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Young People Are Not All the Same! The Theory of Planned Behaviour Applied to Food Waste Behaviour across Young Italian Generations

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Abstract: To reach the SDG 12.3 target, understanding food waste behaviour (FWB) is fundamental, especially among young people. As future generations of parents, leaders, and citizens, they might potentially solve food sustainability issues and other matters arising from food waste. In such a context, this study extends the theory of planned behaviour (TPB) by including personal norms and environmental concern to explain and to predict the FWB of young Italians who belong to Generation Y and Generation Z. The theoretical model was empirically tested by administering a questionnaire to 322 Italian young people and by applying two distinct PLS-SEM models for Generation Y and Generation Z. Our results support not only the main relationship suggested by the TPB model with respect to FWB but also that, in affecting it, personal norms and environmental concern play different roles according to the generations. Understanding the mechanisms through which personal norms and environmental concern translate into reducing food waste is crucial to defining interventions aimed at changing youth behaviour. It could represent a relevant step towards preventing food waste and promoting sustainable management of food chains.

Keywords: food waste management; young consumers; theory of planned behaviour; environmental concern; PLS-SEM

1. Introduction

"There is growing evidence of success in reducing food waste [...]. Much more can be done. We need, for example, to address the role of consumer behaviour, in all cultural contexts [...]. Let us all shop carefully, cook creatively and make wasting food anywhere socially unacceptable while we strive to provide healthy, sustainable diets to all." (Inger Andersen executive director of the United Nations Environment Programme [1]).

Reducing food waste has emerged as a priority for the United Nations [1], which have adopted a specific target in the recently published Sustainable Development Goals (SDGs) to halve global food waste per capita at the retail and consumer levels by 2030 (SDG 12, Responsible consumption and production, Target 12.3). Reducing food waste contributes to two general objectives [2]: (i) improving global food security (SDG 2, zero hunger), and (ii) reducing the environmental footprint associated with food that is wasted (SDG 6, clean water and sanitation, SDG 13, climate action, SDG 14, life below water, SDG 15, life on land).

According to the most recent estimates, around 931 million tonnes of food are wasted each year [1], while between 720 and 811 million people in the world face hunger every day [3], representing an actual "food paradox". In such a context, tackling food waste is deemed to be one of the most effective ways to decrease pressures on the food system and to contribute towards enhanced food and nutrition security [1,2,4].

Wasting food also means wasting resources used for its production. The food system is resource intensive and accounts for 70% of freshwater withdrawals, 38% of land resources, and approximately 30% of energy consumption [5,6]. Therefore, better food waste management could help to solve some environmental sustainability issues related to the global food system, potentially reducing its water, land, ecological, and energy footprint [7]. Food waste also contributes to global greenhouse gas emissions and represents an obstacle to cope with climate change [8,9]. According to Mohareb et al. [10], meeting the 12.3 target could reduce 11% of the total CO_2 emissions per capita.

In the last decade, research on food waste, mainly household food waste, has exponentially increased [11,12]. Households are mainly responsible for food waste, accounting for 61% of the total food waste (nearly 570 million tonnes/year); therefore, they have the highest potential to prevent food waste [1]. Scholars have dedicated their efforts to quantifying food waste and looking for its determinants (socio-demographic features, as well as psycho-social and cultural factors) to better understand the phenomenon and to identify mitigation strategies [13–18]. Recently, significant attention has been given to food management behaviours (FMBs) other than food waste behaviour (FWB) [19–25]. As highlighted by Quested et al. [26], food waste is the result of multiple behaviours, such as planning, shopping, storage, preparation, and consumption of food. As immediate drivers of food waste outcomes [24], understanding such FMBs is crucial to designing and implementing actions to prevent food waste.

Households' FMBs that affect food waste have been investigated in different countries, such as Australia [22], Germany [24], Greece [23], Italy [25], and the UK [20], and similar results have been reached with few differences due to country-specific eating habits and diets. Among the different FMBs, shopping and preparation (e.g., leftovers use) emerge as the most crucial for food waste outcomes in all countries.

Several socio-demographic factors, such as family size and composition, age, and income, have also been related to food management and waste behaviour. Comparing different generational groups (baby boomers, Generation X, Generation Y, and Generation Z), Karunasena et al. [22] found that younger generations tended to waste more food due to a lack of food management skills, especially cooking skills. Their findings were in line with other works in which age and food waste have been found to be negatively related [26–29]. At the same time, their findings contrast with other studies, highlighting how young people are more concerned about food waste and its environmental and financial impacts [30,31]. Whether or not young people are culpable in wasting food more than older people, they remain to be an interesting group to focus on; as future generations of parents, leaders, and citizens, young people might potentially solve food sustainability issues and other matters arising from food waste [32,33]. Understanding youth behaviour and acting on it now represent an opportunity for the future of food system sustainability.

Even though research on the drivers of youth food waste is growing in frequency [22,27,28,33–36], it remains relatively scarce compared with other studies on youth pro-environmental behaviours (e.g., pro-environmental purchase intention towards eco-friendly apparel, energy saving vehicles, and healthy food) (e.g., [37]). In particular, the roles of the cognitive, emotional, and behavioural aspects that influence youth FMBs and food waste have been empirically investigated by only a few studies [34–36]. This lack of studies has limited our understanding of youth behaviour and our ability to identify interventions to prevent food waste and to promote sustainable management of food chains. Based on the above and with the necessity to develop interventions coherent with all specific cultural contexts [1], this study aims to investigate factors affecting the food waste of younger generations in Italy. Specifically, this study extends the theoretically grounded framework of the theory of planned behaviour (TPB) [38] to explain and to predict the FMBs of Italian youths who belong to Generation Y and Generation Z. Several studies have demonstrated that adding factors to the TPB model, such as personal norms and environmental concern, could help to increase its predictive power in explaining people's intentions to conduct pro-environmental behaviours. Moreover, these factors could assume

different roles and relevance according to age. Therefore, we applied an extended TPB model to answer two main questions. Which factor (or factors) has (have) the most effect on intention and food waste reduction behaviours? Do differences across generations exist in the way cognitive and psychological aspects relate to food waste behaviour? Answering these questions can help to identify evidence-based actions for fostering sustainable food waste management systems. This paper is structured as follows: Section 2 introduces the theoretical background supporting the research hypotheses, Section 3 describes the methodology, the results are presented in Section 4, and discussion and conclusions are provided in Sections 5 and 6, respectively.

2. Theoretical Background and Research Hypotheses

2.1. The Theory of Planned Behaviour

Recently, young people, who have been associated with wasting more food than adults, have come under the magnifying lens of scholars in research on food waste [22,27,28,33–36].

Most studies have investigated the motivations that have led youth to waste food, to identify the main prevention actions [22,27,28]. In general, the frenetic lifestyle of youth seems to negatively affect their FMBs (in particular, shopping and cooking) and, consequently, their food waste outcomes [22]. Studies conducted among Italian, Spanish, British, and Australian youths have shown that overbuying and overcooking are the main factors that influence food waste, while planning (e.g., shopping list) and cooking skills (e.g., adequate portions and use of leftovers) are the main actions for food waste prevention [22,28,29,35].

Some studies have also investigated the complexity of young consumers' behaviours toward food waste within the TPB [38]. The TPB is frequently applied to investigate FWB [11]. FWB is the result of short-term cognitive processes, namely intentions that, in turn, are determined by attitude (i.e., an individual's positive or negative evaluation of FWB), subjective norms (i.e., how an individual perceives the social pressure towards FWB), and perceived behavioural control (i.e., an individual's perceptions of their ability to perform a specific FWB). Subjective norms can be further distinguished into injunctive and descriptive norms, which refer to what significant others think the person *ought to do* and what significant others *do* [39]. For a complete treatment of the theory of planned behaviour see [38].

In household food waste studies, attitude has been found to positively affect the intention to avoid food waste, while perceived behavioural control acts both on intention and behaviour. Subjective norms do not have such a significant impact because household food waste is not visible to others, and therefore cannot be criticised [11,26]. Similar results have been found by Mondéjar-Jiménez et al. [35] and Palmieri and Palmieri [36] who adopted the TPB to investigate the antecedents of positive behaviour in reducing food waste among Italian and Spanish youths and Italian students of the Campania region, respectively. Young people who have a positive attitude towards reducing food waste and consider it under their control, have a higher intention to reduce food waste.

Based on the above, we posit the following hypotheses:

H1: *Attitude (H1a), subjective norms (H1b), and perceived behavioural control (H1c) toward food waste are positively related to the intention of reducing food waste.*

H2: *Perceived behavioural control is positively related to the behaviour of reducing food waste.*

Regarding the relationship between intention and behaviour, Amato et al. [19] argued that the relationship between an individuals' intention to reduce food waste and their performed behaviours had not been fully investigated. Indeed, scholars usually measure the intention to reduce food waste as a predictor of the amount of food that is thrown away, which indicates a relationship between the intention not to waste food and FMBs that represent concrete behaviours of wasting food. On the contrary, planning meals, making shopping lists, correctly storing and cooking food, and eating leftovers are proximal

behaviours that lead directly to reduced food waste, and therefore, can be investigated in the TPB framework as actual behaviours [24]. Considering that, we hypothesise:

H3: *Intention should significantly affect behaviours of not wasting food, such as reducing servings and using leftovers.*

2.2. TPB Extension: Personal Norms and Environmental Concern

According to Ajzen's theory, the main TPB constructs should be sufficient to predict behavioural intention, and intention is the main predictor of behaviour [19,38]. However, different studies have shown that consumer behaviour is more complex. Some scholars have integrated the TPB model with several research models [20,40], whereas others have incorporated various critical factors into the TPB model to improve its predictive power. Among them, personal (or moral) norms have been added to the TPB to explain people's intentions to conduct various environmentally friendly behaviours. According to Schwartz [41], personal norms are moral obligations that lead people to follow specific lines of behaviour. They represent an individual's beliefs about what is right or wrong, acceptable or unacceptable, important or not important. In food waste studies, personal norms (i.e., feeling obliged not to waste food) have been shown to significantly predict food waste; people tend to waste less when they have solid personal norms against food waste [42]. In particular, a positive association between personal norms and the intention to avoid food waste has been found, suggesting that social conformity strengthens beliefs against food waste [43]. Following Schwartz's norm activation model [41,44], Nigbur et al. [45] stated that individuals internalise social expectations before acting. Therefore, social norms translate into actions through personal norms. In such a context, personal norms emerge as a significant predictor of intention and play a mediating role between subjective norms and intention [44].

Accordingly, the following hypotheses are suggested:

H4: *Personal norms are positively related to intentions.*

H5: *Personal norms play a mediating role between subjective norms and intention.*

Environmental concern is another crucial factor in explaining people's intentions to conduct pro-environmental behaviours. Environmental concern is the awareness of environmental issues and is an important determinant of a change towards more environmentally friendly behaviour [46]. Environmental concern has been found to promote eco-friendly purchases [47,48], but seems to be less effective in affecting food waste behaviour [42], particularly, among young people [11]. In the TPB framework, environmental concern does not directly affect specific environmentally friendly behaviours, but rather indirectly affects them through some other variables [47]. Bamberg [46] suggested that environmental concern influences an individual's behavioural intention through norms, beliefs, and attitudes. Therefore, environmental concern is an indirect determinant of behavioural intention and an anterior factor of the elements of an extended TPB model [47,48]. Hence, we propose the following hypothesis:

H6: *Environmental concern is positively related to attitude (H6a), subjective norms (H6b), perceived behavioural control (H6c), and personal norms (H6d).*

2.3. Food Waste and Young Generations

Analysing pro-environmental behaviours, Xu et al. [49] found that age affected the size and significance of variables in an extended TPB model. In the EU, youths aged between 15 and 24 are considered to be more inclined to waste food than older people [50]. This could be due to the lack of food management skills, as young consumers find it difficult to identify the correct portion size to purchase and cook and do not always know how to store and reuse leftovers [22,26,28,29]. Moreover, food waste behaviour might be driven by factors such as the experience of food shortage [42] or financial and environmental

concerns [51]. Some research has suggested that younger people may be more concerned about the financial consequences of food waste than the environmental effects [52,53]. On the contrary, in a recent study, Burlea-Schiopoiu et al. [34] showed that during the COVID-19 pandemic, more people reduced food waste and, in particular, young people increased their awareness of the impact of food waste on the environment. The authors found that the perception of young people regarding the impact of food waste on the environment is positively related to their responsible behaviours regarding food waste.

Based on these considerations, we posit that:

H7: *The effects' significance and size in the TPB model are different across generations.*

2.4. Research Framework

The framework for this research integrated the original constructs of the TPB and two additional factors, personal norms and environmental concern, which, in previous literature, have been proven to have explanatory power on pro-environmental behaviours. Figure 1 illustrates the extended model and the related research hypotheses. To test H7, such a model was separately applied for Generation Y and Generation Z.
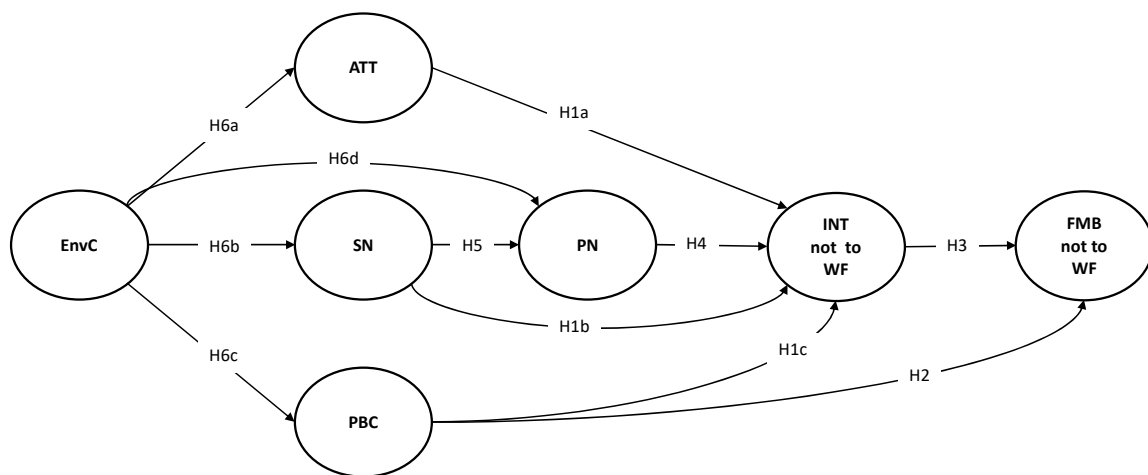

Figure 1. Research framework and research hypotheses (H1–H6) of youths' intentions to implement food management behaviours (FMBs) of not wasting food (WF) (Note: EnvC, environmental concern; ATT, attitude; SN, social norms; PBC, perceived behavioural control; PN, personal norms; INT, intention).

3. Data and Methods

3.1. Survey Design and Data Collection

Following our theoretical model (Figure 1), a questionnaire was designed to investigate the determinants of FMBs not to waste food among young Italians. The questionnaire was defined after a careful literature review on analyses of consumer behaviours' in general and, more specifically, related to consumers' behaviours toward food waste within the TPB framework. The main limitation of previous studies on FWB among youth has been to include young people who usually are not involved in cooking (see [35]). To overcome this limitation, in the questionnaire, we asked whether the respondent was responsible for preparing food at home and to what extent he/she was responsible. For each construct of our model, we adopted items derived from previous studies and a seven-point Likert scale to collect answers, as indicated in Table 1.

Table 1. Constructs, items, and relative sources.

Constructs and Items		Scale	Source
Attitude towards food waste (ATT)			
ATT_1	In my opinion, wasting food is	From not at all negative (1) to extremely negative (7)	
ATT_2	In my opinion, wasting food is	From not at all foolish (1) to extremely foolish (7)	[17]
ATT_3	In my opinion, loading the environment with my household's food waste is	From not at all negative (1) to extremely negative (7)	
Injunctive Subjective Norms (ISN)			
ISN_1	Most people who are important to me believe that I should not throw food away	From strongly disagree (1) to strongly agree (7)	
ISN_2	Other people expect me not to throw food away	From strongly disagree (1) to strongly agree (7)	[19]
ISN_3	Most people whose opinion is important to me approve my avoidance of throwing away food	From strongly disagree (1) to strongly agree (7)	
Descriptive Subjective Norms (DSN)			
DSN_1	Most people close to me do not throw away food.	From strongly disagree (1) to strongly agree (7)	
DSN_2	My friends tend to throw food away (R).	From strongly disagree (1) to strongly agree (7)	[19]
DSN_3	In general, I think most people who are important to me don't throw away as much food.	From strongly disagree (1) to strongly agree (7)	
Perceived Behavioural Control (PBC)			
PBC_1	In my opinion, wasting food is (R)	From avoidable (1) to unavoidable (7)	
PBC_2	In my opinion, loading the environment with my household's food waste is (R)	From avoidable (1) to unavoidable (7)	[17]
PBC_3	Not to throw food away would be (was asked with the same introduction as the intention items) (R)	From easy (1) to difficult (7)	
Personal Norms (PN)			
PN_1	I feel bad when I throw food away	From strongly disagree (1) to strongly agree (7)	
PN_2	I feel obliged not to waste any food	From strongly disagree (1) to strongly agree (7)	
PN_3	It is contrary to my principles when I have to discard food	From strongly disagree (1) to strongly agree (7)	[54]
PN_4	I have been raised to believe that food should not be wasted, and I still live according to this principle	From strongly disagree (1) to strongly agree (7)	
Environmental concern (EnvC)			
EnvC_1	Humans are seriously abusing the environment, and the garbage problem is getting worse	From strongly disagree (1) to strongly agree (7)	
EnvC_2	For the sake of their own future, humans have to live in harmony with nature	From strongly disagree (1) to strongly agree (7)	[55]
EnvC_3	I'm worried about the global environment condition and how it may impact my future	From strongly disagree (1) to strongly agree (7)	
Intention not to waste food (INT)			
Introduction: 'Please answer the following questions thinking about the near future (e.g., next one/two weeks) and your household':			
INT_1	I intend not to throw food away	From strongly disagree (1) to strongly agree (7)	
INT_2	My goal is not to throw food away	From strongly disagree (1) to strongly agree (7)	[17]
INT_3	I will try not to throw food away	From strongly disagree (1) to strongly agree (7)	
Using leftovers (BEH1)			
BEH1_1	I always try to use leftover food	From strongly disagree (1) to strongly agree (7)	
BEH1_2	I always try to use leftovers in a creative way	From strongly disagree (1) to strongly agree (7)	[19]
Reducing servings (BEH2)			
BEH2_1	I try to prepare and serve the right portions to avoid leftovers	From strongly disagree (1) to strongly agree (7)	
BEH2_2	I always try not to put more food on the table than I have to	From strongly disagree (1) to strongly agree (7)	[19]

R-item was reversed for analyses.

The questionnaire was written in English and designed using the "Google Forms" tool. To ensure the appropriateness and clarity of questions, the questionnaire was checked by scholars and pretested with 20 university students who were randomly selected. After that, data were collected by means of a convenience sample. In the first step, the questionnaire was directly administered among secondary-level and university students. In the second step, it was disseminated online through the leading social media channels. Social channels were chosen because they offer a large and varied pool of respondents [56], allowing the possibility to reach young people outside the school boundaries. According

to Burlea-Schiopoiu et al. [34], students, particularly university students, can be used in academic research to investigate complex behaviours, such as food waste, and to provide reliable data.

Data were collected between February and May 2022. The total sample comprised 351 participants distributed across the Italian macro-regions. However, 29 respondents were excluded from the analysis because they were not involved directly in preparing food at home. The final sample size was 322 participants, consisting of 107 Generation Y participants (born between 1980 and 1996) and 215 Generation Z participants (born between 1997 and 2006). The sample characteristics are presented in Table 2.

Table 2. Socio-demographic characteristics of the sample.

Indicator	Frequency	Percent
Generation		
Generation Y	107	33%
Generation Z	215	67%
Gender		
Female	155	48%
Male	167	52%
Education		
Middle and high school	196	61%
Bachelor level	42	13%
Graduate	74	23%
PhD	10	3%
Occupation		
Employed	66	20%
Part-time worker	14	4%
Student	235	73%
Unemployed	7	2%
Living area		
Rural	148	46%
Urban	174	54%
Living situation		
I live alone	23	7%
I live in a shared apartment	30	9%
I live with a parent	239	74%
I live with my partner	30	9%

3.2. Data Treatment and Analysis

The hypothesized relationships between constructs explaining intention and FMBs not to waste food in Figure 1 were empirically investigated using the technique of partial least square structural equation modelling (PLS-SEM) [57]. The model was developed and estimated with the R software version 4.2.2 [58] using the SEMinR package [59,60], one of the most recent packages for PLS-SEM. Developed to test theoretical relationships, PLS-SEM was chosen because of its flexibility to work efficiently with small sample sizes and to handle complex models with many structural model relationships [57,59].

4. Results

4.1. The Measurement Model Evaluation

The quality of the measurement model was evaluated both in terms of reliability (indicator and internal consistency reliability) and validity (convergent and discriminant validity) [57,59]. The indicator reliability was checked by looking at the indicator loadings (outer loadings). Indicators with loadings above 0.708 were kept in the measurement models, while indicators with loading below 0.40 were eliminated. As suggested by Hair et al. [57,59], indicators with loadings between 0.40 and 0.708 were eliminated only if

their deletion led to an increase in internal consistency reliability or convergent validity above the suggested threshold. The latter ones were evaluated using the reliability coefficient rho_A and the average variance extracted (AVE), respectively. All constructs have shown rho_A below the critical value ($rho_A < 0.95$) and an AVE above the minimum acceptable threshold ($AVE \geq 0.50$). Lastly, the discriminant validity was assessed by using the heterotrait-monotrait ratio (HTMT), which, according to Henseler et al. [61], must be lower than 0.85 (conservative threshold). The results of the measurement models assessment, both for Generation Y and Generation Z, are reported in Tables 3–5.

Table 3. Validity measurement model (Generation Y).

Constructs	Items	Loadings	rho$_a$	AVE
Attitude towards food waste (ATT)	ATT_1	0.788	0.822	0.643
	ATT_2	0.744		
	ATT_3	0.869		
Injunctive subjective norms (ISN)	ISN_1	0.918	0.770	0.788
	ISN_2	0.856		
	ISN_3	(D)		
Descriptive subjective norms (DSN)	DSN_1	0.824	0.707	0.749
	DSN_2	(D)		
	DSN_3	0.905		
Perceived behavioural control (PBC)	PBC_1	0.825	0.832	0.723
	PBC_2	0.864		
	PBC_3	0.861		
Personal norms (PN)	PN_1	0.758	0.750	0.549
	PN_2	0.615		
	PN_3	0.786		
	PN_4	0.790		
Environmental concern (EnvC)	EnvC_1	0.855	0.811	0.720
	EnvC_2	0.876		
	EnvC_3	0.815		
Intention not to waste food (INT)	INT_1	0.959	0.911	0.908
	INT_2	(D)		
	INT_3	0.946		
Using leftovers (BEH1)	BEH1_1	0.949	0.913	0.831
	BEH1_2	0.873		
Reducing servings (BEH2)	BEH2_1	0.911	0.763	0.800
	BEH2_2	0.878		

4.2. The Structural Model Evaluation

Once the measurement model reliability and validity were confirmed, we assessed the structural model results. The variance inflation factor (VIF) was used to evaluate the collinearity issue ($VIF < 3$) [57,59], while a bootstrapping procedure (with 10,000 random subsamples and a 95% confidence interval) was performed to assess the significance and relevance of the structural model relationships (path coefficient) [59,62]. The coefficient of determination (R^2) (Table 6) was considered to assess the model's explanatory power [59]. Ranging from 0 to 1, R^2 values of 0.25, 0.50, and 0.75 can be considered weak, moderate, and substantial, respectively, but, in some cases, values as low as 0.10 can also be considered satisfactory [59]. Table 6 also reports the f^2 effect size, namely the effect of a predictor construct on an endogenous construct; in general, f^2 values of 0.02, 0.15, and 0.35 show a small, medium, and large effect, respectively [59]. We also evaluated our model's predictive power (or out-of-sample predictive power), namely the model's ability to predict new or future observations [59]. We used $PLS_{predict}$ [63] that estimates the model on a training sample and evaluates its predictive performance on a holdout sample [64]. Our model shows high power in predicting FMBs of not wasting food, as all indicators have lower RMSE values compared to the LM ones (Table 7) (see [59] for more details).

Table 4. Validity measurement model (Generation Z).

Constructs	Items	Loadings	rho$_a$	AVE
Attitude towards food waste (ATT)	ATT_1	0.832	0.692	0.602
	ATT_2	0.711		
	ATT_3	0.780		
Injunctive subjective norms (ISN)	ISN_1	0.778	0.674	0.601
	ISN_2	0.805		
	ISN_3	0.742		
Descriptive subjective norms (DSN)	DSN_1	0.822	0.881	0.782
	DSN_2	(D)		
	DSN_3	0.942		
Perceived behavioural control (PBC)	PBC_1	0.787	0.733	0.620
	PBC_2	0.793		
	PBC_3	0.783		
Personal norms (PN)	PN_1	0.738	0.810	0.615
	PN_2	0.754		
	PN_3	0.875		
	PN_4	0.762		
Environmental concern (EnvC)	EnvC_1	0.858	0.736	0.646
	EnvC_2	0.803		
	EnvC_3	0.746		
Intention not to waste food (INT)	INT_1	0.886	0.853	0.769
	INT_2	0.886		
	INT_3	0.859		
Using leftovers (BEH1)	BEH1_1	0.934	0.835	0.817
	BEH1_2	0.872		
Reducing servings (BEH2)	BEH2_1	0.928	0.738	0.694
	BEH2_2	0.725		

Table 5. HTMT measurement model (Generation Y and Generation Z).

	EnvC	ATT	ISN	DSN	PBC	PN	INT	BEH1	BEH2
Generation Y									
EnvC									
ATT	0.350								
ISN	0.311	0.364							
DSN	0.140	0.504	0.616						
PBC	0.488	0.251	0.221	0.167					
PN	0.503	0.423	0.326	0.327	0.307				
INT	0.720	0.509	0.384	0.349	0.453	0.873			
BEH1	0.426	0.142	0.124	0.239	0.136	0.497	0.441		
BEH2	0.540	0.283	0.395	0.523	0.417	0.655	0.645	0.595	
Generation Z									
EnvC									
ATT	0.679								
ISN	0.674	0.657							
DSN	0.395	0.482	0.708						
PBC	0.315	0.249	0.256	0.142					
PN	0.791	0.733	0.678	0.512	0.169				
INT	0.715	0.723	0.625	0.562	0.272	0.758			
BEH1	0.570	0.400	0.615	0.368	0.115	0.725	0.542		
BEH2	0.607	0.571	0.776	0.399	0.148	0.732	0.658	0.616	

4.3. The Extended TPB Model Results

Figures 2 and 3 report the TPB model results and show the path coefficients of the structural equation models for the Generation Y and Z samples. Attitude and PBC significantly impact the intention towards food waste reduction in both generations' models, with a positive β associated with the intention to not waste food, thus supporting hypothe-

ses H1a and H1c and confirming the findings of previous empirical studies [65–68]. The relationship between subjective norms and intention is more complex, and hypothesis H1b is only partially confirmed. Indeed, in the Generation Z model, there is a positive link only between descriptive norms and intention. In contrast, the path coefficients between subjective norms (descriptive and injunctive) and intention are not significantly different from zero when Generation Y is considered. This result should be analysed considering the relevance of personal norms in the structural model and the mediation effect stated in H5. Path coefficients of SN on PN are positive and relevant in Generation Z, while they are significant only related to DSN in the Generation Y model. Moreover, coefficients of PN on intention are very high in both models (the highest in the Generation Y model) and show that PN significantly affect intention. That supports hypothesis H4.

　　Values of direct and indirect effects of SN on intention help to better understand the relationships between the constructs of SN and PN (Table 8). As far as the mediation role of PN is concerned, our findings show differences according to the components of subjective norms (i.e., descriptive and injunctive norms) and across generations. In the Generation Y model, the direct and indirect effects of ISN are not significantly different from zero. Therefore, there is no link between ISN and intention, and PN have no mediation effect. On the contrary, DSN have only an indirect effect, proving the full mediation effect of PN in the relationship between DSN and intention. The results are different when referring to Generation Z. In such a case, both ISN and DSN are significantly related to intention, but PN fully mediate the link between ISN and intention, while they have only a partial mediation effect in the DSN–intention relationship. The effect ratio, which accounts for the proportion of the total effect of DSN on intention mediated by PN, is 0.27 (0.067/0.248), indicating that PN mediate 27% of the total effect of DSN on intention [57]. These results provide only partial support for H5 and highlight the need for further investigations on social norms and their role in affecting personal norms and intention, as well as on other factors that contribute to building personal norms.

Table 6. Coefficient of determination (R^2) and f^2 effect size values.

	ATT	PBC	PN	ISN	DSN	INT	BEH1	BEH2
Generation Y								
R^2	0.09	0.16	0.06	0.01	0.21	0.62	0.16	0.31
f^2								
ENV	0.10	0.19	0.16	0.07	0.01			
ATT						0.05		
PBC						0.08	0.00	0.03
PN						0.81		
ISN				0.00		0.02		
DSN				0.03		0.00		
INT							0.17	0.27
Generation Z								
R^2	0.23	0.06	0.23	0.10	0.46	0.51	0.21	0.24
f^2								
ENV	0.30	0.06	0.32	0.29	0.11			
ATT						0.07		
PBC						0.01	0.00	0.00
PN						0.17		
ISN				0.04		0.01		
DSN				0.04		0.05		
INT							0.25	0.31

Table 7. Results of the PLSpredict procedure: RMSE and LM values.

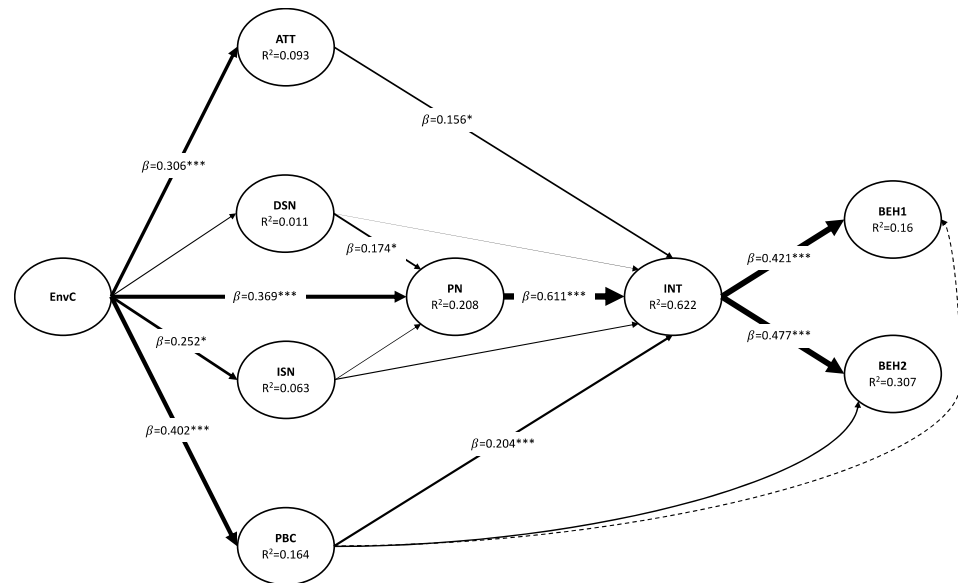|	BEH1_1	BEH1_2	BEH2_1	BEH2_2
Generation Y				
RMSE	1.190	1.491	1.093	1.359
LM	1.231	1.589	1.097	1.475
Generation Z				
RMSE	1.181	1.584	1.175	1.504
LM	1.198	1.602	1.254	1.521

Figure 2. Structural path Generation Y (Note: EnvC, environmental concern; ATT, attitude; DSN, descriptive subjective norms; ISN, injunctive subjective norms; PBC, perceived behavioural control; PN, personal norms; INT, intention; BEH1, using the leftovers; BEH2, reducing servings). * Sig. 0.05; *** Sig. 0.001.
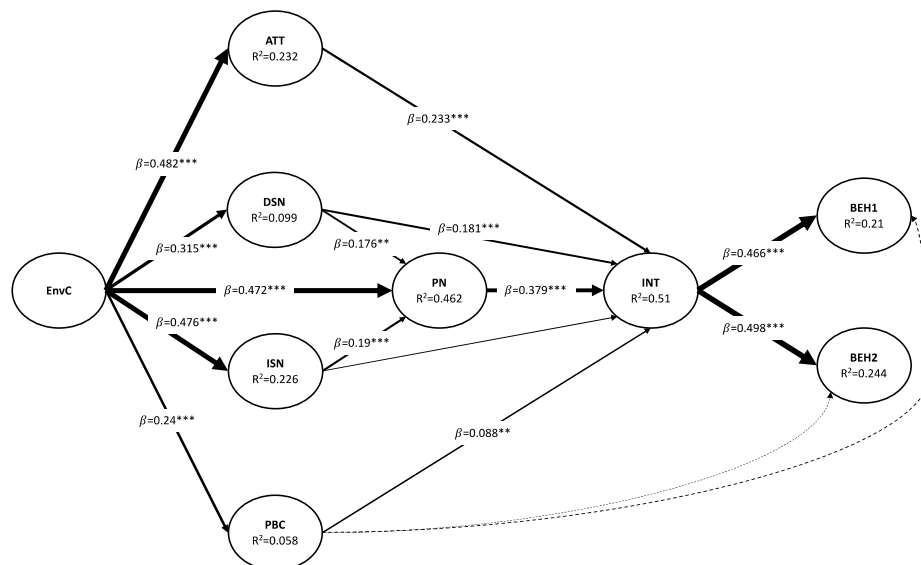

Figure 3. Structural path Generation Z (Note: EnvC, environmental concern; ATT, attitude; DSN, descriptive subjective norms; ISN, injunctive subjective norms; PBC, perceived behavioural control; PN, personal norms; INT, intention; BEH1, using the leftovers; BEH2, reducing servings). ** Sig. 0.01; *** Sig. 0.001.

Table 8. Mediation effect of PN.

Constructs	Direct	Indirect	Total	Type of Mediation
Generation Y				
ISN	-	-	-	Non-mediation
DSN	-	0.106	0.106	Full mediation
Generation Z				
ISN	-	0.072	0.072	Full mediation
DSN	0.181	0.067	0.248	Partial mediation

Path coefficients related to environmental concern mostly confirm hypothesis H6. Awareness of environmental issues is positively related to attitude (H6a), subjective norms (H6b), perceived behavioural control (H6c), and personal norms (H6d). The only exception is the EnvC—DSN link for Generation Y, as the path coefficient is not significant. Therefore, in young adults, environmental concern affects a person's beliefs about how one should behave, but there is no relation with the actual behaviours of other people.

As far as the intention–behaviour relationships are concerned, our findings support hypothesis H3. The path coefficients are positive and highly significant, in line with previous works [19,63]. The estimated TPB model explains 62.2% and 51% of the variance in intention for Generation Y and Generation Z, respectively, while the explanatory power of the behaviours is higher when it concerns portioning, reaching 30.7% of the explained variance in the Generation Y model. The intention results are in line with the explanatory powers of previous models, while the model accounts for the relatively higher variance in behaviour [51,65,69].

Based on the above results, significant differences across generations are found, thus supporting H7. Table 9 synthesises the hypothesis testing results and highlights the main relationships among our models' constructs.

Table 9. Results of hypothesis testing.

		Generation Y		Generation Z	
Hypothesis	Relationship	Path Coefficient	Result	Path Coefficient	Result
H1a	ATT→INT	0.156 *	Supported	0.233 ***	Supported
H1b	SN→INT				
	ISN→INT		Not supported		Not supported
	DSN→INT		Not supported	0.181 ***	Supported
H1c	PBC→INT	0.204 ***	Supported	0.088 **	Supported
H2	PBC →Beh				
	PBC→Beh1		Not Supported		Not Supported
	PBC→Beh2		Not Supported		Not Supported
H3	INT→Beh				
	INT→Beh1	0.421 ***	Supported	0.466 ***	Supported
	INT→Beh2	0.477 ***	Supported	0.498 ***	Supported
H4	PN→INT	0.611 ***	Supported	0.379 ***	Supported
H5	SN-PN→INT				
	ISN→PN		Not Supported	0.190 ***	Supported
	DSN→PN	0.174 *	Supported	0.176 ***	Supported
H6a	EnvC→ATT	0.306 ***	Supported	0.482 ***	Supported
H6b	EnvC→SN				
	EnvC→ISN	0.252 *	Supported	0.476 ***	Supported
	EnvC→DSN		Not Supported	0.315 ***	Supported
H6c	EnvC→PBC	0.402 ***	Supported	0.240 ***	Supported
H6d	EnvC→PN	0.369 ***	Supported	0.472 ***	Supported

* Sig. 0.05; ** Sig. 0.01; *** Sig. 0.001.

5. Discussion

The results support the main relationship suggested by Ajzen's TPB model with respect to food waste behaviour. Coherently with the base TPB model, attitude and PBC are antecedents of the intention to not waste food and intention is able to predict the actual behaviours. These findings are in line with similar studies [51,65–68]. With respect to previous studies, our work aimed to estimate how the relevance of these factors varied with age. Previous studies that have focused on food waste have mainly dealt with age as characterising different behavioural profiles or analysed its relationship with food management behaviours (e.g., [15,18,28,49]). Some other studies have applied the TPB model to young people as a specific age group [34–36]. The novelty of our work is that we studied the differences within young generations by applying two distinct TPB models for Generation Y and Generaton Z, which better highlighted the differences across generations in the nature and strength of the links between the constructs of the behavioural model and also allowed for suggesting more focused and targeted interventions.

Concerning the relevance of antecedents in influencing intention, the data results, firstly, show that, for Generation Z, attitude has the largest direct association with the intention to reduce food waste, while the relationship between PBC and intention is very low. On the contrary, the influence of PBC on intention is the most relevant in the Generation Y model. Therefore, in younger people, the intention not to waste food is mainly affected by the thought of food waste as something bad, while for young adults, their perception of having control of the food waste is the most relevant antecedent of intention.

A second consideration concerns the influence of subjective norms on the intention to not waste food. In the TPB base model, an individual's perception of the expectations and opinions of others about their own behaviour shapes the intention to behave in a certain way. Previous studies on food waste behaviour generally found that the subjective Norms weakly affect the intentions, and that was partly ascribed to its poor measure and the need for a better specification of the normative component [69]. In the present work, including personal norms in the base model responded to this last need. The data results support our expectation that personal norms mediate the effect of social norms on intention, and the findings are in line with similar studies on household waste recycling [45] and other environmentally relevant behaviours [70]. Moreover, our results indicate a high and significant relationship between personal norms and the intention to not waste food. They are consistent with previous studies such as those by Werf et al. [54], Nigbur et al. [45], and Visschers et al. [42]. In our work, the use of two distinct models also highlights that the links between social and personal norms, as well as between personal norms and intention, are different across Generation Y and Generation Z. Personal norms are highly related to social norms (both DSN and ISN) in the Generation Z model, while the link is small and limited to DSN in the Generation Y model. Then, in younger people, personal norms are influenced by what significant others think the person ought to do and what significant others do themselves, and subjective norms are relevant in the formation of PN. Social pressure plays a less important role in young adults, but personal values are still affected by behaviours within one's specific social context.

A third aspect deals with the role of environmental concern. In this study, the model was extended to consider environmental concern as a factor affecting all antecedents of intention. Awareness of environmental issues is a relevant factor acting on all antecedents, but the intensity of the relationships varies across generations. In particular, environmental concern has a higher influence on Generation Z norms; it affects personal norms directly and indirectly through social norms, and norms reflect on the intention to reduce food waste. As far as Generation Y is concerned, environmental concern mainly acts on the perceived behavioural control and personal norms. In contrast, the effects on the social norms are less and limited to injunctive subjective norms. Therefore, in line with previous results [46,47], knowledge of the environmental issues and their consequences represent a key factor to address pro-environmental behaviours, but our work highlights that the

mechanisms through which this awareness translates into food waste reduction behaviours are rather different according to an individual's age.

6. Conclusions

The analysis of the food waste behaviour of Generation Y and Generation Z using two distinct TPB models highlighted how the factors affecting food waste intention and behaviours differ across young Italians. Moreover, including personal norms and environmental concern in the base TPB model widened the research perspective providing further insights and suggestions for preventing food waste.

The findings of this study suggest various research and intervention implications.

The present work underlined the relevance of personal norms in influencing the intention to not waste food and the different relationships between personal norms and social norms according to age. According to Schwartz [41], personal norms are integrated into one's values. Bamberg [46] and Shi et al. [71] considered personal norms to be the individual internalization of social pressure. Therefore, from a research point of view, the different relationships between social and personal norms across generations calls for a deeper knowledge of how experience, social context, and socialization processes act during personal growth and maturation. Moreover, knowledge about how personal norms form, change, and are activated could be helpful to define which factors to act on at the different growth stages of an individual and for the design of social interventions to promote food waste reduction behaviours.

From an operative perspective, the results of this work provide some suggestions to define interventions aimed at changing FW behaviour. In Generation Z, personal norms are highly explained within the model by environmental concern and social norms. Moreover, environmental concern has a strong effect on social norms and attitude. Therefore, educational programs aimed at increasing knowledge about environmental issues related to food waste and awareness-raising campaigns represent relevant instruments to address young people's behaviours toward preventing food waste and promote sustainable management of food chains. They can affect the social context that conditions younger generations and contribute to forming the personal norms that inspire their actions. Educational campaigns could be less effective as age increases. In young adults, personal norms continue to be a direct predictor of the intention to reduce FW but are more structured, less dependent on the social context, and less explained by TPB constructs. In Generation Y, the role of PBC is higher, and interventions to address intention and behaviours toward reducing FW should mainly increase skills and provide instructions to improve food waste management.

This study has some limitations. Firstly, the sample is not representative. We used a convenience sample based on self-selection, and that implies a self-selection bias. Nevertheless, the results are helpful to provide insights into food waste behaviours across young generations and represent a starting point for further investigations. A second limitation could be related to using the English language in the questionnaire. The survey was aimed to collect data from different countries, even if the present work focused on young Italians. The use of English might have led to misinterpretations of the statements. However, the participants volunteered to be involved; therefore, we expected that only participants who understood English should have answered the questions.

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