 1999). Therefore, it ignores intrinsic sources of motivation. Moral norms (MNs) were added to the original TPB model, considering their critical role in the research context, and the ethical dimension of behaviour (Conner and Spark, 2005; Kaiser, 2006; Stefan *et al.*, 2013). Limited research also supports MNs as a predictor of attitude. For example, Graham-Rowe *et al*. (2015) added MNs to their theory-based study to predict household FWR motivation and behaviour. However, high correlations of MNs with self-identity and anticipated regret prevented their inclusion in the model. Consequently, the high correlation between MNs and attitudes complicates the distinction between the two variables. Despite these results, some studies have found that MNs contribute to explaining individuals' environmentally friendly behaviours (Klöckner, 2013; Stefan *et al.*, 2013; Poškus, 2015; Ekasari and Zaini, 2020). In addition to MNs, food waste knowledge (FWK) (Babaei *et al.*, 2015; Xiao *et al.*, 2017) was added to the TPB model, expecting to shape food waste reduction behaviour (FWRB) because, as the literature supports, FWK and its environmental impacts are essential to shaping FWRB (Aschemann-Witzel *et al.*, 2015; Babaei *et al.*, 2015; Principato *et al.*, 2015; Xiao *et al.*, 2017). As a result, adding FWK to extend the TBP model is reasonable. Also, this additional variable contributes to a comprehensive explanation of the chefs' FWRB. Accordingly, MNs (Kaiser, 2006; Stefan *et al.*, 2013) and FWK (Babaei *et al.*, 2015; Xiao *et al.*, 2017) were added to the standard TPB model. All things considered, the present work aimed to explain the FWRB of chefs working in professional kitchens with the extended TBP model, and to contribute to developing FWR strategies.

Theoretical framework and hypotheses

Food waste reduction in kitchens

Food waste occurs in kitchens during (1) planning and purchasing, (2) storage, (3) product delivery, and (4) food preparation stages (Pirani and Arafat, 2016). Many factors and situational variables contribute to food waste generation at these stages. The literature has named several of these variables, with some referring to internal kitchen management, including staff competence and experience (Heikkilä *et al.*, 2016). Different waste reduction measures have been determined through a critical review of relevant studies to reduce food waste in kitchens (Table 1). Suggested FWR measures range from low-effort changes, such as proper storage, to more elaborate approaches, such as regular staff training. Food waste produced at different stages is highly likely to be lowered thanks to these FWR measures implemented by kitchen chefs and managers.

Table 1. FWR measures in kitchens.

Measure	Detail description	Reference
Planning	Effective purchasing and planning	Aamir *et al.* (2018); Bharucha (2018); Vizzoto *et al.* (2021)
	Demand forecast	Betz *et al.* (2015); Ofei *et al.* (2015); Aamir *et al.* (2018)
	Inventory control	Bharucha (2018); Okumus *et al.* (2020); Vizzoto *et al.* (2021)
	Proper storage	Betz *et al.* (2015); Okumus *et al.* (2020)
	Food waste measurement	Silvennoinen *et al.* (2015); Heikkilä *et al.* (2016); Filimonau and De Coteau (2019); Okumus *et al.* (2020); Vizzoto *et al.* (2021)
	Staff participation	Ofei *et al.* (2015); Vizzoto *et al.* (2021)
Preparation	Competent and skilled staff recruitment	Heikkilä *et al.* (2016); Strotmann *et al.* (2017); Okumus *et al.* (2020);
	Staff training	Aamir *et al.* (2018); Okumus *et al.* (2020); Filimonau *et al.* (2020)
	Proper peeling and chopping	Creedon *et al.* (2010)
	Low-waste technology adoption	Bharucha (2018); Filimonau and De Coteau (2019)
Food donation and recycling	Reusing leftovers, shells, and bones in other dishes	FAO (2013); Heikkilä *et al.* (2016); Vizzoto *et al.* (2021)
	Donation of unconsumed food	Pirani and Arafat (2016); Bharucha (2018); Dhir *et al.* (2020)
	Sharing with staff	Aamir *et al.* (2018); Bharucha (2018); Vizzoto *et al.* (2021)

Impact of behavioural intention on food waste reduction behaviour

BI indicates how motivated an individual is to perform any behaviour (Ajzen, 1991). Positive or negative BI affects how attitudes impact behaviours (Bagozzi and Yi, 1988). Weak BI neutralises the mediating role of intentions. Based on Eagly and Chaiken (1993)'s theoretical framework, the postulated causal relationship between PBC and BI posits that individuals' engagement in specific actions predicates their anticipated sense of efficacy and accomplishment. This theoretical assumption has been tested experimentally in several studies (Davies *et al.*, 2002). In light of this scientific evidence, the following research hypothesis was posited:

"H_1 BI has a significant impact on FWRB"

Impact of attitudes on behavioural intention and food waste reduction behaviour

Attitude is the degree to which an individual evaluates behaviours positively or negatively. Positive results after behavioural performance might result in individuals with better attitudes toward the behaviour, and a higher probability of behavioural realisation (Ajzen, 1991). Studies have confirmed the positive relationship between attitudes and behaviours (Hines *et al.*, 1987). Thus, the following hypothesis was proposed:

"H_2 Attitudes have a significant impact on BI to perform FWR"

Impact of subjective norms on behavioural intention and food waste reduction behaviour

SNs represent an individual's perceived social pressure from others to behave in a certain way, and the motivation to conform to their views (Ajzen, 1991; Yang and Jolly, 2009; Ham *et al.*, 2015). Research has yielded mixed results on whether SNs are a significant determinant of environmental behaviours (Davies *et al.*, 2002). Some studies have revealed that SNs are positively linked with intentions to purchase certain products, such as sustainable, green, or organic foods (Arvola *et al.*, 2008; de Maya *et al.*, 2011; Zagata, 2012; Ham *et al.*, 2015; Chen, 2016). Thus, the following hypothesis was proposed:

"H_3 SNs have a significant impact on BI to perform FWR"

Impact of perceived behavioural control on behavioural intention and food waste reduction behaviour

Ajzen (1991) defines PBC as "an individual's perceived ease or difficulty in performing a particular behaviour." In other words, PBC refers to the difficulty level that an individual perceives when completing a particular behaviour after deciding on behavioural performance (Gakobo and Jere, 2016). It has been noted that people are more likely to behave consistently with their behavioural intentions when they are confident that they can realise and control behaviours (Fudge, 2013). Internal and external factors might impact behaviour realisations (Davies *et al.*, 2002). Individuals with a strong ability to perform any behaviour or more resources and opportunities might perceive fewer obstacles to behaviour realisation, and have strong PBC. PB posits that PBC is a significant predictor of BI and behavioural outcomes. Thus, the following hypotheses were proposed:

"H_4 PBC has a significant impact on BI to perform FWR"

"H_5 PBC has a significant impact on FWRB"

Impact of moral norms on attitudes and food waste reduction behaviour

MNs refer to individuals' strongly internalised moral responsibilities for specific actions (Davies *et al.*, 2002; Biel and Thøgersen, 2007). Many studies have revealed that MNs directly impact individuals' environmentally friendly behaviours (De Groot and Steg, 2009; Zhang *et al*., 2013; Shin *et al.*, 2018). Consequently, environmental behaviour is altruistic, and a key predictor of MNs (Schwartz, 1977; Stern *et al.*, 1995). MNs also explain consumers' FWBs (Stefan *et al.*, 2013; Stancu *et al.*, 2016) because consumers report discomfort or guilt for food waste (Bolton and Alba, 2012; Evans, 2012; Stefan *et al.*, 2013). Thus, the following hypotheses were proposed:

"H_6 MNs have a significant impact on attitudes toward FWR"

"H_7 MNs have a significant impact on BI to perform FWR"

Behaviour-related knowledge

Behaviour-related knowledge refers to knowing how to perform the intended behaviour, determining who is responsible for the intended action, and evaluating the perceived effectiveness of the behavioural action (Davies *et al.*, 2002). Fishbein and Ajzen (1975) posited that individuals' cognitive schemas regarding a specific behaviour and its consequent outcomes significantly influence their attitudinal dispositions toward said behaviour. Many studies have also found a positive relationship between behaviour, knowledge, and environmental behaviour (Park *et al.*, 1994; Xiao *et al.*, 2017). In addition, knowledge plays a crucial role in determining recycling intentions. Similarly, it has been argued that consumers' attitudes and behaviours toward food waste management vary based on their knowledge (Farr-Wharton *et al.*, 2014; Principato *et al.*, 2015; Aydin and Yıldırım, 2021). Thus, the following hypotheses were proposed:

"H_8 FWK has a significant impact on attitudes toward FWR"

"H_9 FWK has a significant impact on PBC"

"H_{10} FWK has a significant impact on FWRB"

Figure 1 visually represents the conceptual model developed from a comprehensive literature review.

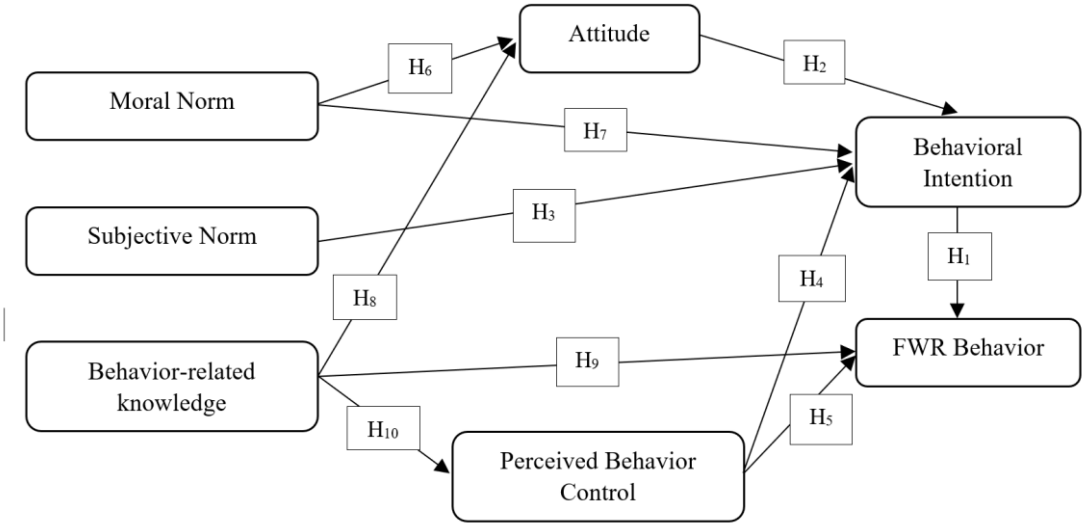

Figure 1. Hypothetical extended TPB model.

Materials and methods

Measures

The survey employed in the present work comprised two main sections; the first consisted of seven sub-sections to measure the primary constructs in the research model. FWRB was obtained by adapting the four-item scale (Li *et al*., 2018. Four BI items were taken from previous studies (Tonglet *et al.*, 2004). The attitude toward FWR was measured using three items (Li *et al.*, 2018). SNs were measured with three items (Tonglet *et al.*, 2004). PBC was assessed using three items (Ajzen, 1991). Three FWK items were adapted from previous research (Li *et al.*, 2018). MNs were measured with two items (Davies *et al.*, 2002; Kaiser, 2006; Stefan *et al.*, 2013).

The second section comprised seven items about participants' socio-demographic characteristics, including age, gender, income, work experience, education level, and working position. The survey was prepared in English, and subjected to a linguistic validity test. The scale items were translated into Turkish using the back-translation method by four language experts with a good command in English and Turkish (Brislin, 1970). The survey's content validity was then evaluated by five academics specialised in research. Minor revisions were made in light of the suggestions. Subsequently, a face-to-face pilot study was conducted with 20 people who were particularly asked to comment on the items. The pilot study simplified two items for participants to understand better. The modified survey was then applied as a data collection instrument.

Data collection

Data were collected through an online survey due to its convenience and low marginal cost (Schillewaert and Meulemeester, 2005). Emails and links to online surveys were sent to professional researcher networks, and distributed through various social media networks to reach the participants between September and October 2022. The survey was also emailed to the communities where chefs are members only. An introduction that included the definition of food waste was made to reach the desired responses, and to inform the participants about the survey's aim. Participants were given no incentives. It took approximately five minutes to complete the survey. Within the scope of the present work, 550 surveys were distributed to chefs, constituting the sampling frame. Following the data collection process, 281 complete and valid questionnaires were obtained, equating to a response rate of 51.1%. This sample size was deemed adequate for testing the proposed model through statistical analyses.

Table 2 displays the participants' demographic characteristics. The small number of female participants agreed with the general situation in the food and beverage industry. About half of the participants were in the 20 - 29 age bracket, and 32% were in the 30 - 39. 44.5% were high school graduates, and 25.6% held undergraduate degrees. Within the context of tourism studies conducted in Turkey, a substantial proportion of research samples demonstrated a notable bias toward younger participants, with this demographic trend being consistently observed across multiple investigations (Gürlek and Tuna, 2019; Eren *et al.*, 2021). It was, therefore, normal for half of the sample in the present work to comprise young employees. 53% had less than five years of work experience, with 5.3% having more than 15 years. While 32.4% were executive chefs, 10% worked as sous chefs. 52.3% worked in restaurants, and 39.3% were employed in hotels. Finally, 42.2% received food waste training.

Table 2. Demographic characteristics of participants.

Characteristic	Distribution of responses
Gender	Male: 63%; Female: 37%
Age	< 25: 14.9%; 25 - 34: 34.4%; 35 - 45: 34.4%; > 45: 16.3%
Education level	< high school: 40.2%; High school degree: 44.5%; Some college or more: 25.6%
Work experience	< 5 years: 53%; 5 - 10 years: 32.0%; 11 - 15 years: 9.6%; > 15 years: 5.3%
Working position	Executive chef: 32.4%; Sous-chef: 10%; Chef de partie: 17.1%; Chef: 30.2%; Commis chef: 14.2%;
Type of business	Hotel: 39.9%; Restaurant: 52.3%; Public institution: 4.6%; Other: 2.8%
Food waste training status	Yes: 42%; No: 57.7%

Data analysis

The analytical framework employed in the present work was Partial Least Squares Structural Equation Modelling (PLS-SEM), a methodology that does not necessitate adherence to stringent distributional assumptions (Henseler *et al.*, 2014). This approach demonstrates robust performance across diverse sample sizes (Hair *et al.*, 2017), and is particularly suited for the validation and testing of exploratory models (Wold, 1983; Mondéjar-Jiménez *et al.*, 2016), as is the case in the present work. The variance-based nature of PLS-SEM aligned well with the exploratory character of the present work, given that food waste has received limited attention within the tourism literature, resulting in a lack of comprehensive theoretical models in this domain. The model contained a complex relationship structure because of its multiple items and latent variables. In this sense, PLS-SEM was considered appropriate for analysing the data obtained in the present work. Smart PLS 3 was employed during the analysis (Ringle *et al.*, 2015). The proposed two-stage approach process was adopted for evaluating PLS-SEM. Based on this approach, the reliability and validity of the outer model were initially examined, followed by the testing of the inner model (Hair *et al.*, 2014; Gürlek, 2021).

Results

Outer model

The outer model was initially tested in the present work (Table 3). Since all the variables specified in the model comprised reflective constructs, reflective model evaluation criteria were considered when evaluating the outer model. External loads, internal consistency, convergence, and discriminant reliability were accordingly tested (Hair *et al.*, 2014).

External loads were examined to determine indicator reliability. It is recommended that the indicator be eliminated if the external load value is more than 0.6, and there are values less than 0.6. The first PBC item, "Many factors impede my performing FWR," was removed because the factor load was below 0.40, followed by the re-analysis. The final analysis indicated that the values of external loads were above 0.70 (Table 2). The Cronbach alpha values of all the variables used in the present work ranged between 0.713 and 0.871, with the specified threshold value above 0.70. In addition, composite reliability (CR) values ranged from 0.714 to 0.872. The average variance extracted (AVE) values for the six variables exceeded the recommended 0.50 threshold, and ranged from 0.556 to 0.648.

When evaluating the outer model, discriminant reliability (Table 4) was ultimately examined. The heterotrait-monotrait (HTMT) ratio was analysed for this. Table 3 shows that all values for the variables remained below 0.85, and discriminant validity was achieved (Henseler *et al.*, 2015). The collected data were consequently tested to meet the thresholds of indicator, internal consistency, convergence, and discriminant reliability.

Inner model

Using the methodology suggested in the literature (Hair *et al.*, 2017; Usakli and Kucukergin, 2018), the inner model (Table 5) was tested after evaluating the outer model's validity and reliability. The variance inflation factor (VIF) value was initially computed, and all values were below the threshold value of 5. No problems with multi-connection were thus observed.

The values of R^2 for potency and Q^2 for predictive power were then examined. 0.75, 0.50, and 0.25 were rated respectively as significant, moderate, and weak in the R^2 assessment (Hair *et al*., 2017). The R^2 values of A, PBC, BI, and FWRB indicated weak and strong impacts. Q^2 values must be greater than zero in determining the predictive power. The Q^2 values of the variables were greater than zero, suggesting predictive power. Path coefficients, significance status, and f^2 values were finally analysed to test the hypotheses. 0.02, 0.15, and 0.35 f^2 are classified as small, medium, and large (Cohen, 1992).

Findings revealed the positive impact of BI on FWRB ($\beta = 0.311$; $p < 0.05$; $f^2 = 0.025$). Attitude significantly and positively affected BI ($\beta = 0.324$; $p < 0.05$; $f^2 = 0.109$). However, SNs did not significantly impact BI ($\beta = 0.048$; $p > 0.05$; $f^2 = 0.002$). PBC did not have a significant effect on BI ($\beta = 0.152$; $p > 0.05$; $f^2 = 0.029$) and FWRB ($\beta = 0.548$; $p > 0.05$; $f^2 = 0.325$). MNs had a significant and positive impact on attitude ($\beta = 0.138$; $p < 0.05$; $f^2 = 0.025$) and BI ($\beta = 0.387$; $p < 0.05$; $f^2 = 0.205$). The impact of knowledge on attitude ($\beta = 0.128$; $p > 0.05$;

Table 3. Outer model results.

Item	Loading	CR	Cronbach's Alpha	AVE
Attitude				
I think it is worthy to perform FWR.	0.732			
I think it is approved to perform FWR.	0.817	0.818	0.818	0.600
I think it is pleasant to perform FWR.	0.772			
Subjective Norm				
Clients approve of my performing FWR.	0.767			
My direct managers approve of my performing FWR.	0.877	0.842	0.841	0.641
My colleagues approve of my performing FWR.	0.752			
Perceived Behavioural Control				
Many factors impede my performing FWR.				
I feel it is easy to perform FWR.	0.704	0.854	0.848	0.648
I believe that I am capable of implementing FWR.	0.838			
Performing FWR is completely within my control.	0.864			
Behavioural Intention				
I am willing to reduce food waste in the future.	0.786			
I am willing to adopt low-waste technology in the future.	0.746	0.856	0.857	0.599
I am willing to reuse the discarded food waste on the recipe in the future.	0.705			
I am willing to sort food waste in the future.	0.850			
FWR Behaviour				
I have reduced food waste in the past.	0.728			
I have adopted low-food waste technology in the past.	0.911	0.872	0.871	0.631
I have reused the discarded food waste on the recipe in the past.	0.791			
I have sorted food waste in the past.	0.736			
Moral Norm				
It is my moral obligation to perform FWR.	0.707	0.714	0.713	0.556
I would feel guilty if I do not implement FWR.	0.783			
Knowledge				
I have sufficient knowledge on the influence of food waste on environment.	0.741			
I have sufficient knowledge on the recycling value of food waste.	0.773	0.838	0.838	0.634
I have sufficient knowledge on how to implement the measures of FWR.	0.870			

Table 4. Discriminant validity (HTMT results).

	SNs	MNs	FWK	A	PBC	BI	FWRB
SNs							
MNs	0.428						
FWK	0.484	0.589					
A	0.626	0.622	0.449				
PBC	0.666	0.310	0.445	0.407			
BI	0.515	0.657	0.470	0.656	0.436		
FWRB	0.476	0.546	0.585	0.453	0.442	0.547	

SNs: Subjective Norms; MNs: Moral Norms; FWK: Food Waste Knowledge; A: Attitude; PBC: Perceived Behavioural Control; BI: Behavioural Intention; and FWRB: FWR Behaviour.

Table 5. Inner model results.

H	Effect	β	t	*p*	Result	VIF	f^2
H_1	BI→FWRB	0.311	4.692	0.000	Supported	1.369	0.025
H_2	A→BI	0.324	2.488	0.013	Supported	2.195	0.109
H_3	SNs→BI	0.048	0.435	0.664	Not Supported	2.415	0.002
H_4	PBC→BI	0.152	1.526	0.128	Not Supported	1.774	0.029
H_5	PBC→ FWRB	0.138	1.858	0.064	Not Supported	1.369	0.025
H_6	MNs→A	0.548	4.216	0.000	Supported	1.533	0.325
H_7	MNs→BI	0.387	3.778	0.000	Supported	1.649	0.205
H_8	FWK→A	0.128	1.111	0.267	Not Supported	1.533	0.018
H_9	FWK→FWRB	0.450	5.385	0.000	Supported	1.421	0.182
H_{10}	FWK→PBC	0.450	7.131	0.000	Supported	1.000	0.255

Attitude: R^2 = 0.399, Q^2 = 0.180; Perceived Behavioural Control: R^2 = 0.203, Q^2 = 0.016; Behavioural Intention: R^2 = 0.559, Q^2 = 0.288; and FWRB: R^2 = 0.453, Q^2 = 0.253. SNs: Subjective Norms; MNs: Moral Norms; FWK: Food Waste Knowledge; A: Attitude; PBC: Perceived Behavioural Control; BI: Behavioural Intention; and FWRB: FWR Behaviour.

f^2 = 0.018) was insignificant, while its effect on FWRB (β = 0.450; $p < 0.05$; f^2 = 0.182) and PBC (β = 0.450; $p < 0.05$; f^2 = 0.255) was significant and positive. In this regard, H_1, H_2, H_6, H_7, H_9, and H_{10} were supported, while H_3, H_4, H_5, and H_8 were not.

Conclusion

The present work aimed to test an expanded TPB model that included two theoretical constructs, MNs and FWK, to explain chefs' FWRB. SNs, attitudes toward food waste, and PBC were assumed to predict FWR intentions. Food-saving intentions and PBC were also considered to predict the FWRB in the TPB model. It was further held that MNs and FWK's critical role in food waste would be significant determinants of FWR intentions.

The present work found that BI positively impacted FWRB (H_1). This agreed with previous studies (Russell *et al.*, 2017; Barone *et al.*, 2019), which showed that individuals with high FWR intentions reported lower waste levels. It was concluded that attitudes toward food waste positively affected predicting chefs' FWR intentions (H_2). This finding concurred with studies suggesting that more positive tendencies toward food waste resulted in a higher likelihood of FWR (Graham-Rowe *et al.*, 2015; Stancu *et al.*, 2016; Barone *et al.*, 2019; Soorani and Ahmadvand, 2019).

Results also found that the effect of SNs on chefs' FWR intentions was lower than expected (H_3). Although the insignificant impact of SNs on FWR intentions differed from the findings of some studies in the literature (Stancu *et al.*, 2016; Russell *et al.*, 2017; Barone *et al.*, 2019; Soorani and Ahmadvand, 2019), it was consistent with some studies reporting the insignificant effect of SNs on intentions (Mondéjar-Jiménez *et al.*, 2016; Visschers *et al.*, 2016; van der Werf *et al.*, 2019). These inconsistencies in the literature suggested that the impact of SNs may vary by sector and cultural context. Moreover, this situation requires in-depth examination in a broader research context because SNs may not always influence individuals' behavioural decisions on any issue within the scope of perceived social pressure (Armitage and Conner, 2001). This may be due to the complex relationship between social influences and individual decision-making processes. Additionally, how SNs are conceptualised and measured within the research context may affect the behavioural model's predictive power. The literature has revealed that conceptualising SNs differently can increase the behavioural model's predictive power (Eckhardt *et al.*, 2008; Rivis *et al.*, 2009; Heuer and Liñán, 2013). For example, from a broader perspective, descriptive or imperative norms can be used to measure SNs.

Different research methods might alter the impact of SNs on BI. Studies have found that SNs positively and strongly affected BI when used in various social environments and emotional states (Stancu *et al.*, 2016; Soorani and Ahmadvand, 2019). Finally, the culinary profession may have contributed to this result because chefs may focus more on organisational norms and efficiency than on societal expectations regarding food waste in a professional

kitchen environment (Principato *et al.*, 2018). Hence, the relationship between SNs and BI is multidimensional, and cannot be explained by a linear relationship.

The impact of PBC on chefs' BI was not proven (H_4), which contradicted the results of some studies in the literature (Graham-Rowe *et al*., 2015; Visschers *et al.*, 2016; Soorani and Ahmadvand, 2019). However, it agreed with some studies reporting no significant influence of PBC on BI (Stefan *et al.*, 2013; Stancu *et al.*, 2016; Russell *et al.*, 2017). This inconsistency might result from factors such as the hierarchical structure adopted by chefs in the kitchen environment, organisational policies, and the work culture in the kitchen, which have a more substantial effect on BI.

Results also showed that PBC did not impact chefs' FWRB (H_5). The lack of effect of PBC on FWRB was consistent with the studies in the literature (Graham-Rowe *et al.*, 2015; Visschers *et al.*, 2016). This suggested that FWRB may sometimes stem from environmental or situational factors beyond the chef's control (Ajzen, 1991; Armitage and Conner, 2001). Chefs' limited PBC in the kitchen due to various factors such as menu design, customer satisfaction, and concerns about food safety and hygiene problems might account for this (Thyberg and Tonjes, 2016; Filimonau and De Coteau, 2019).

It was also found that chefs' MNs had a significant and strong effect on FWR attitude (H_6), suggesting that chefs' MNs played an essential role in shaping their FWR attitudes. In this context, the critical role of MNs should be considered when developing measures and strategies to reduce food waste, as they might promote the adoption of sustainable practices, and bring a moral perspective to the sector's food waste problem. In this regard, social marketing campaigns, ethical leadership, and sustainability training should be provided to strengthen chefs' moral norms, and contribute to their leadership and ethical decision-making processes, since this process is considered to be an effective tool for developing and reinforcing chefs' MNs regarding food waste. Moreover, such strategies might positively influence the FWRB by making chefs aware of and internalising their moral responsibilities. Considering the positive impact of chefs' experiences on adopting sustainable practices (Okumus *et al.*, 2020), how MNs vary in chefs with different professional characteristics can be investigated. FWR strategies might accordingly be developed based on the professional experiences of the chefs working in the business. Considering the significant and strong effect of MNs on FWR intention (H_7), the critical role of MNs in shaping the individual's behavioural intentions was consistent with the research in the literature (Schwartz, 1977; Olsen *et al.*, 2010; Largo-Wight *et al.*, 2012; Chan and Bishop, 2013; Stefan *et al.*, 2013; Mondéjar-Jiménez *et al.*, 2016). Therefore, identifying the factors that increase or decrease MNs' impact may help develop more efficient FWR strategies.

Contrary to expectations within the study's scope, FWK did not influence attitude (H_8). The knowledge-attitude gap can explain this result, which suggested that environmental knowledge might not always translate into positive attitudes or behaviours (Kollmuss and Agyeman, 2002). Additionally, Ajzen *et al*. (2011) stated that detailed information about any behaviour can be more effective than general information on that subject. This may be due to the chefs' superficial FWK. This situation is also thought to affect chefs' adoption and applicability of FWR-related strategies negatively. In addition, the challenges chefs face in the kitchen (*e.g*., customer expectations, managerial problems) may be another obstacle in transforming FWK into attitudes. Consequently, comprehensive training programs, organisational cultures, and strategies might close the gap between FWK, attitude, and FWRB. However, FWK was found to have a significant effect on FWRB (H_9) and PBC (H_{10}). This agreed with the studies indicating that knowledge of the environmental consequences of food waste influences waste reduction behaviour (Barr, 2007; Babaei *et al.*, 2015). Given the significant impact of FWK on chefs' FWRB, this issue needs to be detailed in terms of measures and policies to reduce food waste that should be developed in the hospitality sector because knowledge alone is insufficient for behavioural change (Kollmuss and Agyeman, 2002; Stöckli *et al.*, 2018). Therefore, training to improve chefs' FWK must elaborate and integrate knowledge with practical skills, business capabilities, and strategies.

Theoretical and practical contributions

Findings provided significant theoretical contributions, especially regarding the FWR behaviours of chefs in the hospitality sector. First, the present work supported the relevant literature, maintaining that the predictive power can be increased by adding different variables to the TPB

model (Conner and Armitage, 1998). In addition, it demonstrated the critical importance of MNs and FWK for understanding and modifying chefs' FWR behaviour. It revealed the importance of adopting the interaction of cognitive, emotional, and normative variables within the framework of the extended TPB model in sustainable food waste strategies. This multidimensional approach emphasised that FWR behaviours depended not solely on individual attitudes and perceived control, but were shaped by moral values and industry-specific knowledge.

Findings also offered practical contributions to developing FWRB, especially for chefs in the hospitality sector. First, the strong impact of MNs on attitudes and BIs suggested that social marketing campaigns for FWR might be effective. Focusing on the moral dimensions of food waste in campaigns was recommended in this context. However, this approach alone will not be sufficient. A multidimensional strategy should, therefore, be developed that considers factors such as economic incentives, legal regulations, religion, and especially cultural values to increase the effectiveness of campaigns.

Second, the challenges chefs face should be examined holistically to increase the efficiency of the measures developed for FWR in the hospitality sector. In this context, training programs for chefs should initially be created by integrating the waste management process in the hospitality sector with traditional and innovative culinary techniques. These training programs should focus on FWR strategies that can be applied to even the challenges faced by chefs, and on increasing chefs' knowledge in this area. In addition, food waste's environmental impacts, potential reuse and recycling methods, technology, and innovative approaches should be addressed. Chefs might thus be motivated to change their FWRB. In addition, as chefs' knowledge level increases, their PBC over FWRB may increase, positively affecting this behaviour. Finally, when examining the challenges chefs face, this knowledge-based approach must be supported by data analytics and AI-based tools to predict fluctuating demand accurately. Effective communication strategies should be developed and implemented to manage customer expectations, and encourage more sustainable portion sizes. Additionally, businesses and chefs adopting a culture of open information sharing should create platforms that facilitate sharing strategies and ideas. Forming a FWR culture in the hospitality sector might thus be ensured.

Recommendations for future research

The present work, nevertheless, faced some limitations. First, social desirability bias and respondents' self-assessment of their behaviour as correct might have arisen since self-report questionnaires measure FWRB (Podsakoff *et al.*, 2003). Accordingly, there might have been discrepancies between research participants' actual and reported behaviours. Future research might, therefore, obtain more comprehensive data using experimental or observational research methods. Second, the present work employed a cross-sectional research design. However, cross-sectional research design complicates drawing causal inferences (Levin, 2006). Prospective research could thus employ longitudinal research designs to explore the causal relationships between variables and FWR behaviour more effectively. This approach may allow the evaluation of developed strategies and preventions, and the discovery of factors affecting the change in variables affecting FWR behaviour over time. Third, the present work expanded the TPB by adding moral norms (MNs) and FWK variables. Future research can increase the theoretical framework's explanatory power by adding variables representing personal (*e.g.*, religion, personality types, emotions, and habits) and organisational (*e.g.*, organisational culture, management support, and resource availability) context to explore the variables influencing chefs' FWRB. A holistic study can cover all stakeholders (*e.g.*, managers, chefs, service personnel, consumers, *etc*.) responsible for food waste in hospitality businesses. This approach is expected to contribute to examining food waste dynamics from a broad perspective, and developing more effective strategies. Thus, external factors affecting chefs' FWRB can be identified. Prospective researchers can also include social practices. Analysing the evolution of social practices and networking processes (Erbaş, 2024) can offer a different perspective for FWR strategies in the kitchen, considering not only individual behaviours but also the broader socio-technical context in which these behaviours occur. Finally, even the extended TPB model may be inadequate for exploring the relationships between FWRB and different variables, which are multidimensional and complex. Therefore, the extended TPB model might be integrated with the Norm Activation model (Schwartz, 1977), which focuses on personal norms and the consequences of these norms. Furthermore, FWRB value and belief

factors may be essential because these factors may vary from culture to culture. For this reason, researchers who want to gain a different perspective on FWRB can use the Value-Belief-Norm theory framework.

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