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Abstract

Around one-third of the total food provided for human consumption goes to waste every year. Previous literature shows that throughout the entire production-consumption chain, the final household stage generates the largest proportion of food waste compared to all the other stages. Through the adoption of an extended version of the Theory of Planned Behaviour, this study investigates the drivers of four consumers' food waste practices derived from a survey involving 250 consumers in the municipality of Uppsala. It has been shown that attitude, Perceived Behavioural Control, knowledge, language, education level, children and involvement in a pro-environmental organization were significant predictors for the examined practices. Therefore, policy implications and possible solutions for food waste were suggested.

Keywords: food, waste, behaviour, behaviour, behavioural economics, theory of planned behaviour, Uppsala, household

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Abbreviations

BFC	Bruised Food Club
FAO	Food and Agriculture Organization
FSD	Food Sharing. DE
FSL	Food Sharing Lund
FW	Food Waste
FWB	Food Waste Behaviour
FWL	Food Waste and Loss
GHG	GreenHouse Gas
IMBP	Integrative Model of Behavioural Prediction
PBC	Perceived Behavioural Control
SNFA	Swedish National Food Agency
SDG	Sustainable Development Goal
TPB	Theory of Planned Behaviour
ZWU	Zero Waste Uppsala

1. Introduction

Food Waste (FW) is an extensive economic, environmental, and social problem. Gustavson et al (2011) estimated that one-third of the food produced for human consumption is wasted or lost every day. Given the extents of this issue, the United Nations (2015) included food waste reduction in the 2nd and 12th Sustainable Development Goals (SDGs) adopted in 2015. Moreover, the European Commission (2017) appended the reduction of food waste as a key area of its circular economy package.

Given the emphasis related to this problem, the Swedish Government entrusted the Swedish National Food Agency (SNFA) with the objective of reducing food waste and loss. The action plan adopted by the SNFA displayed nine areas of intervention including measures that encourage a behavioural change by the final consumers (Livsmedelsverket, 2020). This has given rise to several studies on food waste within the Swedish context which focused on different aspects, such as recycle (Bernstad et al., 2013; Linder et al., 2018), waste management (Miliute-Plepiene, 2015; Andersson, 2018) and the role of the packaging (Williams et al., 2012; Wikström et al., 2016).

As estimated by European Commission (2010), the food waste from final consumers approximately accounts for 40% of the total European Food Waste. More recently, the United Nations Environment Programme (2021) estimated that 931 million tonnes of food waste were generated in 2019: around 60% of that amount was produced by the households. Therefore, reducing FW generated by final consumers is extremely important. Economic research on consumer behaviour in food waste management is crucial to guide consumers and to inform FW policymakers. Despite this importance, there is still a lack of research on this topic within the Swedish context.

1.1 Aim of the thesis

To fill the gap within this research's area, this master's thesis aims to
i) investigate the determinants of individuals' behaviour in food waste management in Uppsala municipality and

ii) suggest policy measures that could effectively improve individuals' Food Waste Behaviour (FWB)

More specifically, this thesis focuses on the four following behaviours in food waste handling: planning, shopping, use of leftovers and storing. Furthermore, it will examine the influence of psychological, economic and socio-demographic variables on the four behaviours listed above.

The findings of this study might be useful for future policies of the government and local authorities which aim to reduce FW and prompt positive behavioural changes in FW handling among citizens. Via the inclusion of the role of pro-environmental organizations in influencing individuals' FWB, this thesis provides new insights into the existing food waste literature and calls for future research on this topic.

The paper will be structured as follows; Chapter 2 introduces the FW topic and explains the theory and the model which is utilized. Chapter 3 analyses the collected data and the methodology. Chapter 4 shows the results of this study. Chapter 5 discuss the findings and the policy implications, highlights weakness and limitation of the thesis. Finally, chapter 6 concludes the findings of the research.

2. Conceptual Framework

2.1 Food Waste Behaviour

The Food and Agriculture Organization of the United Nations (FAO) defines Food Waste (FW) as the losses occurring at the end of the food chain, which essentially relates to the consumers´ behaviour and practices (United Nations Environment Programme, 2021).

FW negatively impacts the environment and the ecosystem, and it contributes to climate change with Greenhouses Gas (GHG) emissions. Around 10 per cent of global GHG are associated with the wastage of food, as accounted by Mbow et al (2019). Moreover, Porter et al (2016) argued that FW is associated with the loss of valuable resources such as labour force, land, water, fertilizers, and transportation that have been used to produce wasted food. Furthermore, as Campoy-Muñoz et al (2021) asserted, this problem entails concernments about malnourishment and food security issues. The study from Schwegler (2014) accounted that the economic cost derived from FW is about 750 billion of dollars every year.

FW appears at all stages of the food production and consumption chain. Nonetheless, Griffin (2009) argued that the final consumers' waste has been identified as the most considerable proportion of total wastage. Therefore, policy interventions or research addressed to the final consumers can be seen as the most useful and effective measure to reduce FW.

Economic literature on FW often studied disposal taxes, which are aiming to increase the economic cost of the wasting behaviour. Hodges et al (2011) further delineated that taxes are also employed to internalize the external environmental costs associated with the unnecessary waste of food. A significant number of studies attempted to create a foundation for FW's economic theory such as Morris and Holthausen (1994), de Gorter (2014), Hamilton and Richards (2019).

Quested (2013) pointed out that multiple psychological factors influence food wastage within the final consumption stage. Indeed, economic research pointed out that the food waste volume is the outcome and interconnection of various specific behaviours or practices. First, planning food preparation in advance can significantly reduce domestic FW. Romani et al (2018) and Stefan et al (2013) considered this behaviour as the main factor influencing the FW volume. Chandon

and Wansink (2006) explained that insufficient planning could lead to an overbuying of food products that will be not eaten on time.

Secondly, shopping routines can affect FW volume and therefore, have been incorporated in most of the studies on FW, such the ones from Aydin and Yildirim (2021) and Bravi et al (2019). Specifically, as Diaz-Ruiz et al (2018) illustrated, individuals who buy solely necessary items according to a pre-made shopping list waste less quantity of avoidable food.

Thirdly, the utilization of leftovers also leads to a reduction of food waste. Stöckli et al (2018) and Stancu et al (2016) analyzed the usage of leftovers and found that it is a crucial determinant of the reported amount of FW.

Lastly, food storing is another important practice in determining FW volumes. Wunder et al (2019) showed that consumers who possess essential know-how skills to prolong the product' shelf-life generate less FW. The ability to store domestic food emerged as a fundamental factor in the generation of waste also in the studies by Romani et al (2018) and Farr-Wharton et al (2014).

Within the scope of a master thesis and given the relevance of these four behaviours, they have been chosen as the dependent variables for this thesis.

2.2   Determinant of Food Waste Behaviour

FWBs can be driven by a wide range of factors. The empirical literature focused mainly on the amount of generated FW and it found the consistent presence of several important variables. In this sub-chapter the determinants of FWB have been divided in three categories of drivers: socio-demographic, economics and psychological.

2.2.1 Socio-demographic determinants

A conspicuous number of studies focused on the socio-demographic characteristics of consumers. Age has been found to determine the amount of produced FW. Specifically, Mondéjar-Jimenez et al (2016) stated that young individuals are more likely to waste food. On the contrary, older consumers were less likely to report FW. These findings are in line with Hamilton (2005). Concerning gender, contrasting findings have been discovered. Several studies such as Gallo, (1980) and Guthrie and Buzby, (2002) noticed that women produce more

FW than men. However, more recent papers such as Barr (2007) pointed out that females are less likely to waste edible food.

Stuart (2009) highlighted that different cultures and nationalities have significant diversities concerning FWB. In addition, Secondi et al (2015) investigated the behaviour of 27 European nationalities and highlighted huge gaps in the reported FW. Moreover, Koivupuro et al (2012) mentioned that smaller households generate less FW per capita. Lastly, relevant studies, such as the one from Stancu et al (2016), underlines that the presence of children increasingly affects the amount of FW from the final consumers.

2.2.2 Economic determinants

While most of the economic research concentrated on the quantitative accounting of FW, a few studies have investigated the economic drivers behind the behaviours that leads to wasting food.

Several economic models have been structured for studying food waste behaviour: the majority of them are models of food discarding behaviour or food utilization. Economic drivers for FW have been included in the model developed by Morris and Holthausen (1994), which shows that the level of waste is a function of economic variables such a input prices, wage rates, income and productivity time spent on activities related with the production and reduce of waste.

Hamilton and Richards (2019) proved that the price elasticity for fresh food is a significant driver for FWB. Moreover, they also discover that policies which aim to reduce FW varying food prices, may have a narrow efficacy, because of the heterogeneous reactions amongst the households. Higher-income families turned out to behave with less caution than the poorer ones, as suggested by the study of Koivupuro et al (2012). Instead, the paper by Wenlock et al (1980) revealed no correlation between FWB and income.

Moreover, Lusk and Allison (2020) specified that individual characteristics can also affect household's FW. The authors underline that human capital, which includes characteristics such as knowledge and education, plays an important role.
Several studies have explored the role of knowledge as a determinant of a particular food waste behaviour. Farr-Wharton et al (2014) and Barr (2007) found that experiences and knowledge about food considerably affect intention towards the adoption of behaviour related to the disposal of food. Moreover, Principato et al (2015) discovered that consumers with insufficient knowledge about the

expiration date are more likely to waste food. Graham-Rowe et al (2015) and Aschemann-Witzel et al (2018) also demonstrate that the FWB is substantially affected by the individuals' knowledge about the ability to manage food.

Furthermore, also the educational level of consumers has been qualified as a significant driver. The study from WRAP (2011) surprisingly found out that consumers with a greater level of education have been correlated with a worse FWB compared to the less-educated ones.

All these aforementioned models reveal that FW is the result of a decision-making process, which can be influenced by economic variables. Nonetheless, further economic research could enhance the academic knowledge on this topic.

2.2.3 Psychological determinants: Theory of Planned Behaviour

Psychological factors including habits, attitudes, and norms might affect FWB among consumers.

In order to understand such psychological elements, numerous theories have been applied. The role of morals and other considerations are the main drivers of pro-environmental behaviour. This thesis was supported by Stern et al (1999) in their Value-Belief-Norm theory. Other alternative theories included irrational and non-cognitive factors such as the role of emotions - Sheeran et al (2013)- or self-regulation concepts - Hagger et al (2010)-. More recently, new theories have taken inspiration from previous models and applied new ideas to behavioural studies. For instance, Aydin and Yildirim (2021) and Abdelradi (2018) can be referenced as examples of these new experimental models. Besides, Fishbein and Ajzen (2001) shaped the Integrative Model of Behavioural Prediction (IMBP) merging elements from different theories. Among all these theories, the Theory of Planned Behaviour (TPB) modeled by Ajzen (1991) is the most common for analyzing FW topics.

The theory of Planned Behaviour (TPB) is a powerful framework to explain behaviours across different contexts, as affirmed by Stancu et al (2016). Many studies have applied this theory to understand food waste behaviours -e.g., Porpino (2016), Visschers et al (2016), Stefan et al (2013)-

Most of the relevant studies within this field, successfully employed this theory. Sniehotta et al (2014) criticized the TPB but at the same time admitted that it has been employed by many policymakers in the last 50 years.

TPB assumes that intentions are the most proximal determinant of the human behaviours. Attitudes, norms and Perceived Behavioural Control (PBC) are modeled as the determinants of intentions. Specifically, attitudes towards a particular behaviour reflect the evaluation to perform or not perform it; behaviours are therefore the outcome of more favorable attitudes. Norms represent consumers'

social pressure on the execution of the behaviour and have a significant effect on behaviours. The PBC accounts for all the potential impediments or barriers toward a specific action and it is mostly measured by the perceived difficulty of performing a certain behaviour.

Romani et al (2018) applied TPB and found that wasting food does not derive from one single behaviour, but it is the result of a spectrum of different behaviours intertwined with each other. Storing behaviour seems to have the biggest impact for the minimization of the amount of FW, while the planning behaviour has been detected as the most important impediment for the reduction of household's FW. Other food waste studies that employed TPB show that planning and shopping routines affect the FWB: policies aiming to ameliorate these routines should provide practical tools to help the purchasing and storage of food, as stated by Stefan et al (2013). Thus, nudging people's attitude will have a positive effect on FW. Stancu (2016) identified PBC and attitude toward shopping and leftovers' usage behaviours as the main determinants of FW, while intentions has been classified as an insignificant variable.

One of the advantages of TPB is that it allows the inclusion of additional predictors, as stated by Ajzen (1991). Many studies in FWB have incorporated additional elements to the classical model. For instance, Romani et al (2018) included demographic variables and the "lack of concern". Graham-Rowe et al (2015) extended the TPB by adding other psychological factors such as "self-identity" and "anticipated regret". "Feeling of guilt" was incorporated into the extended TPB in the study by Soorani and Ahmadvand (2019). Visschers et al (2016), added household planning habits, knowledge about storage and socio-demographic variables to examine the determination of the drivers for self-reported FW from Swiss consumers.

2.2.4 Theory Modification

This study employed a modified theory that excludes some variables from the original TPB and adds some others that are not standard components of the classical TPB.

The first dropped variable is the "intention". According to Armitage and Conner (2001) intentions are not always an attainable way to predict an individual´s behaviour. Intention is difficult to measure and, when related to FWB topics, "intentions to waste food" does not really make any sense. This is because ideally, no one wants or has the intention to waste food. Several works, such as the one

from Stefan et al (2013), captured this variable in an opposite way, formulating the questionnaire's propositions as the "intention to not waste food". Anyway, the authors did not find a significant impact of intention on the reported FW. Other studies such as Wong and Sheth (1985) strongly questioned the role of intentions as a good predictor of behaviours. Moreover, as pointed out by Stöckli et al (2018) the literature noticed an "intention–behavior gap" where the routines of the household have been discovered as better predictors for FWB than their behavioural intentions.

Secondly, the variable regarding subjective norms has also not been incorporated in this project. Several researchers, such as Conner and Armitage (1998), Trafimow and Finlay (1996) and Godin and Kok (1996) displayed that subjective norms are poorly and weakly correlated to behaviour when compared to the attitude. Moreover, an English study conducted by Graham-Rowe et al (2015) pointed up that norms did not have any significant predictive power. Also, Stancu et al (2016) find out that norms did not add any relevant contribution to the findings of their study.

On the other hand, Conner and Armitage (1998) indicated that the addition of other independent variables could enhance the model's predictive utility. As such, in this study, some sociodemographic and economic variables that are well-informed by previous literature were added into the original TPB.

The sociodemographic added variables consist of gender, age, language, work status, number of people in the house, and the presence of children (see Table 1). In addition, within the socio-demographic characteristics, the variable *organization* has been included to capture the consumers' level of involvement in a food-waste or waste-related organization. This variable has been overlooked in previous food waste literature but have been supported by several studies on pro-environmental behaviour. Chawla (1999) examined the origin of the individuals' environmental commitment in the US and Norway. His results showed that organizations play an important role to build up environmental engagement, especially during childhood. Monroe (2003) stated that most of pro-environmental organizations aspire to influence different stakeholders toward supporting pro-environmental behaviours. Lastly, Lombardi and Costantino (2020) explained that food organizations are interested to change the behaviour of individuals through educational activities.

The economic variables that have been included were income, education and knowledge. Education and knowledge represents human capital in practising FW handling, which has been explained by Katare et al (2017). The authors pointed out that insufficient education and knowledge result in excessive purchase of food,

which often lead to an increase of FW. These variables have already been studies by several related papers - Visschers et al (2016) and Aydin and Yildirim (2021)- Therefore, they have been inserted in TPB model to analyse their impact on the households' behaviour.

In summary, the resultant model can be described as an extension of the TPB. The variable *intentions* and subjective *norms* have been dropped and two additional groups of variables -*sociodemographic* and *economic*- have been added. Figure 1 exhibits the extended model created in this study: the grey items are the new included variables. Attitude, PBC, and economic and sociodemographic variables are therefore investigated as the potential drivers for the four FWBs.
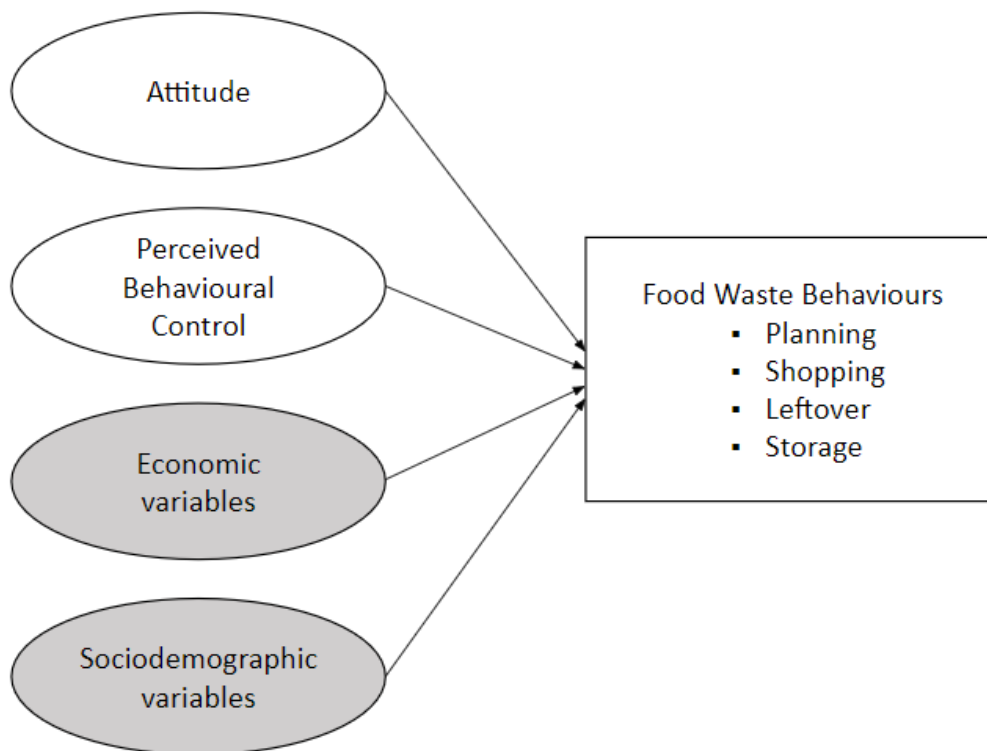
Figure 1. Extension of the TPB

3. Methodology

3.1 Survey description

To collect data, an online survey designed by the author has been used. A questionnaire draft has been tested via a pilot survey delivered to twenty individuals in Uppsala. Based on the received feedback and suggestions, several corrections have been made. After the pilot study, the official online survey was created with the web-based software Google Form. The survey was delivered online during the third and second week of March 2022 and it received 250 usable answers.

A convenience sampling method was employed, where individuals can subjectively choose to participate or not in the survey. Though convenience sampling implies several limitations due to the self-selection of the participants, it can be usefully employed when the population is vast and when the author has limited time and economic availability, as pointed out by Etikan et al (2016).

The questionnaire has been diffused thanks to word of mouth among the student community in Uppsala and with the use of some physical stickers pasted in public spaces in Uppsala. The stickers contained a provocative sentence to catch the attention of the readers and a QR code generated by the author, who directed the users directly to the online survey.

Table 1 shows the characteristics of the surveyed respondents. Given the sampling method above, the sample of this study was overrepresented by young consumers, women, and students.

	Category	Frequency	% of the sample
Language	Swedish	91	36.4
	English	159	63.6
Gender	Female	175	70.0
	Male	73	29.2
	Other	2	0.8
Age	<21	19	7.6
	21-30	193	77.2
	31-40	26	10.4
	>40	12	4.8

Education	Primary school	3	1.2
	Secondary school	48	19.2
	Vocational training	2	0.8
	University	197	78.8
Working Status	Student	185	74.0
	Employee	55	22.0
	Other	10	4.0
Monthly Income	0-6 000	90	36.0
	6 000-　12 000	82	32.8
	12 000-　26 000	41	16.4
	>26 000	37	14.8
Household	Single	171	68.4
	Couple	55	22.0
	Family	24	9.6
Children	Yes	230	92.0
	No	20	8.0
Organization	Unaware	77	30.8
	Aware	95	38.0
	Passively involved	68	27.2
	Actively Involved	10	4.0

Table 1. Sample Description

3.2 Variables measurement

3.2.1 Dependent variables

According to Quested et al (2013), wasting food is not caused by a single practice but instead, by a broader spectrum of behaviours. This study considers four specific behaviours of food waste management: planning, shopping, use of leftovers and storing. These specific FWBs were captured via ten questions demanding the frequency of execution for each behaviour with a 5-point Likert-type scale (never,

rarely, sometimes, often, and always). Table 2 provides a detailed list of these questions. Following the literature, a higher frequency of the actions described in the propositions implies better FWB. The mean column shows the average score for each proposition: ranging from one to five, small scores picture low frequency while large scores represent high frequency.

Variables	Question Items	Sources	Mean	Standard Deviation
1. Planning (FWBplan)	I plan meals days ahead	Stefan et al (2013)	3.188	1.026
2. Shopping (FWBshop)	I make a shopping list before the shopping, and I purchase according to it	Soorani and Ahmadvand (2019)	3.736	1.102
	When I'm shopping, I only buy items that I really need	Author's formulation. Inspired by Romani et al (2018)	3.548	.922
3. Leftovers (FWBleft)	If I have leftovers, I restore them for the next meals	Neff et al (2015)	4.52	.822
	I adjust my meal plan to use leftovers	Soorani and Ahmadvand (2019)	4.096	1.067
4. Storage (FWBstor)	After the shopping, I restore the food in the proper place	Author's formulation. Inspired by WRAP (2007)	4.284	.9669

Table 2. List of question items measuring dependent variables and descriptive statistics.

3.2.2 Independent variables

Attitude was measured by five items with the responses on a 5-point Likert-type scale, ranging from 1 "Not important at all" to 5 "Very Important".

PBC has been coded in terms of easiness and it has been quantified with a 5 Likert-scale from 1 "Totally disagree" to 5 "Totally agree".

Attitude and PCB's propositions have been filed in Table 3.

Variables	Question Items	Sources	Mean	Standard Deviation
Planning attitude	Planning and organize meals days ahead	Author's formulation	3.504	.978
Shopping attitude	Making a shopping list and purchase according to it	Author's formulation	3.68	1.049
Leftovers attitude	Eating or utilize leftovers	Author's formulation	4.52	. 740
Storage attitude	Properly storing all the food inventories in my house	Author's formulation	4.508	.689
Planning PCB	Planning meals days in advance is easy for me	Author's formulation. Inspired by Visschers (2016)	3.344	1.127
Shopping PCB	I find it easy to make a shopping list in advance and purchase	Author's formulation. Inspired by Visschers (2016)	3.816	1.024
Leftovers PCB	I find it easy to eat or utilize leftovers	Author's formulation. Inspired by Visschers (2016)	4.248	.949
Storage PCB	I find it easy to appropriately store the food in my house	Author's formulation. Inspired by Visschers (2016)	4.512	.712

Table 3: List of question items measuring attitude and PBC items and descriptive statistics.

Table 4 shows ten items used to capture the knowledge of food waste handling. Each item has three answering options: true, false, or "I don't know". Following several studies in FWB, the "I don't know" answers has been counted as incorrect. The number of correct answers forms an index that reflects knowledge level.

Questions items	FWB	Source	Correct answer	"I don't know" %	Correct answers %
Planning meals several days ahead does not contribute to reduce food waste.	Planning	Mallinson et al (2016)	False	24.0	69.2
Retailers' price offers (such as bulk offers, discounts, 2x1 etc..) that push consumers to overpurchase food, are a significant cause of food waste.	Shopping	Schmidt (2016)	True	21.2	66.8
Thawed meat can be refrozen after cooking.	Leftovers	Delley and Brunner (2017)	True	22.4	46.4
Leftovers from warm meals should be cooled down before they are put in the refrigerator or freezer.	Leftovers	Visschers (2016)	True	11.6	84
The "use by" date means that food products can become a health risk from this date on and should therefore no longer be consumed.	Storage	Visschers (2016)	True	9.2	48.8
The "best before" date indicates how long a product will retain its specific characteristics (e.g., yogurt should remain creamy) when stored properly.	Storage	Visschers (2016)	True	7.6	82.8
Once open, the "best before" date does not prevail anymore, and the food has to be consumed within a few days.	Storage	Delley and Brunner (2017)	True	16	60.0
Fruits excrete a gas during storage, which keeps vegetables fresh longer; Fruits and vegetables should therefore be stored together.	Storage	Visschers (2016)	False	47.6	39.6

Table 4. List of question items measuring knowledge

The beginning of the questionnaire requested the participants to select the language of the survey: English or Swedish. The choice of language has been used as a proxy of "nationality" variable. Therefore, respondents who complete the survey in Swedish have been categorized as "Swedish"; the ones who responded in English have been included in the category "International". Subsequently, the gender and the age has been asked. As shown in Table 1, 70 per cent of the respondents were women. The sample was relatively young with an age ranging between 20 and 30 years old. The average age was 26.5 with a standard deviation of 7.1. As displayed in Table 1, most of the sample was represented by students with a university educational level. Income has been coded as an ordinal variable indicated with 5 different income intervals. The choices of household typology included in our questionnaire were: single, couple, family, or other. Once again, given the presence of relatively young students, the category "single" received large count. Subsequently, it has been asked about the presence of children in the household. Lastly, the involvement in organizations was captured by two questions. The first asked, *"Do you know any organization involved in food, food waste or waste issues?"*. Four possible options were available for the respondents:

BFC. Bruised Food Club is a food-rescue organization based in Uppsala. It was officially established as a non-profit organization in October 2020 and its mission is to reduce hunger and food waste at the local level. In 2021, the organization succeeded to save around 7.9 tons of food (Bruised Food Club 2021, Impact Report).

ZWU. Zero Waste Uppsala is another local non-profit organization that intends to raise awareness of waste reduction. Thanks to different events and activities based in Uppsala, ZWU aims to embrace a transition towards a more sustainable and green way of life (Zero Waste Uppsala, 2022).

FSL. Food Sharing Lund is mainly based on its Facebook page which counts more than 1400 members. The aim of this group is to exchange spare food among the student community of Lund. (Food Sharing Lund, 2022)

FSD. Food Sharing is a German organization born in 2012 that aims to promote a sustainable food system. The organization counts more than 450 000 users and more than 100 000 volunteers all over the world. Although not based actively in Uppsala, this kind of organization represents the best example in terms of structure and number of members who are targeting FW problematics. (Food Sharing.de, 2022)

Not surprisingly, the first two organizations based in Uppsala received a much higher level of awareness.

The last question of the survey asked about the level of involvement in the above organizations. The combined data gathered from the two questions built a 4-scale categorical variable indicating the level of involvement within organizations:

1) Not knowing any organization
2) Knowing but not involved at any level
3) Knowing and passively involved
4) Knowing and actively involved

Given the nature of these organizations, the author expected a positive relationship between the level of participation and the frequency of performing food waste management behaviours.

3.3 Method

Given the ordinal nature of the dependent variables, an ordered logit regression has been employed. The statistical regression and analysis have been conducted with the software STATA 15.1. Preliminary analysis, assumptions and steps required for this procedure are explained above.

3.3.1 Factor analysis for independent variables

Each independent variable was originally measured by several scales. To assess the reliability and validity of the measurement scale, a confirmatory factor analysis has been conducted. To test the internal consistency among the components in the behaviours´ item, Cronbach's alpha was used. The Cronbach´s alpha for the items describing the leftovers and storage behaviours was respectively 0.7599 and 0.8655. Moreover, convergent validity was calculated using factor loading. The values of factor loadings were higher than 0.50 on their corresponding factors showing acceptable values.

Based on the conducted factor analysis, the four behaviours have been analysed in the following manner. Planning behaviour (FWBplan) has been measured by the statement: "I plan meals days ahead." The shopping variable has been generated by the mean score of two statement: "I make a shopping list before the shopping and I purchase according to it" and "When I'm shopping, I only buy items that I really need ". Usage of leftovers has been measured with the item "If I have leftovers, I restore them for the next meals and "I adjust my meal plan to use leftovers". Lastly,

the question "After the shopping, I restore the food in the proper places (fridge, freezer, shelf at room temperature)" has been chosen to represent the storage behaviour.

3.3.2 Assumptions of ordered logit regression

Since the dependent variables are ordinal data, ranging from 1 (Never) to 5 (Always), an ordered logit model has been employed to investigate the drivers of the four FWB. The ordered logit model requires the fulfilment of some fundamental assumptions.

To test for the non-multicollinearity of the independent variables, the centered Variance Inflation Factors (VIF) have been calculated. All the VIF obtained acceptable values; therefore, it has excluded any significant multicollinearity among the independent variables. Secondly, the proportional odds assumption has been proved, stating that there is the same set of coefficients across categories of the dependent variables.

As demonstrated just above, all the assumptions for the ordinal logit model have been successfully satisfied, so the ologit command has been run in STATA for the regressions analysis.

4. Results

Table 5 reports the table of results for each of the four FWB ordered logit regressions. According to the proportional odds assumption modeled by McCullagh (1980) the coefficient represents the shift between every consecutive category (Never-Rarely, Rarely-Sometimes, Sometimes-Often, Often-Always).

Among psychological variables, Perceived Behavioural Control turned out with significant coefficient for the four behaviours, while attitude achieved significant results for all of the behaviours except for the storage one.

Regarding the economic variables: the coefficient relative to the income did not produce any significant result; the education's variable generates significant result for three behaviours: planning, leftovers and storage. As for the variable *knowledge,* a significancy level of 5% was discovered for the storage behaviour.

The sociodemographic variables *gender, age, work, and household* have not obtained any significant results in this study. Besides, the variables *language, children, organization,* had significant results for some of the studied FWBs.

For a better interpretation of size and magnitude, the marginal effects have been included, representing the probability of being in the highest category (Always) in the item describing the dependent variable. In the next paragraph, the results from the explanatory variables are explained separately for each FWB. The table below summarizes the obtained results.

	Planning		**Shopping**		**Leftovers**		**Storage**	
	Coefficient (SE)	Marginal Effect (SE)	Coefficient (SE)	Marginal Effect (SE)	Coefficient (SE)	Marginal Effect (SE)	Coefficient (SE)	Marginal Effect (SE)
Language	.791** (.336)	.044 (.019)	.477 (.329)	.022 (.016)	.681* (.348)	.117 (.058)	3.495*** (.528)	.562 (.061)
Gender	.404 (.288)	.023 (.016)	.302 (.292)	.014 (.014)	.466 (.290)	.0803 (.049)	.267 (.310)	.043 (.049)
Age	.002 (.030)	.001 (.001)	.005 (.032)	.001 (.002)	.021 (.032)	.003 (.005)	.008 (.034)	.001 (.005)
Education	.561*** (.186)	.031 (.010)	.280 (.187)	.013 (.009)	.551*** (.195)	.094 (.032)	.442* (.264)	.071 (.041)

Work	.114	.006	.091	.004	.122	.020	.131	.021
	(.244)	(.013)	(.252)	(.012)	(.247)	(.042)	(.260)	(.041)
Income	.067	.003	.146	.007	.059	.010	.060	.009
	(.132)	(.007)	(.130)	(.006)	(.135)	(.023)	(.138)	(.022)
Household	.350	.019	.012	.001	.272	.046	.179	.028
	(.229)	(.013)	(.244)	(.011)	(.237)	(.040)	(.265)	(.042)
Children	-.002	-.001	-.201	-.009	.377	.064	-1.543*	-.248
	(.745)	(.042)	(.818)	(.039)	(.805)	(.138)	(.824)	(.130)
Organization	.158	.009	.402***	.019	.035	.006	.319**	.052
	(.149)	(.008)	(.154)	(.008)	(.157)	(.027)	(.161)	(.025)
Attitude	1.182***	.067	.841***	.040	.777***	.133	.291	.046
	(.183)	(.012)	(.163)	(.011)	(.226)	(.037)	(.204)	(.032)
PBC	1.148***	.065	.645***	.030	1.426***	.245	.950***	.152
	(.157)	(.011)	(.166)	(.010)	(.197)	(.028)	(.206)	(.031)
Knowledge	.388	.028	-.031	-.001	.189	.032	.266**	.042
	(.304)	(.022)	(.275)	(.013)	(.218)	(.037)	(.135)	(.021)

Table 5. Ordered Logit Results. Note: numbers in brackets are standard errors (SE); ***, **, *: significant at 1%, 5%, 10% level, respectively.

Table 5 shows that *language, education, attitude, and PCB* are significant predictors of food planning behaviour. Looking at the margin effect, Swedish consumers are about 4.4% more likely to report the always-frequency in planning their meals compared to international consumers. A higher level of education leads to a higher frequency of planning. In line with the literature review, *attitude and PCB* are positively correlated with this behaviour. The marginal effect's coefficients for these two components are more or less equal in magnitude. Individuals with a higher level of attitude are about 6.7% more likely to report the highest frequency.

Surprisingly, neither *language* nor *education* are correlated with shopping behaviour. On the other hand, being involved in environmental organizations is associated with a higher frequency to apply good shopping practices. Moreover, *attitude and PCB* achieve highly significant results and, once again, similar coefficient sizes. Moreover, the coefficient relative to the variable *organization* turned out with a significancy level of 1%.

The leftover behaviour has the same significant predictors as the planning one: *language, education, attitude, and PCB*. Likewise, the coefficient´s sign and magnitude are similar. Regarding *attitude and PCB*, a spread of more than 10 percentage points in the marginal effects is noticed.

The storage behaviour is the item that obtained the largest number of significant outcomes. The interpretation of results concerning *language and education* is equivalent to the one for planning and leftover. Nevertheless, the impressive size of the marginal effect regarding the *language* necessarily needs a more detailed explanation and it will be analyzed in Chapter 5. Exceptionally, the variable indicator *children* attain results a 90% significance level: having children influences negatively FWB and reduces by 25% the likelihood to respond with the *always* category. Likewise shopping, the *organization* element produces significant and positive-sign outcomes. *Attitude* coefficients are abnormally not significant. Uniquely, the *knowledge* component yields significant results: the marginal effect on the category "Always" is 4.3%. Though small in magnitude, this result is highly considerable because demonstrates the relationship between higher knowledge and better behaviour.

5. Discussion

5.1 Discussion

Attitude was a significant predictor for all the behaviours except for storing. The marginal effect for the leftovers behaviour was considerably larger compared to the others. In line with the papers by Stancu et al (2016) and Stefan et al (2013), a better attitude reflected better behaviour.

In this study the item related to the PBC has been coded in terms of ease to perform a behaviour, earning a positive relationship with all the examined four. This correlation is in line with the paper of Ajzen and Fishbein (2005), which demonstrated that PBC is a fundamental predictor for specific behaviour.

Economic determinants generated different results among the four behaviours. Table 4 shows that knowledge of planning and shopping as a driver to reduce FW was relatively low. Concerning the question "thawed meat can be refrozen after cooking", the percentage of correct answers was less than 50%. As written by the Food Safety and Inspection Service from the United States Department of Agriculture (2013), thawed meat can be refrozen after cooking if all the correct hygiene requirements and procedures are fulfilled. The knowledge regarding to food labelling by the final consumers has been already considered very low by Abeliotis et al (2014) and resulted incorrect for 51.2% of the responses. The results of this thesis are in line with the research made by WRAP (2011) which showed that 45-49% of individuals do not correctly understand the meaning of food labels. Lastly, the lowest score of correctness was registered for "Fruits excrete a gas during storage, which keeps vegetables fresh longer; fruits and vegetables should therefore be stored together". As the study by Burg and Burg (1965) underlined, fruits and vegetables secrete ethylene gas, which accelerates the process of ripening. Therefore, the most ethylene-excreting fruits such as apples, bananas, apricots and pears should be stored separately from other food.

Regarding the role of knowledge as a predictor of behaviour, the present study identifies a weak but significant positive relationship between storage knowledge and proper storage behaviour from individuals. A higher level of knowledge is correlated with better storage behaviour. However, most of the related studies found an insignificant role of knowledge in determining FW or FWB. For instance, Visschers et al (2016) detected an insignificant relationship between knowledge and the behaviour of consumers. On the other hand, Aydin and Yildrim (2020) did not find a direct effect of the knowledge on FWB, but solely an indirect one through

the shopping practices: individuals with higher awareness and knowledge of food conservation purchase with more caution and ergo, they waste less food.

Income was not associated with any behaviour. This finding is in line with Wenlock et al (1980), where no correlation between FWB and income has been detected.

Education was a significant predictor for planning, leftover and storage behaviour. A higher level of education reflects better behaviour. The education outcomes were in conformity with the results of Abdelradi (2018), who showed that individuals with a university education generate less FW compared to individuals with a fewer level.

Summarily, economic variable seems to have an impact on FWB. The effect of income was slightly positive but insignificant. Education and knowledge, which reflect human capital, strongly correlate with behaviours related to the waste of food.

As underlined by Secondi et al (2015), different nationalities have different food waste behaviours and they recorded huge gaps in the amount reported FW. The "nationality" variable, which was indirectly captured by the use/non-use of Swedish as a language to respond to the survey, seems to be an important variable in this thesis. Thus, it could explain three out of four studied food waste practices: meal planning, leftover utilization and storage practices. Swedish-language respondents were more likely to practice these behaviours frequently than non-Swedish. Although investigating the diversity in the habits and routines among different nationalities is beyond the scope of this thesis, a couple of considerations should be noted. According to the impressive marginal effect on storage behaviour, Swedish-language respondents were 56% more likely to answer with the "Always" choice than international consumers. A possible, perhaps speculative, explanation for this result could be found by analysing in detail the sample of this study. Thus, the Swedish-language respondents had on percentage a better working status, a higher income and a slightly higher average age. Moreover, most of the English-language respondents were international students. Perhaps, Swedish-language consumers have more comfortable and spacious accommodations than their international colleagues. These superior dwellings could lead to greater storing behaviour. Instead, international students, living mostly in corridor rooms and having fewer facilities, could encounter more difficulties to adopt good storage practices. On the other hand, some cultural differences could have driven these results. The Robecosam Country Sustainability Ranking (2021) stated that Sweden represents the first country in terms of sustainability. Moreover, Fudge and Rowe (2000) classified Sweden as the most ambitious and modern country in the world in terms

of environmental issues. Lidskog and Elander (2012) argued that Sweden has historically adopted an ecologic approach to modern society where environmental values, social welfare and economic growth are the main pillars. Therefore, the pro-environmental attitude of the Swedish government across recent history could have deeply affected the behaviour of its citizens and vice versa.

The findings of this thesis show that having children negatively affects storage behaviour. Perhaps, the household's managers with children have less time and energy to store the food properly. In addition, a higher control, and a larger caution about the physical accessibility of the food for infants could considerably decrease the space addressed for the food's storage, causing an overall worse storage behaviour. Cappellini and Parsons (2013) argued that having children strongly influences the food behaviours of the food manager in the household. Specifically, the presence of infants or kids augments the final FW as shown in the paper by Evans (2012).

Previous studies did not investigate the role of the involvement in a pro-environmental organization in FWB. As such, this variable can be considered as a novelty of this study. Anyhow, as described in section 3.2.2, a positive relationship is expected between larger participation in an organization and an enhanced FWB. In line with these expectations, we found a positive association between participation in pro-environmental organizations with storage and shopping practices. Clearly, individuals with a larger involvement in a pro-environmental organization have already a bigger caution and care for the environment and thus they can already have a better FWB thanks to their principles or routines, despite the level of participation in the organization.

5.2 Policy implications

Given the UN and Swedish goal of reducing FW, accurate policies targeting specific clusters of population are needed. Specifically, local authorities´ interventions within Uppsala County that aim to enhance the FWB of the citizens, should target international students, as they are more likely to perform flawed behaviours regarding FW handling. Considering that international students were less likely to conduct correct storage behaviour and assuming the lack of proper storage facilities as a determinant cause of it, policy interventions should try to ameliorate the common kitchens and storage facilities of international students. More straightforward interventions could include educational programmes for the enhancement of the FWB of students in Uppsala.

Though better behaviour from the university students has been identified, further education should be implemented, especially during primary and middle school. As suggested by Derqui et al (2018) this measures does not solely imply the education of the scholars but also to improve the awareness of all the actors embedded in the school system (teachers, supervisors, kitchen staff, etc…).

In this thesis, a positive correlation between the degree of participation in environmental organizations and the FWB regarding shopping and storage has been discovered. Therefore, governments should take into consideration to support bureaucratically and financially this kind of non-profit association. Besides their positive impact on society achieved with practical actions –saving and redistributing food- the enlargement of food-related organizations can also affect the behaviour of consumers through educational activities. Indeed, augmenting the basic know-how about food-storing practices has been related to better behaviour. Educational programs that aim to reduce FW from the consumers should focus on specific topics- like the ones listed in section 5.1- and they should be programmed to adjust missing or wrong knowledge from the consumers, as already suggested by Schanes et al (2018). Moreover, the crucial role of planning and shopping in the reduction of FW, as summarized by Stefan et al (2013) is fundamental: hence consumers should be informed and aware of it. In addition, in line with the observations made by the European Commission -Lyndhurst (2018)- this thesis underlines the importance of the skills and abilities in storing food: once again, this kind of specific knowledge should be particularly deepened.

5.3 Limitations, weaknesses, and potential improvements

Due to lack of data regarding the amount of FW, this thesis focuses on the behaviour toward FW. The accessibility to quantitative information from the local waste management provider in Uppsala, could perhaps lead to further research and precise suggestion for policy interventions from the authorities or NGOs.

An additional simplification of this study was the choice of the four FWBs to be investigated. Understandably, not all the behaviours related to the FW could be included in a single study. Thus, potentially relevant behaviours were excluded (preparing, cooking, consuming etc…).

Secondly, this thesis employed an online survey. This tool is useful to reach a potentially enormous number of respondents and it is relatively easy and fast to create. Nonetheless, Bethlehem (2010) explained that an online survey does not avoid several methodological problems. First of all, the limited access to the survey

for those who possess an internet connection and basic internet skills is an indisputable issue. This under-coverage problem, combined with the tools employed for spreading the survey, resulted in an evident bias in the sampling of the population. As Table 1 shows, the difficulty to reach adult consumers and the under-coverage bias brought a non-homogeneous and non-representative population sampling. Furthermore, self-selection bias could also arise. This bias occurs when the authors of the survey are not in control of the selection of the respondents and the individuals self-select themselves into the sampling choosing or not to answer the questionnaire. This could lead to a non-random sample: solely consumers who were pleased to reply to the survey, effectively have been part of the sample population. On the other hand, individuals with zero or very low interest or concern in FW were not realistically represented. Lastly, Podsakoff et al (2003) defined the social desirability bias. This issue occurs when respondents answer more as what they think is agreeable to society rather than to be fully truthful and honest. Therefore, the results of this thesis may suffer from an overestimation of the good behaviour of the population study.

In addition, face-to-face interviews or weekly diaries could obtain more realistic results, as shown by Delley and Brunner (2018). Further research in this field should embrace the idea of employing this kind of tool. To what concern the validity of the result and its implication, the biggest proportion of the sample is represented by international university students, as we show in Chapter 3.1. Thus, research focused on a local level should try to improve the representativeness of the data sample.

Moreover, although the survey has been distributed among the municipality of Uppsala, additional indications concerning the precise location could have been implemented. Perhaps, potential interesting discrepancies in FWB between different neighbourhoods may have been discovered and diverse kinds of interventions could be employed for different locations within the municipality.

The role of organizations has been analysed with the employment of the data gained from only three questions in the survey. Given the significance of the results regarding two FWB, further research regarding this variable should be done. Specifically, analysing the changing behaviour of an individual before and after joining an organization, could be a relevant measurement for the determination of the role of an environmental organization. Thence, different strategies against FW could lead to different results: determining the most effective ones, can be crucial to understanding which tools could be the most efficient for reducing FW.

Given the characteristics of our sample, it can be said that the results of this thesis are hardly transferrable in other contexts. Nonetheless, even if the external validity of these results is limited, several policy implications for the local authorities and stakeholders have been suggested.

6. Conclusion

Review of recent literature concerning food waste behaviour from the consumers shows a lack of empirical evidence within the Swedish area. This thesis attempts to fill this gap collecting and analysing data on a local scale, among the municipality of Uppsala, Sweden. Furthermore, the inclusion of the role of food-related organizations as a potential driver for FWB, offers new insight for the existing literature and calls for a deeper investigation from future research.

The results of the study show that several sociodemographic, economic and psychological drivers have been found to have a strong correlation with four examined FWBs. Within the sample study, socio-demographic characteristics such as language and level of involvement in an organization turned out to affect the behaviours. Specifically, Swedish-language respondents were more likely to perform correct FWBs. Citizens involved in pro-environmental organizations are less likely to behave in incorrect manners. The economic variable regarding education revealed that an increased level of education is associated with a better probability to act with proper behaviours. The knowledge appeared to be a significant predictor solely for the storage behaviour: higher degree of knowledge was associated with enhanced behaviours.

Finally, the psychological factor attitude and PBC have respectively a positive and negative impact on the final behaviour.

Given the commitment made by the Swedish Government toward the reduction of FW, this thesis provides useful findings for the policymaker within the local community. Several suggestions and conclusions could also be taken as an insight for studies outside the area and may be employed for further analysis in this field. Nonetheless, further and broader research on consumers´ FWB is still needed.

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