**BACHELOR THESIS**

# Understanding sustainable environmental behaviour – the case of household food waste

To which extent does food get wasted in households and what are the possible predictors for this food waste behaviour?

**Marnix Roovers (s1135058)**
**Psychology**

**26-01-2018**

Faculty of Behavioural Sciences
Department Psychology of Conflict Risk & Safety (PCRS)
University of Twente, 7500AE Enschede, The Netherlands

**Supervisors:**
1. **Dr. M.W.M. Kuttschreuter (Department PCRS, University of Twente)**
2. **Dr. Ir. P.W. de Vries (Department PCRS, University of Twente)**

## Abstract

Households in European countries can be held responsible for a large amount of food that gets wasted, because it is not consumed. This waste of food has large impacts on the environment. In order to address this problem, it is important to determine and understand the predictors of consumers' food waste behaviour. A survey was conducted in the Netherlands in order to investigate which determinants could predict the self-reported household food waste. These determinants were predominantly taken from the theory of planned behaviour (TPB) with some additional predictors that can be adopted into the existing model. Household planning habits were also involved as a situational predictor of food waste. For six different food waste categories, the self-reported amounts and frequencies of waste were assessed. The determinants from the TPB, together with the household planning habits proved to explain the amount of food waste rather well. Moreover, it was found that different predictors could explain the food waste among different categories of food. In order to reduce household food waste, interventions should focus on consumers' perceived health risks, their personal attitude and household planning habits.

*Keywords:* food waste, theory of planned behaviour, perceived health risks, personal attitude, household planning habits.

## Samenvatting

Huishoudens in Europese landen kunnen verantwoordelijk worden gehouden voor een grote hoeveelheid van voedselverspilling, omdat het voedsel niet geconsumeerd wordt. Deze verspilling van voedsel heeft grote gevolgen voor de omgeving. Om dit probleem aan te pakken is het belangrijk om de predictoren van voedselverspilling bij de consument te bepalen en te begrijpen. Een onderzoek is uitgevoerd onder Nederlandse consumenten om te begrijpen welke determinanten de zelfgerapporteerde voedselverspilling kunnen verklaren. Deze determinanten zijn voornamelijk ontleend aan de theorie van gepland gedrag (TPB) met enkele additionele predictoren die in het bestaande model geadopteerd kunnen worden. Huishoudelijke plan gewoontes zijn aan het model toegevoegd als een situationele voorspeller van voedselverspilling. Voor zes verschillende voedselcategorieen zijn de zelfgerapporteerde hoeveelheiden en frequenties vastgesteld. De determinanten van de TPB blijken samen met de huishoudelijke plan gewoontes goede voorspellers te zijn voor de mate van voedselverspilling. Bovendien is er ook aangetoond dat verschillende voorspellers de voedselverspilling kon verklaren tussen verschillende voedselcategorieen. Om huishoudelijke voedselverspilling tegen te gaan zouden interventies zich moeten richten op de waargenomen gezondheidsrisico's, persoonlijke attitudes en huishoudelijk plan gedrag.

*Trefwoorden:* voedselverspilling, theory van gepland gedrag, waargenomen gezondheidsrisico's, persoonlijke attitude, houshoudelijke plan gewoontes.

# Table of Contents

# 1 Introduction

The world population keeps growing every single year due to high birth-rate and the increased health expectancies of elder people. This natural growth has implications for the society, as all of these people have the need of the same primary necessity; food. In order to produce the food people need resources such as land, water and energy. It would seem obvious that the population have a collective responsibility to make good use of these resources and to prevent any waste. The food production goes hand in hand with greenhouse gas emission (GHG) that is released in the atmosphere during this process (Tukker & Jansen, 2006; UNEP, 2010). After a number of chains within the distribution process, the food that has been produced by companies eventually reaches the consumers on a household level. When this food does not get consumed, but instead gets discarded, this will result in even more GHG emissions, more use of the previous mentioned resources and a greater change in biodiversity than should be necessary (FAO, 2013).

According to estimations the consumers in Europe and North America are responsible for the discarding the most foods, between 95 and 115 kg per capita per year (FAO, 2011). This is equal to over one third of the total amount of food that is being produced in these countries. It is therefore safe to say that food waste is a significant global problem which should be addressed sooner rather than later. The main focus within this research paper lies on the so-called avoidable food waste, meaning the foods and drinks that get discarded even though they are, or were at some point, still perfectly edible or because they are no longer wanted by the consumers (e.g. meal leftovers, WRAP, 2009). WRAP makes a distinction between two other food waste groups that are not considered within this particular research: possibly avoidable food waste and unavoidable food losses. The possibly avoidable food waste refers to food that gets discarded because some people believe it to be inedible, although the food is still safe to eat, or food that gets eaten in some situations and not in others (e.g. cucumber peels). The unavoidable food losses come from items that are simply inedible (e.g. bones, coffee grounds and banana peels).

The main focus within this research paper will be on the household food waste, as they are responsible for the majority of food waste. There have been numerous studies that have tried to investigate the consumers' perceptions and behaviours in relation to food waste (e.g. Abeliotis, Lasaridi, & Chroni, 2014; Evans, 2001; Graham-Rowe, Jessop, & Sparks, 2014; Quested, Marsh, Stunell, & Parry, 2013; Stefan, van Herpen, Tudoran, & Lähteenmäki, 2013; Visschers et al., 2016). Despite the numerous studies that were previously mentioned, the topic of household food waste has not received much research attention. This is why the aim of the current study is to investigate the possible perceptual and behavioural predictors of food waste in consumers' households. More specifically, this study attempts to determine the amount of food waste for several food categories and the determinants that can be linked to this wasteful behaviour.

## 1.1 Demographic predictors of food waste behaviour

Out of all the demographic predictors, a participants' gender might be the most obvious to look at. A study by Visschers et al. (2016) showed that being female resulted in more waste of food in certain categories (fruits and vegetables, protein and bakery products).

Another frequently mentioned demographic predictor of food waste behaviour is the age of the person that is preparing the food. Quested et al. (2013) found that the older they were, the less food that was wasted. A possible explanation for this phenomenon was older people's experience with periods of time in which food was scarce, in a war, or in periods when food prices were much higher.

Educational levels are another demographic variable to take into account. The previously mentioned research by Visschers et. al (2016) showed that medium and higher levels of education were related to more food waste in the fruits and vegetables category, while a medium educational level was also associated with the waste of more bakery products.

There are numerous studies that have identified certain situational characteristics that can be related to the amount of household food waste. One of these situational characteristics is the size of the household: the larger the household, the more food is being wasted (Koivupuro et al., 2012; Parizeau, von Massow, & Martin, 2015; Van Garde & Woodburn, 1987; Williams, Wikström, Otterbring, Löfgren, & Gustafsson, 2012). Households that included more children produced more food waste (Parizeau et al., 2015; Van Garde & Woodburn, 1987).

## 1.2 Situational predictors of food waste behaviour

Household planning habits have proven to be a relevant factor in regard to household food waste (Visschers et al. 2016). Planning the groceries within a household has been related to the amount of food that is being wasted. It was found that households that would go out shopping less often than other households threw away more food in the end (Williams et al., 2012).

## 1.3 Predictors from the theory of planned behaviour (TPB)

The TPB (Ajzen, 1991) has shown to be a very influential theory in the field of psychology over the years. Klöckner (2013) showed that on average 40% of all published papers in the field of the environmental psychology have used the TPB as theoretical framework of their research. The main focus of the TPB builds upon the assumption that one's behaviour is directly determined by one's intentions. These intentions can be predicted by attitudes, subjective norms, and perceived behavioural control (Ajzen, 1991).

First of all, the attitudes need to be in favour of the target behaviour. This means that a person's intentions to engage in a specific behaviour are increased when they are showing a positive attitude towards this target behaviour. In regard to food waste behaviour, a person's attitude towards food waste should be negative in order to prevent the unnecessary waste of food.

Second, people that can be considered important to the person in question need to have norms and opinions that are in favour of the target behaviour (subjective norms). This means that the person that is responsible for the food waste behaviour is influenced by those that stand close to him/her. When the person in question is strongly influenced by this peer pressure this could have consequences for their wasteful behaviour.

Finally, the person in question needs to feel in control over the target behaviour (i.e. perceived behavioural control). When they feel in control over the target behaviour they can than act towards it. As far as food waste is concerned, when people in a household feel that they have a reasonable amount of control over their food waste behaviour, they should be able to act towards it.

## 1.4 Extended model of the TPB

The original model of the TPB (Ajzen, 1991) as illustrated in the section above includes personal attitude, subjective norms and perceived behavioural control in order to predict intentions towards behaviour. Former research (Yuhni & Heesup, 2010) has shown that the TPB can be an affective theoretical framework to use when addressing environmental issues. This research focused on customers' intention to pay conventional hotel prices for a green hotel. The essence of these green hotels was based on the environmental benefits that could be achieved by reusing towels or using recycled toilet paper. Results of this study show that an extensive model of the TPB can be used to predict consumers' behaviour sufficiently. A psychological construct that the researchers have added to the classical TPB was benefit awareness. This construct proved to be an important factor in customers' decision making. Over the years more (sub-)constructs were added (eg. financial attitudes, personal norms, perceived health risks) to the classic theoretical framework (Ajzen, 2011; Visschers et al., 2016).

For the financial attitude, the amount of money that was being spent on groceries in a household also showed a relation to the amount of food waste. The more money they spent on groceries, the bigger food wasters they proved to be in comparison to households that got a smaller budget (Graham-Rowe et al., 2014; Quested et al., 2013).

Perceived health risks refer to the experience of health concerns that a person may encounter in certain situations. In regard to food waste behaviour, perceived health risks could prove to be an important factor for consumers to show wasteful behaviour.

Personal norms refer to the moral awareness of people in regard to a situation (Quested et al., 2013). Respondents from the study of Visschers et al. (2016) reported feeling guilty after throwing food away.

## 1.5 Categories of food waste

This study built largely upon a study from Visschers et al. (2016) who have conducted a very similar, though more extensive research among participants in Switzerland. Their aim was to investigate which determinants could be held responsible for the self-reported amount of food waste among different categories. The TPB (Ajzen, 1991) was their prominent theoretical framework. They found that different predictors were responsible for waste in different food categories and that one of the most obvious ways to reduce food waste in households was to develop interventions that focused on the increase of consumers' perceived behavioural control. These food categories were examined using demographic predictors, situational predictors and predictors from the TPB (Ajzen, 1991). As this research focuses largely upon the constructs from the TPB, highlights in the different food categories below are made for the psychological construct that are related to the TPB (Visschers et al., 2016).

Fruits and vegetables were shown to be discarded very often. Perceived behavioural control, intention to avoid food waste and financial attitude were three statistically significant negative predictors of household food waste within this category, indicating that the higher the score within each of these constructs went the less food waste would occur.

Protein (meat and fish) was one of the food waste categories in which very little waste was reported. Two important statistically significant negative predictors of food waste were perceived behavioural control and the intention to avoid food waste. Moreover, perceived health risks were a positive statistically significant predictor for the food waste within this category, implicating that when participants experienced any health concerns in regard to protein, they would show a tendency to waste food in this category.

Bakery products was the food category with the most average waste per household. As in most of the other categories, perceived health risks and the intention to avoid food waste were statistically significant negative predictors of food waste within this category.

Ready-to-eat products were reported to be the category in which the least amount of food waste occurred. Just one statistically significant negative predictor of food waste can be seen here, namely perceived behavioural control. This negative tendency implicates that when a person feels more in control of the target behaviour the food waste will decline.

The starches category (potatoes, rice, pasta and corn) did not show a lot of food waste either and there were two prominent statistically significant negative predictors for food waste in this category: perceived behavioural control and intention to avoid food waste.

Dairy products showed about the same amount of food waste per household as starches. Similarly, perceived behavioural control and intention to avoid food waste were also statistically significant negative predictors for food waste in this category.

## 1.6 Current study

The aim of this study is to investigate possible predictors of food waste behaviour for different food categories among the Dutch population. A comparison will be made between demographic, situational and TPB predictors. The demographic predictors taken into consideration here are gender, age, educational level, and household composition. The situational predictor is the household planning habits, and the TPB (Ajzen, 1991; Visschers et al., 2016) predictors are personal attitudes, personal norms, subjective norms, financial attitudes, perceived health risks, perceived behavioural control and intention to avoid food waste. The goal is to find possible significant psychological constructs in regard to food waste behaviour for the different categories of food, in order to get a good idea of what constructs possible future interventions can focus on to help reduce the problem of food waste.

# 2 Method

## 2.1 Research design

A cross-sectional survey was conducted where participants were gathered through snowball sampling. Participants took part in a single-session online survey where they were asked questions regarding household food waste. The nature of this research was correlational as it studied the relationship between a number of quantifiable variables and self-reported food waste amongst households. The quantifiable variables that were used in this study were age, gender, educational level, composition of household, personal attitude, personal norms, subjective norms, household planning habits, financial attitude, perceived health risks, perceived behavioural control and the intention to avoid food waste. Moreover, the household food waste was measured using a self-reported food waste scale.

## 2.2 Participants

Between November and December 2017, the participants in this study were gathered through snowball sampling. There were 108 recorded responses after this time period. After deleting 10 cases with missing values, 98 cases remained for analysis purposes. This total of 98 participants have fully completed the single session online survey (43% male, 57% female). The participants' age ranged between 17 and 73 years ($M$ = 40.92, $SD$ = 14.93). Only 2% ($n$ = 2) of the participants reported their highest education level to be primary school. Secondary school showed a total of 5.1% ($n$ = 5). Middle professional education had 22 cases, which corresponds to 22.4%. Higher professional education was the most prominent level of education amongst the participants in this study with 45.9% ($n$ = 45). University showed 24.5% of all cases ($n$ = 24).

## 2.3 Instruments

### *2.3.1 Demographic variables*

The demographic questions included gender (male/female), as former research suggested that gender might be a moderating variable in food waste (Visschers et al., 2016), age (minimum age 16), composition of participants' household (number of adults/children in the household) and their highest education level (primary school, secondary school, middle professional education, higher professional education, university).

### *2.3.2 Household food waste*

In this study the household food waste was the dependent variable. The concept of food waste per household was measured by using a self-reported food waste scale that was derived from Visschers et al. (2016). The self-reported food waste scale consisted of six different food groups (fruits & vegetables, proteins, bakery, ready-to-eat products, starches and dairy). The self-reported amount and frequency of the participants' estimated food waste in their household was recorded (see Appendix B, Table 10) and recoded in such a way that there would be a distinct score for the household food waste in each of the six different food groups. An example of a self-reported food waste question was: "How often do fruits and vegetables get discarded in your household?" Participants had six options to choose from,

ranging from 6-7 times a week to less/never, where the following recoding scheme was used: 6-7 times per week (recoded as 6.5 times), 3-5 times per week (recoded as 4), 1-2 times per week (recoded as 1.5), 2-3 times per month (recoded as 0.625), about once per month (recoded as 0.25) and less often or never (recoded as 0.1). After the frequency was recorded, the participants were asked the estimate amount that was being wasted in their household for this specific food category. There were four options for the amount of household food waste; more than three portions (recoded as 4), 2-3 portions (recoded as 2.5), 1 portion and ½ portion and less/nothing (recoded as 0). The recoded frequency was then multiplied by the recoded amount of food waste per category in order to create a distinctive score.

### *2.3.3 Predictors from the extended version of the TPB and situational predictors*

The possible predictors for the food waste behaviour that have been derived from the extended version of the TPB (Ajzen, 1991; Visschers et. al, 2016) were recorded on a 7-point Likert scale, where a higher value meant a stronger agreement with the statement (1= strongly disagree to 7= strongly agree). These variables consisted of eight constructs with three items each (see Appendix, Table 9). Some of these items were reverse coded and therefore recoded in SPSS. These questions consisted of 3 items for each of the eight constructs.

*Personal attitude* (Cronbach's α = .73, *n* = 3, *M* = 5.45, *SD* = 1.22) included questions about the participants attitude towards food waste. An example of a question within this construct was: "It is unnecessary to waste food: it can always be used in some way.

*Subjective norms* (Cronbach's α = .63, *n* = 3, *M* = 5.32, *SD* = 1.06) refers to the opinions of significant others in regard to food waste. An example of a question within this construct was: "People who are important to me find my attempts to reduce the amount of food waste unnecessary".

*Perceived behavioural control* (Cronbach's α = .52, *n* = 3, *M* = 5.19, *SD* = 1.08) included questions that could determine whether or not participants felt that they were in control of their behaviour regarding food waste. An example of a question from the perceived behavioural control was: "I find it difficult to make sure that only small amounts of food are discarded in my household". Because the Cronbach's α for this construct was below average an additional measurement for internal reliability was conducted using Guttmann's lambda. This resulted in the exact same outcome of .52 which is still below average. It is however decided to still include the perceived behavioural control as a construct for further analysis.

*Intention to avoid food waste* (Cronbach's α = .72, *n* = 3, *M* = 5.99, *SD* = 0.99) looked at the participants' intentions to avoid wasteful behaviour. An example of a question was: "I always try to eat all purchased foods".

*Financial attitude* (Cronbach's α = .45, *n* = 3, *M* = 4.98, *SD* = 1.07) included questions about the financial aspect as a possible determinant for food waste behaviour. "I think that wasting food is a waste of money", was an example question within this construct. Because the Cronbach's α for this construct was below average an additional measurement for internal reliability was conducted using Guttmann's lambda. This resulted in a slightly higher outcome of .48 which is still below average. It is however decided to still include the financial attitude for further analysis.

*Perceived health risks* (Cronbach's α = .72, *n* = 3, *M* = 3.58, *SD* = 1.47) includes questions that refer to the participants' experienced health concerns in regard to food waste. An example of a question within this construct was: "I believe that wasting food is a waste of money".
*Personal norms* (Cronbach's α = .80, *n* = 3, *M* = 5.48, *SD* = 1.26) looked at the participants' feel of guilt in reference to food waste behaviour. "I feel bad when I throw away food", was an example question within this psychological construct.
*Household planning habits* (Cronbach's α = .70, *n* = 3, *M* = 4.85, *SD* = 1.19) included questions about participants' planning behaviour. An example question in this category was: "I always plan the meals in my household ahead and I keep to this plan".

## 2.4 Procedure

Participants in this study volunteered to cooperate and fill out a short survey regarding food waste in households. Firstly, participants were welcomed and thanked in advance for their participation in the study. They were told to take their time and read the instructions that were given carefully. An informed consent was implemented in the online survey which stated that the participants agreed to participate out of their own free will and they reserve the right to withdraw from the study at any time. It was also stressed that the participants' data would be processed anonymously. Participants also had the option to note the email address of the researcher if they wished to contact him at any point.

The first instruction that was given to the participants stated that they were asked to fill out some demographic questions. After these questions they would see a number of statements regarding food waste and that they were kindly asked to respond to these questions. The participants were then informed that if they had any questions prior to the survey they could contact the researcher. When they have read the instructions and had no questions they were asked for a digital autograph and they could advance to the questions.

The next instruction stated that the participants would have to answer a number of questions regarding household food waste. They were notified of a common definition of food waste in order to make sure that every participant understood the type of food waste that is targeted in this research, namely the avoidable food waste; discarding of food that is still actually perfectly edible.

Participants would then start answering a total of 24 questions regarding household food waste on the 7-point Likert scale.

Next, participants were instructed that they would receive a set of 12 questions regarding the frequency along with the amount of household food waste for 6 different kinds of food types. Again they were instructed that the targeted food waste behaviour was avoidable food waste and that 1 portion equalled a handful of food. They were instructed to give estimates for their entire household. During the entire survey a progress bar was visible so the participants could see their progression throughout the session. After the participants had completed the survey they were notified that their data was stored successfully. Again they were kindly thanked for their participation in the research and the e-mail address of the researcher was provided again so that they could contact the researcher if they had any questions.

## 2.5 Analysis

The data was gathered via Qualtrics, an online application. For all analyses SPSS version 24 was used. The internal reliabilities of the intention to avoid food waste, personal and financial attitudes, personal and subjective norms, perceived health risks, perceived behavioural control and household planning habits were analysed using Cronbach's α. Means and standard deviations will be calculated for every variable. Pearson's correlation coefficients will be calculated between every variable used in this research. T-tests are run to see if there is any significant difference between men and women in regard to food waste. A hierarchical linear regression was then used to determine how the TPB can predict self-reported household food waste. At the first level for the hierarchical regression the respondents' age, gender, educational level and the composition of the household were entered as possible predictors for the household food waste. The second level for the hierarchical regression included the possible predictors from the extended model of the TPB (Ajzen, 1991; Visschers et al., 2016) as well as the household planning habits (Visschers et al., 2016; Williams et al., 2012).

# 3 Results

## 3.1 Descriptives

Fruits and vegetables, bakery and starches were food categories that showed the most waste of food, whereas protein, ready-to-eat products and dairy products were discarded less often (Table 1). Respondents' intention to avoid food waste proved to be quite high ($M$ = 5.99, $SD$ = 0.99, on 7-point Likert scale). The personal attitudes towards food waste were rather high as well ($M$ = *5.45*, $SD$ = 1.22), indicating that the respondents had negative attitudes towards food waste behaviour. Both the personal and subjective norms showed an opposing tendency towards food waste behaviour ($M$ = 5.48, $SD$ = 1.26 and $M$ = 5.32, $SD$ = 1.06, respectively). The perceived behavioural control ($M$ = 5.19, $SD$ = 1.08) indicates that the respondents showed a high level of control over the waste of food in their households. Financial attitudes were not particularly high in the sample ($M$ = 4.98, $SD$ = 1.07). Moreover, the perceived health risks of the participants was rather average ($M$ = 3.58, $SD$ = 1.47) and the household planning habits ($M$ = 4.85, $SD$ = 1.19) indicates that they were not over actively planning their groceries.

Table 1.
*Means (M), standard deviations (SD), and Pearson's rank correlations between the variables*

| | Variables | *M* | *SD* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | FW total | 4.05 | 3.73 | | | | | | | | | | | | | | | | | |
| 2 | FW fruits & vegetables | 0.97 | 1.10 | .58** | | | | | | | | | | | | | | | | |
| 3 | FW proteins | 0.21 | 0.49 | .34** | .39** | | | | | | | | | | | | | | | |
| 4 | FW bakery | 1.10 | 1.87 | .76** | .18 | .12 | | | | | | | | | | | | | | |
| 5 | FW ready-to-eat | 0.31 | 0.54 | .38** | .12 | .17 | .11 | | | | | | | | | | | | | |
| 6 | FW starches | 1.04 | 1.43 | .67** | .24* | .03 | .30** | .28** | | | | | | | | | | | | |
| 7 | FW dairy | 0.42 | 0.79 | .42** | .13 | -.04 | .28** | .05 | .08 | | | | | | | | | | | |
| 8 | Age | 40.92 | 14.93 | -.20 | -.01 | -.10 | -.08 | -.16 | -.21* | -.16 | | | | | | | | | | |
| 9 | Educational level | 3.86 | 0.92 | .13 | .12 | .13 | .06 | -.06 | .14 | .02 | -.01 | | | | | | | | | |
| 10 | Members in household | 2.85 | 1.36 | .09 | -.11 | .07 | .09 | .06 | .15 | -.01 | -.04 | .06 | | | | | | | | |
| 11 | Personal attitude | 5.45 | 1.22 | -.26* | -.23* | -.25* | -.21* | -.02 | .03 | -.28** | .22* | -.06 | -.02 | | | | | | | |
| 12 | Subjective norms | 5.32 | 1.06 | -.03 | -.20* | -.14 | .01 | -.11 | .28** | -.22* | -.10 | -.02 | .05 | .26** | | | | | | |
| 13 | Perceived behavioural control | 5.19 | 1.08 | -.16 | -.22* | -.32** | -.14 | -.10 | .15 | -.13 | -.01 | -.08 | -.04 | .39** | .45** | | | | | |
| 14 | Intention to avoid food waste | 5.99 | 0.99 | -.28** | -.32** | -.44** | -.19 | -.22* | .11 | -.19 | .24* | -.09 | -.05 | .70** | .43** | .43** | | | | |
| 15 | Financial attitude | 4.98 | 1.07 | -.09 | -.08 | -.17 | -.16 | -.03 | .04 | .12 | .02 | -.10 | .01 | .24* | -.06 | .23* | .26** | | | |
| 16 | Perceived health risks | 3.58 | 1.47 | .35** | .18 | .29** | .11 | .24* | .29** | .26** | -.37** | -.03 | -.09 | -.09 | .14 | .03 | -.07 | .08 | | |
| 17 | Personal norms | 5.48 | 1.26 | -.10 | -.17 | -.31** | -.05 | -.06 | .15 | -.15 | .22* | -.03 | .02 | .76** | .30** | .33** | .74** | .24* | .01 | |
| 18 | Household planning habits | 4.85 | 1.19 | -.21* | -.24* | -.39** | -.19 | -.06 | .10 | -.14 | .14 | -.10 | -.09 | .64** | .17 | .35** | .64** | .41** | .03 | .58** |

Note. *** $p < .001$, ** $p < .01$; * $p < .05$. $N = 98$ (2-tailed)

Pearson's R correlations (Table 1) show that there are numerous significant correlations between the variables.

On a first level the correlations between all of the dependent variables (food waste) can be seen. Because the total food waste is a sum score of all the different food waste categories we see significant correlations between each category and the total amount of food waste. Moreover, food waste in the starches and protein category show significant correlations with the food waste of fruits and vegetables ($r = .39$, $p < .01$ and $r = .24$, $p < .05$, respectively). Food waste in the bakery category shows significant correlations with the food waste category of starches and dairy ($r = .30$, $p < .01$ and $r = .28$, $p < .01$, respectively). Food waste in the ready-to-eat category also shows significant positive correlation with food waste in the starches category ($r = .28$, $p < .01$).

On a second level the correlations between all the different food waste categories can be seen with the demographic variables. Only one statistically significant negative correlation can be seen between age and the food waste category of starches ($r = -.21$, $p < .05$).

On a third level the correlations between all the different food waste categories can be seen with the psychological constructs. Personal attitude shows a significant negative correlation with the food waste of fruits and vegetables ($r = -.23$, $p < .05$), the food waste of proteins ($r = -.25$, $p < .05$), bakery ($r = -.21$, $p < .05$) and dairy ($r = -.28$, $p < .01$). Subjective norms correlates significantly negative with the food waste categories fruit and vegetables and dairy ($r = -.20$, $p < .05$ and $r = -22$, $p < .05$, respectively) and a significant positive correlation with the food waste category of starches ($r = .28$, $p < .01$). Perceived behavioural control shows a negative correlation with two out of the six food waste categories, fruit and vegetables ($r = -.22$, $p < .05$) and protein ($r = -.32$, $p < .01$). The intention to avoid food waste shows statistically significant negative correlations with three out of six food categories, fruits and vegetables, protein and ready-to-eat products ($r = -.32$, $p < .01$, $r = -.44$, $p < .01$ and $r = -.22$, $p < .05$, respectively). Financial attitudes show no significant correlations with any food category. The perceived health risks show a positive correlation with four out of the six food waste categories. This illustrates that when the participants feel that there is a low health risk then will tend to waste less food in these categories. On the other hand when the participants feel that there is a high health risk they will tend to waste more food in these categories, due to the fact that they perceive the risk of becoming ill by these foods. This goes for protein ($r = .29$, $p < .05$), ready-to-eat products ($r = .24$, $p < .05$), starches ($r = .29$, $p < .01$) and dairy ($r = .26$, $p < .01$). Personal norms and household planning habits both only show one significant negative correlation with the same food waste category, protein ($r = -.31$, $p < .01$ and $r = -.39$, $p < .01$, respectively).

Moreover, an interesting finding is the way in which the intention to avoid food waste correlates positively with the three main constructs from the TPB (Ajzen, 1991), personal attitude ($r = .70$, $p < .01$), subjective norms ($r = .43$, $p < .01$) and perceived behavioural control ($r = .43$, $p < .01$).

Means and standard deviations were calculated for all the variables between men and women, because former research has found differences between genders in terms of wasteful behaviour (Visschers et al., 2016). T-tests showed no significant differences between these two groups (Table 2), so this will not be taken into further consideration.

Table 2.

*Means, SDs and t-tests of difference for men and women, N = 98.*

| | Men | | Women | | Difference | | |
|---|---|---|---|---|---|---|---|
| Variable | *M* | *SD* | *M* | *SD* | *t* | *df* | *p* |
| Age | 36.38 | 13.18 | 44.32 | 15.37 | -0.95 | 96 | .34 |
| Educational level | 3.90 | 0.93 | 3.82 | 0.92 | -0.18 | 96 | .85 |
| Members in household | 2.67 | 1.48 | 2.98 | 1.26 | -0.55 | 96 | .59 |
| Personal attitude | 5.31 | 1.27 | 5.55 | 1.18 | -1.40 | 96 | .16 |
| Personal norms | 5.45 | 1.33 | 5.50 | 1.21 | 1.74 | 96 | .09 |
| Subjective norms | 5.44 | 0.98 | 5.23 | 1.12 | 0.53 | 96 | .60 |
| Household planning habits | 4.78 | 1.14 | 4.91 | 1.23 | 0.46 | 96 | .65 |
| Financial attitude | 4.80 | 0.89 | 5.11 | 1.18 | -0.50 | 96 | .62 |
| Perceived health risks | 3.87 | 1.30 | 3.36 | 1.55 | -0.34 | 96 | .74 |
| Perceived behavioural control | 5.25 | 1.00 | 5.14 | 1.14 | 1.23 | 96 | .22 |
| Intention to avoid food waste | 6.04 | 1.02 | 5.95 | 0.97 | 0.11 | 96 | .91 |
| Food waste Fruit & vegetables | 0.91 | 0.92 | 1.02 | 1.22 | -0.39 | 96 | .70 |
| Food waste Protein | 0.19 | 0.29 | 0.23 | 0.61 | -0.69 | 96 | .49 |
| Food waste Bakery | 1.37 | 2.52 | 0.90 | 1.17 | -0.95 | 96 | .34 |
| Food waste Ready-to-eat | 0.32 | 0.41 | 0.30 | 0.63 | -0.18 | 96 | .85 |
| Food waste Starches | 0.98 | 0.99 | 1.09 | 1.70 | 0.94 | 96 | .35 |
| Food waste Dairy | 0.35 | 0.63 | 0.46 | 0.89 | -0.55 | 96 | .59 |

Note. $^{***}$ $p < .001$, $^{**}$ $p < .01$; $^{*}$ $p < .05$.

## 3.2 Food waste predicted by demographics and predictors from the TPB

### *3.2.1 Food waste: Fruits and vegetables*

The hierarchical regression analysis for demographic, situational and TPB predictors of food waste in the fruits and vegetables category (Table 3) showed no significance for model 1 and model 2 showed a trend towards significance. However, it did show that model 2 contains statistically significant more explanatory value than model 1 ($F_{(8,85)} = 2.06$, $p < .05$ , $R^2$ change = .16). Perceived health risks showed a trend towards significance as a positive predictor ($\beta = .22$, $p < .05$) for fruits and vegetables. The higher the perceived health risks tend to be for this category, the higher the food waste.

Table 1.

*Hierarchical regression analysis for demographic, situational and TPB predictors of food waste for fruits & vegetables.*

| | Food Waste (Fruits & Vegetables) | |
|---|---|---|
| | 1 | 2 |
| | β | β |
| Gender | .08 | .07 |
| Age | -.03 | .10 |
| Educational level | .13 | .10 |
| Members in household | -.12 | -.12 |
| Personal attitude | | -.04 |
| Subjective norms | | -.08 |
| Perceived behavioural control | | -.06 |
| Intention to avoid food waste | | -.26 |
| Financial attitude | | .00 |
| Perceived health risks | | $.22^{+}$ |
| Personal norms | | .14 |
| Household planning habits | | -.12 |
| $R^2$ | .03 | $.19^{+}$ |
| $R^2$ change | .03 | $.16^{*}$ |

Note. $^{***}$ $p < .001$, $^{**}$ $p < .01$, $^{*}$ $p < .05$, $^{+}$ $p < .10$. $N = 98$

### *3.2.2 Food waste: Protein*

The hierarchical regression analysis for demographic, situational and TPB predictors of food waste in the protein category (Table 4) showed no significance for the demographic predictors from model 1. It can however be seen that model 2 contains statistically significant more explanatory value than model 1 ($F_{(8,85)} = 5.66$, $p < .001$, $R^2$ change = .34). Personal attitude is a statistically significant predictor of food waste ($\beta = .32$, $p < .05$) as well as perceived health risks ($\beta = .36$, $p < .001$), while household planning habits were a negative predictor ($\beta = -.26$, $p < .05$), the latter indicates that the more the people are planning their groceries the less protein they will waste.

Table 2.

*Hierarchical regression analysis for demographic, situational and TPB predictors of food waste for protein.*

| | Food Waste (Protein) | |
|---|---|---|
| | 1 | 2 |
| | β | β |
| Gender | .06 | .03 |
| Age | -.11 | .10 |
| Educational level | .13 | .09 |
| Members in household | .05 | .06 |
| Personal attitude | | .32* |
| Subjective norms | | .04 |
| Perceived behavioural control | | -.19+ |
| Intention to avoid food waste | | -.31+ |
| Financial attitude | | -.01 |
| Perceived health risks | | .36*** |
| Personal norms | | -.15 |
| Household planning habits | | -.26* |
| $R^2$ | .03 | .37*** |
| $R^2$ change | .03 | .34*** |

Note. *** $p < .001$, ** $p < .01$, * $p < .05$, + $p < .10$. $N = 98$

### *3.2.3 Food waste: Bakery*

The food waste category bakery (Table 5) showed no statistically significant predictors for model 1 and model 2 according to the hierarchical regression analysis. The hierarchical regression analysis for demographic, situational and TPB predictors of food waste in the bakery category showed no statistically significant explanatory value when comparing both models and therefore the significant findings within model 2 have to be seen as non-significant. However a trend towards significance can be found for personal norms (β = .34, $p < .10$) within model 2.

Table 3.

*Hierarchical regression analysis for demographic, situational and TPB predictors of food waste in the bakery category*

| | Food Waste (Bakery) | |
|---|---|---|
| | 1 | 2 |
| | β | β |
| Gender | -.12 | -.10 |
| Age | -.05 | .02 |
| Educational level | .04 | .01 |
| Members in household | .10 | .07 |
| Personal attitude | | -.25 |
| Subjective norms | | .09 |
| Perceived behavioural control | | -.06 |
| Intention to avoid food waste | | -.25 |
| Financial attitude | | -.08 |
| Perceived health risks | | .06 |
| Personal norms | | .34$^{+}$ |
| Household planning habits | | -.01 |
| $R^2$ | .03 | .13 |
| $R^2$ change | .03 | .10 |

Note. $^{***}$ $p < .001$, $^{**}$ $p < .01$, $^{*}$ $p < .05$, $^{+}$ $p < .10$. $N = 98$

### *3.2.4 Food waste: Ready-to-eat products*

The food waste category ready-to-eat products (Table 6) showed no statistically significant predictors for model 1 and model 2. The hierarchical regression analysis for demographic, situational and TPB predictors of food waste in the ready-to-eat category showed no statistically significant explanatory value when comparing both models and therefore the significant findings within model 2 have to be seen as non-significant. However, a trend can be seen for perceived health risks ($\beta = .22$, $p < .10$) and the intention to avoid food waste was a negative predictor of food waste in this category ($\beta = -.38$, $p < .05$).

Table 4.

*Hierarchical regression analysis for demographic, situational and TPB predictors of food waste in the ready-to-eat category*

| | Food Waste (Ready-to-eat products) | |
|---|---|---|
| | 1 | 2 |
| | *β* | *β* |
| Gender | .02 | -.02 |
| Age | -.16 | -.05 |
| Educational level | -.07 | -.08 |
| Members in household | .05 | .07 |
| Personal attitude | | .24 |
| Subjective norms | | -.06 |
| Perceived behavioural control | | -.04 |
| Intention to avoid food waste | | -.38* |
| Financial attitude | | -.03 |
| Perceived health risks | | .22+ |
| Personal norms | | .07 |
| Household planning habits | | .04 |
| $R^2$ | .03 | .16 |
| $R^2$ change | .03 | .12 |

Note. *** $p < .001$, ** $p < .01$, * $p < .05$, + $p < .10$. $N = 98$

### *3.2.5 Food waste: Starches (potatoes, rice, pasta and corn)*

The hierarchical regression analysis for demographic, situational and TPB predictors of food waste in the starches category (Table 7) showed that model 1 includes one negative statistically significant predictor (β = -.23, $p < .05$) for age. Moreover, model 2 contains statistically significant more explanatory value than model 1 ($F_{(8,85)} = 2.23$, $p < .05$ , $R^2$ change = .16). Perceived health risks was a positive predictor (β = .23, $p < .05$), indicating that the higher the perceived health risks, the higher the food waste in this category.

Table 5.

*Hierarchical regression analysis for demographic, situational and TPB predictors of food waste in the starches category*

| | Food Waste (Starches) | |
|---|---|---|
| | 1 | 2 |
| | β | β |
| Gender | .09 | .15 |
| Age | -.23* | -.15 |
| Educational level | .13 | .16 |
| Members in household | .13 | .13 |
| Personal attitude | | -.24 |
| Subjective norms | | .19 |
| Perceived behavioural control | | .06 |
| Intention to avoid food waste | | .04 |
| Financial attitude | | -.03 |
| Perceived health risks | | .23* |
| Personal norms | | .20 |
| Household planning habits | | .10 |
| $R^2$ | .09 | .25* |
| $R^2$ change | .09 | .16* |

Note. *** $p < .001$, ** $p < .01$, * $p < .05$, + $p < .10$. $N = 98$

### *3.2.6 Food waste: Dairy (product made of or containing milk)*

The hierarchical regression analysis for demographic, situational and TPB predictors of food waste in the dairy category (Table 8) showed that model 2 contains statistically significant more explanatory value than model 1 ($F_{(8,85)} = 2.53$, $p < .05$ , $R^2$ change = .18). Personal attitude is a statistically significant negative predictor of food waste ($\beta = -.37$, $p < .05$), while perceived health risks was a positive predictor ($\beta = .25$, $p < .05$). The higher the personal attitude, the lower the food waste, while the higher the perceived health risks, the higher the food waste.

Table 6.

*Hierarchical regression analysis for demographic, situational and TPB predictors of food waste in the dairy category*

| | Food Waste (Dairy) | |
|---|---|---|
| | 1 | 2 |
| | β | β |
| Gender | .13 | .15 |
| Age | -.20 | -.11 |
| Educational level | .02 | .03 |
| Members in household | -.04 | -.01 |
| Personal attitude | | -.37* |
| Subjective norms | | -.24 |
| Perceived behavioural control | | .02 |
| Intention to avoid food waste | | .14 |
| Financial attitude | | .12 |
| Perceived health risks | | .25* |
| Personal norms | | .13 |
| Household planning habits | | -.08 |
| $R^2$ | .04 | .23* |
| $R^2$ change | .04 | .18* |

Note. *** $p < .001$, ** $p < .01$, * $p < .05$, + $p < .10$. $N = 98$

## 3.3 Summary of results

Overall, the hierarchical regression analysis for demographic, situational and TPB predictors of food waste in the six different food waste categories showed that model 2 contains statistically significant more explanatory value than model 1for four out the six food groups (fruits and vegetables, protein, starches and dairy).

Perceived health risks was determined three times to be a statistically significant (or a trend towards significance) positive predictor of food waste. Personal attitude occurred twice (a positive predictor for food waste in the protein category and as a negative predictor for food waste in the dairy category), while perceived behavioural control and the intention to avoid food waste occurred once as negative predictor of food waste, however not statistically significant, but as a trend towards significance. Household planning habits have proven to be a statistically significant negative predictor of food waste just once.

The food waste category protein showed the most (five) predictors, two of which being trends. Fruits and vegetables showed only one positive predictor and the same goes for the starches category (perceived health risks in both cases). The dairy food waste category showed two predictors, one negative (personal attitude) and one positive (perceived health risks).

Two of the six food categories, bakery and ready-to-eat products were not predictable through demographic variables, constructs from the TPB or household planning habits, because they were not statistically significant according to model 2. Moreover, financial attitude, personal and subjective norms were no significant predictors of food waste behaviour in any of the food waste categories.

# 4 Discussion

### *4.1.1 Predictors of food waste behaviour*

The study at hand investigated possible predictors of food waste behaviour for different categories of food. The TPB (Ajzen, 1991) would suggest that one's behaviour is directly determined by one's intentions and that these intentions in their turn can be predicted by constructs such as attitudes, subjective norms, and perceived behavioural. Moreover, financial attitude, perceived health control and personal norms are constructs which can predict intention towards behaviour (Visschers et al., 2016).

Personal attitudes showed high values for this construct meaning that the participants had a negative attitude towards food waste behaviour. It would be expected that the higher the score on this particular construct was, the lower the actual food waste would be. However, there was a contradiction found for this construct when the hierarchical linear regression was performed. For the food waste category of protein, personal attitude proved to be a positive predictor of food waste in this category, whilst in the diary category personal attitude proved to be a negative predictor. The theory of planned behaviour (Ajzen, 1991) would have suggested that in this case personal attitude should have been a negative predictor for food waste (as is the case in the dairy category in this study), because a high negative attitude would implicate less food waste. It is possible that some of the participants may have experienced a conflict between their personal attitudes and their perceived health risks regarding food waste. Their personal attitudes can be strongly against the waste of food, but if their perceived health risks are high, they still may end up wasting food (Evans, 2011).

Perceived health risks were the most viable predictor for the amount of food waste among the different food categories. Perceived health risks were statistically significant positive predictors in three out of the six food waste categories (protein, starches and dairy) and a trend was seen for fruits and vegetables. The fact that these health concerns were more likely to increase the waste of food in the categories mentioned above probably has to do with the knowledge that people may possess about the consumption of these foods once they are spoilt. Associations with animal-related microbiological risks such as Salmonella and Escherichia coli (Bearth, Cousin, & Siegrist, 2014; Visschers et al., 2016) may be formed and people might discard these foods more rapidly than other foods to prevent them from becoming ill.

The food waste category protein was the most predictable dependent variable with five predictors in total, two of those being trends towards significance. Personal attitude and perceived health risks both were statistically significant positive predictors of food waste behaviour in this category. The finding that the protein category was the most predictable dependent variable should not be surprising, as this was the food waste category in which respondents reported the least amount of waste. Household planning habits were a statistically significant negative predictor of food waste behaviour in the protein category. Perceived behavioural control and intention towards food waste both showed trends towards significance as negative predictors of food waste behaviour.

Two food categories (bakery and ready-to-eat) were not predicted by any variable through the model of the hierarchical regression analysis. As bakery was the food waste

category with the highest amount of self-reported waste, this high variance could explain the fact that this food group does not show any statistically significant predictors.

### *4.1.2 Limitations*

In this study the amount of food waste per household was established through self-report measurement, due to time efficiency. Other, more objective methods have been considered, but they were simply too much work. It is however possible that participants in the study would not have known the exact amount and frequencies of the food that was reported to have been wasted, because this behaviour is fairly unimportant in daily life and not much conscious attention is given to this behaviour normally (Kormos & Gifford, 2014; Visschers et al., 2016).

Moreover, the possibility exists that the participants have reported smaller amounts and lower frequencies than were actually true, because they would have known that the researcher cannot verify their report of waste. On the other hand, the participants have been guaranteed through the informed consent that any collected data would be processed completely anonymous, which should reduce the amount of social desirable answers. Nevertheless, a more objective way to assess the overall avoidable food waste should still be preferred above a self-reported measurement scale.

The limited number of items per constructs might be another important aspect to look at. The internal reliability scales were calculated with Cronbach's α. This resulted in two below average scores on two out of the eight psychological constructs. The scores on the financial attitudes and the perceived behavioural control showed to have insufficient internal reliability. Guttmann's lambda might have been a better alternative in this situation, because this reliability scale is less susceptive to a small number of items per construct. However, the Guttmann's lambda did not provide a satisfactory solution for the internal reliability for the two previously mention constructs. It is therefore possible that more items per construct would have created a much higher internal reliability.

Moreover, the self-reported food waste scale (i.e. in frequency and amount per food category) had a different format than the items from the psychological constructs (i.e. 7-point Likert scales), which might have caused confusion among participants.

Throughout the years the TPB has received some criticism in general. It was often said that the TPB could not explain behaviour satisfactorily and that other factors should be added to the theory as predictors of behaviour (Conner, 2014; Sniehotta et al., 2014; Visschers et al., 2016). Therefore, it might be a reason to look at a more comprehensive model to predict food waste behaviour. As Yuhni & Heesup (2010) have shown in their research on the modification of the TPB, it can prove to be fruitful to add constructs to the TPB. They have added the benefit awareness to the model, which proved to be an important predictor in the customer decision-making process.

### *4.1.3 Implications for food waste reduction*

This research report focused on the psychological constructs from a more extended version of the TPB (Ajzen, 1991; Visschers et al., 2016). Findings within this research can be transformed to implications for the reduction of the amount of household food waste and, consequently, to decrease the environmental impact.

First, since the perceived health risks showed the most predictive value within this research as this was a positive statistically significant predictor of food waste for three out of the six different food categories that were included and a trend towards significance for another food category, consumers should be made aware of the possible risks certain types of food can bring along. Moreover, the expiration dates on products should not automatically be linked to the fact that the product cannot be consumed once it has expired. Consumers should be trained to use their senses (eg. seeing, smelling) to determine whether a product brings possible health risks. Workshops can be organised around shopping areas, where consumers can be educated by professionals in the field of food storage. They should emphasise the differences among certain food categories in terms of health risks. Dairy products are a perfect example of a highly perishable food category. When a container of milk (dairy product) has past the expiration date, consumers should not immediately discard the product, but instead smell if the milk does not have a certain smell which implicates that milk is no longer fresh for consumption.

Additionally, governments should always try to address consumers' personal attitudes towards food waste behaviour. Results from this study show that psychological construct of personal attitudes was a significant predictor for food waste behaviour in two occasions. The consumer should be made aware of the environmental impact of food waste in order to help tackle this issue. This can be achieved through billboards or television commercials where the consumer can get a clear view of what consequences food waste can have on the environment.

Moreover, the analyses within this research showed that it might be worth focusing on different predictors for different food categories. For example, for protein (meat and fish), it might be more effective to focus on the possible health risks, because this is a perishable food category, whereas for dairy products the personal attitudes seems to be the predictor for the food wasted in this category and therefore these personal attitudes should try to be altered in such a way that they show negative tendency towards food waste (Bearth, Cousin, & Siegrist, 2014; Visschers et al., 2016).

### *4.1.4 Future research*

In the light of this research there are some recommendations that can be made for future research. A more objective way of measuring food waste is most highly recommended within future research, because this eliminates the possibility of participants to give social desirable answers through self-reported amount and frequencies of food waste.

Moreover, a stronger emphasis on the different predictors among different food categories can be made. When more research is performed, meta-analysis could determine specific predictors for different food categories in order to start with interventions that can help contribute to the environmental impact food waste has on the society.

Future research can also build upon findings from this correlational study through more progressive and extensive research methods. As certain predictors such as household planning habits, perceived health risks and personal attitudes show strong correlations with the dependent variable food waste, it could be an interesting and challenging job to build upon these predictors and try to establish if there are any causal relations between the previously mention variables through experimental research.

Furthermore, since there is a lot of criticism surrounding the TPB, the model should always tried to be extended with more predictors. Within the topic of household food waste, benefit awareness might be a very suitable construct to predict food waste behaviour (Yuhni & Heesup, 2010). When people possess high benefit awareness, they know what consequences their food waste behaviour has on the environment. When this construct is added to the theory in a more extensive model in future research, this might prove to be a good way to address the environmental impact that food waste has on society.

# References


Abeliotis, K., Lasaridi, K., & Chroni, C. (2014). Attitudes and behaviour of Greek households regarding food waste prevention. *Waste Management & Research*, 32, 237-240.

Ajzen, I., (1991). The theory of planned behaviour. *Organizational Behaviour and Human Decision Processes*, 50 (2), 179-211.

Bearth, A., Cousin, M.E., & Siegrist, M. (2014). Poultry consumers' behaviour, risk perception and knowledge related to campylobacteriosis and domestic food safety. *Food Control*, 44, 166-176.

Conner, M. (2014). Extending not retiring the theory of planned behaviour: A commentary on Sniehotta, Presseau and Araújo-Soares. *Health Psychology Review*, 9, 141-145.

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

FAO. (2013). *Food wastage footprint: Impacts on natural resources*. Summary report. Rome: Food and Agriculture Organization of the United Nations.

Graham-Rowe, E., Jessop, D.C., & Sparks, P. (2014). Identifying motivations and barriers to minimising household food waste. *Resources, Conservation and Recycling*, 84, 15-23.

Gustavsson, J., Cederberg, C., & Sonesson, U. (2011). *Global food losses and food waste: Extent, causes and prevention. Rome: Food and Agriculture Organization of the United Nations (FAO).* FAO. (2011). *Global food losses and food waste – Extent, causes and prevention*. Rome: Food and Agriculture Organization of the United Nations.

Klöckner, C.A., Blöbaum, A., (2010). A comprehensive action determination model: toward a broader understanding of ecological behaviour using the example of travel mode choice. *Journal of Environmental Psychology*, 30, 4, 574-586.

Koivupuro, H.K., Hartikainen, H., Silvennoinen, K., Katajajuuri, J.M., Heikintalo, N., Reinikainen, A., et al. (2012). Influence of socio-demographical, behavioural and attitudinal factors on the amount of avoidable food waste generated in Finnish households. *International Journal of Consumer Studies*, 36, 183-191.

Kormos, C., & Gifford, R. (2014). The validity of self-report measures of pro-environmental behaviour: A meta-analytic review. *Journal of Environmental Psychology*, 40, 359-371.

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

Quested, T.E., Marsh, E., Stunell, D., & Parry. A.D. (2013). Spaghetti soup: The complex world of food waste behaviours. *Resources, Conservation and Recycling*, 79, 43-51.

Russell, S.V., Young, C.W., Unsworth, K.L. & Robinson, C. (2017). Bringing habits and emotions into food waste behaviour. *Resources, Conservation & Recycling*, 125, 107-114.

Sniehotta, F.F., Presseau, J., & Araújo-Soares, V. (2014). Time to retire the theory of planned behaviour. *Health Psychology Review*, 8, 1-7.

Stefan, V., van Herpen, E., Tudoran, A.A., & Lähteenmäki, L. (2013). Avoiding food waste by romanian consumers: The importance of planning and shopping routines. *Food Quality and Preference*, 28, 375-381.

Tukker, A., & Jansen, B. (2006). Environmental impacts of products: A detailed review of studies. *Journal of Industrial Ecology*, 10, 159-182.

UNEP – Hertwich, E., van der Voet, E., Suh, S., Tukker, A., Huijbregts, M., Kazmierczyk, P., P., Lenzen, M., McNeely, J., & Moriguchi, Y. (2010). *Assessing the environmental impacts of consumption and production: priority products and materials, a report of the working group on the environmental impacts of products and materials to the international panel for sustainable resource management.*

Van Garde, S., & Woodburn, M. (1987). Food discard practices of householders. *Journal of the American Dietetic Association*, 87, 322-329.

Visschers, V.H.M., Wickli, N., & Siegrist, M. (2016). Sorting out food waste behaviour: A survey on the motivators and barriers of self-reported amounts of food waste in households. *Journal of Environmental Psychology*, 45, 66-78.

Williams, H., Wikström, F., Otterbring, T., Löfgren, M., & Gustafsson, A. (2012). Reasons for household food waste with special attention to packaging. *Journal of Cleaner Production*, 24, 141-148.

Yunhi, K., & Heesup, H. (2010). Intention to pay conventional hotel prices at a green hotel – a modification of the theory of planned behavior. *Journal of Sustainable Tourism*, 18, 997-1014.

# Appendix A

Table 7.
*Items per construct for the possible predictors of food waste with means, standard deviations and Cronbach's α.*

| Items per construct | Cronbach's α | *Items* | *M* | *SD* |
|---|---|---|---|---|
| *Personal attitude* | .73 | 3 | 5.45 | 1.22 |
| It is unnecessary to waste food: it can always be used in some way. | | | | |
| It is immoral to discard foods while other people in the world are starving. | | | | |
| It upsets me when unused products end up in the waste bin. | | | | |
| *Personal norms* | .80 | 3 | 5.48 | 1.26 |
| I feel bad when I throw food away. | | | | |
| I feel obliged not to waste any food. | | | | |
| It is contrary to my principles when I have to discard food | | | | |
| *Subjective norms* | .63 | 3 | 5.32 | 1.06 |
| People who are important to me find my attempts to reduce the amount of food waste in my household unnecessary.* | | | | |
| People who are important to me don't like it when I try to reduce my food waste.* | | | | |
| People who are important to me encourage me when I try to reduce my food waste. | | | | |
| *Household planning habits* | .70 | 3 | 4.85 | 1.19 |
| I am a person who likes to plan things. | | | | |
| Before I prepare food, I always consider precisely how much I need to prepare and what I will do with the leftovers. | | | | |
| I always plan the meals in my household ahead and I keep to this plan. | | | | |
| *Financial attitude* | .45 | 3 | 4.98 | 1.07 |
| I think that wasting food is a waste of money. | | | | |
| Saving money does not motivate me to discard less food.* | | | | |
| I rarely think about money when I throw away food.* | | | | |
| *Perceived health risks* | .72 | 3 | 3.58 | 1.47 |
| I believe that the risk of becoming ill as a result of eating food past its use-by date is high. | | | | |
| I am not worried that eating leftovers results in health damage.* | | | | |
| I think that one can perfectly safely eat food products whose use-by dates expired a few days ago.* | | | | |
| *Perceived behavioural control* | .52 | 3 | 5.19 | 1.08 |
| I find it difficult to prepare a new meal from leftovers.* | | | | |
| I find it difficult to make sure that only small amounts of food are discarded in my household.* | | | | |
| I have the feeling that I cannot do anything about the food wasted in my household.* | | | | |
| *Intention to avoid food waste* | .72 | 3 | 5.99 | 0.99 |
| I try to waste no food at all. | | | | |
| I always try to eat all purchased foods. | | | | |
| I try to produce only very little food waste. | | | | |

Note. *Item was reverse coded. All items were assessed on a 7-point Likert scale; higher values correspond to stronger agreement with the statement.

# Appendix B

Table 8.
*Items, answer options, means and standard deviations for food waste behaviour*

| | | Fruits & vegetables | | Proteins (meat & fish) | | Bakery (bread & bakery products) | | Ready-to-eat (convenience and processed) | | Starches (potatoes, rice, pasta and corn) | | Dairy (product made from or containing milk) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Items per food waste category | Weight | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* | *M* | *SD* |
| How often do …* get discarded in your household? | | 0.89 | 0.99 | 0.36 | 0.53 | 0.87 | 1.12 | 0.32 | 0.31 | 0.72 | 0.77 | 0.43 | 0.62 |
| - 6-7 times per week | 6.5 | | | | | | | | | | | | |
| - 3-5 times per week | 4 | | | | | | | | | | | | |
| - 1-2 times per week | 1.5 | | | | | | | | | | | | |
| - 2-3 per month | 0.625 | | | | | | | | | | | | |
| - Approximately once per month | 0.25 | | | | | | | | | | | | |
| - Less or never | 0.1 | | | | | | | | | | | | |
| What is the amount of …* that is being wasted in your household? | | 1.09 | 0.87 | 0.43 | 0.60 | 1.08 | 0.94 | 0.65 | 0.78 | 1.19 | 1.07 | 0.77 | 0.78 |
| - More than 3 portions | 4 | | | | | | | | | | | | |
| - 2-3 portions | 2.5 | | | | | | | | | | | | |
| - Approximately 1 portion | 1 | | | | | | | | | | | | |
| - Half a portion or less | 0 | | | | | | | | | | | | |

Note. * Food waste categories: Fruits & vegetables, Proteins (meat & fish), Bakery (bread & bakery products), Ready-to-eat (convenience and processed), Starches (potatoes, rice, pasta and corn), Dairy (product made from or containing milk).

# Appendix C

Table 9.
*Hierarchical linear regressions of food waste per category predicted by demographics and predictor from the extended TPB model.*

| | | | FW Total | | FW Fruits & Veg. | | FW Protein | | FW Bakery | | FW Ready-to-eat | | FW Starches | | FW Dairy | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| | M | SD | β | β | β | β | β | β | β | β | β | β | β | β | β | β |
| Gender | | | .04 | .06 | .08 | .07 | .06 | .03 | -.12 | -.10 | .02 | -.02 | .09 | .15 | .13 | .15 |
| Age | 40.92 | 14.93 | -.20 | -.04$^{+}$ | -.03 | .10 | -.11 | .10 | -.05 | .02 | -.16 | -.05 | -.23$^{*}$ | -.15 | -.20 | -.11 |
| Educational level | 3.86 | 0.92 | .12 | .10 | .13 | .10 | .13 | .09 | .04 | .01 | -.07 | -.08 | .13 | .16 | .02 | .03 |
| Members in household | 2.85 | 1.36 | .07 | .07 | -.12 | -.12 | .05 | .06 | .10 | .07 | .05 | .07 | .13 | .13 | -.04 | -.01 |
| Personal attitude | 5.45 | 1.22 | | -.23 | | -.04 | | .32$^{*}$ | | -.25 | | .24 | | -.24 | | -.37$^{*}$ |
| Subjective norms | 5.32 | 1.06 | | .04 | | -.08 | | .04 | | .09 | | -.06 | | .19 | | -.24 |
| Perceived behavioural control | 5.19 | 1.08 | | -.05 | | -.06 | | -.19$^{+}$ | | -.06 | | -.04 | | .06 | | .02 |
| Intention to avoid food waste | 5.99 | 0.99 | | -.25 | | -.26 | | -.31$^{+}$ | | -.25 | | -.38$^{*}$ | | .04 | | .14 |
| Financial attitude | 4.98 | 1.07 | | -.03 | | .00 | | -.01 | | -.08 | | -.03 | | -.03 | | .12 |
| Perceived health risks | 3.58 | 1.47 | | .31$^{**}$ | | .22$^{+}$ | | .36$^{***}$ | | .06 | | .22$^{+}$ | | .23$^{*}$ | | .25$^{*}$ |
| Personal norms | 5.48 | 1.26 | | .31$^{+}$ | | .14 | | -.15 | | .34$^{+}$ | | .07 | | .20 | | .13 |
| Household planning habits | 4.85 | 1.19 | | -.05 | | -.12 | | -.26$^{*}$ | | -.01 | | .04 | | .10 | . | -.08 |
| $R^2$ | | | .06 | .26$^{**}$ | .03 | .19$^{+}$ | .03 | .37$^{***}$ | .03 | .13 | .03 | .16 | .03 | .25$^{*}$ | .03 | .23$^{*}$ |
| $R^2$ change | | | .06 | .19$^{**}$ | .03 | .16$^{*}$ | .03 | .34$^{***}$ | .03 | .10 | .03 | .12 | .03 | .16$^{*}$ | .03 | .18$^{*}$ |

Note. *** $p < .001$, ** $p < .01$, * $p < .05$, + $p < .10$. $N = 98$