CUSTOMER'S APPRECIATION OF THE USE OF NUDGING TECHNIQUES BY SUPERMARKETS TO ENHANCE FOOD WASTE REDUCTIONS AT THE HOUSEHOLD LEVEL IN CATALONIA (SPAIN).

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Abstract

It is estimated by the Food and Agriculture Organization of the United Nations (FAO) that around one third of the food produced with human consumption purposes is lost or wasted, that equals to large amounts of resources being misused throughout the food supply chain. Taking into consideration that around one million people suffer from malnutrition, this challenge is not only an economic or environmental problem, but also an ethical one.

The focus of this research is food waste at household level. Basically, because food waste occurs mainly at households (more than 40%). In Catalonia, an autonomous community of Spain, each citizen wastes an average of 39,4 kg of food annually, supposing a total of 262.471 annual tones, equivalent to the use of 20% of the useful agricultural surface of Catalonia.

The aim of the research is to understand which techniques a supermarket could incorporate to help their clients generate less food waste in a way they would appreciate them.

Key words: household food waste, sustainable consumption, nudge, consumer behaviour, food purchase.

Acknowledgement

Being born in Spain, I have a special interest for this country. Being aware of the negative contribution Spain is having to the environment in terms of food waste, I have decided to focus the project on this country. Specifically, in the autonomous community of Catalonia, in the northeast of the country, in which I was raised. Not only that, but it is also one of the regions that generates the most food waste in the country.

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List of Acronyms

Food and Agriculture Organization of the United Nations (FAO)

Food Supply Chain (FSC)

Greenhouse gas (GHG)

Circular Economy (CE)

United Nations (UN)

European Union (EU)

Sub-questions (SQ)

Ministerio de Agricultura, pesca y Alimentación (MAPA)

Sustainable consumption and production (SCP)

Spanish Confederation of Consumers and Users Cooperatives (HISPACOOP)

National Consumption Institute (INC)

Theory of planned behaviour (TPB)

Perceived behavioural control (PBC)

1. Introduction

1.1. Context

It is estimated by the Food and Agriculture Organization of the United Nations (FAO) that around one third of the food produced with human consumption purposes is lost or wasted, causing 1,3 billion tons of wasted food per year (Gustavsson et al., 2011). This equals to large amounts of human and natural resources being misused throughout the food supply chain (FSC), which refers to everything included from production to consumption of food, that causes unnecessary greenhouse gas (GHG) emissions. Moreover, it supposes an equivalent of around 940 billion dollars of loses per year (González-Santana et al., 2020). Taking into consideration that around one million people suffer from malnutrition, this challenge is not only an economic or environmental problem, but also an ethical one (Bräutigam et al., 2014).

Food loss refers to the lost food caused by inefficiencies in the FSC. Food waste refers to the food that is discarded in the stages of sale and consumption (González-Santana et al., 2020) because of any other reason, such as lack of awareness or lack of planification.

Food loss and food waste occur mainly in developed countries, and it is mostly related to the consumer behaviour and to the lack of coordination between the different stakeholders in the FSC (Gustavsson et al., 2011). Looking into depth into the FSC, in Europe, as shown in Table 1, the first (agricultural production) and last (consumption) phases, are the ones generating the most food waste (Bräutigam et al., 2014).

Table 1. Total amount of food waste in 1000 tonnes and share of the individual stages of the food chain across EU-27 in 2006. Source: Bräutigam, Jörissen, and Priefer (2014).

	Food waste in total	Specific amount of food waste	Share of the individual stages (%)				
	1000 tonnes	kg per capita	Agricultural production	Postharvest handling and storage	Processing and packaging	Distribution	Consumption
EU-27	142,748.1	288.5	33.0	10.6	11.6	5.0	39.8
Austria	2276.1	275.0	28.1	10.3	13.0	5.4	43.1
Belgium	3222.6	304.4	39.2	12.1	10.2	4.3	34.2
Bulgaria	1638.8	215.0	27.9	18.5	12.0	4.2	37.3
Cyprus	256.5	244.8	43.4	11.6	8.0	4.4	32.6
Czech Republic	1941.6	189.0	23.1	4.7	16.3	6.2	49.6
Denmark	1868.6	343.4	33.8	10.1	14.4	5.1	36.6
Estonia	303.5	230.1	26.9	3.2	15.7	5.6	48.6
Germany	18,671.8	223.0	25.8	10.1	13.7	5.5	44.9
Greece	4838.9	437.8	37.1	18.4	8.1	3.8	32.6
Finland	1196.7	227.2	24.5	11.7	13.3	5.6	44.9
France	18,500.2	299.1	32.6	9.4	11.8	5.3	40.9
Hungary	2723.6	270.3	33.5	9.1	11.9	4.8	40.7
Ireland	1189.3	281.4	32.5	5.3	14.6	5.5	42.0
Italy	19,696.4	333.4	38.4	8.8	9.8	4.7	38.3
Latvia	572.6	260.6	36.5	4.4	13.0	4.9	41.2
Lithuania	881.8	272.2	30.5	5.5	13.8	5.6	44.6
Luxembourg	101.3	217.5	21.1	3.5	14.0	7.0	54.4
Malta	102.3	245.3	25.3	10.6	12.2	5.7	46.2
The Netherlands	6494.9	396.6	41.9	18.5	7.9	3.5	28.2
Poland	12,116.0	317.2	35.1	13.4	11.9	4.3	35.3
Portugal	3237.9	307.3	33.3	8.3	11.5	5.5	41.4
Romania	7261.2	329.1	34.5	11.2	11.1	4.3	38.8
Slovakia	943.4	174.8	24.5	5.4	15.9	5.9	48.3
Slovenia	473.4	235.6	25.8	8.9	13.7	5.5	46.0
Spain	16,494.3	374.5	43.0	12.9	8.3	4.5	31.4
Sweden	2075.4	228.3	20.1	14.9	12.9	5.7	46.3
UK	13,669.2	224.6	20.4	4.8	15.8	6.5	52.6

The Agenda 2030 comprises of 17 Sustainable Development Goals (SDGs), each of which is composed of different targets, supposing a total of 169, that were adopted on the 25th of September of 2015 by all United Nations (UN) Member States. These goals were developed with the purpose of ensuring peace and prosperity for the people and the planet ("THE 17 GOALS, Sustainable Development", 2022).

Goal 12 aims to "Ensure sustainable consumption and production patterns" and includes a specific target regarding food waste, the goal of which is to reduce food waste by half per capita at retail and consumer levels by 2030 (target 12.3). There is the Food Loss Index (FLI) that measures the change in percentage loss from production to retail level (without including this last one). Moreover, there is a proposal under construction for a new sub-indicator, promoted by the UN, for measuring food waste ("12.3.1 Global food losses, FAO", 2022). It is not rare to see efforts in this context then, as it shows the importance of measuring and giving value to what supposes wasting food along the FSC.

Looking into Table 1, Germany, France, Italy, and Spain are the countries in the European Union that generate the most food waste. However, between these 4 countries, Spain and Italy are the ones that generate more food waste per capita.

The consumption choices that every person makes can makes a difference to the household food waste generation and therefore to the contribution to circular economy (CE) ("An EU action plan for the Circular Economy", 2022). CE is referred to the economic model that aims to avoid waste and preserve resources for as much time as possible (Zarask, 2021). The European Commission (EC) promotes the integration of best practices and supports new business and consumption models to improve the efficiency of the food chain in the European Union (EU). Specifically, the EC includes food waste prevention as part of the Circular Economy Package, launched in 2015, with the aim to meet the global SDGs by 2030 and move towards a CE ("Legislative train schedule | European Parliament", 2022).

Each country in the EU counts with its own characteristics in terms of food waste along the FSC and therefore, even if it is a global challenge, it requires understanding their details to find the most effective solutions in each case.

Regarding Spain and Italy, which have been mentioned before, both have made efforts to achieve these goals. In Italy, since 2016 there is a national law focused on food waste. In Spain however, even if the Ministry of Agriculture, Fishery and Agriculture, the so called "Ministerio de Agricultura, Pesca y Alimentación" (MAPA), launched a national strategy called "More food, less waste" (translated from the Spanish version "Más alimento, menos desperdicio") in 2013, there is still not a national law approved ("Nuestra estrategia, aquí no se tira nada", 2022). This strategy was designed into two phases, one from 2013 to 2016 and a second from 2017 to 2020 ("Nuestra estrategia, aquí no se tira nada", 2022). However, there is an upcoming law that will enter into force by 2023 and that aims to prevent food waste along the FSC.

The fact that there is the upcoming law at national level regarding food waste in Spain, gives the actors in the FSC the opportunity of stepping above and planning the best ways to contribute to its goals in advance. Therefore, it is the perfect time to consider the food waste challenge in Spain.

1.2. Research gap

Nowadays, food waste is considered mainly only from a social perspective, rather than an environmental or economic challenge also (González-Santana et al., 2020). Spain is not an exception for this, unfortunately. In Spanish households, the main factors that are influencing food waste are

the lack of awareness of what is being wasted (such as leftovers from meals), the lack of planning when shopping, the lack of storage techniques, the misunderstanding of the labels and the portions served in the supermarkets (Ministerio de Agricultura, Pesca y Alimentación de España (MAPA), 2013).

Nowadays, the main efforts of the different actors in the FSC are in reusing the already produced food (by redistributing the surplus of it) instead of trying to reduce the amount of food being produced and consequently being wasted. In other words, the focus is on providing the excess of food to social entities instead of reducing or avoiding the generation of this excess from a beginning (Residus, 2014).

In Catalonia, food trashed is estimated to be 1,18 million tonnes per year, however, not taking into consideration the food that is inevitable to be trashed, a total of 262.000 tonnes are wasted every year (Residus, 2014). This means that each citizen wastes an average of 39,4 kg of food a year supposing an equivalent of 112 euros per year to each (Residus, 2014). These numbers show how consumers need to also take responsibility of the change, not only for their effect on the planet and society, but also on themselves (Residus, 2014).

Even though the present legislation in Catalonia refers to the need of involving consumers, it doesn't show any sanctions to them, leaving their contribution to the problem in somehow up to them. Being such an important problem to tackle, it is necessary to find the way to change the level of awareness of citizens, and to ensure a change in their behaviour at a domestic level, specially. The supermarkets being the principal location with food availability for consumer purchase, they have been selected for this research as the main intermediator of good practices to reduce the amount of food waste in households. At a Catalan level, the law 3/2020 of 11th March, on the prevention of food loss and waste, gives the responsibility of raising awareness of customers to public administrations (Generalitat de Catalunya, 2020). However, the upcoming law at a Spanish level, the "Law for the prevention of food loss and waste", which will enter into force the 2nd of January of 2023, adds the responsibility also to supplier companies, such as supermarkets, to promote good practices addressed to reduce food waste (Gobierno de España, 2021).

Many solutions to reduce food waste suggested in literature focus their efforts in changing the behaviour of consumers, as it is usually in the consumption stage where more food waste is generated. These have been addressed through awareness-raising campaigns mainly (Närvänen et al., 2019). However, there are also other interventions to address this behavioural change that are becoming popular and that are based on behavioural economics, design thinking and technological innovations.

In terms of behavioural economics, nudging is a strategy that is becoming popular and that aims to influence the behaviour and decision-making of people (Weijers et al., 2021). This term has become popular in the past decades and was determined by the economist Richard Thaler and the legal scholar Cass Sunstein, who built much of their work on the findings of Daniel Kahneman and Amos Tversky (von Kameke & Fischer, 2018).

The present research aims to understand which nudge techniques promoted by supermarkets can modify the behaviour of customers in a more appreciated way. At the same time, the supermarket could take the chance to position itself in the market as a promoter of food waste reductions, anticipating to the national upcoming law. This not only contributes to the achievement of SDG 12, but also improves the reputation of the supermarket, while it increases the number of loyal customers with the same values.

1.3. Research goal and questions

The reduction of food waste generated in households and the contribution of supermarkets to ensure it, are crucial. The research objective is to offer an understanding of the preferences of consumers regarding food waste nudging techniques introduced by supermarkets with the aim of impacting citizens behaviour to reduce the volume of food waste they generate at a domestic level. Knowing the preferences of the customers of a supermarket can be very effective to design more effective nudges.

With the intention to give an answer to the described situation, the research is driven by the following research question:

What type of nudging techniques introduced by supermarkets would be preferred by consumers to reduce the volume of food waste they generate in their households in Catalonia (Spain)?

To respond the main research question, four different sub-questions (SQ) have been defined which are the following:

SQ1: What type of nudges can be incorporated in a supermarket to contribute to reduce food waste at households?

SQ2: What is the opinion of citizens on the incorporation of nudges, in general, in favour of food waste reductions in their households?

SQ3: What is the preferred type of nudging techniques of customers to tackle food waste at households' level?

SQ4: Which of the selected nudging techniques would the supermarket be willing to incorporate to contribute to avoiding food waste generation at households' level?

1.4. Thesis outline

Chapter 1 includes an introduction to the context of food waste and a description of the main research questions the present document will try to give answer to. Moreover, it offers an understanding of why this research is crucial to be done and how can it be useful to cope with the challenge of food waste. Chapter 2 describes the literature review carried out to define the methodologies required. This chapter includes the presentation of the nudging theory and other relevant theoretical frameworks. Chapter 3 describes the different methods used to collect data, that correspond to a customer survey and an expert interview. In Chapter 4, results are presented and discussed, followed by Chapter 5, in order to finish with a closing conclusion.

2. Literature review

Chapter 2 reviews the literature and the key concepts that are relevant for the present research. The literature review includes the concepts of food waste and food losses, an overview of the FSC and the potential of supermarkets position and the main drivers that lead to food waste in Spanish households.

2.1. Theoretical background

2.1.1. Food waste and food losses

In Chapter 1, a brief definition of food waste and food losses has been provided. On the one hand, food loss is the decrease in the quality or quantity of food that results from the food suppliers (without including retailers, food service providers and consumers) due to their decisions or actions. On the other hand, food waste refers to the same but also regarding retailers, food service providers and consumers ("Technical Platform on the Measurement and Reduction of Food Loss and Waste | Food and Agriculture Organization of the United Nations", 2019). Figure 1 represents how this terminology is determined by the stage in which food surplus is being found in the FSC.

Figure 1. Classification of food waste by categories and according to its generation in the different stages of the food chain.

Source: González-Santana et al. (2020).

As mentioned in Chapter 1, the focus in this research is on household food waste, which therefore is understood as the food waste generated in the consumption stage, represented in the right side of Figure 1.

Regarding food waste, there are three main categories. Avoidable food waste refers to the food that even if it is in perfect conditions for consumption, is discarded (for example, slices of bread). Possible avoidable refers to the food that is in optimal conditions and that for some reason some people trash it (for examples, bread crusts). Last, inevitable, refers to the remains of food that are not edible. This last category includes, between many, bones or skins of products (González-Santana et al., 2020).

2.1.2. The food supply chain

The FSC chain refers to all the processes and actors going from agricultural raw material to food consumption. In other words, it is the system composed of organizations, people, and activities that go from the generation of food to the consumption of it (González-Santana et al., 2020).

In Figure 2, the food elements of the system are represented in a diagram to show how each step is interlinked with the next one (Dankbar, 2021). This means that whenever one stage is disturbed, the whole FSC is affected, usually supposing changes on prices (Los, 2019).
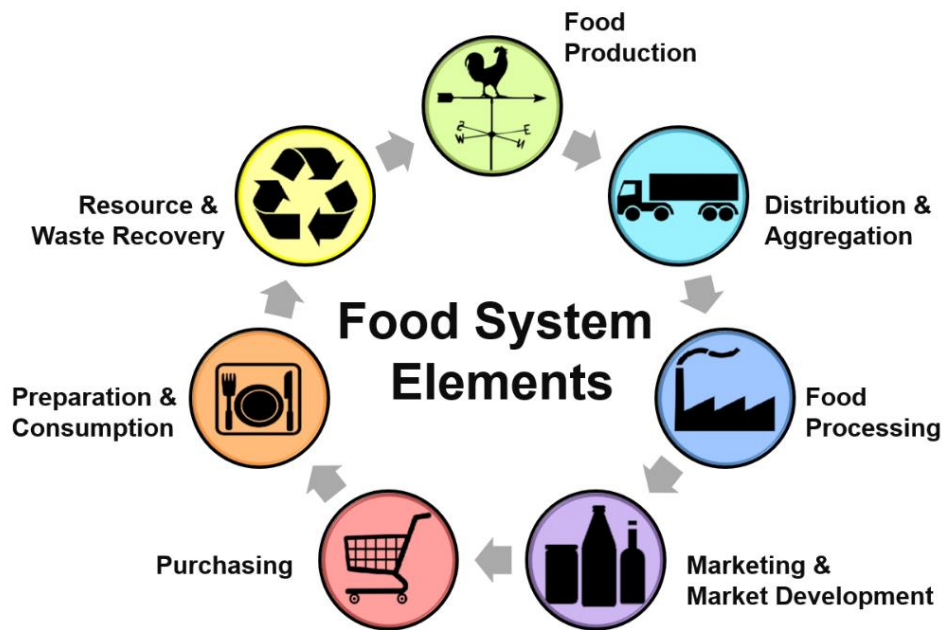
Figure 2. Food System Elements. Source: Dankbar (2021).

For the present research, purchasing food has been selected as the element in the FSC where more efforts can be done to contribute to the reduction of household's food waste. Especially, because it is not a technological challenge, but a more behavioural challenge. Purchasing takes place in food retailers, such as supermarkets, therefore, supermarkets are a perfect point to influence people's behaviours (Huitink et al., 2020). In other words, retailers intermediary position makes it possible to impact other actors such as consumers (Närvänen et al., 2019).

Even if nudging techniques have some limitations, they can still be more effective than marketing techniques (Gonçalves et al., 2021). As seen in Figure 2, marketing is one of the elements in the food system and that is the step where nudging interventions could be developed to achieve more responsible food purchases and consumption behaviours.

2.1.3. Household food management behaviour

Food waste is a result of many factors, which makes it a difficult challenge to tackle. It is an unstructured problem as it is difficult to identify its causes and effects and therefore there is not a global definition of the problem (Närvänen et al., 2019). It has been mentioned before that each country has its own characteristics, and these mainly are influenced by the particularities of the FSC. This leads us to the fact that food waste is also a cross-cutting problem, as it involves many actors thought all the stages from food production to food consumption (Närvänen et al., 2019). Unfortunately, it is not only a complex problem, but it also doesn't have one unique solution, which

makes food waste a relentless problem. This research focuses on households impacts and supermarkets contribution; however, this doesn't mean they are the solution to the problem. Efforts need to be ensured through the FSC and commitment between actors needs to be guaranteed.

Household food waste includes any waste generated from planning the purchase of food to the consumption of it, passing through shopping, storing, and preparing. In Figure 3, the dashed lines show food movement, and solid lines indicate where waste can be generated along these stages (Närvänen et al., 2019).
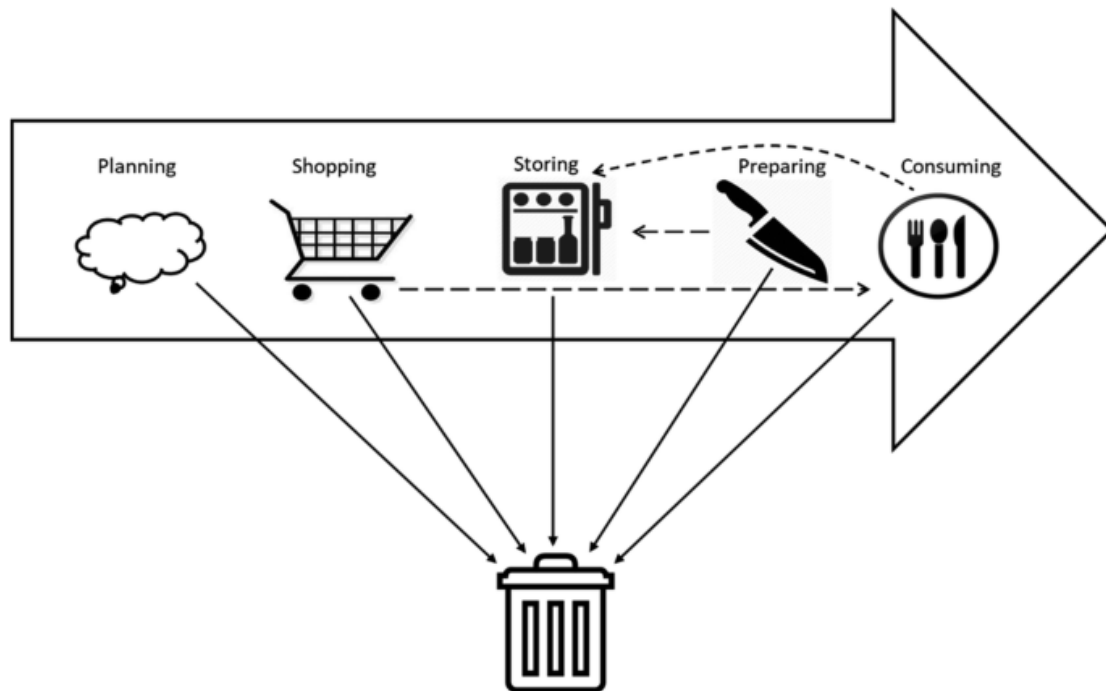
Figure 3. Household food management. Source: Närvänen et al. (2019).

Focusing on stage 1, planning can lead to accurate purchasing, reducing unnecessary food waste. In stage 2, shopping, the behaviour of people influences the type and amount of food they purchase. In here there can be a differentiation, for example, between people that are more price-oriented or attracted to offers. In this stage it is important to understand the customer target of the supermarket and its way of thinking to adapt the nudges in the best way. In stage 3, the way in which people store food determines the useful life of a product. Therefore, adequate storing practices can reduce the food waste generated in households. Moreover, in the stage 4 of preparing, good cooking skills or well determined dish sizes can contribute to less food waste generation. Finally, stage 5 of consumption, cannot be taken for granted, as actions such as eating leftovers is also a good practice to trash less food (Närvänen et al., 2019).

All the steps mentioned refer to food waste that can be generated at a household level, however, not everything is in the customers' hand. Many decisions made by producers, distributors, and

supermarkets, has always influenced the total amount of food waste in favour of more economic benefits. An example is supermarkets giving away products with a 2x1 offer, a promotion meant to sell more, which ends up causing more food waste (Secondi et al., 2015). Also, the supply of big portion sizes of food (big packaging) which are not useful for dish elaborations and also suppose surplus food being trashed (Secondi et al., 2015). However, the present project focuses on food waste at household level.

In Figure 4, the main reasons for food waste generation throughout the household food management stages are presented. The results are extracted from a study, based on responses of a survey addressed to Spanish households, published in 2013 by the Spanish Confederation of Consumers and Users Cooperatives (HISPACOOP) and endorsed by the National Consumption Institute (INC) (Ministerio de Agricultura, Pesca y Alimentación de España (MAPA), 2013). Between them, leftovers from meals, products that have deteriorated due to poor preservation or storage or because of the passage of time, and leftovers intended for use, are the main reasons of food waste generation.
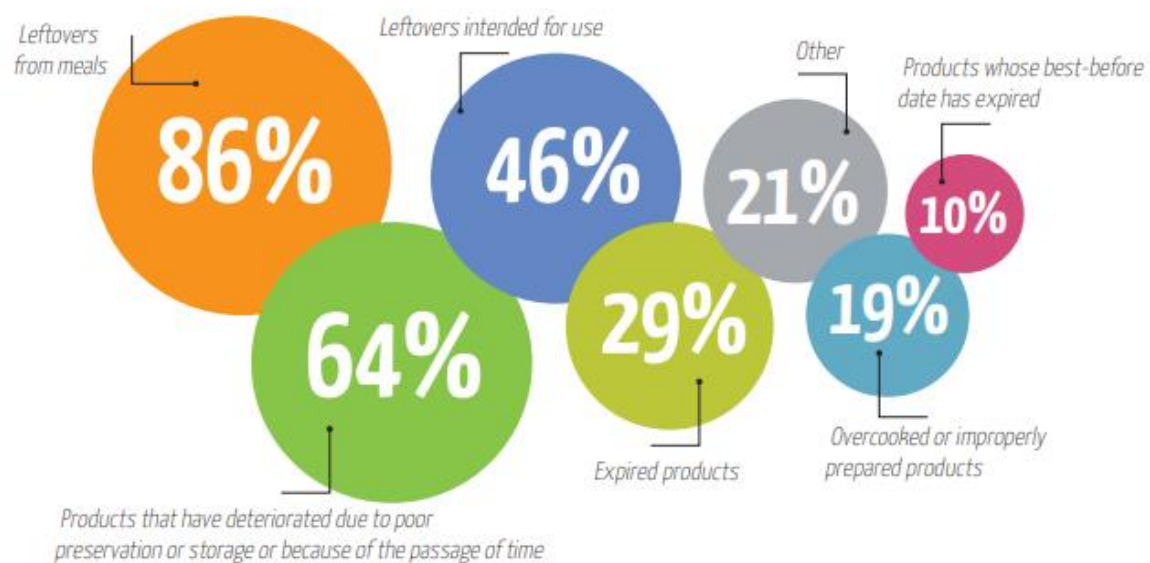
Figure 4. Reasons for throwing out food in Spain. Source: Ministerio de Agricultura, Pesca y Alimentación de España (MAPA) (2013).

Looking at these reasons for throwing food at the household levels, we can see how consumer behaviour is key to be changed to improve the impact society has on the environment. To do this, a strategy is needed to behave more sustainably, by, for example, incentivising sustainable behaviours, giving access to pro-environmental choices, engaging people to get involved and giving example with policies and practices (Jackson, 2005).

2.1.4. Sustainable consumption

Food waste is a result of an unsustainable way of producing and consuming. Sustainable consumption and production (SCP) are understood as the use of services and products to cover basic needs by reducing the use of natural resources ("Sustainable consumption and production policies", 2022) (Filimonau & Gherbin, 2017). SCP is not only a way of reducing food waste, but also a chance to increase food security and reduce environmental pressure (Filimonau & Gherbin, 2017).

Achieving a change toward sustainable consumption needs to be considered a long-term process and requires the collaboration of all the actors involved (von Kameke & Fischer, 2018). It has already been mentioned that consumers play an important role in food waste reduction efforts, therefore, options need to be facilitated to consumers to change their behaviour into more sustainable ways of consumption.

Literature lists three ways in which people can learn new ways of behaviour, that are, first, trial and error, second, persuasion and third, through forms of modelling (social learning) (Jackson, 2005). Trial and error refers to learning what to do by experiencing positive and negative effects to our behaviours (Jackson, 2005). Social learning is the same but complemented with learning from others by observing them and modelling our behaviours on what they do (Jackson, 2005). This term is very much linked to self-evaluating as doing so to oneself comes mainly from comparing ourselves to others (Jackson, 2005). Also, models that are more attractive or influential to us are more likely to make us learn (Jackson, 2005). Social learning turns out to be very useful in ordinary behaviours, reason why it has been used in many forms in marketing and advertising (Jackson, 2005). Moreover, the principles of persuasion rely on, 1) understanding the target audience, 2) using emotional and imaginative appeal, 3) immediacy and directness, 4) commitments and loyalty schemes and 5) use of retrieval cues to catalyse that help people bring the persuasive messages to their mind (Jackson, 2005). However, persuasion can be confounded with external information that the consumer receives (Jackson, 2005).

Retailers are in a unique position in the food system and can have the power to change the demand towards more sustainable actions (Bauer et al., 2022). Therefore, the initiatives that they boost are great opportunities for lasting behaviour change towards a more sustainable consumption of consumers (Bauer et al., 2022).

Sustainable-oriented innovations include approaches to sustainability retail marketing such as the use of in-store nudges, that can modify the decisions of consumers into more sustainable ones (Bauer et al., 2022). These decisions, if they are maintained constant over time, can lead to a behavioural change that will ensure a sustainable future for food waste (Barker et al., 2021).

2.2. Theoretical framework

2.2.1. Nudge theory

Economist Thaler and legal scholar Sunstein defined the term nudge as anything that modifies the behaviour of people in a predictable way without forbidding any options or significantly changing their economic incentives (Thaler, R. H., & Sunstein, 2008). By the proper use of nudges, we can address many of the major challenges in the world and improve the lives of people (Thaler, R. H., & Sunstein, 2008).

Ordinary consumer behaviour, understood as the result of taking low-cognitive-effort decisions, such as sometimes purchasing food, which in most of the cases is a routine, leads to unconscious or immediate decisions (Jackson, 2005). Habitual behaviours can move customers away from rational decision because when purchasing, lack of time, complexity of choosing between products and lack of knowledge on the consequences of their decision, leads them to automatic and easy purchasing, reducing the cognitive effort of buying in a way it reduces food waste (Jackson, 2005). Therefore, nudges, are a good solution to these ordinary consumer behaviours (Jackson, 2005).

Until now, nudges have been used most in the food sector to promote healthy diets, specially to avoid overweight (Thaler, R. H., & Sunstein, 2008). However, food waste behaviour change studies by the use of nudges, still lack on quality (Barker et al., 2021).

Still, there are some studies on reducing consumer food waste, however, the focus of them is on situations of eating out at canteens or restaurants mainly (Bauer et al., 2022). Nevertheless, even if most of the studies focus on health issues, environmental sustainability is becoming more popular (Bauer et al., 2022).

It is true that nudges are not the solution to everything, and that its applicability needs more research. However, nudges must be considered not as a replacement of policies, but as a complement to them (Bauer et al., 2022). Nudges are affordable and easy to implement and therefore can adapt well to the context they are applied to (Barker et al., 2021).

Considering the fact that supermarkets will be required by law to raise the awareness of consumers at a Spanish level by 2023, nudge techniques are a cost-effective solution (Sunstein, 2014) that can help comply with it, at the same time it makes supermarkets contribute to change customers behaviour towards more sustainable ways of consumption. In Table 2 there is a list of nudges applicable to food waste contexts in line with the definitions stated by the originators of the concept, Thaler and Sunstein.

Nevertheless, in Chapter 4.1, specific examples of different nudges that have been listed in literature, both as suggestions or/and as real interventions, will be described.

Table 2. Identification of nudges. Source: Barker et al. (2021).

A. Default rules, e.g., automatic enrolment in programs such as external meal planning and fee-based strategically portioned food ingredient delivery
B. Simplification, e.g., reducing barriers of target behaviour
C. Use of social norms, e.g., Regular exchange about personal experiences on the reduction in food waste with friends and neighbours
D. Increase in ease and convenience, e.g., making low-waste food options visible
E. Disclosure, e.g., revealing environmental costs associated with food waste
F. Warnings, graphic, or otherwise, e.g., Pictures that demonstrate how food waste damages the environment
G. Pre-commitment strategies, e.g., A challenge on household food waste reduction with a friend
H. Reminders, e.g., Tips on shopping planning via email
I. Eliciting implementation intentions, e.g., asking "do you plan to reduce food waste?"
J. Informing people of the nature and consequences of their own past choices, e.g., Feedback on financial costs of an individual's food waste

2.2.2. Consumer behaviour theories

Conceptual models are very important in understanding consumer behaviour and possible drivers of behavioural change (Jackson, 2005). These have been used as frameworks to test the strength of relationships under specific circumstances to explore ways of behavioural change (Jackson, 2005).

Frequently theoretical frameworks applied in food waste research are the social cognitive theory (that started as social learning theory) or the theory of planned behaviour (TPB) (Barker et al., 2021). These can help identify which nudges are more effective, as nudge techniques can be used in a parallel way to these theoretical frameworks (Barker et al., 2021).

SQ3 of this research aims to give an answer to what type of nudges would be preferred by consumers. To address the questions to consumers (through a customer survey that is explained in further chapters) to comprehend their preferences, first their behaviour needs to be understood.

The TPB explains how attitudes, social norms and perceived behavioural control can lead to predictable behaviours (Barker et al., 2021), as represented in Figure 5. Attitudes refer to what lead us to a particular behaviour, such as knowledge, prejudices… The attitude of someone includes the beliefs about something (expectations) and the evaluation of the resulting behaviour (Jackson, 2005). Stronger beliefs, then, lead to more success, as the attitude towards a behaviour is more confident

(Jackson, 2005). Subjective or social norms refers to the way we see a specific behaviour based on what we think others believe (Jackson, 2005). Our need to feel part of a group and fit in, makes us adhere to some social norms or others (Jackson, 2005). Perceived behavioural control (PBC) refers to the extent to which we think we are capable to behave in a way (Jackson, 2005). This last concept affects our intentions, as it is influenced by if we consider we will be able to change our behaviour or not, and therefore determines our real behaviour (Jackson, 2005). In other words, people that are confident that they can do something, are also more likely to be successful and accomplish it.

TPB until now has been mainly used in health psychology, such as predicting the intentions of people in topics like smoking or drinking (Brookes, 2021). However, it is also the framework predominantly used when doing research on food waste behaviour (Schanes et al., 2018).
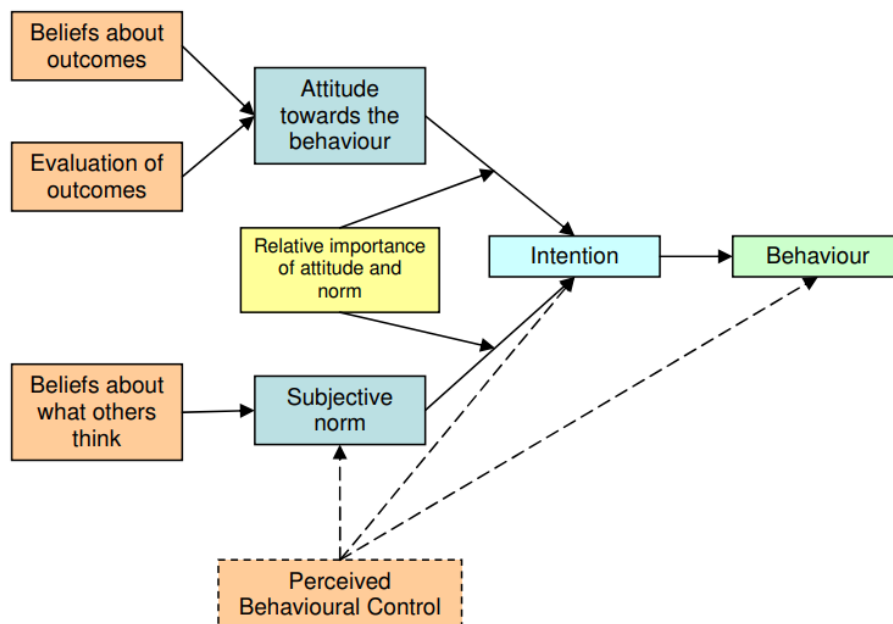
Figure 5. The Theory of Planned Behaviour. Source: (Jackson, 2005).

However, these frameworks are sometimes considered insufficient as they do not include normative (moral), affective (emotional) and cognitive (such as habits or routines) dimensions of people's behaviour (Jackson, 2005). For example, moral behaviours can arise from the moment someone is aware of the consequences of their actions (Jackson, 2005). Emotions, too, can lead us to unconscious thinking (Jackson, 2005). Habits and routines, also, can bring us to a behavioural "lock-in" where we end up limiting our intentions because of this automaticity (Jackson, 2005). In conclusion, these frameworks are good at describing individual (internal) decisions but may not be enough to reflect contextual (external) elements (Jackson, 2005).

The mentioned theories are socio-psychology-oriented approaches, often in the areas of consumer behaviour or environmental psychology. However, other more sociological approaches such as the social practice theories are also applied in these type of researches (Schanes et al., 2018). These may broaden the perspective on the food waste challenge as, instead of focusing on the individual with theories such as the TPB, it is concerned with the implementation of practices and how these are reproduced, maintained, stabilised and surpassed (Frost et al., 2020). Therefore, it takes into consideration a wider range of characteristics that include social, economic and cultural structures of everyday life (Schanes et al., 2018). In other words, social theories argue that behavioural change must be a collective thing at social level, as individual efforts are insufficient (Jackson, 2005).

In terms of these external structures, Giddens' (1984) structuration theory explains that human action is related to the social structures that surround it (Shove, 2012). This means that not all the processes in which we are involved are result of our decisions, but most come in an unconscious way, mainly due to social relations in routine. Giddens defended that there are social actors that participate in day-to-day activities that reproduce structural features of social systems. This combination is what is understood as "practice", and it is through practices that agents and structures are combined and not seen as independent concepts. In other words, it is a temporally and spatially combination of doings and sayings (Shove, 2012). In Figure 6, a practice is graphically represented by three elements (competence, meaning and material). Competence is referred to the skills, know-how and techniques of people. Meaning refers to the symbolic meanings, ideas, and aspirations of people. And material refers to the technologies, entities or stuff of what things are made. Some social practices of food are named in Figure 3, of which this report will focus on the shopping social practice.

Overall, sociologists defend that, even if we pursue someone towards pro-environmental behaviour, making them change their attitudes or believes, this doesn't mean they will actually behave in pro-environmental ways (Jackson, 2005).
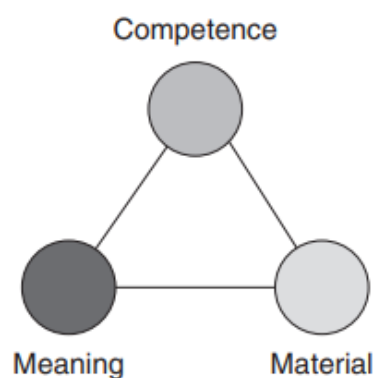
Figure 6. Link between elements that compose a practice. Source: (Shove, 2012).

Nevertheless, there are integrative theories that consider consumer behavioural from a multi-dimensional view, considering both, internal and external factors. Paul Stern is one of the most known people to develop social-psychology models in favour of pro-environmental consumer behaviours. Paul Stern and his colleagues, to do so, defend the need to consider 1) motivations, attitudes and values 2) contextual or situational factors, 3) social influences, 4) personal capabilities and 5) habits, when making sense of behaviour (Jackson, 2005). They didn't develop this modelling framework; however, they claimed that any integrative model should include four concepts: 1) attitudes, 2) contextual factors, 3) personal capabilities, and 4) habits (Jackson, 2005). This claim is very similar to the developed theory by the social psychologist Harry Triandis in his Theory of Interpersonal Behaviour, represented in Figure 7.

All the theories and different perspectives explained have been mentioned for two reasons. One, to understand what aspects determine human behaviours. Second, to highlight the large number of variables and ways of explaining human behaviours and ways to pursue change. For the present study, rather than focusing on one framework or the other, variables will be looked at into detail. Understanding these concepts will be useful to determine how some nudges might work and why some might not. Nevertheless, the nudge theory will be the predominant focus.
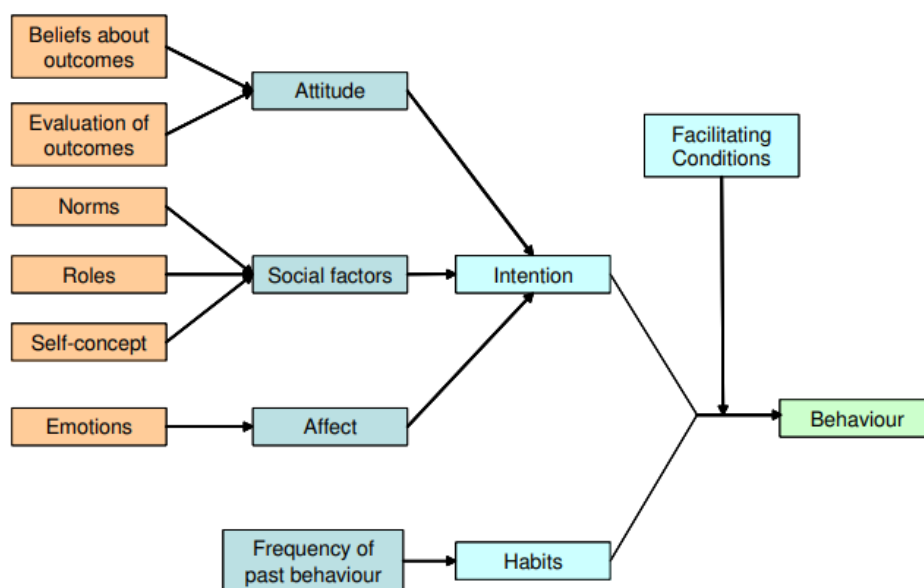
Figure 7. Triandis' Theory of Interpersonal Behaviour.

Variables that influence a decision

Human behaviour is difficult to understand, and it has been perceived differently along history. In this chapter, rather that only looking into a specific theoretical framework, variables that are considered for the case study are detailed.

A concept that can influence the decision of a customer and that will be considered in this study is the **attitude**. Attitudes are what is perceived from the results of acting in a specific behaviour. In other words, the degree to which a person is favourable or unfavourable towards the behaviour in question (Guo et al., 2018). Specifically, the attitude towards food waste reductions is considered in this case study.

The second variable to investigate is **subjective (or social) norms**, which refers to the way we see a behaviour based on the idea we have of what others think. In other words, it is a social pressure we feel as individuals to perform or not to perform a specific behaviour (Guo et al., 2018). Therefore, a social norm can interfere with customers individual preferences (Jackson, 2005).

It has been said before that socio-psychological frameworks sometimes lack normative (moral), affective (emotional) and cognitive (such as habits or routines) dimensions of people's behaviour, main reason why integrative theories were described previously.

Psychologist Schwartz, in his Norm-Activation Theory, defended **moral behaviours** as the result of personal norms, that are determined by the **level of awareness of the consequences of an own action**, and the **assumption of the responsibility of the consequences** in matter (see Figure 8 for better clarification). In his model, he defended that social norms influence individual decisions through personal norms, which are influenced by awareness of the consequence and ascription of responsibility, two variables that will be also considered.
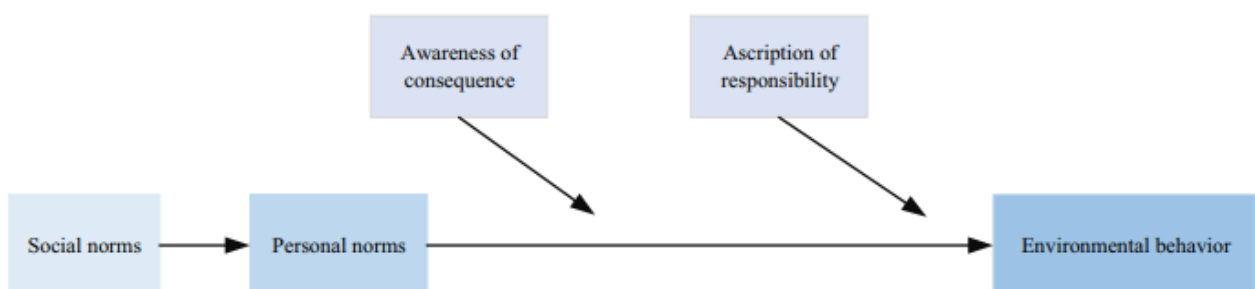
Figure 8. Normative-activation model by Schwartz.

Moreover, **affection**, which are emotional (sometimes) unconscious decisions that affect own intentions. This is because consumers tend to build affective relationships with products or brands, and this influences how they buy and behave (Jackson, 2005). Sometimes, affective, and moral concerns can conflict, though.

Finally, **habits**, which are automated repetitive actions (Jackson, 2005). The best way to change towards a pro-environmental habit is to `unfreeze´ existing behaviours.

Consumer action is influenced by many variables and never in the same way. We cannot easily therefore assume that one variable will have the same level of importance in all situations. However, gaining knowledge of these can be helpful to determine similar patterns and encourage pro-environmental behaviours preferences (Jackson, 2005).

Finally, not only psychological, or social factors can influence the behaviour of a consumer, but also it is determined by **socio-demographics**. In this study, **age**, **type of household** and **gender** are taken into consideration.

In a first instance, as the nudge theory pretends not to forbid any options or significantly change the economic incentives of customers (Thaler, R. H., & Sunstein, 2008), an economic variable has not been included in this study.

Overall, these are the variables that were studied, taking into consideration various consumer behavioural theories mentioned. To analyse them, a customer survey was held, which is explained in the following chapter.

3. Research design

Chapter 3 provides an overview of the methods that are used to answer the research SQs. Different methodologies are applied to address the questions.

3.1. Data collection of research sub-questions

As previously stated in section 1.3, four SQs were defined to answer the main research question. Different research methods are addressed for each of the SQs that are mentioned in Table 3 and detailed in section 3.2.

Moreover, as human participation is involved in the data collection, ethical considerations are included to ensure the correct use of the information obtained.

Table 3. Data collection of research sub-questions. Source: Own.

Sub-Question	Target group	Research method	Data analysis	Answered in section
What type of nudges can be incorporated in a supermarket to contribute to reduce food waste at households?	Customers & Supermarket	Desk research	Qualitative data analysis	4.1
What is the opinion of citizens on the incorporation of nudges, in general, in favour of food waste reductions in their households?	Customers	Customer Survey	Descriptive statistical analysis	4.2.1
What is the preferred type of nudging techniques of customers to tackle food waste at households' level?	Customers	Customer Survey	Descriptive statistical analysis	4.2.2
Which of the selected nudging techniques would the supermarket be willing to incorporate to contribute to avoiding food waste generation at households' level?	Customers & Supermarkets	Expert Interview	Qualitative data analysis	4.2.3

3.2. Research methods

The goal of this research is to explore the different nudging techniques and to understand which of them would be preferred by customers. To give answer to the main research questions a customer survey and an expert interview to the responsible of the sustainability department of a supermarket present in Barcelona have been held. Prior to it, desk research was done, part of which has already been described in previous chapters.

3.2.1. Desk research

Desk research was done to help answer the different SQs, especially SQ1 "What type of nudges can be incorporated in a supermarket to contribute to reduce food waste at households?", as well as to understand the context of food waste. Published articles from different databases, such as Scopus, Web of Science or Google Scholar, were used to obtain a complete view of food waste and the use of nudges. The collection of existing data was conducted via search of keywords like 'nudging customers in supermarkets', 'nudging techniques to reduce food waste', 'drivers of food waste' or 'household food waste'.

Moreover, Spanish governmental platforms were checked to obtain specific data. For example, the website provided by the Ministry of Agriculture, Fishery and Agriculture, which counts with food waste publications and documents. Also, the Food Waste Quantification Panel website, which was promoted also by the Ministry of Agriculture, Fisheries and Food, and counts with specific documents regarding food waste in the country. Finally, also the Idescat, which is the catalan institut of statistics, for general official statistics in Catalonia.

3.2.2. Customer Survey

A survey addressed to customers, which gives answer to SQs 2 and 3 was also developed. This survey was held to understand what the opinion of customers was about the introduction of nudges and their preferences regarding specific nudges, which are listed

 in the following chapters.

An online survey was used to collect data for the research, which was addressed to residents in the autonomous community of Catalonia in Spain. The structure of the customer survey was designed following three sections, which can be found in appendix A. The platform used to collect data was Google Forms, that is a survey management software that stores data in an anonymous format. Respondents were approached via own different online social media platforms, mainly Instagram, WhatsApp, and LinkedIn. Overall, 318 respondents finished the survey. However, four responses were not considered for several different reasons: two of the respondents indicated they don't buy in supermarkets, another one because they receive food from social charities, and another response was repeated. This means, there was a total of 314 completed and useful survey responses that were used to extract the results.

The first section of the survey was addressed to all the respondents. The goal of this section was to determine basic socio-demographic characteristics of the respondents and other variables such as

level of awareness of the consequences of own actions (in terms of generation of food waste) and assumption of the responsibility of the consequences (to reduce food waste). There was one last question in the first section that asked about the food purchasing responsibility of the respondent. If this person answered they were (or they shared this responsibility with another person) then they were directed to section two of the survey. Those who did not have this responsibility were directed to section three, which was addressed to all the respondents.

Section two addressed questions regarding purchasing habits (number of days the respondent buys food for), affection towards specific food brands and attitudes towards food waste reductions (with the use of nudges). In this section, the idea is to give answer to SQ2 "What is the opinion of citizens on the incorporation of nudges, in general, in favour of food waste reductions in their households?". Moreover, they were asked if they would appreciate the help of the supermarket that would help them accomplish a reduction of food waste at a household level.

Finally, section three listed six different nudges, which respondents had to give for each of them one of the three possible punctuation status which were: 1) They do not appreciate, 2) They would appreciate one time, 3) They would appreciate several times. The specific six nudges are included in Chapter 4.1.1.

More information doesn't mean more chances to change a behaviour, as it can lead to confusion or the feeling of being helpless, and people usually prefer to learn at their own pace (Jackson, 2005). It is very important to bear this in mind, as offering too much information to customers can make them feel useless and then careless of the problem (Jackson, 2005). One of the reasons for asking consumers to evaluate different nudges is to ensure that they don't feel overloaded with unnecessary nudges in future situations.

Overall, to ensure an ethically responsible research practice, the customer survey was held anonymously, as already mentioned. This means that no questions were asked in a way that could link the responses to a specific person, avoiding identification of respondents and ensuring confidentiality of their responses. Beforehand, the study had received ethical approval from the Ethics Committee of the faculty of Behavioural Management and Social Sciences of the University of Twente. The data was collected in the period from 16/06/2022 until 28/06/2022.

3.2.3. Expert interviews

It is important not only to evaluate the use of nudges from a customer point of view, but also from a retailer's point of view. Once the data was collected from the customer survey, an interview via

Teams took place the 29/06/2022 with the responsible of a big chain ecological supermarket that is present in the autonomous community of Catalonia.

The idea of this semi-structured interview was to understand what would motivate the supermarket to incorporate food waste reduction initiatives and if the nudges preferred by their consumers would be also the ones that they would be willing to introduce. In a first instance, some reasons for willing to introduce nudges were thought to be for marketing purposes, upcoming policies, or sustainable volunteer commitment. But an interview with someone involved in the food sector was required to validate these hypotheses, reason why it was held.

3.3. Data analysis

For the SQs which require the customer survey, as mentioned in Table 3, descriptive statistical analysis has been performed to describe the results obtained. Results obtained from the survey are presented in several Graphs in Chapter 4.

For the SQs regarding the expert interview, as mentioned in Table 3, qualitative data analysis has been performed.

Having different data analysis methods offers different insights to the research questions and ensures a better validity of the results. Therefore, even if it is more time consuming, it can help create a more comprehensive analysis.

4. Findings

4.1. Nudging approaches

As stated in Table 3, the first question to be answered is SQ1 "What type of nudges can be incorporated in a supermarket to contribute to reduce food waste at households?". To do so, even if the focus is on Catalonia's food waste reduction, there were no restrictions in terms of location when doing research.

Nudging customers leads them the way to a wanted behaviour in an easy way. Nudging, therefore, can be understood as designing a tiny habit, which doesn't require complex choices (Robra-Bissantz & Lattemann, 2017).

Based on the ten nudge categorizations by Sunstein (2014), many studies have been developed to understand people's perceptions on the use of nudges. In the case of Von Kameke & Fischer (2018), a

survey in Germany addressed to 101 participants, was launched to see what customers perceptions were with the use of nudges to reduce food waste in households. Participants had to rate a list of ten nudges from 1 (great supporting nudge) to 5 (not supporting at all). Each nudge was a proposal (except for one, which had three proposals) for each of the identified most effective nudges by Sunstein (2014) (von Kameke & Fischer, 2018). It is important to point out that these proposed nudges, listed in Figure 9, were developed without considering retailers support as they wouldn't be interested in incorporating them (as they mainly focus on increasing profit).

Item	Proposed nudge
e1	External meal planning and fee-based food ingredient delivery
e2a	Tips on shopping planning via mail.
e2b	Tips on shopping planning via email or app.
e2c	Tips on shopping planning via an internet platform.
e3	Public promotion of food waste reduction by a respected person.
e4	Regular suggestions for weekly meal planning.
e5	Feedback on financial costs of the individual food waste produced.
e6	Pictures that demonstrate the extent of the food waste amounts.
e7	Regular exchange about personal experiences on the reduction of food waste with friends and neighbors.
e8	Reminders about using shopping plans in order to reduce food waste.
e9	A challenge on household food waste reduction with a friend.[a]
e10	Feedback on the actual food waste amounts generated by the individual household.

Figure 9. Nudges suggested by Von Kameke & Ficher (2018), aligned to nudge-type identification by Sunstein (2014). Source: (Filimonau & Gherbin, 2017).

Results showed that respondents were interested the most in nudges that offered feedback on their own behaviours (such as e5 and e10 in Figure 9), in social exchange nudges (e7 and e9), as bets, challenges, or similar social interactions on the topic with community members, or, finally, nudges that offer specific advice on meal planning (such as e4). Moreover, results showed that young people or respondents living in big households, were more likely to prefer food waste reduction nudges.

4.1.1. Selected nudges for survey

For the study, six nudges for the survey were selected that are summarized in Table 5 in Appendix B and that cover the nudge typologies stated in Table 2.

Information is key in changing the behaviour of consumers, as market information makes consumers do rational choices (which turns out to be the choice that maximises the expected benefits of an individual). Rational choices not only determine consumption behaviours but also non-consuming behaviours (Jackson, 2005). In reference to food waste, determining the individual costs and benefits of non-purchasing extra amounts of food that will end up being wasted could be useful to

understanding the behaviours of consumers. Reducing the misalignment between the attitudes people have regarding food waste reductions and the actual efforts of food waste reductions would involve behavioural change (Smit, 2019). To do so, a nudge to inform people of the consequences that their behaviour has is included in the survey. This is in line with nudge J "Informing people of the nature and consequences of their own past choices" and E "Disclosure" of Table 2. Moreover, this could be exposed with graphics or pictures, however, it is a more aggressive way of presenting a challenge and might not be welcomed by supermarkets. That is why, nudge F "Warnings, graphics or otherwise" is not proposed as a nudge in the survey. Having said this, the first nudge described in the survey is: "**Information posters on annual food waste. E.g.: On average, each citizen generates 35 kg of food waste every year, that supposes 112 € of losses every year**".

Also, giving information in a simplified way can be key to help consumers accomplish their goals of reducing food waste. Simplifying the information that one can find on the internet by placing it in a supermarket close to the food products, can improve the understanding of the clients by providing them with input ideas that they can incorporate in their lives afterwards. Therefore, another way of offering information can be by explaining how other recipes in a short format can be elaborated with parts of a food that usually are thrown away due to lack of knowledge. For example, the leaves of the carrots, which people usually don't consume, have several alternatives. This nudge is in line with nudge types B "Simplification" and H "Reminders". Therefore, the second nudge described in the survey is: "**Recipe suggestions (where you find the product in the supermarket) to reduce food waste by using parts of that food products that are usually throw away. E.g.: You can use the leaves of the carrot such as parsley, as part of broths, stews, or soups, for a salad, for green smoothies…**"

Written information sometimes has little effect (Abrahamse, 2020). Encouraging people to change their behaviour sometimes has a bigger effect when information is deliberated in a face-to-face format (Abrahamse, 2020). In the case of study, instead of addressing to the customer with details on how they can buy different, the cashier would explain a way in which the customer could waste less at home by offering the use of a tool. This nudge would maybe encourage customers, in the last minute, to think of the food waste they generate, and to be provided with a quick solution to cope with it. This would be in line with nudge G "Pre-commitment strategies", in this case in a household level, as the consumer would be accepting an indirect challenge. This can be linked also to nudge I "Eliciting implementation intentions" if the cashier asks them also a powerful question on if the consumer in planning to reduce the food waste he or she generates or not. The third nudge eventually turns out to be: "**Reminders and tools to preserve food given by the cashier. E.g.: "Are**

you planning to reduce your food waste? Would you like to take with you these freezer bags, so that you can keep food longer and reduce your food waste? "

Moreover, even if the supermarket store might be the primary point to offer information to a consumer, there are also other ways rather than in-store, promoted and facilitated by the supermarket group. Using the supermarket apps or supermarket websites are examples. In this case, a mixed example of nudges H "Reminders" and C "Use of social norms" could be the adoption of a "Food Waste" space in the supermarkets website that included tips on how to reduce food waste, videos on recipes that use common wasted food products parts or information on how to preserve food longer. This could include reminders in the format of web or app notifications that tell you not to forget to consume the products you bought and that might eventually turn bad. The fourth nudge described in the survey is: "**Digital opportunities to learn how to reduce waste. E.g.: Section on the website and app of the supermarket with cooking classes, videos, tips, and recipes to reduce food waste and optimize purchases of food, while being connected with other customers.**"

Not only these, but default rules, as expressed in nudge A, are also a powerful and direct way of moving a customer from a way of purchasing to another. There are two options to this. First, offering a pre-selected box of food products or offering shopping lists at the entrance of the supermarket to pre-determine the imminent purchase. Different options would be made visible, depending on the number of people in the households and number of days for which the customer wants to buy food. The first option would be more suitable for people with limited time. The second, with people that lack shopping planification and tend to overbuy, making them, not only buy the necessary, but also reducing the time spent in the supermarket. In this case, the fifth nudge is: "**Receiving a curated shopping list or box of products (based on previous shopping history) at the entrance of the supermarket so that you can stick to it and not buy excess food. This list would be adapted to your household size and days you want food for.**"

Finally, redistributing products in-store can facilitate the understanding of food labels and encourage pro-environmental choices of customers. Among others, greenwashing news, complexity of eco-labels and large number of types of eco-labels, make it difficult for customers to effectively make use of them (Vlaeminck et al., 2014). Therefore, redistributing products in-store can facilitate the understanding of food labels and encourage these expected sustainable behaviours. Also, people are sometimes self-interested and make decisions based on the price of things. Therefore, adjusting the prices of products in favour of pro-environmental and pro-social behaviours is an option. To do so, a last sixth nudge suggested for the survey is: "**Close-to-expiry date products easier to find, cheaper. E.g.: Redistribution of fresh products based on their expiry date, such as dividing a section in an**

aisle in two parts: 1) Consume preferably in the following 2 days and 2) Consume preferably in the following 5 days. Price discounts would be in place for products close to expiry."

Overall, these six nudges have been selected to evaluate different types of nudges and to understand which ones are preferred, based on different customers. With all these nudges, all the nudge typologies listed in Table 2 are covered. In the next chapters, the results obtained in the customer survey are selected.

4.2. General results of the customer survey

From the 314 respondents, mentioned before, 65,29% identified themselves as women, 34,39% identified themselves as male, and a 0,32% as other. Moreover, there were four ranges of age defined in the survey, in which it was showed that the range of 50-64 years old and the range of less than 35 years old, were the ones answering the most, with a 43,95% and a 35,67%, respectively. Followed by the range of 35-49 years old and more than 64, with a 10,83% and 9,55%, respectively. This data is summarized in Table 4 and is randomized, as respondents were random.

Table 4. Demographics of the customer survey. Source: Own.

Men	**108**	**34,39%**
Less than 35	32	10,19%
35-49	15	4,78%
50-64	49	15,61%
More than 64	12	3,82%
Women	**205**	**65,29%**
Less than 35	80	25,48%
35-49	18	5,73%
50-64	89	28,34%
More than 64	18	5,73%
Other	**1**	**0,32%**
35-49	1	0,32%
Total	**314**	**100,00%**

Moreover, luckily, about the question of the first section of the survey on how the respondent considers food waste to be, most of them answered it is an economic, social, and environmental issue as mentioned in the first chapters of the report. In Chapter 1.2, it was mentioned that

nowadays, food waste is considered mainly only from a social perspective, rather than an environmental or economic challenge also. This is shown in Graphic 1 as a second reason (for both female and male), which verifies the perception. Still, however, 15 people argued that it is not a problem at all, which verifies that there is still lack of understanding on this topic. Of this 15, 66,67% live in a household with children.

Food waste in your house is:
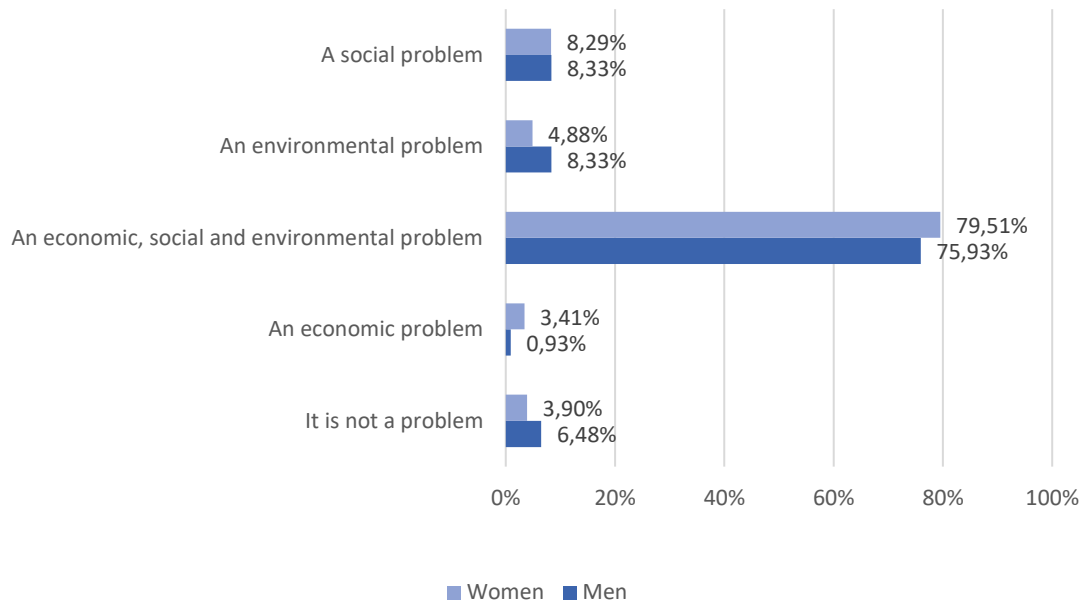
Graphic 1. Level of awareness of consequences of food waste. Source: Own.

The level of awareness of the consequences of own actions seems to be high, which is why most of respondents consider themselves to be part of the solution (87,26% of all the respondents). Also, 89,4% of the respondents with the highest level of knowledge (that answered food waste is a social, environmental, and economic problem) argued they are responsible of reducing food waste. This of course cannot be extrapolated to the whole Catalan society, as the percentage of responses is not significant if compared to the total population and it only takes into consideration people with access to internet (who were able to answer the survey), but it gives an understanding that conscious customers are more willing to contribute positively and feel responsible for this problem. In conclusion, therefore, knowledge needs to be continuously shared to raise awareness among consumers, who will then be more proactive to reducing food waste. Moreover, respondents consider supermarkets to be the second actor group responsible of reducing food waste, followed by governments (represented in Graphic 2).

Who do you consider to be responsible to reduce your food waste at home?
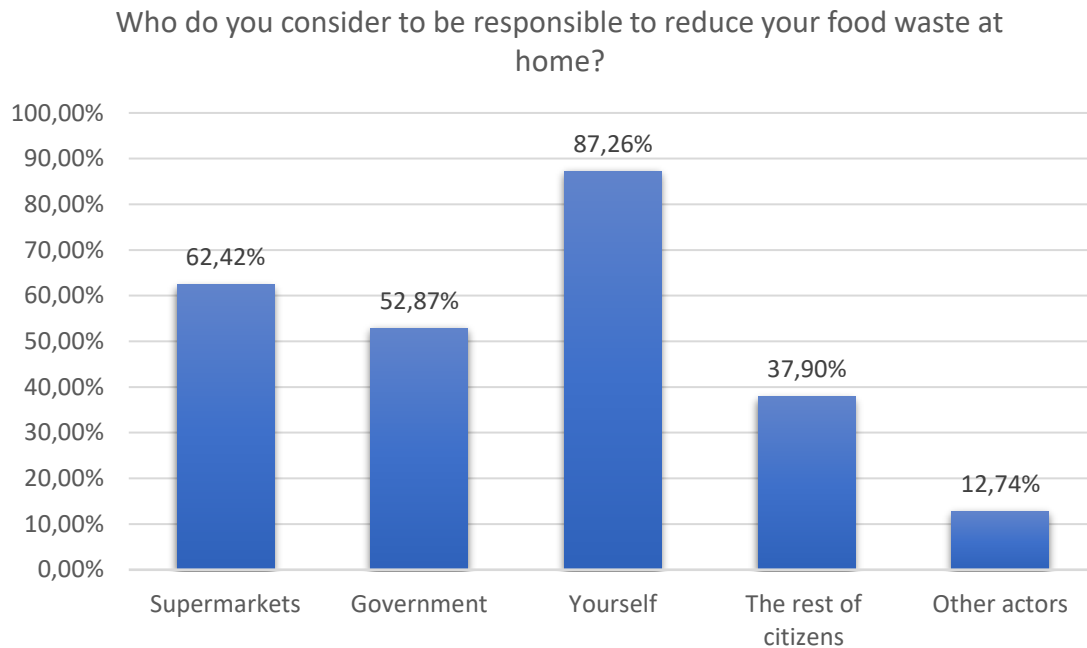
Graphic 2. Level of assumption of the responsibility of the consequences of food waste. Source: Own.

4.2.1. The consumers' opinion of nudges

The opinion of customers on the use of nudges to answer SQ2 "What is the opinion of citizens on the incorporation of nudges, in general, in favour of food waste reductions in their households?" is determined in section two of the customer survey.

To the survey question "Would you be willing to receive suggestions (directly or indirectly) from the supermarket to reduce food waste in your households?", many customers answer that they would be willing to. In this case, only the respondents in charge of going to the supermarket were asked this question, as those are the ones that would be perceiving the most the future nudges implemented. In section two, therefore, 262 responses were counted (as 52 respondents were not in charge of the purchasing habit). As seen in Graphic 3, out of the 262 respondents, 77,86% would be willing to receive nudges, 19,47% aren't sure and answer that it depends, and only a 2,67% would be against this type of initiatives. This shows the high motivation of customers to be part of the solution of food waste and the eagerness to do so hand by hand with supermarkets. Also, as shown in Graphic 4, out of these customers, a 92,75% would appreciate a supermarket that includes these types of initiatives and 6,11% respond that it depends.

Would you be willing to receive suggestions (directly or indirectly) from the supermarket to reduce food waste in your households?

■ No ■ It depends ■ Yes
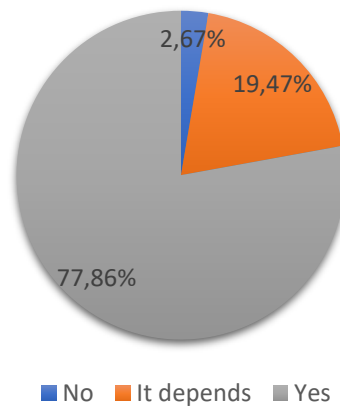
Graphic 3. Respondents willing to receive (direct or indirect) nudges. Source: Own.

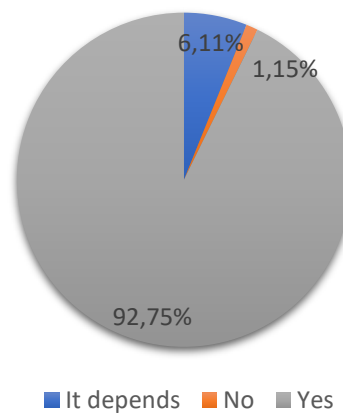### Would you appreciate a supermarket that helps you reduce food waste?

■ It depends ■ No ■ Yes

Graphic 4. Respondents' appreciation of the incorporation of nudges by supermarkets. Source: Own.

Overall, to SQ2 "What is the opinion of citizens on the incorporation of nudges, in general, in favour of food waste reductions in their households?", the answer is positive. Comparing Graphics 4 and 5, not only consumers would like to receive these inputs from a supermarket, but also would appreciate the supermarket that does so. Therefore, not only consumers consider themselves and supermarkets the main responsible of reducing food waste, but they also verify the strategic position of supermarkets by responding their appreciation towards them.

4.2.2. The consumers' nudging preferences

The level of appreciation of customers to answer SQ3 "What is the preferred type of nudging techniques of customers to tackle food waste at households' level?" was asked in the third section of the customer survey. As mentioned before, six nudges were detailed and respondents had to choose if they would appreciate one time the initiative, several times or none. These nudges are described in Table 5 in Appendix B.

Results have been extracted, bearing in mind if the respondent was or not responsible of the purchase of food for its household. However, emphasis is given to the first group of customers, as these are the ones frequenting more the supermarket and whose opinions have more value in this case study.
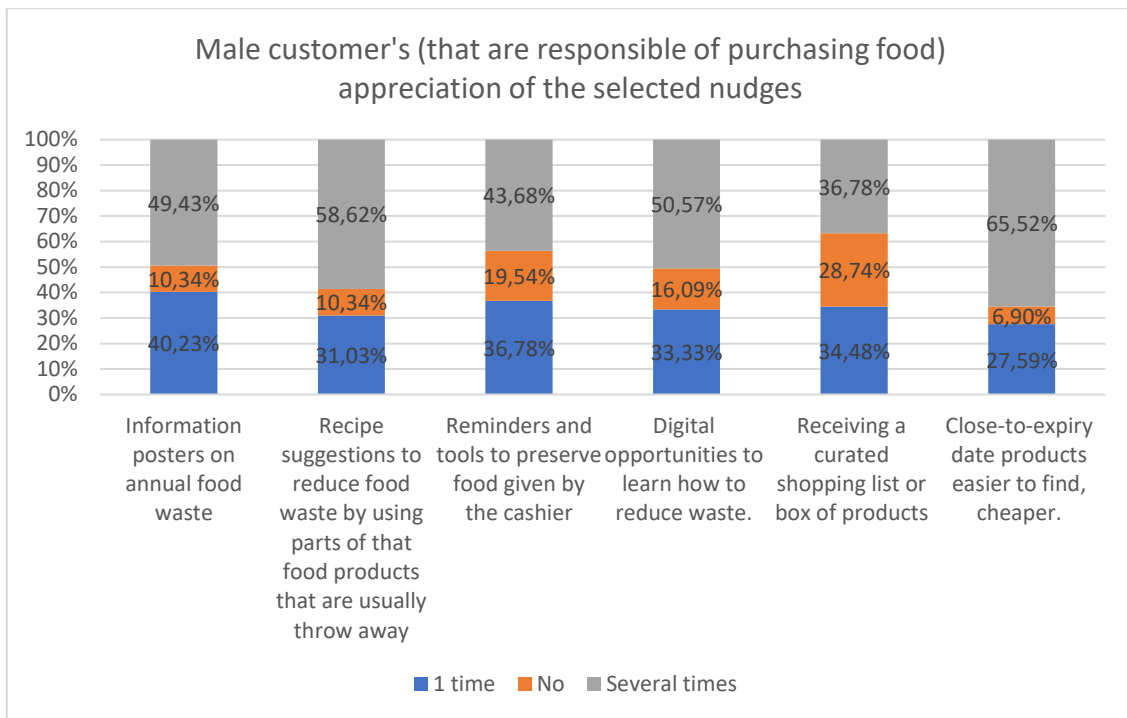
Considering first, the responses of men that are responsible of purchasing, Graphic 5 represents the percentage of men than have evaluated each nudge in a way or in another. As the focus is this group, the results for the remaining men have been incorporated in Appendix C. However, just to mention, comparing both groups of responses, is interesting how, for all nudges, respondents that are not responsible of food purchases, give a higher percentage of appreciation to all six nudges than the rest of the consumers. This shows how people that don't enter so frequently a supermarket are less specific with the type of nudges they prefer, maybe because they don't visualize themselves in these establishments.

Going back to frequent male buyers, the preferred nudges over time are: 1) Nudge 6 (Close-to-expiry date products easier to find, cheaper), 2) Nudge 2 (Recipe suggestions where you find the product in the supermarket) and 3) Nudge 4 (Digital opportunities to learn how to reduce waste).

Moving to women, results have been described in Graphic 6 and show that also, women are price oriented, showing preference towards nudge 6. However, Nudge 6 is very close in percentage to Nudge 2 in their case, showing that women are more welcoming to new recipes and ideas. Actually, it is Nudge 2, the initiative showing the highest difference of opinion between men and women.

Moreover, the smallest difference with nudge appreacition between male and women is regarding Nudge 1 (information posters). This shows that most of respondent are willing to gain infomation on the impact of their decisions.

Finally, it is important to comment that in all cases, Nudge 5 that aims to offer shoppping lists/box of products for those who do not organize their purchases, has the least pleasant responses. This shows that people prefer deciding their own purchases, even if it might take more time and even if this supposes indirectly wasting more food at home.

Male customer's (that are responsible of purchasing food) appreciation of the selected nudges

	1 time	No	Several times
Information posters on annual food waste	40,23%	10,34%	49,43%
Recipe suggestions to reduce food waste by using parts of that food products that are usually throw away	31,03%	10,34%	58,62%
Reminders and tools to preserve food given by the cashier	36,78%	19,54%	43,68%
Digital opportunities to learn how to reduce waste.	33,33%	16,09%	50,57%
Receiving a curated shopping list or box of products	34,48%	28,74%	36,78%
Close-to-expiry date products easier to find, cheaper.	27,59%	6,90%	65,52%

Graphic 5. Male customer's (that are responsible of purchasing food) appreciation of the selected nudges. Source: Own.

Female customer's (that are responsible of purchasing food) appreciation of the selected nudges

	1 time	No	Several times
Information posters on annual food waste	35,63%	11,49%	52,87%
Recipe suggestions to reduce food waste by using parts of that food products that are usually throw away	23,56%	4,02%	72,41%
Reminders and tools to preserve food given by the cashier	27,01%	14,94%	58,05%
Digital opportunities to learn how to reduce waste.	30,46%	9,20%	60,34%
Receiving a curated shopping list or box of products	26,44%	25,29%	48,28%
Close-to-expiry date products easier to find, cheaper.	22,99%	1,72%	75,29%

Graphic 6. Female customer's (that are responsible of purchasing food) appreciation of the selected nudges. Source: Own.

Results were not only represented by gender, but also by age, which are present in Appendix C. All four age groups have similar results but with some differentiation. All of them prefer the nudge of

"redistribution of close-to-expiry date products" the most, except the group 35-49 years old, which prefers the most receiving suggestions of recipes. Also, out of the others, it is the respondents under 35 that prefer the most finding cheaper products redistributed by expiry-date, representing 83,33% of them voting this option.

It is also interesting to see that while groups from 35-49 and older than 64 consider the digital opportunities nudge as a third powerful initiative, 50-64 years old respondents prefer receiving tools and not having to check information once at home.

As seen, nudges differ by gender and age, which are the main socio-demographic variables considered in this survey. However, this doesn't mean these are the only variables affecting appreciation and proves the need to consider a customer segmentation when designing and implementing nudges to have a bigger impact.

4.2.3. Supermarket's willingness to incorporate nudges

It has been mentioned previously that supermarkets have a potential intermediary position to influence customers behaviour to reduce food waste. However, the willingness of these to incorporate them, is still unclear and can depend on different factors.

In previous years, some supermarkets have undertaken initiatives in a voluntarily basis (Närvänen et al., 2019), mainly for social or environmental aspects. However, legislation also has a huge impact on how actors respond to global challenges such as food waste (Närvänen et al., 2019).

Once findings from the customer survey were explored, an interview with the responsible of the sustainability department of a big chain ecological supermarket was done. During the meeting, done the 29/06/2022, the results from the survey were shared to give answer to SQ4 "Which of the selected nudging techniques would the supermarket be willing to incorporate to contribute to avoiding food waste generation at households' level?".

To start, the interviewee was asked if they were already doing any type of nudge-oriented techniques to reduce food waste. The answer was no, as the only initiatives they were doing was giving away all the surplus of food to social entities. This again shows how the social perspective is the main way businesses tackle the problem of food waste.

Graphic 1 and Graphic 2 were shared after. To this, they were asked if they consider that supermarkets are assigned more responsibility to reduce food waste than what they are. The interviewee mentioned that if they receive this message of responsibility from customers, it is

because they consider their part of responsibility. Therefore, it is not that they are made more responsible by others that they are, but they assume their responsibility to contribute to food waste reductions, because they are as responsible as any other actor group. However, this opinion would have been interesting to compare to other opinions, who may have agreed to having too much responsibility.

Some comments in the last open question of the customer survey showed that some customers would never trust initiatives coming from a supermarket, that only wants to sell more and more. However, Graphic 3 and Graphic 4 were shared with the interviewee to show the high level of interested respondents overall (both responsible of purchasing and not) in the incorporation of nudges and how the vision of supermarkets could be improved. Therefore, nudges, if well explained, could be a way to improve the image of the supermarket and connect in a deeper way with customers.

Before presenting the most preferred nudges, the interviewee was asked if the supermarket group would be interested in incorporating initiatives to reduce food waste at households. Apart from the marketing tool and way to approach to customers in a more trustable way, the interviewee considered it is an ethical issue and needs to be tackled also voluntarily. Therefore, the supermarket group would be willing to incorporate some nudges, but not any type, especially if they suppose a very high investment. To link to this point then, once nudges were presented, the interviewee was therefore opposed to Nudge 3 (reminders and tools to preserve food given by the cashier), as giving away tools could suppose a cost difficult to compensate, especially if offered for free or at a lower price in the cashier.

The second concern that the interviewee was afraid of was the overload of information that the customers would be receiving with some of the rest of nudges. For example, also with Nudge 3, being so invasive with messages to conscious customers (of for example this ecologic supermarket), would bore the consumer during the act of purchase. Therefore, not all nudges work for all type of customers and probably a future customer segmentation would be required in more detail. This also applies to Nudge 1, then, to avoid excess of useless information.

However, regarding Nudge 2 (recipe suggestions to reduce food waste by using parts of that food products that are usually thrown away), the interviewee confirms that it is the initiative that they would like the most. However, once again, it should be thought of in combination with other type of messages present in the supermarket. Also, a way should be developed to be able to assess the actual impact of these initiatives, as reduction levels at household level are difficult to measure.

In terms of the differences between men and women, the interviewee was asked why they considered women to be more welcoming to new recipes and ideas. This question was addressed mainly because it is Nudge 2, the initiative showing the highest difference of opinion between men and women. To the question, the aswer was the difference in type of contracts that women receive compared to men.

Looking into statistic of Idescat (the catalan institut of statistics), of the total number of jobs full-time in Catalonia, 56,37% corresponded in 2021 to men, and 43,63% to women. Regarding part-time jobs, men supposed a 27,32% while women a 72,68% ((Idescat. Anuario estadístico de Cataluña. Población ocupada. Por tipo de jornada y sexo, 2022). This probably justifies why women are willing to receive more initiatives taking place in the supermarket, as they are are the ones not only purchasing, but still cooking the most, as a consequence of more free time. However, this is just an assumption and cannot be assumed as a validated result in reference to the opinion on nudges.

To conclude, it is mentioned that it is true that customers are very much price-oriented, so the interviewee was not surprised that Nudge 6 (close-to-expiry date products easier to find, cheaper) was the most popular among respondents. However, redistributing products would complicate the logistics of the supermarket and would also suppose requiring an extra-large space in the supermarket for this option. Therefore, it is not the most willing nudge to incorporate by the supermarket group.

Overall, the interviewee was in favour of nudges and considered them a very good option to educate and involve consumers in food waste reduction techniques. However, as a business, the interviewee was always looking for their business and not all techniques suited their business model. To finish then, nudges are a promising option both liked by consumers and supermarket, but prior to a possible incorporation, both opinions need to be considered and balanced to ensure the success of this type of initiatives.

4.3. Discussions

The results obtained contribute to this field of research by determining the most effective nudge interventions for altering food waste behaviour in households in Catalonia, based on the preferences of consumers.

To give answer to the main research question "***What type of nudging techniques introduced by supermarkets would be preferred by consumers to reduce the volume of food waste they generate in their households in Catalonia (Spain)?***", different consumer behaviour theories were mentioned.

Overall, it was the integrative theories that consider consumer behavioural from a multi-dimensional view the ones that have been more practical to give an answer to the question. This is mainly, because, as it includes internal and external factors, it is less limiting in terms of what variables it includes. Nevertheless, the use of nudges in the food waste context is not a topic that has undergone a lot of research, and therefore, requires more in-depth studies.

Also, even if consumer behaviour theories were required to understand how people act, it has been the nudge theory, the predominant. Taking into consideration the responses of customers and the opinions of a supermarket manager of nudges, the most effective nudges have been determined to answer the main question of the research. It is Nudge 2 "Recipe suggestions to reduce food waste by using parts of that food products that are usually throw away" and Nudge 4 "Digital opportunities to learn how to reduce waste" the most welcoming by both. Considering the nudge typologies by economist Thaler and legal scholar Sunstein, it is "simplifications", "reminders" and "use of social norms", those nudge types that seem to be most effective in the long term, not only due to the positive opinion (strong preference) on them, but also on the approval from the supermarket side. And even if nudge 6 "close-to-expiry date products easier to find, cheaper) is a welcoming approach by customers, from the supermarkets side it is not the best solution, as it supposes more investment and the logistics are difficult. In other words, it is true people are price-oriented, however, supermarkets prefer information and educating rather than changing the logistics for cheaper products to solve the food waste challenge.

Von Kameke & Fischer (2018) research results were mentioned previously and showed that nudges that have social exchange, feedback of own behaviour and advice on meal planning, were the ones more appreciated.

Therefore, giving advice in a simplified way in-store (both of recommendations or impact of own actions), followed of a digital solution that can continue giving recommendations and make reminders when being out of the supermarket, seems to be the best combination overall. Not to forget that all the information needs to be given in a way that brings consumers closer to consumers so that they influence each other (giving messages in a collective format or giving the change to interact, for example in the digital solution).

To conclude, even if there is a bit of a difference in terms of preferences of nudges, it is indisputable that the use of nudges is not only a technique than customers are willing to receive, but that they would appreciate from a supermarket, which could make them change their (many times negative) vision towards supermarkets. Therefore, nowadays where the public opinion is so strong, and the food waste challenge so necessary to tackle, it is important to, from the retailer's side, introduce

these techniques in an aligned way to its own clients' preferences. Therefore, this type of studies is very necessary, especially in Spain, whereby the beginning of 2023, a food waste law will enter into force.

4.3.1. Research limitations

The study needs to be considered with some limitations, especially due to the lack of time, mainly in the data gathering and the limited resources to publish the survey.

First of all, it is important to mention that the survey was shared in my own social media, specifically LinkedIn, WhatsApp and Instagram, as mentioned previously. Even if it is my own, it doesn't mean it is only received by known people, as connections in social media are based on likes and shares, which means than anyone could have received the survey (if they had access to the internet). However, for future research studies with more time, it would be beneficial to diversify the collection of responses from other platforms, or even from face-to-face formats, such as asking random people on the streets.

Additionally, a concept that was thought that could serve as a limitation in this research in a first instance was the loyalty of customers to their favourite brands. This was mainly because people might end up buying their favourite brands, regardless of the food waste reduction nudges they received. However, this seemed not to be the case, as in the question in the survey "In the past, have you changed the brand of a food product to reduce food waste?", 52,67% answered yes and 14,89% didn't know. However, these results are difficult to extrapolate to the whole Catalan society, and to justify them, in future cases, it would be preferable to count with a larger number of responses.

Moreover, in terms of the socio-demographic variables, an economic variable could have been added to formulate more detailed results. What has been seen to be missing to make better correlations between different profiles of customers is for example, the lack of information regarding the specific area of residence in the autonomous community (which usually informs of the economic standard of the area) or the monthly total household net income. This could have given a clear idea of the budget the family has for purchasing food (which also can determine the type of supermarket they do to) and the level of affordability to adapt their behaviours.

Moving to more systemic issues found, a big problem is the lack of methods to measure the actual food waste reduced by the suggested nudges. Mainly, because its focus is on households, were there is no external control to food waste generation. This makes it difficult to use nudges with focus on

households, basically, because it is difficult to qualify their impact and therefore, people involved lose interest.

However, even if data is difficult to extrapolate to bigger customer groups and is lacking some variables that are thought to be helpful, it is considered as a good first approach for future research. Being able to extract a first set of data to be able to discuss with supermarkets and set a structure for coming studies in this line has been possible and this, can be used as a start for the future studies, which are necessary.

5. Conclusions

Environmental issues are sometimes uncertain for consumers as the impacts their actions have on the environment are distant in space or time, and usually not visible (Jackson, 2005). Moreover, even if we pursue someone towards pro-environmental behaviour, changing their attitudes or believes, doesn't mean they will actually behave in pro-environmental ways (Jackson, 2005). Nudges, therefore, are a very powerful tool to change people's behaviour in a more indirect way.

There is an emerging perception among policy-makers on the need to look for innovative ways to support behaviour change (Jackson, 2005). The challenge to reduce the generation of food waste must be met with shared responsibility and active engagement of the different actors in the food system. This means that, even if public policy has a very important role, solving the food waste challenge should not only rely on it (Bauer et al., 2022). Having held the survey shows that many people are aware that food waste is a problem, but some still don't, and those that do, sometimes don't have the enough information or tools to tackle the problem. To change this situation, then, options need to be facilitated to consumers to move to more sustainable ways of consumption.

Businesses have made use of the knowledge they have on consumer behaviour to implement different techniques and strategies to persuade people to buy and consume their products. Consumers, in consequence, usually find themselves "locked in" unsustainable patterns of behaviours, promoted by social norms, far away from individual control, or by institutional contexts (Jackson, 2005). It is the time for businesses to join forces with customers, to find a balance of doing well in business and doing good, too, to society and the planet. Knowing what they prefer and appreciate from businesses, can be the start to achieve it.

Moreover, lasting behavioural change relies on the people consciously engaging with and elaborating on the topic (Jackson, 2005). Doing so, sustainable consumer behaviours can end up being the new habitual behaviour which we aim for. In the present research, for these habits to works out in the

long-term, it has been seen to be important to understand what can make customers be willing to change, but also what supermarkets are also willing to introduce. These are the reasons why the survey and the interview were performed.

Moreover, the main differences were given, not by gender or age, but by responsibility of purchase. This means that it is important to focus future initiatives on those that have the habit of purchasing food and spend time in supermarkets. Not doing so, could lead to useless or with less effect nudges in the future.

Having said all this, it is important to conclude saying that nudges can end up being a very useful and impactful tool to reduce food waste at household level if used correctly. It has been seen that not adapting them to the target customer would have no real impact and would suppose a loose of money, time, and resources. Therefore, evaluating customers preferences, even if it is a time-consuming task, is a way to accomplish food waste reductions with happy consumers, which is more likely to make them loyal customers.

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Appendices

Appendix A: Customer survey

<u>Reduce food waste (with focus in Catalonia)</u>

Hi! My name is Samanta Medina, I am a student in the Master of Environmental and Energy Management programme of the University of Twente in the Netherlands.

Did you know that around one third of food produced for human consumption is wasted? The good thing though, is that you can also contribute, without much effort, to reduce this challenge!

By completing this survey, you will aid me find the best ways, with the help of *Supermarket X (specify name once selected)* to help you reduce your food waste at home.

The data collected in this survey is treated confidentially and processes anonymously and in accordance with the European data protection regulation. If you have any questions or comments about the study, please feel free to contact me: samantamedinam@hotmail.com

Please make sure you click the submit button to save the answers. By doing so, you agree that the information you provide will be processed and that you have understood the purpose of the experiment.

*Please, only answer if you live in Catalonia.

<u>Section 1</u>: everyone

1. How do you identify yourself?
    - o Female
    - o Male
    - o Other

2. Age:
    - o Less than 35
    - o 35-49
    - o 50 to 64
    - o More than 65

3. In which type of household do you live?
    - o Living on my own/ Shared flat but organizing my own food purchase
    - o Adults without children (living at home)

      o   Adults with children (living at home)

      o   Single-parent household

4. What is the main supermarket in Catalonia where you buy food (indicate 1)?

      o   OPEN QUESTION

5. Food waste in your house is:

      o   An environmental issue

      o   A social issue

      o   An economic issue

      o   All the above

      o   Not an issue

6. Who do you consider to be responsible to reduce your food waste at home? Mark more than one if you consider.

      o   Supermarkets

      o   Governments

      o   Other actors

      o   Yourself

      o   Rest of citizens

7. Are you the main person responsible in your household for buying food at the supermarket?

      o   Yes

      o   No

      o   Shared responsibility with another person

Section 2: for people that answer yes or shared responsibility in previous question

8. If you are, when you go to the supermarket, for how many days do you plan on buying?

      o   Less than 3 days

      o   Between 3 and 7 days

      o   More than one week

9. In the past, have you changed the brand of a food product to reduce food waste?

    o   Yes

    o   No

    o   I don't know

10. Would you be willing to receive suggestions (directly or indirectly) from the supermarket to reduce food waste in your households?

    o   Yes

    o   No

    o   It depends

11. Would you appreciate a supermarket that helps you reduce food waste?

    o   Yes

    o   No

    o   It depends

Section 3: everyone

Mark with a cross the option you feel the most.

Nudges	Would you appreciate it if the supermarket included these initiatives?		
	No	1 time	Repeated times
Information posters on annual food waste. Ex: On average, each citizen generates 35 kg of food waste every year, that supposes 112 € of losses every year.			
Recipe suggestions (where you find the product in the supermarket) to reduce food waste by using parts of that food products that are usually throw away. Ex: You can use			

the leaves of the carrot such as parsley, as part of broths, stews, or soups, for a salad, for green smoothies…			
Reminders and tools to preserve food given by the cashier. Ex: "Are you planning to reduce your food waste? Would you like to take with you these freezer bags, so that you can keep food longer and reduce your food waste?			
Digital opportunities to learn how to reduce waste. Ex: Section on the website and app of the supermarket with cooking classes, videos, tips, and recipes to reduce food waste and optimize purchases of food, while being connected with other customers.			
Receiving a curated shopping list or box of products (based on previous shopping history) at the entrance of the supermarket so that you can stick to it and not buy excess food. This list would be adapted to your household size and days you want food for.			
Close-to-expiry date products easier to find, cheaper. Ex: Redistribution of fresh products based on their expiry date, such as dividing a section in an aisle in two parts: 1) Consume preferably in the following 2 days. and 2) Consume preferably in the following 5 days. Price discounts would be in place for products close to expiry.			

Do you have any comments on these initiatives you would like to share (both, negative and/or positive)?

- o   OPEN QUESTION

Appendix B: Summary of selected nudges

*Table 5. Selection of nudges for the customer survey. Source: Own.*

Nudge number	Nudge type of Table 2	Specification of the nudge in the customer survey
Nudge 1	Nudge J: Informing of the nature and consequences of the customers own past choices. Nudge E: Disclosure	**Information posters on annual food waste.** E.g.: On average, each citizen generates 35 kg of food waste every year, that supposes 112 € of losses every year.
Nudge 2	Nudge H: Reminders Nudge B: Simplification	**Recipe suggestions (where you find the product in the supermarket) to reduce food waste by using parts of that food products that are usually throw away.** E.g.: You can use the leaves of the carrot such as parsley, as part of broths, stews, or soups, for a salad, for green smoothies…
Nudge 3	Nudge G. Pre-commitment strategy on a household level Nudge I: Eliciting implementation intentions.	**Reminders and tools to preserve food given by the cashier**. E.g.: "Are you planning to reduce your food waste? Would you like to take with you these freezer bags, so that you can keep food longer and reduce your food waste?
Nudge 4	Nudge C. Use of social norms Nudge H: Reminders	**Digital opportunities to learn how to reduce waste.** E.g.: Section on the website and app of the supermarket with cooking classes, videos, tips, and recipes to reduce food waste and optimize purchases of food, while being connected with other customers.
Nudge 5	Nudge A: Default option Nudge B: simplification	**Receiving a curated shopping list or box of products** (based on previous shopping history) at the entrance of the supermarket so that you can stick to it and not buy excess food. This list would be adapted to your household size and days you want food for.

| **Nudge 6**	Nudge B: Simplification Nudge D. Increase in ease and convenience.	**Close-to-expiry date products easier to find, cheaper.** E.g.: Redistribution of fresh products based on their expiry date, such as dividing a section in an aisle in two parts: 1) Consume preferably in the following 2 days. and 2) Consume preferably in the following 5 days. Price discounts would be in place for products close to expiry.

Appendix C: Customer survey results
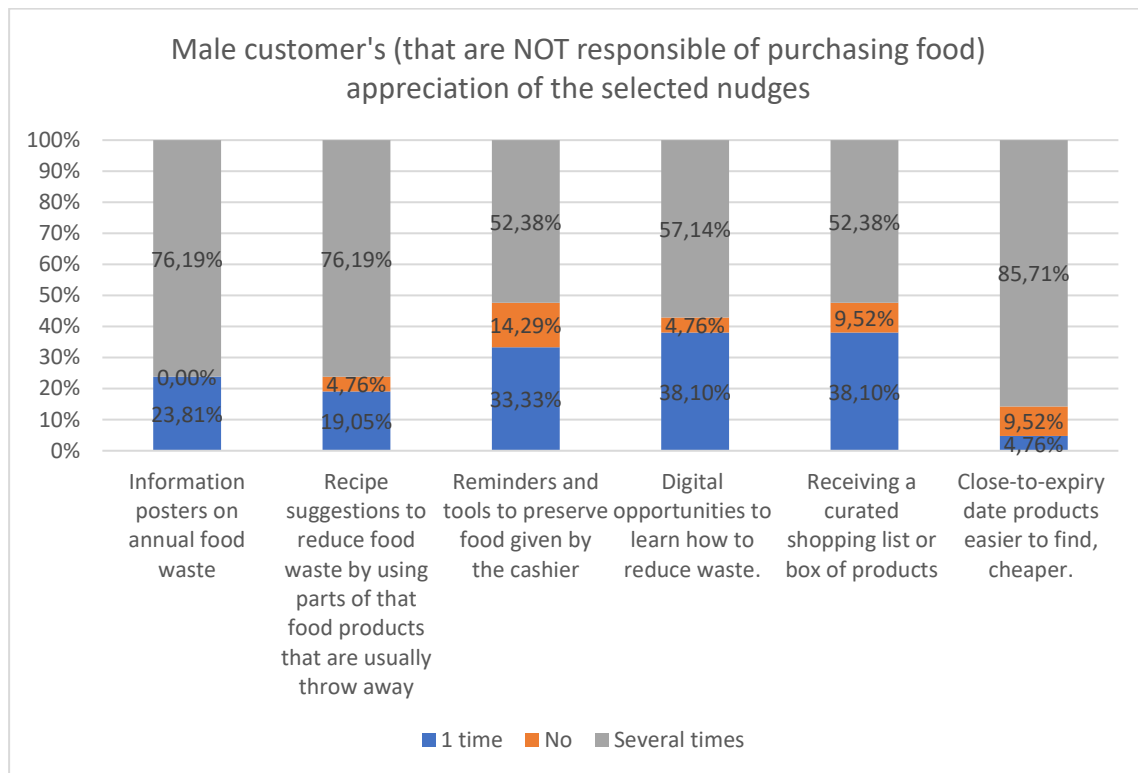
Graphic 7. Male customer's (that are NOT responsible of purchasing food) appreciation of the selected nudges. Source: Own.
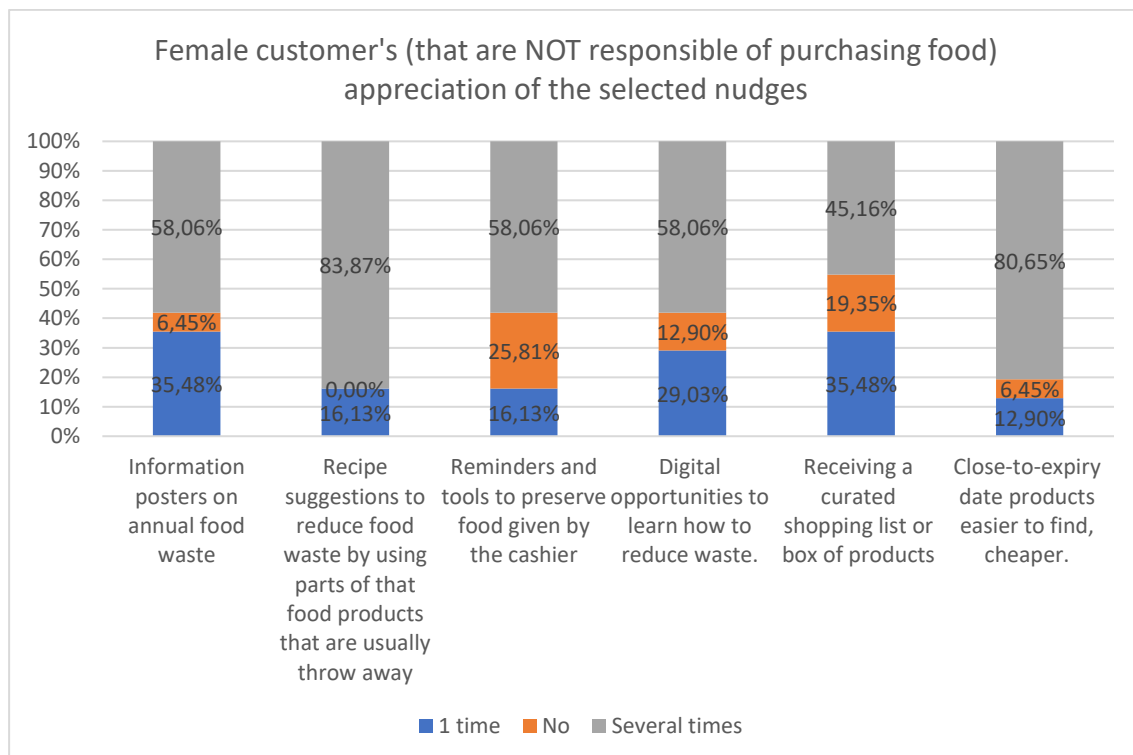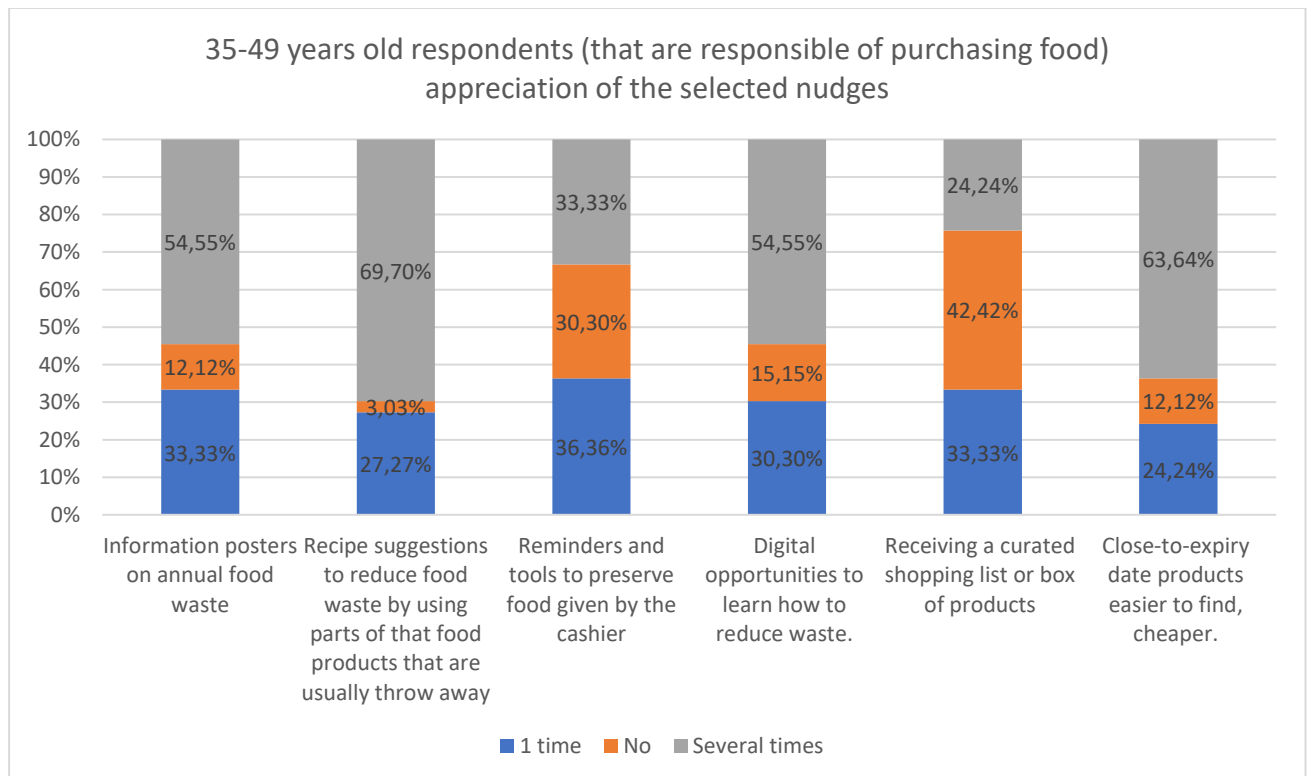

Graphic 8. Female customer's (that are NOT responsible of purchasing food) appreciation of the selected nudges. Source: Own.
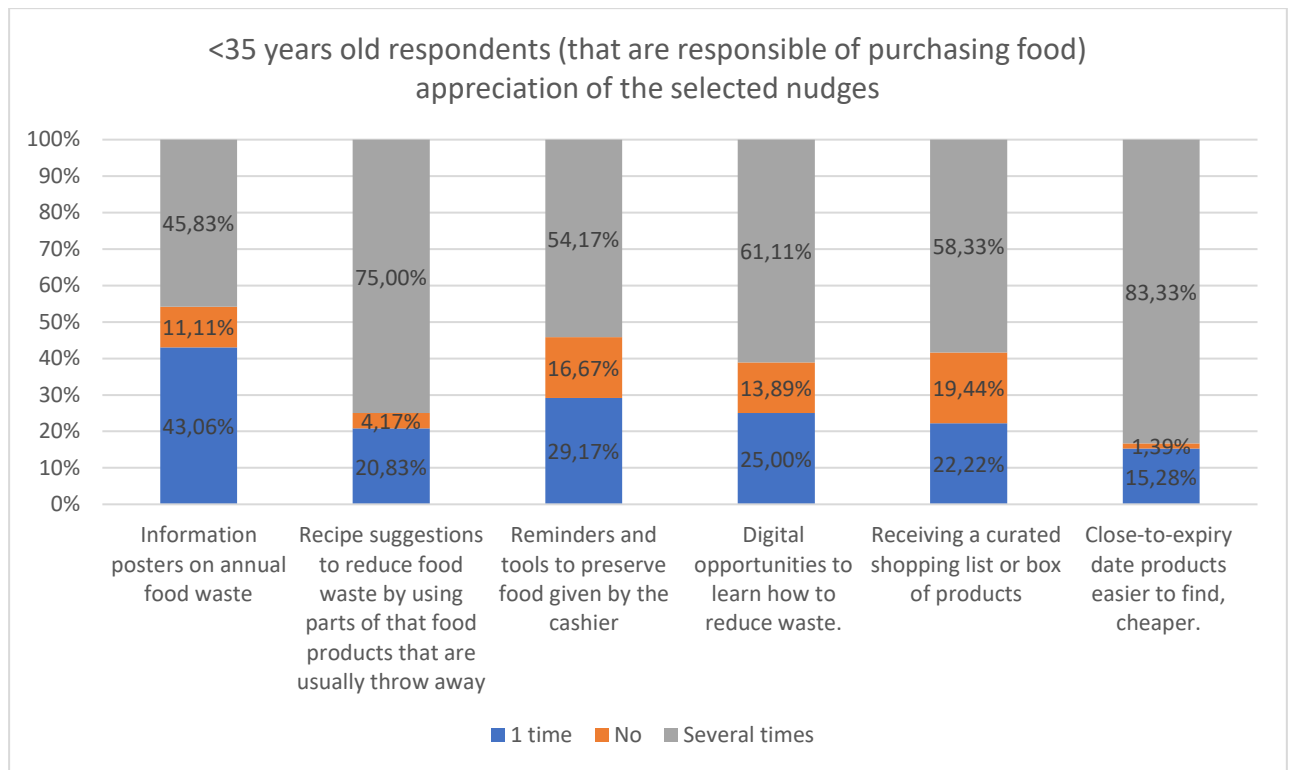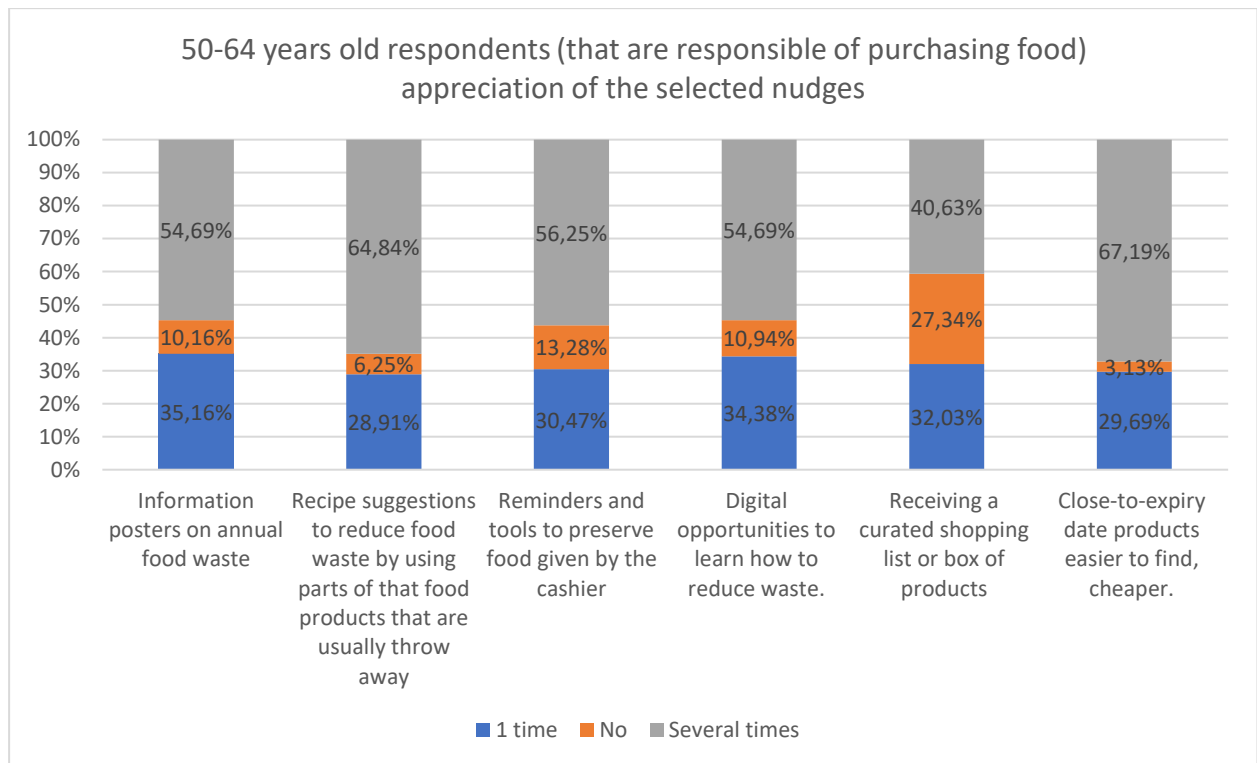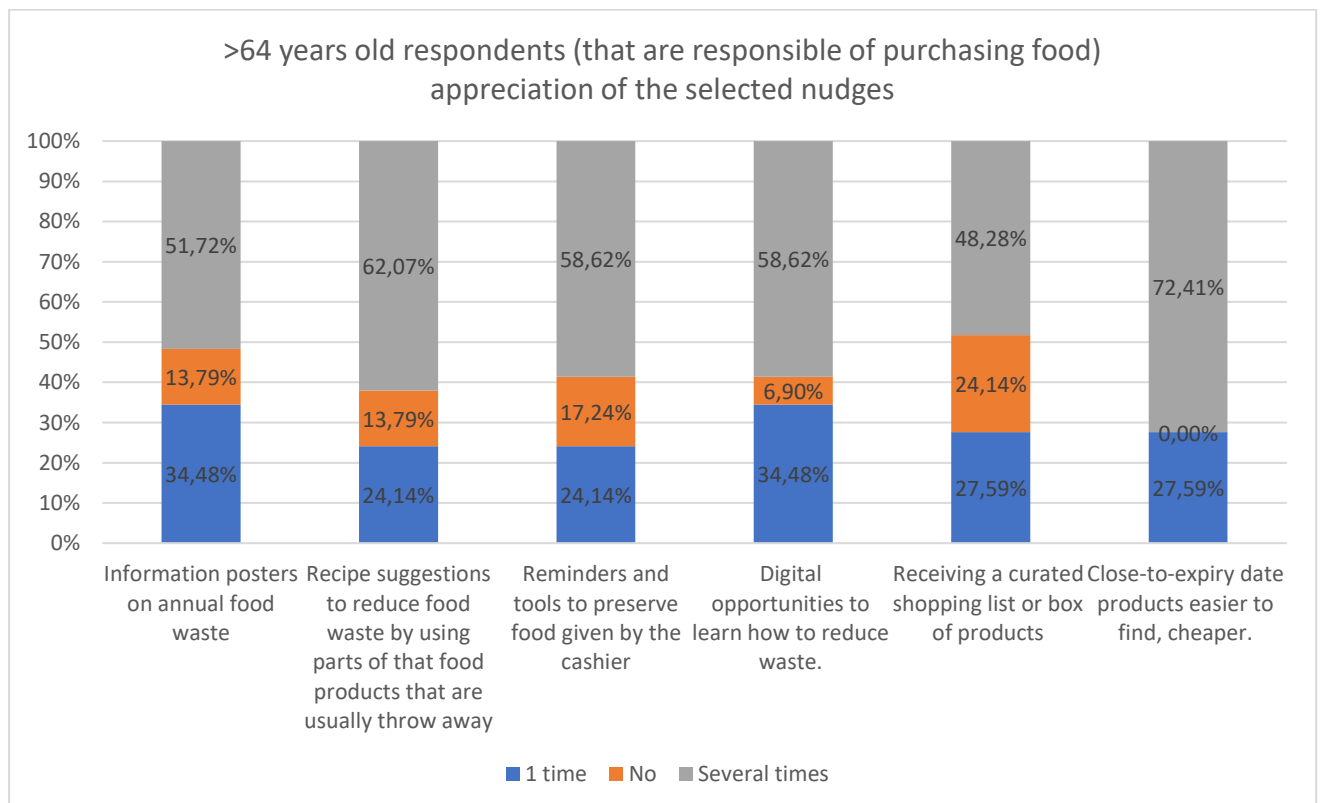
Graphic 9. Responsible customers (less than 35 years old) appreciation of the selected nudges. Source: Own.

Graphic 10. Responsible customers (between 35 and 49 years old) appreciation of the selected nudges. Source: Own.

Graphic 11. Responsible customers (between 50 and 64 years old) appreciation of the selected nudges. Source: Own.

Graphic 12. Responsible customers (older than 64 years old) appreciation of the selected nudges. Source: Own.