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SEGMENTING CONSUMERS AND TAILORING BEHAVIOURAL INTERVENTIONS TO REDUCE CONSUMER FOOD WASTE

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European Consumer Food Waste **Forum**

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Contents

Abstract

Behavioural interventions, such as nudges, are gaining popularity as a means to promote behavioural change, particularly in reducing consumer food waste. Consumer food waste is a pertinent concern due to its contribution to carbon dioxide emissions. At the same time, reducing food waste presents a straightforward and effective way for individuals to decrease their ecological footprint. This report explores how practitioners and policymakers can leverage consumer segmentation techniques to create targeted and tailored behavioural interventions that effectively and efficiently reduce consumer food waste. It introduces these methods, outlines their potential benefits and challenges, and includes relevant examples from scientific literature on food waste reduction.

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Executive summary

Policy context

Citizens of the European Union create a considerable amount of food waste. In 2020, **the average EU household wasted around 70 kg of food**, which accounted for 53 % of the total food waste throughout the supply chain (Eurostat, 2023). This wastage contributes to the EU's carbon footprint, with the food consumption system alone accounting for 7 % of the carbon footprint in 2020 (calculations based on Sanyé Mengual and Sala (2023)).

To address this problem, **the EU and its Member States have committed to halve per capita global food waste** at the retail and consumer levels by 2030, aligning with goal 12.3 of the UN sustainable development goals. As part of the European Green Deal, the EU has implemented an action plan to reduce food loss and waste, embedded within its farm-to-fork strategy. In 2023, the European Commission establishes legally binding food waste reduction targets across the EU to accelerate progress towards this goal. The Commission's actions include supporting the development and dissemination of best practices and solutions for food waste reduction, as well as mobilising key players in this field. Two key players are the EU Platform on Food Losses and Food Waste (FLW) and the European Consumer Food Waste Forum (ECFWF) [1].

Key conclusions

To achieve effective and efficient consumer food waste reduction, it is good practice to consider individual differences in the population. A 'one-size-fits-all' approach in intervention design may be less effective than **targeted and tailored interventions** supported by scientific evidence. For example, some individuals may have a larger margin to reduce food waste or be more interested in food waste reduction. Such **segmentation** of the population into groups, based on scientific evidence, may increase the effectiveness of food waste reduction interventions that take this information into account.

Practitioners and policymakers are encouraged to recognise the scientific evidence available on this topic, and be aware of the presented challenges associated with employing segmentation techniques.

Main findings

Behavioural change is necessary to reduce food waste at the consumer level, which occurs at the end of the supply chain. While many people acknowledge the importance of reducing food waste, motivation alone is not sufficient for behavioural change. It is also essential to possess the necessary skills and knowledge to minimise food waste and have opportunities readily available to engage in waste-reducing actions.

Understanding the reasons behind food waste and identifying groups of people with similar characteristics related to food waste can help identify relevant segments within the population. Segments are particularly relevant if their behaviour can be changed with minimal effort, if they face considerable economic disadvantages due to the costs of food waste, or if they generate high amounts of food waste. These segments may be judged by practitioners or policymakers as particularly relevant recipients of behavioural change interventions.

Identified segments form the basis of targeted or tailored behavioural interventions to reduce food waste. Targeting involves selecting and implementing interventions for specific groups or contexts, while tailoring matches aspects of the intervention, or the type of intervention to the characteristics of the group or context. Employing these techniques can enhance the effectiveness and efficiency of behavioural interventions, thus appealing to practitioners and policymakers.

Successful implementation of both segmentation and targeting/tailoring techniques requires practitioners and policymakers to **adopt a behavioural science mindset and incorporate experimentation into their strategies**. Empirical evidence obtained through experiments is a crucial element for effectively utilising segmentation and targeting/tailoring in behavioural interventions. However, conducting experiments poses its own challenges, such as the need for a substantial number of participants. Behavioural scientists should ideally complement the topical knowledge of practitioners and policymakers.

Segmentation has already been investigated to a considerable degree in the scientific literature concerning consumer food waste and is feasible for practitioners and policymakers. Targeting and

(1) For more information: https://food.ec.europa.eu/safety/food-waste_en.

tailoring is a relatively new and less-explored approach in behavioural science research on food waste. Therefore, additional research is necessary to inform the science-based implementation of targeted or tailored interventions to reduce food waste on a large scale.

Related and future Joint Research Centre work

This report is part of the JRC's broader contribution to the Commission's commitments to food waste reduction. It stems from the ECFWF, a pilot project following the *Recommendations for Action in Food Waste Prevention* report developed by the FLW (EU Platform on Food Losses and Food Waste, 2019). The ECFWF consists of a network of food waste practitioners and researchers. It has supported the identification of drivers and levers of behavioural change, developed an evaluation framework for assessing food waste prevention actions, identified and evaluated 78 consumer food waste reduction interventions using this framework, and derived a set of **tools and recommendations to help reduce consumer food waste**. This report on segmentation and targeting/tailoring is one of those tools. The results and insights from the ECFWF will be disseminated and can be further pursued by other networks, such as the EU Platform on FLW.

Quick guide

To reduce food waste, practitioners and policymakers often adopt a one-size-fits-all or 'shotgun' approach in implementing general behaviour change interventions for all individuals. However, it may be more effective and efficient to consider the characteristics of the specific individuals whose behaviour needs to be changed, thereby identifying key sub-groups. These sub-groups are called segments, identifying and creating these sub-groups is called segmentation. Based on this analysis, practitioners and policymakers can design interventions that are more appealing or effective for specific segments. This exercise is referred to as targeting or tailoring. Both **segmentation and targeting/tailoring require an evidence-based approach and should ideally be complemented by scientific experiments**.

1 Introduction

Many scientists, practitioners and policymakers view **behavioural interventions as useful tools for public policy.** For instance, nudges are often considered good complements or alternatives to traditional policy interventions. Nudges are commonly defined as interventions affecting behaviour in a predictable way without restricting options and significantly changing economic incentives (Thaler and Sunstein, 2008). Nudges have been used to promote pro-environmental behaviour including reducing food waste (Abrahamse, 2020; Reynolds et al., 2019; Tian et al., 2022; Farrow, Grolleau, and Ibanez, 2017; Nisa et al., 2019). However, it is important to recognise their limitations (Bryan, Tipton, and Yeager, 2021; Hummel and Maedche, 2019; Maier et al., 2022; Nisa et al., 2019; Szaszi et al., 2018; Mertens et al., 2022). Notably, a nudge that works in one context (such as reducing electricity consumption or reducing food waste) may not work as effectively or at all in another. Additionally, a nudge may be effective for some groups but not for others, and it could even produce unintended effects (Costa and Kahn, 2013; Osman, 2020). While these limitations may be seen as disadvantages, they also present important opportunities.

Recognising that nudges or interventions may not work universally, i.e. in all situations or for all groups, presents opportunities for setting more realistic expectations and informing intervention design, implementation, and evaluation. By considering this early on, interventions can be implemented in a more practical and policy-relevant manner, leading to greater efficiency. To make behavioural interventions for reducing consumer food waste more effective and efficient, it is crucial to understand the contexts in which food waste occurs and the people and groups responsible for it.

This understanding enables the design and implementation of more effective and efficient interventions. **The following insights are particularly helpful for practitioners and policymakers** in selecting, designing and implementing food waste reduction interventions:

- knowing **who will respond** to a particular intervention, to what extent, and in which context, and ideally understanding the reasons behind their response or lack thereof;
- identifying the individuals or groups **most in need of intervention**;
- identifying those who **generate the highest amount of food waste**.

The examples outlined below illustrate the significance of understanding the context in which individuals make decisions regarding food, of identifying the target group for an intervention (i.e. user segments, recipients), and demonstrate how this information can be used to tailor and target interventions effectively.

Examples of the importance of context

Example 1. Nudges at different stages of the food waste journey

An informational nudge that provides practical tips on avoiding food waste during meal preparation can effectively reduce food waste occurring at that stage (Blondin and Attwood, 2022; van Geffen, van Herpen and van Trijp, 2016). However, it is important to consider that food waste can occur before meal preparation when people decide what food to buy. They might later realise during meal preparation that some ingredients cannot be used for their meal and thus end up being thrown away. In such cases, the same nudge may fail to reduce food waste because it does not affect any decision at the purchasing stage. This insight suggests the need to provide nudges at different moments, during food purchasing and meal preparation.

Example 2. Nudges based on personal characteristics

Nudges that make it easier and more convenient to avoid food waste are likely to be effective for people who see reducing food waste as an effort. However, for others, the issue may simply not be a priority. Regardless of how easy it would be to avoid food waste, they might not consider it important enough to change their behaviour. Understanding this before implementing one-size-fits-all interventions is valuable because it allows for the identification of additional interventions that are more likely to show the value of decreasing food waste for this specific group.

It is crucial to understand the contexts in which food waste occurs and the people and groups responsible for it.

The objective of this document is to outline and discuss two important approaches for **improving consumer food waste reduction interventions**. First, it introduces the concept of segmentation, which helps to acknowledge and incorporate different contexts and target groups relevant to intervention effectiveness. Segmentation is also known as profiling and clustering. Secondly, it outlines two approaches, targeting and tailoring, that utilise this information to 'fine-tune' interventions and make them more effective.

Segmentation involves dividing a larger group of individuals into smaller sub-groups (called segments) based on one or several characteristics. These segments can be identified by criteria such as their level of food waste or their likelihood to respond to interventions. The purpose is to create groups that are more similar to each other within the segment than to individuals in other segments.

Targeting and tailoring are related but distinct actions. Targeting refers to selecting and implementing an intervention specifically for a particular group or context. Like a targeted advertisement campaign on social media that reaches a specific user segment, a targeted nudge for influencing food choices would only be implemented for a specific group of consumers. On the other hand, tailoring involves adapting aspects of an intervention such as the content, or the type of intervention, to match characteristics of a particular group or context (Teeny et al., 2021). For instance, providing information on how to avoid food waste can be tailored to the prior knowledge levels of different recipient groups. Both targeting and tailoring are often expected to enhance the effectiveness and efficiency of interventions.

The **main arguments** that serve as **the common thread** through this document are the following:

1. Nudges can have varying degrees of effectiveness.
2. The effectiveness of nudges can be influenced by individual and contextual factors.
3. Individual and/or context characteristics can be the basis of creating segments.
4. Segmenting people allows for the identification of groups that are more likely to respond to specific interventions or are in greater need of intervention.
5. Identifying responsive or high-need groups helps inform the design and selection of interventions.
6. Interventions can be targeted and tailored to be effective for specific groups.

This is followed by an outline of the central limitations of segmentation and tailoring, case studies, results from an expert survey and a summary.

2 Different effects of behavioural interventions

1 Nudges can have varying degrees of effectiveness.

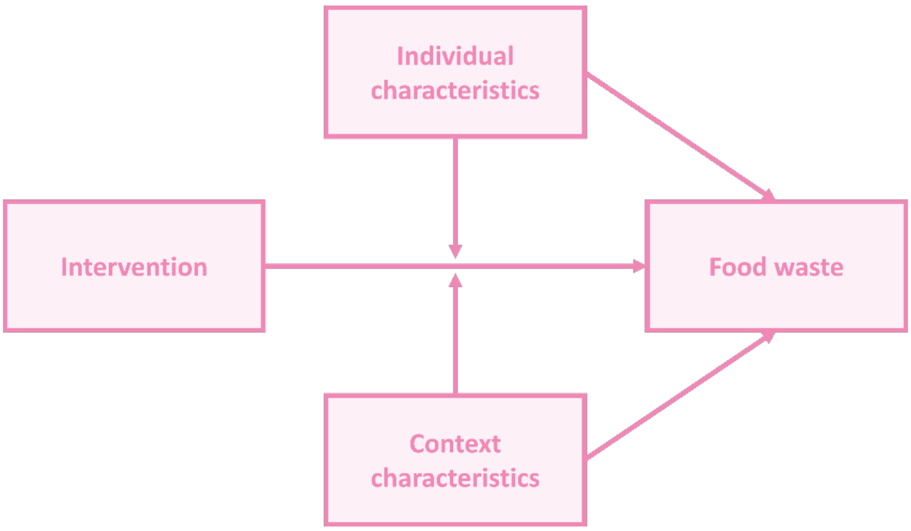
2 The effectiveness of nudges can be influenced by individual and contextual factors.

Most nudges do not work everywhere or for everyone. Their effects vary depending on the context and the group of people involved, i.e. the effects are **heterogeneous** (Bryan, Tipton, and Yeager, 2021). For example, a nudge that successfully reduces food waste in an experiment with students may not work when tested on a sample that represents the entire population. Similarly, nudges may work in one country but not in another.

Heterogeneous effects demonstrate that **interventions have different outcomes for different groups of people or situations**. A nudge may only work for certain individuals with a specific socio-demographic or psychological profiles, such as older people with high income or highly motivated individuals. It might influence behaviour during meal preparation but not during the food purchasing phase. This implies that individual and context characteristics shape the effects of interventions on outcomes. Figure 1 illustrates this concept by using arrows pointing from the individual and context characteristics to the arrow representing the effect of interventions on food waste. In other words, the effect of an intervention on food waste depends on (is conditional on) individual and context characteristics. In statistical terms, this is referred to as interaction or moderation.

Interaction effects and **effect moderation** are two terms that essentially mean the same thing: treatment effects vary across different situations or groups. These terms describe situations where the relationship between two variables changes depending on a third variable. When the effect of a food waste reduction intervention on food waste depends on another variable, there is an interaction or moderation effect.

Figure 1. Conceptual representation of individual and context characteristics moderating the effect of interventions on food waste



NB: The figure depicts the effect of an intervention, along with individual and context characteristics on food waste. Additionally, it depicts that the individual and contextual characteristics that affect food waste can also influence how well an intervention performs at reducing food waste.
Source: Own elaboration.

Typically, empirical studies estimate the average effect of a treatment on an outcome such as food waste. This effect is known as the **average treatment effect (ATE)**. The treatment can be an intervention, such as a nudge to reduce food waste. The ATE provides an estimate of the expected overall impact across different groups and contexts. However, it is important to recognise that every person reacts differently to an intervention.

For example, participants in an experiment might be exposed to a nudge that emphasises the existing positive social norms related to food waste (Blondin and Attwood, 2022). Person A might feel strongly compelled to align with their peers and take significant measures to reduce food waste conform to these norms. Person B, on the other hand, might not care about the behaviour of their peers and remain unaffected. Person C might take some measures but only marginally reduce their food waste compared to person A (2). Moreover, individuals may respond differently to social norms depending on the context in which they are making a decision.

When experiments are used to inform real interventions, the ATE is the best guess of the intervention's effectiveness as a policy instrument.

By observing many individual reactions in an experimental study, researchers can estimate the average treatment effect, which represents the average impact of the nudge on all participants in that study. This estimate provides the best guess of the expected effect if the same experiment was repeated. The best guess of the expected effect would be the average treatment effect (3). When experiments are used to inform real interventions, the average treatment effect is the best guess of the **intervention's effectiveness as a policy instrument.**

The average treatment effect is an average of all the individual effects. What, however, if you need to provide your best guess for the effect of a nudge (the treatment) specifically for a certain group, like people older than 50 years? Based on the available information from the initial experiment, it is possible refer to the ATE – which involves individuals younger and older than 50 years – as the best guess. However, this may not provide the most accurate estimate for the targeted group. This is where the **conditional average treatment effect (CATE)** comes in.

When experiments are used to inform real interventions, and when people with specific characteristics are the relevant target group, the CATE is the best guess for the impact on this group.

The CATE is the average treatment effect for a subgroup conditional (i.e. based) on a characteristic, such as age. In fact, if people aged above 50 years respond differently than people equal to or below 50, then the CATE would be a better estimate when asked to predict the effect of the nudge for people over 50. When experiments are used to inform real interventions and there is an identified sub-group to target, the CATE becomes the best guess for the actual impact on that group.

When evaluating a nudge across multiple countries or groups of people or in different contexts, relying solely on a single estimate for the entire sample (i.e. the ATE) may hide important variations in treatment effects. This means that researchers and practitioners might miss valuable information. For example, if the nudge only affects young people and not older people, calculating the ATE would fail to detect the impact on young people. For more details, refer to the box 'Why heterogeneous treatment effects are important'.

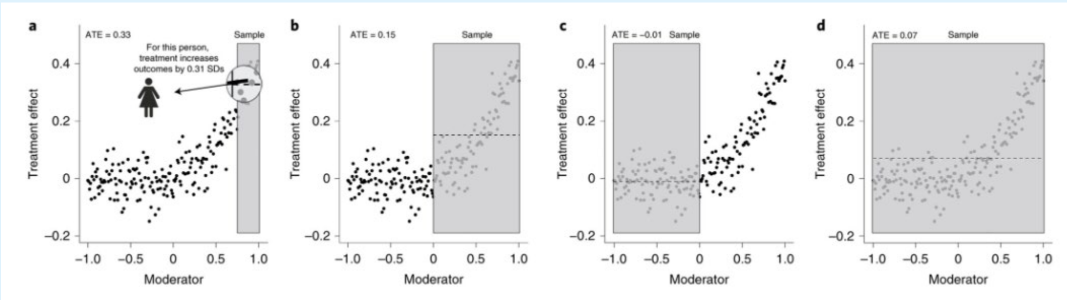
(2) This is a simplification of how the ATE is estimated in an experimental study. In an experiment, participants are assigned to one of at least two conditions – for example, one group with an intervention and one without. Researchers can then observe their behaviour only in the condition they have been assigned to. To determine the treatment effect for each individual, ideally, they would need to observe their behaviour in both conditions while keeping everything else the same. This, however, is not possible (and is thus referred to as 'counterfactual'). In experiments, researchers use the average behaviour observed in one group to estimate how individuals would behave in situations where their behaviour could not be directly observed. With this information , they can estimate the ATE.

(3) The accuracy of this estimate depends on the quality of the experiment and how well it reflects real-world conditions.

Why heterogeneous treatment effects are important

This box provides an example of a hypothetical study that demonstrates the importance of considering heterogeneity in interpreting study findings. The example is based on Bryan et al. (2021). Figure 2 shows individual treatment effects from four hypothetical studies based on characteristics of the context or individuals. The y-axis shows the treatment effect, which indicates how much the intervention affects the outcome. The x-axis shows the value of the characteristic (i.e. the variable on which the treatment effect depends). For instance, the treatment effect could measure the impact of a nudge on participants' awareness of the importance of reducing food waste. The value for the moderator on the x-axis could represent participants' ratings of the importance of protecting the climate (with 0 indicating average rating of importance, + 1 indicating people with 1 standard deviation above average, and – 1 indicating 1 standard deviation below average ratings of importance, respectively).

Figure 2. Relation of the study population to a hypothetical study's sample and estimated treatment effect



Source: (Bryan, Tipton, and Yeager, 2021).

Each dot on the graph represents an individual participant with a specific characteristic value indicated on the x-axis and a corresponding treatment effect on the y-axis. Each dot that is in the shaded area is part of the sample of the respective hypothetical study (**a**, **b**, **c**, **d**). You can think of all the dots as the entire population, and the dots within the shaded region as the participants in each study (i.e. the sample). The dashed line represents the average of the dots within the shaded area, which is the ATE measured in that study.

In hypothetical study **a**, only individuals who highly value climate protection participate (located on the rights side of the x-axis). For them, the average treatment effect is very high. Study **b** has a broader sample, but participants still rate climate protection as relatively important. The average treatment effect is smaller in that study. Study **c**, on the other hand, includes participants with below-average ratings of climate protection importance and there is no treatment effect in this sample. Finally, study **d** includes the entire sample and finds a moderate treatment effect. Study **d** can be seen as revealing the true ATE because it includes the entire population.

The key takeaways from this example are as follows:

(1) Studies **a**, **b**, and **c** provide biased (incorrect) estimates of the true ATE shown in study **d**.
(2) Conducting study **d** allows for deriving all the CATEs shown in studies **a**–**c**, using appropriate statistical procedures. As it has the largest sample, it provides the most comprehensive picture.
(3) If study **d** was conducted without considering heterogeneous effects, one might conclude that the treatment is not particularly effective.
(4) If study **d** was conducted considering heterogeneous effects, examining the CATEs (treatment effects for specific sub-groups) – i.e. the effects for sub-groups with very high rating of importance of climate protection (**a**), higher than average rating of importance (**b**) and below-average rating of importance (**c**) – can reveal that the treatment is quite effective for some of these groups, for example the group in study **a**.

To uncover a potentially important conditional effect on young people, it is required to conduct an analysis that allows for the possibility of treatment effects that depend on age. By considering the effect conditional on age, it is possible to accurately identify the impact on young people. If age was neglected, we would incorrectly conclude that the intervention had no effect, while the CATE analysis would have revealed the positive effect on young people.

One problem with focusing on ATEs is that **much of the behavioural science research is limited to WEIRD samples**, which mainly consist of **W**hite, **E**ducated, **I**ndustrialised, **R**ich and **D**emocratic individuals (Henrich, Heine, and Norenzayan, 2010). This means that other groups, including minorities, are often underrepresented in these studies. If policies are based solely on findings from WEIRD samples but also impact people from non-WEIRD backgrounds, the effects on the latter group are uncertain. Moreover, if interventions that are effective for WEIRD samples prove ineffective or even counterproductive for non-WEIRD samples, these **policies can have unintended negative consequences** (Bryan, Tipton, and Yeager, 2021; Teeny et al., 2021).

- ✓ Nudges may not work in certain situations or for specific groups of people.
- ✓ The ATE is the average of all the individual effects that an intervention has on people. The CATE is the average treatment effect conditional (i.e. dependent) on a characteristic.
- ✓ Focusing on the ATE across different contexts and groups can lead us to overlook important CATEs.
- ✓ Relying solely on ATEs can have negative consequences for sub-groups, such as non-WEIRD samples, minorities, or at-risk groups.
- ✓ The acronym WEIRD stands for samples that are predominantly White, Educated, Industrialised, Rich and Democratic.
- ✓ Recognising the presence of heterogeneous treatment effects and identifying CATEs can enhance the effectiveness of policy design.

3 From different treatment effects to segmentation

3 Individual and/or context characteristics can be the basis of creating segments.

4 Segmenting people allows for the identification of groups that are more likely to respond to specific interventions or are in greater need of intervention.

Segmentation involves dividing a group of individuals into smaller sub-groups (called segments) based on specific characteristics they possess. This helps to highlight the similarities within each group while distinguishing them from other groups.

To determine similarity or difference, one needs to **quantify specific characteristics**. It is not useful to simply label individuals as similar or different without considering at least one particular characteristic. A simple example is age. Two people who are 20 and 30 years old are more similar in terms of age than two people who are 20 and 70 years old. However, this similarity is only respective to age. The 20- and 70-year-old people might be more similar than the 20- and 30-year-old people based on other characteristics, such as personality. Other characteristics that can be used to evaluate similarity include motivation, opportunities and abilities related to food waste, as described in the Motivation–Opportunity–Ability model (Ölander and Thøgersen, 1995).

Motivation describes 'a person's willingness to perform actions that reduce the likelihood or amount of food waste being generated. Relevant aspects of motivation are attitudes, awareness, and social norms'. **Opportunity** factors describe 'the availability and accessibility of materials and resources required to prevent food waste. Relevant aspects of opportunity are time and schedule, material and technologies, and infrastructure'. **Ability** factors describe 'a person's proficiency to solve the problems that he or she encounters when performing actions that help prevent food waste. Relevant aspects of ability are knowledge and skills' (van Geffen, van Herpen, and van Trijp, 2016).

There are two approaches to segmentation: a priori class specification and clustering.

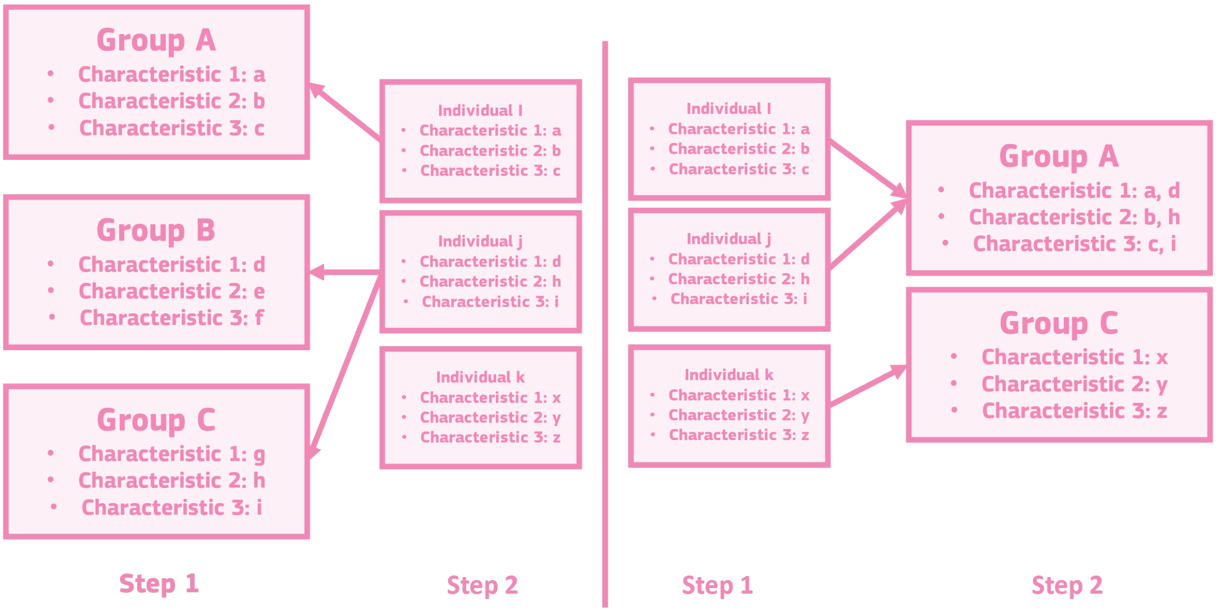
Groups can also be formed based on people's weekly levels of generated food waste or the different stages of the food waste journey at which people create food waste (planning, shopping, storing, preparing, consuming). Notably, similarity can be calculated based on one or multiple characteristics simultaneously ([4]).

There are two approaches to segmentation: a priori class specification and clustering (Van Hove et al., 2021). Both approaches require an initial selection of characteristics to group individuals. Selecting characteristics can be a solely statistical exercise (i.e. using those characteristics that best allow to differentiate between different groups) or an informed exercise based on the relevance of certain characteristics for the topic at hand, for example for food waste or intervention effectiveness.

In the first approach, **a priori class specification**, the researcher defines groups based on specific characteristics and assigns individuals to these groups if they share those characteristics (see left panel of Figure 3). The groups can be determined by what one already knows about them, what one is interested in (e.g. designing tailored interventions, see Section 4), or based on existing theories. This approach underlies the analysis of interaction effects, where researchers investigate

([4]) Grouping individuals based on similarity helps to structure data, reduce complexity and facilitate interpretation. For example, calculating the average age simplifies data that consists of individuals with different ages. Instead of considering each person individually, one can talk about a group with an average age. Creating groups of similar individuals also reduces the complexity of data. The case is similar to the focus on ATEs discussed in the previous section. Each person responds differently to a treatment, but by looking at the ATE, a statistical measure, one can reduce data complexity. This is one of the purposes of statistics.

Figure 3. Conceptual differentiation between a priori class specification and clustering approaches



NB: The figure compares some key aspects of a priori class specification (left) and clustering (right). The boxes represent either groups or individuals with certain characteristics, such as age or motivation to reduce food waste. The characteristics can have specific value ranges, such as 25–35, or high, medium and low, represented by the small letters. The arrows indicate that for a priori class specification, individuals are assigned to the most fitting groups (which are pre-defined), and for clustering, groups are created based on the individuals and their (shared) characteristics.
Source: Own elaboration.

if, for example, interventions perform differently in these groups. The advantage of this approach is that the created groups are relevant because the researcher defined them according to characteristics deemed informative. The challenge is that individuals may belong to multiple groups or not fit into any of the groups. In such cases, the researcher must decide how to assign them.

The second approach is **clustering**, which relies on pre-defining the desired number of groups, but not the characteristics defining them. These groups, in the end, will consist of individuals with similar characteristics but distinct from individuals in other groups (see the right panel of Figure 3).

For example, an algorithm ([5]) can take as input the information on people's attitude towards climate change, their rated importance of reducing food waste and their level of extraversion to assign everyone to a group – similar people to the same group and different people to another group. The characteristics of these groups depend on the data, desired number of groups and technical assumptions of the algorithm. Importantly, the characteristics of these groups are an output of the exercise; they result from the data itself (which is not the case for a priori class specification). The advantage of this approach is that everyone is assigned to exactly one group. The challenge is that the groups need to be interpreted with respect to their implications for food waste or tailored interventions. This interpretation can be challenging, because the groups may have characteristics that do not provide clear insights for the question at hand.

Both approaches to segmentation require a large number of participants in order to be insightful. The more sub-groups one wants to look at, the more data is needed.

Both approaches to segmentation require a large number of participants in order to be insightful. The more sub-groups on wants to look at, the more data is needed. In fact, dividing individuals into two groups does not just require double the number of participants. Rather, the additional number of observations needed depends on the difference in intervention effects between the two groups. If the difference is smaller, indicating a smaller interaction effect, more observations are

([5]) Here, algorithm refers to the statistical techniques that allocate individuals to groups of similar individuals. More generally, An algorithm is a step-by-step procedure or set of rules designed to solve a specific problem or perform a particular task.

required to statistically detect it. With more sub-groups, the number of individuals per group decreases (assuming a fixed total number of participants). This reduces the likelihood of detecting a difference between the intervention effects through statistical testing. Conversely, with more sub-groups, more participants are needed to maintain a constant likelihood of detecting a difference between intervention effects in both groups (Baranger, 2019). The box titled 'Processes for a priori class specification and clustering' outlines the steps involved in both clustering and a priori class specification.

The segmentation exercises outlined above can help identify groups that are (most/ more/ less/ least) likely to respond to specific interventions or those that are (most/ more/ less/ least) in need of intervention. But how can segmentation help to identify specific groups like 'low-hanging fruit' (more likely to respond), 'hot spots' (individuals that waste a lot), or vulnerable groups (e.g. low-income individuals)?

Here, **low-hanging fruit** refers to groups that are more likely to respond to interventions and whose behaviour or perceptions are therefore easier to change. **Hot spots** refer to groups that need intervention because they waste a lot. **Vulnerable groups** refer to people in precarious situations, such as people with low income. The segmentation exercises outlined above can help identify groups that are (most/more/less) likely to respond to specific interventions or that are (most/more/less) in need of intervention.

Segmentation can help identify groups with varying likelihoods to respond to interventions or with different needs of intervention.

Heuristics, meaning rules of thumb, and empirical evidence can be used to inform step 1 (selecting characteristics) of both approaches, and/or to inform step 2 of the a priori class specification approach (using the characteristics to create groups). In step 1, one can **focus on characteristics that we believe have implications for the effectiveness of interventions** or that can define **risk groups**. For example, if one thinks that awareness of the importance of food waste as a contributor to climate change affects the effectiveness of a food waste reduction intervention, one should use that characteristic to group individuals. Identifying **non-WEIRD groups or vulnerable segments** requires selection and measurement of relevant characteristics to detect them. Naturally, reliable measures of food waste are required to identify hot spots. During step 2 of a priori class specification, one can create groups with characteristics that are likely to impact the effectiveness of interventions or define groups at risk or in need of intervention.

Processes for a priori class specification and clustering

Here, we outline the steps involved in a priori class specification and clustering. The aim is not a comprehensive guide, but a highlight of key differences. The following steps are involved:

A priori class specification:

(1) decide which characteristics will be used to group people;
(2) create groups by specifying the range of values for these characteristics that individuals must exhibit;
(3) assign individuals to their respective groups;
(4) determine how to assign individuals who do not fit into any of the existing groups.

Clustering:

(1) decide which characteristics will be used to group people;
(2) choose a clustering algorithm, which determines how similarity is assessed;
(3) define the number of groups to which individuals will be allocated;
(4) run the clustering algorithm to assign individuals to their respective groups;
(5) evaluate the quality of the clustering outcomes;
(6) interpret the resulting groups.

The main difference is that a priori class specification defines groups in advance. For example, defining an 'old' and a 'young' group can be specified by assigning all people aged between 18 and 40 to the 'young' group and all people aged between 40 and 80 to the 'old' group. If people with lower or higher age participate, they need to be assigned manually. In clustering, on the other hand, the user specifies the desired number of groups, and the algorithm determines the range of characteristics for each group, such as whether one group ranges from 18 to 40 or from 18 to 30.

For example, to identify hot spots, one can define a group with significantly higher amounts of food waste. One can also collect data on people's attitudes towards interventions or their intentions to respond to them, which can be included in the segmentation exercise.

Experiments that directly test the effect of an intervention can be particularly insightful to identify groups that may be more likely to respond ('low-hanging fruit') (for an introduction to experiments on food waste interventions see Bruns and Nohlen (2023)). Next to data on intervention effectiveness, experiments can also include a questionnaire to collect data on additional characteristics needed for the segmentation exercise such as consumer characteristics. With this information, one can segment participants into groups and assess whether any of the tested interventions are more or less effective for these groups.

- ✓ Segmentation starts with selecting the characteristics to assess the similarity of individuals.
- ✓ There are two approaches to segmentation: one uses the selected characteristics as inputs to define groups (a priori class specification), and the other generates groups with specific characteristics as the output (clustering).
- ✓ Both approaches require large simple sizes for reliable insights.
- ✓ Segmentation helps identify groups that are more responsive to interventions (low-hanging fruit) or in greater need of intervention (hot spots and vulnerable groups). This identification can be informed by heuristics, empirical evidence and experiments.
- ✓ Here, low-hanging fruit refers to groups that are more likely to respond to interventions and whose behaviour or perceptions are therefore easier to change. Hot spots refer to groups that need intervention because they waste a lot. Vulnerable groups refer to people in precarious situations, such as people with low income.

4 From segmentation to tailored interventions

5 Identifying responsive or high-need groups helps inform the design and selection of interventions.

6 Interventions can be targeted and tailored to be effective for specific groups.

Identifying relevant segments is the first step towards implementing targeted and tailoring interventions. Targeting and tailoring are sometimes used interchangeably with personalising and matching. For us, targeting involves selecting and implementing an intervention for a specific group or context where it is expected to be the most effective. Tailoring interventions means customising aspects of the intervention or the type of intervention to match the characteristics of a particular group or context (Teeny et al., 2021).

Targeted and tailored interventions can be more effective than one-size-fits-all approaches. The idea behind tailored interventions is that people can have different reasons for their behaviour. This leads them to prioritise and respond differently to interventions (Teeny et al., 2021).

Several characteristics can influence how much food people waste or how they respond to behavioural interventions aimed at reducing food waste, such as motivations, abilities, capabilities, and demographic factors (Vittuari et al., 2023). Persuasion psychology, which studies the processes by which people's attitudes or behaviours are influenced by communication from other people, has identified various factors that influence how people respond to messages (Cialdini, 2007; Teeny et al., 2021). To some extent, these aspects can be extended to people's reactions towards interventions.

The following factors can affect how people respond to an intervention:

(1) characteristics of the **recipient**;
(2) characteristics of the **implementer**;
(3) design and choice of the **intervention**;
(4) **context** in which the intervention is administered.

These factors, including recipient and implementer characteristics, intervention design, type and context can affect people's reaction to interventions.

Tailoring persuasive messages using information about these factors has been commonly used in health and climate change communication (Dixon, Hmielowski, and Ma, 2017; Joyal-Desmarais, Rothman, and Snyder, 2020; Luong, Garrett, and Slater, 2019; Noar, Benac, and Harris, 2007; Pink et al., 2021). The tailoring of behavioural interventions, such as nudges, has only recently been investigated and discussed more prominently (Mills, 2020; Peer et al., 2020).

Characteristics of both the recipient and implementer of an intervention, the design and type of intervention, and the context can affect how people react to an intervention.

Tailoring involves adjusting the design and choice of the intervention, mentioning or framing its source and determining the context in which the intervention is delivered to specific individual or contextual characteristics (Hirsh, Kang, and Bodenhausen, 2012; Matz et al., 2017; Schmid et al., 2008). Adapting the design and choice of an intervention (point 3) refers to the design of a given intervention (e.g. whether a default value is set to EUR 5 or EUR 100, or information on which relevant peer group is provided as part of a social norm intervention) and to the choice between different interventions (e.g. whether a default or social norm information is used) (Mills, 2020).

Essentially, the information provided on the implementer, as well as the customisation of the intervention choice, design and context (delivery setting, meaning the environment in which the intervention is implemented) can be tailored to characteristics of the recipients (i.e. segments). Whether or to what extent this is possible in practice depends on various details relating to the context, intervention, recipients, etc.

Table 1 illustrates that different aspects of an intervention (shown in the columns) can be tailored towards specific recipient characteristics (the rows, which are here distinguished according to the Motivation–Opportunity–Ability model, along with demographic variables).

For instance, the person or institution implementing an intervention can be portrayed in a way that makes it appealing to people with low motivation to prevent food waste. Likewise, the intervention can be designed or selected in a way that makes it specifically appealing for individuals who are motivated but lack the necessary abilities to prevent food waste. Furthermore, the context can be chosen or framed to enhance the effectiveness of the intervention for individuals who struggle with the practical aspects of preventing or reducing food waste.

Arguably, the aspects mentioned above can seem abstract. What exactly does it mean to 'select or design a context to make the intervention particularly effective for people lacking knowledge on how to prevent food waste'? Or how does one determine the best choice of intervention for unmotivated yet capable people? In fact, **tailoring is (still) more of an art than a science.** In other words, there does not appear to be a completely scientific approach to designing an intervention or context that guarantees maximum effectiveness for a specific group. However, as outlined in Section 3, **heuristics, empirical evidence and experimental tests** can help inform this process or make it more scientific**.**

The information provided on the implementer, as well as the customisation of the intervention choice, design and context in which it is delivered can be tailored to characteristics of the recipients.

In fact, there is **evidence showing why tailored interventions can be more effective** than untailored ones. This evidence provides insights into how to tailor and target food waste reduction interventions with a view on increasing effectiveness and efficiency. More details are provided in the box titled 'Why tailored interventions can be more effective'.

Table 1. Possible combinations of audience and message characteristics

		INTERVENTION CHARACTERISTICS		
		Implementer	Intervention type and design	Context
RECIPIENT CHARACTERISTICS	Demographic			
	Motivation			
	Opportunity			
	Ability			

NB: The table shows intervention characteristics in the columns and recipient characteristics in the rows. Therefore, the cells represent the possible ways in which intervention characteristics can be tailored to recipient characteristics.
Source: Own elaboration.

Why tailored interventions can be more effective

Tailored interventions can be more effective than untailored ones for several reasons (Petty and Cacioppo, 1986; Teeny et al., 2021). We have generalised the original list, which focused on messages, to interventions. Here are some reasons why tailored interventions can be effective:

- they appear more relevant;
- they appear more fitting;
- they seem familiar;
- they are assessed more fluently;
- they empower individuals and make them feel more capable;
- they appear genuine and authentic;
- they attract more attention.

However, there are also potential drawbacks to tailored interventions compared to untailored ones (Teeny et al., 2021). Tailored interventions can be perceived as:

- intrusive to privacy;
- manipulative attempts;
- based on unfair or stereotypical judgments about the person;
- repetitive, conveying information already known.

Overall, if people are aware that an intervention is tailored, they are more likely to react negatively compared to when they are unaware (Teeny et al., 2021). Interventions that remain undisclosed as tailored might show their full potential, although important ethical concerns arise (see Section 6).

- ✓ Targeted interventions are chosen for specific groups or contexts, while tailored interventions are designed or chosen to consider the characteristics of their recipients.
- ✓ Different aspects of an intervention, such as information about the implementer, type or choice of intervention, or the context of application, can be tailored to different characteristics of recipients, such as their demographic status or motivations, abilities and opportunities. Specific interventions can be targeted to specific segments.
- ✓ Targeting and designing tailored interventions is more of an art than a science. It relies on heuristics but can also involve empirical and experimental testing to become more scientific.
- ✓ There are multiple reasons why targeted interventions can be more effective than untargeted ones. However, there are also risks associated with targeted and tailored interventions.

5 Examples and insights from segmentation, targeting and tailoring in food waste studies

This section provides **examples of segments identified in food waste studies and the implications they have derived for targeted or tailored interventions.** Many studies have focused on creating segments relevant for food waste behaviours in different countries. We provide a list of the identified studies that use segmentation techniques and that discuss insights for targeting and tailoring in Table 2 in the Appendix. It is important to note that this is not an exhaustive list of relevant studies, and we do not provide a comprehensive discussion of the related literature.

We will provide **examples** to highlight the key elements of this literature and inspire future work and reading.

5.1 Segmentation

The reviewed studies divide the population into different segments, ranging from as few as two (uncaring vs. caring consumers) (Flanagan and Priyadarshini, 2021) to as many as seven segments (Gaiani et al., 2018). These studies consider various factors related to food waste, which can be presented within the Motivation-Opportunity-Ability model.

- **Motivations and intentions** to reduce food waste encompass attitudes, awareness, concern, self-identity, feelings of responsibility, guilt and other related feelings. These motivations can be expressed in relation to food waste itself, food-waste relevant issues (e.g. climate change, the environment in general, the role of eating leftover or unaesthetic food), and interventions aimed at reducing food waste (e.g. a food waste tax, information campaigns).
- **Opportunity factors** depict whether individuals have the means to avoid food waste, including the (perception of) available time, financial resources and the existing routines.
- **Abilities** related to reducing food waste involve knowledge and skills in planning, storing and cooking and, understanding of date markings.

Segments can be based on characteristics related to motivations and intentions, opportunities and abilities, as well as **other factors** such as socio-demographic characteristics or amounts of food waste.

Segments can be based on characteristics related to people's motivations and intentions, opportunities and abilities to reduce food waste, as well as other factors, such as socio-demographic characteristics or amounts of food waste.

Although not a component of the motivation opportunity ability framework, **amounts of wasted food** are also frequently considered to differentiate between different consumer segments. It is important to note that food waste amounts are often self-reported and should be interpreted with caution. In addition, they are not really a characteristic of a person but rather a consequence of behaviours associated with a person (and partially caused by the behavioural factors outlined above). However, information on food waste generated by specific segments can be valuable in selecting interventions. It can identify hot spots where intervention is most needed due to high levels of food waste. Conversely, it can identify groups with minimal waste, where interventions would not yield significant reductions due to already low waste levels.

5.1.1 Motivational factors, intentions to reduce food waste and perceptions of interventions

Many of the studies we reviewed focused on the motivations and intentions of individuals regarding food waste reduction. Segmenting based on motivations and intentions to reduce food waste can **reveal groups that already have desirable motives and intentions but may lack the necessary abilities or opportunities to translate these into action.** It can also identify segments that have no intentions to reduce food waste. For instance, a study conducted in Türkiye identified segments such as 'conservers' with the highest intentions to reduce food waste, and 'reluctants' and 'prodigals' with markedly lower intentions to reduce food waste (Coskun, 2021).

Motivational factors can take various forms. They can reflect people's positive or negative attitudes towards food waste, the extent to which they personally identify with the issue, or their awareness and concern about the problem. They also refer to people's feelings of responsibility or guilt towards food waste that was generated by themselves or others. For example, in an Italian sample, segments were characterised by considering people's concern about the financial consequences of food waste (Vittuari et al., 2020). Another study in Italy defined segments based on people's feelings of responsibility and awareness of the problem of food waste (Di Talia, Simeone, and Scarpato, 2019). More specifically, a Romanian analysis identified a segment of people who did not consider themselves responsible for food waste at all and thus indicated no motivation to change their behaviour, despite their awareness of the subject (Pocol et al., 2020).

Some studies also examined people's perceptions of interventions commonly used to reduce food waste. For example, segments were characterised by their openness to receiving information on food waste reduction, their willingness to accept price-based interventions as a means to make food waste more costly, or their openness to using technologies that make food waste reduction easier (Aschemann-Witzel, de Hooge, and Almli, 2021; Gaiani et al., 2018). Segmentation based on these factors provides valuable insights into the most promising interventions ([6]).

5.1.2 Opportunity factors

Opportunity factors primarily refer to people's (lack of) time and resources – real or perceived. When it comes to reducing food waste, having the **motivation and skills alone are not enough – sufficient time and resources are also necessary.** Importantly, it is also relevant to consider people's perceptions of these factors. Even if someone has enough time to better plan their meals to reduce waste, if they do not perceive this time as available, they will not act accordingly.

For instance, a Swiss study identified segments called 'short-termist' and 'consumerist' (Delley and Brunner, 2017). Both segments are characterised by individuals who lack time for household tasks related to food waste. Another study involving consumers from multiple countries identified a segment the researchers called 'time-constrained'. Time-constrained individuals may waste food because they do not have enough time to engage in behaviours to reduce food waste. However, there is also a segment referred to as 'convenience lovers', who do not necessarily lack time but consider reducing food waste as less relevant to spend their time on (Merian et al., 2022). When considering opportunity factors, it is important differentiate groups that genuinely lack opportunities or time from those who perceive a lack of time (while potentially lacking motivation) ([7]).

5.1.3 Ability factors and date markings

Many people may lack the necessary abilities to reduce food waste – or at least think they do. Some studies consider these factors when identifying consumer segments. Lack of skills or knowledge on how to reduce food waste can affect various stages of the food waste journey and related decisions, such as purchasing, preparation and storage. For instance, a Danish study identified segments characterised as 'well-planning cooks' who had lower amounts of food waste – presumably because of their good planning skills (Aschemann-Witzel, de Hooge, and Almli, 2021).

Another ability factor is the lack of knowledge on how to correctly interpret date markings. An Italian study found that a small sample of consumers had trouble interpreting them (Gaiani et al., 2018). Similarly, another Italian segment was characterised by their lack of attention to such markings (Vittuari et al., 2020).

([6]) It's important to consider that the insights gathered from people's preferences are based on self-reported data, which may not always align with the interventions that effectively lead to food waste reduction. It's worth noting that people's preferences may lean towards interventions that have the least impact on changing their behaviour.

([7]) Again, measurements relying on self-reports might be of limited value here.

5.2 Targeting and tailoring

We will now provide some examples of the specific insights from the segmentation studies for targeted and tailored interventions. It's important to note that **the studies do not validate the effectiveness of the proposed interventions for each segment.** The recommendations are based on experience – not empirical testing. However, experimental tests are necessary for verification, even when it may seem straightforward to choose the best intervention for a segment based on their characteristics. The box titled 'A case study' presents one study in more detail for illustration purposes.

5.2.1 Based on food waste amounts (hot spots)

Identifying segments with high levels of food waste is a useful starting point for targeting interventions. These segments can be hot spots and have the potential for high reductions of food waste, because there is more to reduce in a segment that wastes on average 10 kg per week, compared to a segment that wastes only 100 g per week. While the amount of food waste can indicate the need to target specific segments, it does not provide clear guidance on how to tailor interventions effectively. This is an example where the need for targeting is clear, but the potential for tailoring is less clear. Also, to be more precise: just because hot spots waste a lot and there is a lot of reduction possible, it is not guaranteed that they will react to the implemented interventions. To gain insights for tailoring, it is important to **understand their motivations, opportunities and abilities** (also to possibly further sub-divide and thus understand this group), along with other characteristics such as socio-demographics. This information can inform effective tailored interventions.

Groups with relatively low levels of food waste may still require intervention to maintain their good behaviours. While immediate reductions may be limited, interventions can focus on acknowledging and encouraging their pro-environmental attitudes and behaviours. These segments can also serve as role models for others, inspiring them to reduce food waste and providing helpful tips (Funk, Sütterlin, and Siegrist, 2021; Nikravech et al., 2023).

5.2.2 Based on psychological characteristics as reasons for food waste (motivation, opportunity, ability)

Identifying the characteristics that contribute to higher levels of food waste in certain segments is a good starting point for targeted interventions. Different interventions can be used based on the specific characteristics of each segment. For example, for segments that lack awareness about food waste, **awareness-raising campaigns** are a suitable choice (Di Talia, Simeone, and Scarpato, 2019). For segments with a lack of knowledge on how to reduce food waste, interventions that provide **education and prevention strategies** can be effective (Annunziata, Muca, and Mariani, 2022). Similarly, one study suggests **emphasising the environmental benefits** of reduction to consumers that are already concerned about the problem of food waste (but still waste food) to get them to act on their concerns. This is another example showing that motivations, attitudes or intentions to reduce food waste do not always translate into consistent behaviour ([8]).

If a **segment wastes a relatively small amount of food**, it may be argued that they don't require intervention. Similarly, segments that are not aware of the problem or are unmotivated to reduce food waste may not be the target for intervention, as the positive effects are deemed unlikely or require significant effort. For instance, researchers in an Australian study state that interventions should not focus on what they call 'uninvolved' and 'self-centred segments' (Pearson and Amarakoon, 2019). Relatedly, the role of food prices in motivating consumer segments affects the suitability of price-based incentives to address food waste. For those who seek cheap deals and end up wasting food, interventions that adjust prices based on the likelihood of generating food waste or highlight cost savings from avoiding food waste can be effective (Merian et al., 2022) ([9]).

([8]) This is often referred to as the attitude-behaviour gap, intention-action gap or intention-behaviour gap (Sheeran and Webb, 2016).

([9]) When policymakers use economic incentives like taxes, small payments, or bans to promote pro-social behaviour, they should be aware of the potential impact on intrinsic motivation. It is important to consider that economic incentives can sometimes reduce the intrinsic motivation that drives pro-social actions, especially without other interventions in place (Bowles, 2008).

A case study

Funk, Sütterlin and Siegrist (2021) conducted a study involving 817 Swiss people responsible for household shopping. They used a questionnaire to assess environmentally friendly behaviour related to food consumption. The questionnaire covered areas such as food choice, consumption frequency, food waste management, sharing behaviour, and eating habits.

Through cluster analysis, the researchers identified six consumer segments with different levels of environmentally-friendly food choice behaviour and consumption. The segments were as follows:

(1) 'meat- and fish-eaters' (19.5 %);
(2) 'origin-focused food savers' (18.0 %);
(3) 'ambiguous consumers' (28.8 %);
(4) 'food waste reducing sharers' (19.7 %);
(5) 'renouncement aversives' (9.0 %);
(6) 'consequent pro-environmental consumers' (5.0 %).

Each segment was described in more detail, and the authors suggested that distinct communication strategies could be targeted towards each segment.

For example, the 'consequent pro-environmental consumers' exhibited a strong positive attitude towards the environment and engaged in environmentally-friendly behaviour across various domains including food consumption and food waste. The authors recommended supporting this group in their efforts rather than trying to further stimulate their sustainable food consumption behaviour. For example, it may make sense to show them how their actions contribute to environmental improvement.

On the other hand, the 'renouncement aversives' were identified as the least environmentally-friendly consumer segment. They showed low food involvement and their consumption behaviour appeared to be driven by practical and economic reasons. The authors suggested that cost savings could be more effective in encouraging this group to change their food consumption than solely emphasising environmental aspects.

While these two segments represent the 'extremes', the other four segments vary in the extent to which their behaviour is environmentally friendly across different domains. The authors emphasised the importance of considering this differentiation when designing food waste interventions to effectively and efficiently address these groups.

Segments characterised by lacking knowledge and skills can benefit from interventions such as training programs or information campaigns. However, it can be challenging to effectively and sustainably provide knowledge and skills with simple and often one-shot interventions. Naturally, for segments that struggle with understanding date labels, **improved, actionable and user-friendly date markings** can be helpful (Gaiani et al., 2018). Such improvements in date markings would not exclusively target those who misunderstand labels, but also benefit other consumers. In such cases, targeting could aim to ensure that these groups receive and understand the improved date markings, assuming that other types of consumers would profit as well.

Segments that perceive food waste reduction as time-consuming and challenging can benefit from **messages emphasising that reducing food waste is easy.** It is also important to stress the importance of being involved in food decisions (Funk, Sütterlin, and Siegrist, 2021). Simple tips for better food preparation, storage, handling and reuse can also be provided (Marek-Andrzejewska and Wielicka-Regulska, 2021).

5.2.3 Based on further characteristics (such as socio-demographics)

As mentioned earlier, **segments can differ in various ways beyond the factors explicitly used to distinguish them.** While one segment may have high problem awareness, and another segment may have low problem awareness, they can also differ or be similar based on other variables. For instance, the segment with low problem awareness may be significantly younger, on average, than the segment with high problem awareness. These **additional variables can provide valuable insights for creating optimal tailored interventions.** For example, for younger segments, it was suggested to use **social and digital media, games and role models** to effectively disseminate educational materials (Annunziata, Muca, and Mariani, 2022). Another study proposed using of messages that incorporate **religious arguments** for segments with religious affiliations (Kutlu, 2022).

- ✓ Several studies have categorized consumers into segments based on different characteristics related to food waste.
- ✓ Segments can be created based on factors like motivation, intentions to reduce food waste, perceptions of interventions, opportunities, abilities and actual food waste amounts.
- ✓ The reviewed segmentation studies provide recommendations for tailored or targeted interventions, but they have not been empirically tested for effectiveness. It would be ideal to verify their effectiveness through experiments.
- ✓ Insights for targeting and tailoring were derived using food waste amounts, psychological and socio-demographic characteristics.

6 Challenges and limitations

As we have outlined so far, there are potentials and benefits to analysing heterogeneous treatment effects, audience segmentation and tailoring interventions. However, there are also **important challenges to consider.** We highlight the most pervasive ones below.

(1) **Analysing and detecting heterogeneous treatment effects requires a large number of observations** (Baranger, 2019). This is because we need enough data to accurately estimate average treatment effects for separate sub-groups (the CATEs), not just for the average person. Each subgroup requires a sufficient number of individuals to estimate the CATEs accurately. However, recruiting an adequate number of participants can be particularly challenging for certain groups, such as non-WEIRD, marginalised or vulnerable communities. Moreover, recruiting more participants, especially from specific groups, is costly. Importantly, dividing individuals into two groups does not simply double the number of required participants – it usually requires many more additional observations. For example, if the goal is to test an intervention not just for the overall sample but for two segments, all else being equal, four times the number of participants would be needed.

(2) **Choosing the characteristics to segment people and tailor interventions can be challenging** and involve a lot of guesswork. However, this process should not be random. It is ideal to base it on theories, previous scientific knowledge, or empirical testing.

(3) There are important **ethical limitations when it comes to gathering and using data** to segment consumers and customise interventions. Exposing people to tailored interventions raises concerns as well (see Box 6 for more on this). Tailoring interventions requires individual information. Obtaining consent to gather data in empirical studies is usually not an issue. However, it becomes problematic when data is collected without people's awareness or knowledge of its purpose. Individuals may not agree to be segmented, especially if done automatically. The case of Cambridge Analytica serves as a cautionary tale, as it involved the use of personal data for psychometric profiling without explicit consent and with potentially significant implications (for the 2016 American election) (Kleinman, 2018; Van der Linden, 2023). Therefore, obtaining consent and complying with the General Data Protection Regulation (GDPR) is necessary.

(4) It is important to carefully consider the **ethics of exposing people to different types or specifications of interventions** or policies based on their characteristics or associated group. Such decisions can be discriminatory because they may rely on generalisations about individuals or exclude some people from beneficial interventions based on certain characteristics. For example, imagine a situation where some people receive financial aid to reduce food waste while others, who are equally in need, do not. These cases require thorough legal and ethical assessment and evaluation in advance.

(5) There are **practical risks associated with the reliability of data.** When publicly available data is used to determine individual characteristics like psychological profiles or amounts of food waste, using low-quality data can lead to false conclusions and potential harm to individuals (Matz et al., 2017). Additionally, there is a general challenge in relying on self-reported information to measure data. Many attempts to segment people rely on self-reported information, which can be unreliable. This applies not only to measuring food waste but also to motivational, opportunity and ability factors that rely on self-reports. If the measurement is unreliable or biased, the insights for targeted and tailored interventions are, at best, limited.

(6) **Targeted interventions can be used to cause harm.** If targeted interventions are more effective than untargeted interventions, they are more successful in achieving their goal. If this goal is detrimental to an individual, this is undesirable. In such cases, targeted interventions may do more harm than untargeted interventions (Matz et al., 2017). While this is not an inherent characteristic of tailored interventions, it is still important to consider.

It is important to consider the challenges related to segmentation and targeting/tailoring – especially those relating to the need of data and ethics – right from the start.

(7) **Scaling up targeted and tailored interventions can be challenging.** Scaling up involves implementing interventions in different and mostly realistic contexts or for diverse populations (Al-Ubaydli, List, and Suskind, 2017; Al-Ubaydli, List, and Suskind, 2019). Since targeted and tailored interventions heavily depend on the specific characteristics of the context and population, scaling up can be difficult. Moreover, the fact that segments can change over time is also relevant. People's characteristics may evolve, making them better suited for a different segment. This means that segmentation studies can become outdated at some point, along with the related decisions for targeted and tailored interventions.

These challenges should be assessed and addressed on a case-by-case basis. As discussed further in the box titled 'Ethical challenges of targeted and tailored interventions', involving relevant stakeholders, especially those who will be impacted by the interventions, during the conceptual and design phases can be an effective strategy for mitigating some of these challenges, especially in policy-relevant situations (Matti et al., 2022).

Ethical challenges of targeted and tailored interventions

When designing behavioural interventions, it is essential to consider the ethical implications. Such interventions are sometimes viewed as manipulative, paternalistic, and infringing on individual autonomy (Bruns and Perino, 2023). To address these concerns, behavioural interventions should aim to increase personal and social welfare transparently, respecting people's rights to individual welfare, autonomy and dignity. They should aim to assist and enable people who wish to reduce food waste in translating their preferences into action. Importantly, changing behaviour is not equivalent to manipulation, which involves covertness, deception, concealment or the omission of relevant information (Sunstein, 2016). Therefore, behavioural interventions should be transparent (Bruns et al., 2018), subjectable to public scrutiny (Kuehnhanss, 2019), and the people involved should be fully informed or at least have access to information about their purpose and potential consequences. It is crucial to consider the potential negative impact of certain intervention strategies, such as nudges inducing guilt, which may reduce food waste but negatively affect individuals' personal welfare. Cost–benefit analyses can be employed and future recipients of such interventions should be involved (Allcott and Kessler, 2019). Furthermore, guidelines and toolkits, such as the BASIC toolkit by the Organisation for Economic Co-operation and Development (OECD, 2019) and its *Good practice principles for ethical behavioural science in public policy* report (OECD, 2022) or the FORGOOD framework (Lades and Delaney, 2020) provide guidance for ethical use in public policy.

Targeting and tailoring bring about their own challenges (Mills, 2020; Collier et al., 2022). Three general points are worth noting. First, to tailor or target interventions, knowledge about different segments of people is needed. Article 22 of the EU GDPR emphasizes an individuals' right not to be subject to decisions based solely on automated processing or profiling that have significant legal or similar effects. According to Article 4, profiling refers to using personal data to analyse or predict various aspects of a person's life (Roberts, 2022). People have the right to object to the collection of such data about them.

Second, it can be problematic to target certain segments with interventions while excluding others or providing them with different, potentially less effective interventions. When policy interventions are implemented, it might be unethical if some segments get certain interventions but others do not.

Third, the way interventions are targeted or tailored can vary greatly. However, they all involve using information about specific groups of people. This information can sometimes be biased, stereotypical, inaccurate, or discriminatory. Certain characteristics should not be used to segment people or tailor/target interventions. For example, targeting interventions towards specific ethnic groups can be entirely inappropriate. In some cases, the affected groups may consider the selection of interventions for them as inappropriate. It is crucial to consider these factors right from the beginning. If possible, the relevant target groups should be involved in or consulted when designing targeted or tailored interventions.

7 Results from an expert survey

On 16 February 2023, the Commission organised a hybrid **workshop in collaboration with the FLW and the ECFWF.** The workshop involved experts from both the scientific and practical fields, focusing on various aspects of reducing consumer food waste.

As part of the workshop, a **survey** was conducted, consisting of seven questions related to the participants' knowledge levels and plans to use segmentation and targeting/tailoring in their work, as well as their perceived benefits and challenges. In this section, we briefly summarise the most relevant insights. The corresponding figures displaying the survey responses can be found in the Appendix.

A total of **45 experts** participated in the survey, although not all of them answered every question. The responses regarding **knowledge of segmentation techniques** indicated a significant level of knowledge, with over 30 % of participants indicating to have a lot or expert knowledge in this area. However, the majority of respondents expressed less familiarity with this topic, with approximately 44 % stating that they have a bit of knowledge on the topic. Similar patterns were observed regarding **knowledge of targeting and tailoring methods.** More than 30 % of participants indicated to have a lot or expert knowledge on the topic, while the majority had less knowledge, with around 44 % indicating a bit of knowledge. As expected, given the motivation of this paper and the expert groups involved, a large majority of **80 % expressed interested in both techniques.**

Four open-ended questions inquired about the expected benefits and challenges of both techniques. These questions also aimed to understand the type of information, tools and support needed to effectively use either technique, along with segments in which the experts were particularly interested. To analyse the responses, we carefully read all the answers and determined the main concept they addressed. A response could address multiple concepts ([10]).

Overall, the participants identified eight different **benefits associated with these techniques.** The most significant benefit, mentioned by 40.7 % of respondents, was the effectiveness of segmentation and targeting/tailoring. This was followed by expected improvements in efficiency (14.8 %) and increased relevance of interventions (13 %). Other benefits were mentioned only once and included a potentially broader reach, interventions better addressing people's specific needs, more focused interventions, segmentation as a tool for better understanding the drivers of food waste, and segmentation as a tool for distinguishing between different types of actors involved.

Participants highlighted 19 different types of **challenges related to segmentation and targeting/tailoring.** The most commonly mentioned challenge, noted by 22.4% of respondents, was the higher expected cost associated with these techniques. This was followed by required knowledge (13.8 %) and time resources (6.9 %). Other challenges such as the need for an underlying theory, guidance and data were each mentioned by 3.4 % of respondents. The remaining challenges were mentioned individually.

Participants mentioned 25 needs. 20 % of respondents expressed a need for guidance on segmentation and tailoring/targeting. Specific knowledge about the relevant drivers of food waste for segmentation and best practices were each mentioned by 6.2 % of respondents. Additionally, 3.1 % of respondents each expressed a need for step-by-step explanations, insights on how to reach target groups, an understanding of the pros and cons of these techniques and concrete examples. The remaining challenges were single mentions.

Finally**, participants mentioned 32 distinct segments that they believed should receive targeted intervention.** The most prominently mentioned segment, noted by 14.8% of respondents, was children or young people. This was followed by groups that waste a lot of food (8.6 %), family households (7.4 %), single households (6.2 %) and food service providers (6.2 %). Other mentioned segments included young adults (4.9 %), households in general (4.9 %), actors with a high motivation to change (3.7 %) and vulnerable actors (2.5 %). The remaining identified challenges were single mentions.

([10]) Please note that this coding is partially subjective, as we had to read the answers and then decide which concept we thought was addressed. Thus, we may have lost some detailed information.

- Experts' expect segmentation and targeting/tailoring to result in more effective, efficient and relevant interventions.

- The main barrier to using these techniques, according to experts, is the associated costs, which stem from the need for a large number of participants (see Section 6). Knowledge and time are also important factors, highlighting the importance of collaboration between practitioners and scientists.

- Food waste reduction experts are interested in receiving guidance and best practices in this area. This document aims to fulfil some of these requirements, and future work should further explore these techniques in the context of food waste.

- Various groups are considered relevant recipients of targeted and tailored interventions. Notably, young people and individuals who waste significant amounts of food are seen as appropriate targets.

8 Summary

The purpose of this document is to recognise that behavioural interventions, particularly nudges, have diverse effects on different groups of people, and to make this knowledge useful. It argues that it is important to acknowledge **that there is no one-size-fits all intervention that works for everyone.** In fact, the characteristics of individuals and contexts can account for the fact that sometimes nudges work better or less well. Understanding when and why nudges work better or less well, i.e. acknowledging heterogeneous treatment effects, can **benefit scientists, practitioners and policymakers.** This is particularly relevant when policies target hot spots, low-hanging fruit, risk groups or people from diverse, non-WEIRD backgrounds.

By identifying individual or context characteristics, **people can be grouped into distinct segments.** Based on an informed selection of the relevant individual or context characteristics, these segments can be predefined or created using more complex clustering techniques. It is essential to note that both approaches require large sample sizes to ensure reliable insights, which may limit their practicality. Segmentation helps identify groups that respond differently to specific interventions, those who are most in need of intervention or those who require protection and assistance.

The final step of tailoring and targeting behavioural interventions towards different segments is more of an art than a science. However, this process can lead to **interventions that are more effective than one-size-fits-all approaches.** It can also make interventions **more efficient** by optimising them for specific groups, while not targeting others. Different aspects of an intervention can be tailored towards different characteristics of recipients and contexts. This document recognises the possibility of segmenting recipients according to their demographic characteristics, amounts of food waste and perceptions of food waste reduction interventions, along with characteristics regarding their motivation, abilities and opportunities to reduce food waste. Other approaches are also possible. The document highlights the implementer, specific intervention types and choices, and the intervention context as aspects that can be adapted. When tailoring and targeting interventions, **it is important to consider the mechanisms that explain why targeted interventions may be more or less effective** than non-targeted ones.

We also discussed **ethical and practical limitations and considerations.** This includes ethical concerns about data collection and usage, the non-universal implementation of interventions and potential challenges during the tailoring and targeting process. These challenges emphasise the **importance of participatory approaches in intervention design**, which can help identify and address problematic aspects. Results from an expert survey confirm the interest in segmentation and targeting/tailoring, but also stress the need for further work, guidelines and empirical testing to improve the practices of targeting and tailoring.

References

Abrahamse, W., 'How to Effectively Encourage Sustainable Food Choices: A Mini-Review of Available Evidence', *Frontiers in Psychology*, Vol. 11, 2020, p. 589674.

Al-Ubaydli, O., J.A. List, and D.L. Suskind, 'What Can We Learn from Experiments?', *American Economic Review: Papers & Proceedings*, Vol. 107, No. 5, 2017, pp. 282–286.

Al-Ubaydli, O., J. List, and D. Suskind, *The Science of Using Science: Towards an Understanding of the Threats to Scaling Experiments*, National Bureau of Economic Research, Cambridge, MA, May 2019.

Annunziata, A., F.L. Muca, and A. Mariani, 'Preventing Household Food Waste in Italy: A Segmentation of the Population and Suggestions for Action', *Sustainability*, Vol. 14, No. 12, 2022, p. 7005.

Aschemann-Witzel, J., I.E. de Hooge, and V.L. Almli, 'My Style, My Food, My Waste! Consumer Food Waste-Related Lifestyle Segments', *Journal of Retailing and Consumer Services*, Vol. 59, 2021, p. 102353.

Aschemann-Witzel, J., I.E. de Hooge, V.L. Almli, and M. Oostindjer, 'Fine-Tuning the Fight Against Food Waste', *Journal of Macromarketing*, Vol. 38, No. 2, 2018, pp. 168–184.

Baranger, D., 'Interaction Analyses – How Large a Sample Do I Need? (Part 3)', June 8, 2019. https://davidbaranger.com/2019/08/06/interaction-analyses-how-large-a-sample-do-i-need-part-3/.

———, 'Interaction Analyses – Power (Part 1)', June 8, 2019. https://davidbaranger.com/2019/08/06/interaction-analyses-power-part-1/.

Blondin, S., and S. Attwood, 'Making Food Waste Socially Unacceptable: What Behavioral Science Tells Us About Shifting Social Norms to Reduce Household Food Waste', *World Resources Institute*, 2022.

Borg, K., M. Boulet, G. Karunasena, and D. Pearson, 'Segmenting Households Based on Food Waste Behaviours and Waste Audit Outcomes: Introducing Over Providers, Under Planners and Considerate Planners', *Journal of Cleaner Production*, Vol. 351, 2022, p. 131589.

Bowles, S., 'Policies Designed for Self-Interested Citizens May Undermine 'The Moral Sentiments'', *Science*, Vol. 320, No. 5883, 2008, pp. 1605–1609.

Bruns, H., E. Kantorowicz-Reznichenko, K. Klement, M. Luistro Jonsson, and B. Rahali, 'Can Nudges Be Transparent and Yet Effective?', *Journal of Economic Psychology*, Vol. 65, 2018, pp. 41–59.

Bruns, H., and H.U. Nohlen, *A Simple Introduction to Using Experiments to Evaluate Consumer Food Waste Interventions*, Publications Office of the European Union, Luxembourg, 2023.

Bruns, H., and G. Perino, 'The Role of Autonomy and Reactance for Nudging', *Journal of Behavioral and Experimental Economics*, Vol. 106, 2023, p. 102047.

Bryan, C.J., E. Tipton, and D.S. Yeager, 'Behavioural Science Is Unlikely to Change the World without a Heterogeneity Revolution', *Nature Human Behaviour*, Vol. 5, No. 8, 2021, pp. 980–989.

Cialdini, R.B., *Influence*, Rev. ed., *Collins Business Essentials*, Collins, New York, NY, 2007.

Coskun, A., 'Identification of Different User Types for Designing Household Food Waste Interventions', *International Journal of Sustainable Engineering*, Vol. 14, No. 4, 2021, pp. 609–617.

Costa, D.L., and M.E. Kahn, 'Energy Conservation "Nudges" and Environmentalist Ideology: Evidence from a Randomized Residential Electricity Field Experiment', *Journal of the European Economic Association*, Vol. 11, No. 3, 2013, pp. 680–702.

Delley, M., and T.A. Brunner, 'Foodwaste within Swiss Households: A Segmentation of the Population and Suggestions for Preventive Measures', *Resources, Conservation and Recycling*, Vol. 122, 2017, pp. 172–184.

Di Talia, E., M. Simeone, and D. Scarpato, 'Consumer Behaviour Types in Household Food Waste', *Journal of Cleaner Production*, Vol. 214, 2019, pp. 166–172.

Dixon, G., J. Hmielowski, and Y. Ma, 'Improving Climate Change Acceptance Among U.S. Conservatives Through Value-Based Message Targeting', *Science Communication*, Vol. 39, No. 4, 2017, pp. 520–534.

EU Platform on Food Losses and Food Waste, ‘Recommendations for Action in Food Waste Prevention’, 2019. https://ec.europa.eu/food/system/files/2021-05/fs_eu-actions_action_platform_key-rcmnd_en.pdf.

Eurostat, ‘Food Waste and Food Waste Prevention - Estimates’, March 17, 2023. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Food_waste_and_food_waste_prevention_-_estimates&stable=0&redirect=no.

Farrow, K., G. Grolleau, and L. Ibanez, ‘Social Norms and Pro-Environmental Behavior: A Review of the Evidence’, *Ecological Economics*, Vol. 140, 2017, pp. 1–13.

Flanagan, A., and A. Priyadarshini, ‘A Study of Consumer Behaviour towards Food-Waste in Ireland: Attitudes, Quantities and Global Warming Potentials’, *Journal of Environmental Management*, Vol. 284, 2021, p. 112046.

Funk, A., B. Sütterlin, and M. Siegrist, ‘Consumer Segmentation Based on Stated Environmentally-Friendly Behavior in the Food Domain’, *Sustainable Production and Consumption*, Vol. 25, 2021, pp. 173–186.

Gaiani, S., S. Caldeira, V. Adorno, A. Segrè, and M. Vittuari, ‘Food Wasters: Profiling Consumers’ Attitude to Waste Food in Italy’, *Waste Management*, Vol. 72, 2018, pp. 17–24.

Henrich, J., S.J. Heine, and A. Norenzayan, ‘Most People Are Not WEIRD’, *Nature*, Vol. 466, No. 7302, July 2010, pp. 29–29.

Hirsh, J.B., S.K. Kang, and G.V. Bodenhausen, ‘Personalized Persuasion: Tailoring Persuasive Appeals to Recipients’ Personality Traits’, *Psychological Science*, Vol. 23, No. 6, 2012, pp. 578–581.

Hummel, D., and A. Maedche, ‘How Effective Is Nudging? A Quantitative Review on the Effect Sizes and Limits of Empirical Nudging Studies’, *Journal of Behavioral and Experimental Economics*, Vol. 80, 2019, pp. 47–58.

Joyal-Desmarais, K., A.J. Rothman, and M. Snyder, ‘How Do We Optimize Message Matching Interventions? Identifying Matching Thresholds, and Simultaneously Matching to Multiple Characteristics’, *European Journal of Social Psychology*, Vol. 50, No. 3, 2020, pp. 701–720.

Kleinman, Z., ‘Cambridge Analytica: The Story so Far’, 2018. https://www.bbc.com/news/technology-43465968.

Kuehnhanss, C.R., ‘The Challenges of Behavioural Insights for Effective Policy Design’, *Policy and Society*, Vol. 38, No. 1, 2019, pp. 14–40.

Kunszabó, A., D. Szakos, A. Dorkó, C. Farkas, and G. Kasza, ‘Household Food Waste Composting Habits and Behaviours in Hungary: A Segmentation Study’, *Sustainable Chemistry and Pharmacy*, Vol. 30, 2022, p. 100839.

Kutlu, M.B., ‘A Trait-Based Consumer Segmentation for Food Waste Reduction Campaigns’, *Social Marketing Quarterly*, Vol. 28, No. 2, 2022, pp. 130–146.

Luong, K.T., R.K. Garrett, and M.D. Slater, ‘Promoting Persuasion With Ideologically Tailored Science Messages: A Novel Approach to Research on Emphasis Framing’, *Science Communication*, Vol. 41, No. 4, 2019, pp. 488–515.

Maier, M., F. Bartoš, T.D. Stanley, D.R. Shanks, A.J.L. Harris, and E.-J. Wagenmakers, ‘No Evidence for Nudging after Adjusting for Publication Bias’, *Proceedings of the National Academy of Sciences*, Vol. 119, No. 31, August 2, 2022, p. e2200300119.

Mallinson, L.J., J.M. Russell, and M.E. Barker, ‘Attitudes and Behaviour towards Convenience Food and Food Waste in the United Kingdom’, *Appetite*, Vol. 103, 2016, pp. 17–28.

Marek-Andrzejewska, E.M., and A. Wielicka-Regulska, ‘Targeting Youths’ Intentions to Avoid Food Waste: Segmenting for Better Policymaking’, *Agriculture*, Vol. 11, No. 4, 2021, p. 284.

Matti, C., G. Rissola, P. Martinez, L. Bontoux, J.-M. Joval, A. Spalazzi, and D. Fernandez, *Co-Creation for Policy: Participatory Methodologies to Structure Multi-Stakeholder Policymaking Processes*, Publications Office of the European Union, Luxembourg, 2022.

Matz, S.C., M. Kosinski, G. Nave, and D.J. Stillwell, ‘Psychological Targeting as an Effective Approach to Digital Mass Persuasion’, *Proceedings of the National Academy of*

Sciences, Vol. 114, No. 48, 2017, pp. 12714–12719.

Merian, S., S. Stöeckli, K.L. Fuchs, and M. Natter, 'Buy Three to Waste One? How Real-World Purchase Data Predict Groups of Food Wasters', *Sustainability*, Vol. 14, No. 16, 2022, p. 10183.

Mertens, S., M. Herberz, U.J.J. Hahnel, and T. Brosch, 'The Effectiveness of Nudging: A Meta-Analysis of Choice Architecture Interventions across Behavioral Domains', *Proceedings of the National Academy of Sciences*, Vol. 119, No. 1, January 5, 2022, p. e2107346118.

Mills, S., 'Personalized Nudging', *Behavioural Public Policy*, Vol. 6, No. 1, 2020, pp. 150–159.

Närvänen, E., N. Mesiranta, H. Saarijärvi, and J. Nevalainen, 'Examining Consumer Food Waste through Grocery Retailers' Customer Data: Segments and Practical Implications', *International Journal of Consumer Studies*, Vol. 47, No. 4, 2023, pp. 1273–1290.

Nikravech, M., N. Langen, E. van Herpen, S. Schuster, and M. Speck, '"Out of the Meal Box": A Latent Class Analysis on Dinner Leftover Management Practices', [Manuscript submitted for publication], 2023.

Nisa, C.F., J.J. Bélanger, B.M. Schumpe, and D.G. Faller, 'Meta-Analysis of Randomised Controlled Trials Testing Behavioural Interventions to Promote Household Action on Climate Change', *Nature Communications*, Vol. 10, No. 1, 2019, p. 4545.

Noar, S.M., C.N. Benac, and M.S. Harris, 'Does Tailoring Matter? Meta-Analytic Review of Tailored Print Health Behavior Change Interventions', *Psychological Bulletin*, Vol. 133, No. 4, 2007, pp. 673–693.

Ölander, F., and J. Thøgersen, 'Understanding of Consumer Behaviour as a Prerequisite for Environmental Protection', *Journal of Consumer Policy*, Vol. 18, No. 4, December 1995, pp. 345–385.

Osman, M., *Backfiring, Reactance, Boomerang, Spillovers, and Rebound Effects: Can We Learn Anything from Examples Where Nudges Do the Opposite of What They Intended?*, 2020.

Pearson, D., and U. Amarakoon, 'Environmentally Friendly Social Changes: Profiling Individuals for Household Food Waste Reductions', *Australasian Journal of Environmental Management*, Vol. 26, No. 4, 2019, pp. 311–327.

Peer, E., S. Egelman, M. Harbach, N. Malkin, A. Mathur, and A. Frik, 'Nudge Me Right: Personalizing Online Security Nudges to People's Decision-Making Styles', *Computers in Human Behavior*, Vol. 109, 2020, p. 106347.

Petty, R.E., and J.T. Cacioppo, 'The Elaboration Likelihood Model of Persuasion', *Advances in Experimental Social Psychology*, Vol. 19, 1986, pp. 123–205.

Pink, S.L., J. Chu, J.N. Druckman, D.G. Rand, and R. Willer, 'Elite Party Cues Increase Vaccination Intentions among Republicans', *Proceedings of the National Academy of Sciences*, Vol. 118, No. 32, 2021.

Pocol, C.B., M. Pinoteau, A. Amuza, A. Burlea-Schiopoiu, and A.-I. Glogoveţan, 'Food Waste Behavior among Romanian Consumers: A Cluster Analysis', *Sustainability*, Vol. 12, No. 22, 2020, p. 9708.

Reynolds, C., L. Goucher, T. Quested, S. Bromley, S. Gillick, V.K. Wells, D. Evans, et al., 'Review: Consumption-Stage Food Waste Reduction Interventions – What Works and How to Design Better Interventions', *Food Policy*, Vol. 83, 2019, pp. 7–27.

Richter, B., 'Knowledge and Perception of Food Waste among German Consumers', *Journal of Cleaner Production*, Vol. 166, 2017, pp. 641–648.

Romani, S., S. Grappi, R.P. Bagozzi, and A.M. Barone, 'Domestic Food Practices: A Study of Food Management Behaviors and the Role of Food Preparation Planning in Reducing Waste', *Appetite*, Vol. 121, 2018, pp. 215–227.

Sanyé Mengual, E., and S. Sala, *Consumption Footprint and Domestic Footprint: Assessing the Environmental Impacts of EU Consumption and Production. Life Cycle Assessment to Support the European Green Deal*, Publications Office of the European Union, Luxembourg, 2023.

Schmid, K.L., S.E. Rivers, A.E. Latimer, and P. Salovey, 'Targeting or Tailoring?', *Marketing Health Services*, Vol. 28, No. 1, 2008, pp. 32–37.

Sheeran, P., and T.L. Webb, 'The Intention-Behavior Gap', *Social and Personality Psychology Compass*, Vol. 10, No. 9, 2016, pp. 503–518.

Sunstein, C.R., *The Ethics of Influence*, Cambridge University Press, New York, NY, 2016.

Szaszi, B., A. Palinkas, B. Palfi, A. Szollosi, and B. Aczel, 'A Systematic Scoping Review of the Choice Architecture Movement: Toward Understanding When and Why Nudges Work', *Journal of Behavioral Decision Making*, Vol. 31, No. 3, 2018, pp. 355–366.

Teeny, J.D., J.J. Siev, P. Briñol, and R.E. Petty, 'A Review and Conceptual Framework for Understanding Personalized Matching Effects in Persuasion', *Journal of Consumer Psychology*, Vol. 31, No. 2, 2021, pp. 382–414.

Thaler, R.H., and C.R. Sunstein, *Nudge*, Yale University Press, New Haven, CN, 2008.

Tian, X., Z. Xia, J. Xie, C. Zhang, Y. Liu, and M. Xu, 'A Meta-Analytical Review of Intervention Experiments to Reduce Food Waste', *Environmental Research Letters*, Vol. 17, No. 6, 2022, p. 064041.

Van der Linden, S., *Foolproof: Why Misinformation Infects Our Minds and How to Build Immunity*, First American edition., W.W. Norton & Company, New York, NY, 2023.

Van Hove, S., M. Karaliopoulos, L. Tsolas, P. Conradie, M. Amadori, I. Koutsopoulos, K. Ponnet, and F. Anagnostopoulos, *Profiling of Energy Consumers: Psychological and Contextual Factors of Energy Behavior*, September 30, 2021.

Vittuari, M., L. Falasconi, M. Masotti, S. Piras, A. Segrè, and M. Setti, ''Not in My Bin': Consumer's Understanding and Concern of Food Waste Effects and Mitigating Factors', *Sustainability*, Vol. 12, No. 14, 2020, p. 5685.

Vittuari, M., L.G. Herrero, M. Masotti, E. Iori, C. Caldeira, Z. Qian, H. Bruns, et al., 'How to Reduce Consumer Food Waste at Household Level: A Literature Review on Drivers and Levers for Behavioural Change', *Sustainable Production and Consumption*, Vol. 38, 2023, pp. 104–114.

List of figures

List of tables

Annex

Table 2. Studies segmenting the sample into food waste relevant groups and derived insights for targeting and tailoring

Nr	Reference	Country	Number of participants	Segments	Tailored interventions
1	Annunziata, A., F.L. Muca, and A. Mariani, 'Preventing Household Food Waste in Italy: A Segmentation of the Population and Suggestions for Action', Sustainability, Vol. 14, No. 12, 2022, p. 7005.	Italy	530	1. 'Self-indulgent' (20 %) 2. 'Proactive' (55 %) 3. 'Discouraged' (25 %)	1. 'Self-indulgent': Prevention initiatives like educational campaigns or social marketing to increase awareness and improve attitudes. Opinion leaders, social and digital media. Highlighting moral issues. Promoting recovery and redistribution of surplus food. 2. 'Proactive': Promoting and informing about food donation and sharing initiatives. 3. 'Discouraged': Educational and empowering interventions to strengthen perceived behavioural control (e.g. labels).
2	Aschemann-Witzel, J., I.E. de Hooge, and V.L. Almli, 'My Style, My Food, My Waste! Consumer Food Waste-Related Lifestyle Segments', Journal of Retailing and Consumer Services, Vol. 59, 2021, p. 102353.	Denmark, Germany, Netherlands, Norway, Sweden	4 214	1. 'Young foodies' 2. 'Well-planning cooks and frugal food avoiders' 3. 'Convenience and price-oriented low income' 4. 'Uninvolved young male waster' 5. 'Established'	1. 'Young foodies': Communicating about suboptimal foods and possibilities to donate surplus food. 2. 'Well-planning cooks and frugal food avoiders': Information to improve meal planning and food handling. Price reductions for suboptimal food. 3. 'Convenience and price-oriented low income': Communication appealing to budget-saving motives. 4. 'Uninvolved young male waster': Marketing and nudging (e.g. smarter packaging, assortment changes). 5. 'Established': Marketing appeals to culinary interests. Meal boxes.
3	Aschemann-Witzel, J., I.E. de Hooge, V.L. Almli, and M. Oostindjer, 'Fine-Tuning the Fight Against Food Waste', Journal of Macromarketing, Vol. 38, No. 2, 2018, pp. 168–184. (Aschemann-Witzel et al., 2018)	Denmark	848	1. 'Cooking involved and spontaneous' 2. 'Price v quality-oriented and disliking cooking'	1. 'Cooking involved and spontaneous': Apps supporting planning and stock management. Labels highlighting operators' contribution to food waste avoidance. Education or dissemination of knowledge on purchase and meal planning. Social norm communication. 2. 'Price v quality-oriented and disliking cooking': Food

				3. ‘Very involved and cooking-engaged’ 4. ‘Good food- involved and price-dismissive’ 5. ‘Least concerned, normative and social’	price reduction for products near expiration date/suboptimal food/canteen leftovers. Easy tips for storage and food handling. Financial incentives via waste bin. Communicate personal economic benefits of avoiding food waste or of ‘thriftiness’. Education or dissemination of knowledge on purchase and meal planning. 3. ‘Very involved and cooking-engaged’: Household management advice. Education or dissemination of knowledge on effective household management. Incentivise sharing of advice with peers. Communicate social norms on thriftiness and simplicity. Support of NGOs or citizen activities. 4. ‘Good food-involved and price-dismissive’: Labels highlighting operators’ contribution to food waste avoidance. Actions reducing guilt, heightening status, boosting cooking enjoyment. Price- and service-based interventions (e.g. box schemes). Labels highlighting operators’ contribution to food waste avoidance. Communication of ‘sufficiency’ social norms. 5. ‘Least concerned, normative and social’: Nudging strategies to sell otherwise wasted food. Less diverse food assortment. Smart packaging, longer expiration dates. The authors provide a detailed outline in their Table 6.
4	Borg, K., M. Boulet, G. Karunasena, and D. Pearson, ‘Segmenting Households Based on Food Waste Behaviours and Waste Audit Outcomes: Introducing Over Providers, Under Planners and Con-siderate Planners’, Journal of Cleaner Production, Vol. 351, 2022, p. 131589.	Australia	2 803	1. ‘Over Providers’ (23 %) 2. ‘Under planners’ (32 %) 3. ‘Considerate planners’ (45 %)	1. ‘Over Providers’: Calculators and reminders reflecting the required amount of food to affect them at buying and preparation stages. Involvement of children in food planning and use of schools as lever. Mentoring by ‘considerate planners’. 2. ‘Under planners’: Planning interventions. Changes in food units and packaging with proportionate pricing. 3. ‘Considerate planners’: Use as mentors for ‘over providers’.
5	Coskun, A., ‘Identification of Different User Types for Designing Household Food Waste Interven-	Türkiye	150	1. ‘Conservers’ (50 %) 2. ‘Considerates’ (28 %) 3.’Reluctants’	1. ‘Conservers’: Waste diaries. Food sharing. 2. ‘Considerates’: *No insights about targeting/tailoring* 3. ‘Reluctants’: Smart stock management. 4. ‘Prodigals’: No waste diaries.

	tions', International Journal of Sustainable Engineering, Vol. 14, No. 4, 2021, pp. 609–617. (Coskun, 2021)			(16 %) 4. 'Prodigals' (6 %)	*They also elicit the preferences of the different segments for interventions (shown in their Table 3).*
6	Delley, M., and T.A. Brunner, 'Foodwaste within Swiss Households: A Segmentation of the Population and Suggestions for Preventive Measures', Resources, Conservation and Recycling, Vol. 122, 2017, pp. 172–184.	Switzerland	681	1. 'Conservative' (23.9 %) 2. 'Self-indulgent' (7.5 %) 3. 'Short-termist' (20.9 %) 4. 'Indifferent' (27.4 %) 5. 'Consumerist' (14.1 %) 6. 'Eco-responsible' (6.2 %)	1. 'Conservative': Emphasis on financial losses and savings. Promotion of local and sustainable products. Provision of recipes made from leftovers. Organisational tips. Involvement in workshop organisation and leadership role. Enhance know-how, awareness and responsibility endorsement. 2. 'Self-indulgent': Emphasis on status-enhancing actions. Communication on contributions of political leaders. Encouraging sharing of excessive food stock. Enhance know-how, awareness and responsibility endorsement. 3. 'Short-termist': Emphasis on status-enhancing actions. Communication about food waste management in state canteens. Promote ingredients packaged with recipes. Shopping and meal list templates and portion size advice. Help to purchase proper quantities. Use personal contacts and coping. Enhance know-how, awareness and responsibility endorsement. 4. 'Indifferent': Create early awareness. Promotion of innovation with time gain arguments. 5. 'Consumerist': Create early awareness. Provide onsite portion size advice. Help in purchasing proper quantities. Promotion of innovation with fun-related arguments. 6. 'Eco-responsible': Involvement in workshop organisation and leadership role. Involvement in NGOs, enhance know-how, awareness and responsibility endorsement. New date labelling system was mentioned for all segments. Enhance know-how about food production was mentioned for all segments except 'conservatives'. *The authors provide a detailed outline in their Table 11.*
7	Di Talia, E., M. Simeone, and D. Scarpato, 'Consumer Behaviour Types in Household Food Waste',	Italy	213	1. 'Non-conscious consumer' (45 %) 2. 'Consumers unaware but not	1. 'Non-conscious consumer': Awareness-raising campaigns that aim to increase sensitivity about the problem and improve food management practices.

	Journal of Cleaner Production, Vol. 214, 2019, pp. 166–172.			wasteful' (26 %) 3. 'Conscious consumers' (29 %)	2. 'Consumers unaware but not wasteful': Awareness-raising campaigns that aim to increase sensitivity about the problem and improve food management practices (especially via mobile apps). 3. 'Conscious consumers': No specific intervention needed.
8	Flanagan, A., and A. Priyadarshini, 'A Study of Consumer Behaviour towards Food-Waste in Ireland: Attitudes, Quantities and Global Warming Potentials', Journal of Environmental Management, Vol. 284, 2021, p. 112046.	Ireland	2 062	1. 'Uncaring consumers' (63 %) 2. 'Caring consumers' (37 %)	*No insights about targeting/tailoring*
9	Funk, A., B. Sütterlin, and M. Siegrist, 'Consumer Segmentation Based on Stated Environmentally-Friendly Behavior in the Food Domain', Sustainable Production and Consumption, Vol. 25, 2021, pp. 173–186.	Switzerland	817	1. 'Meat- and fish-eaters' (19.5 %) 2. 'Origin-focused food savers' (18 %) 3. 'Ambiguous consumers' (28.8 %) 4. 'Food waste reducing sharers' (19.7 %) 5. 'Renouncement aversives' (9 %) 6. 'Consequent pro-environmental consumers' (5 %)	1. 'Meat- and fish-eaters': Emphasising social desirability of food waste reduction. General use of status- or image-based interventions. 2. 'Origin-focused food savers': Information about recent replacement products and organised sharing services. 3. 'Ambiguous consumers': Information about the environmental impact of food waste and concrete guidance to lower food waste. 4. 'Food waste reducing sharers': Appeals to preference for tasty food and openness to new experiences. 5. 'Renouncement aversives': Acknowledgements of their price-reduction induced food waste reduction behaviour. Messages highlighting that food waste reduction is easy. Stressing importance of being involved in food decisions. Highlighting positive effect of food reduction activities on the environment. 6. 'Consequent pro-environmental consumers': Messages encouraging and acknowledging their beneficial behaviour.
10	Gaiani, S., S. Caldeira, V. Adorno, A. Segrè, and M. Vittuari, 'Food Wasters: Profiling Consumers' Attitude to Waste Food in Italy', Waste Management, Vol. 72, 2018, pp. 17–24.	Italy	3 087	1. 'Conscious fussy' (22 %) 2. 'Conscious-forgetful' (20 %) 3. 'Frugal consumer' (23 %) 4. 'Confused	1. 'Conscious fussy': Improved date markings. 2. 'Conscious-forgetful': Food education and information improving their abilities and knowledge. 3. 'Frugal consumer': *No insights about targeting/tailoring* 4. 'Confused (about labelling)': *No insights about targeting/tailoring* 5. 'Exaggerating cook': Guidance on food storage.

				(about labelling)' (3 %) 5. 'Exaggerating cook' (22 %) 6. 'Exaggerated shopper' (3 %) 7. 'Unskilled cook' (5 %)	6. 'Exaggerated shopper': *No insights about targeting/tailoring* 7. 'Unskilled cook': *No insights about targeting/tailoring*
11	Kunszabó, A., D. Szakos, A. Dorkó, C. Farkas, and G. Kasza, 'Household Food Waste Composting Habits and Behaviours in Hungary: A Segmentation Study', Sustainable Chemistry and Pharmacy, Vol. 30, 2022, p. 100839. (Kunszabó et al., 2022)	Hungary	1 002	1. 'Average composters' (26.07 %), 2. 'Uninterested urban citizens' (14.74 %), 3. 'Helpless apartment residents' (29.48 %), 4. 'Active environmentalists' (29.72 %)	*No insights about targeting/tailoring*
12	Kutlu, M.B., 'A Trait-Based Consumer Segmentation for Food Waste Reduction Campaigns', Social Marketing Quarterly, Vol. 28, No. 2, 2022, pp. 130–146.	Türkiye	301	1. 'Frugal believers' (18 %) 2. 'Frugal seculars' (23 %) 3. 'Conscientious individuals' (20.3 %) 4. 'Casual females' (19.9 %) 5.'Casual males' (17.6 %)	1. 'Frugal believers': Messages involving religious arguments against food waste. Messages by religious leaders. Messages in religious places. Appeals to saving money related to food waste. 2. 'Frugal seculars': Appeals to saving money related to food waste. 3. 'Conscientious individuals': Messages with info about necessary tasks to avoid food waste (e.g. shopping plans, inventory control of food items). 4. 'Casual females': Interventions to increase conscientiousness. 5.'Casual males': Interventions to increase conscientiousness.

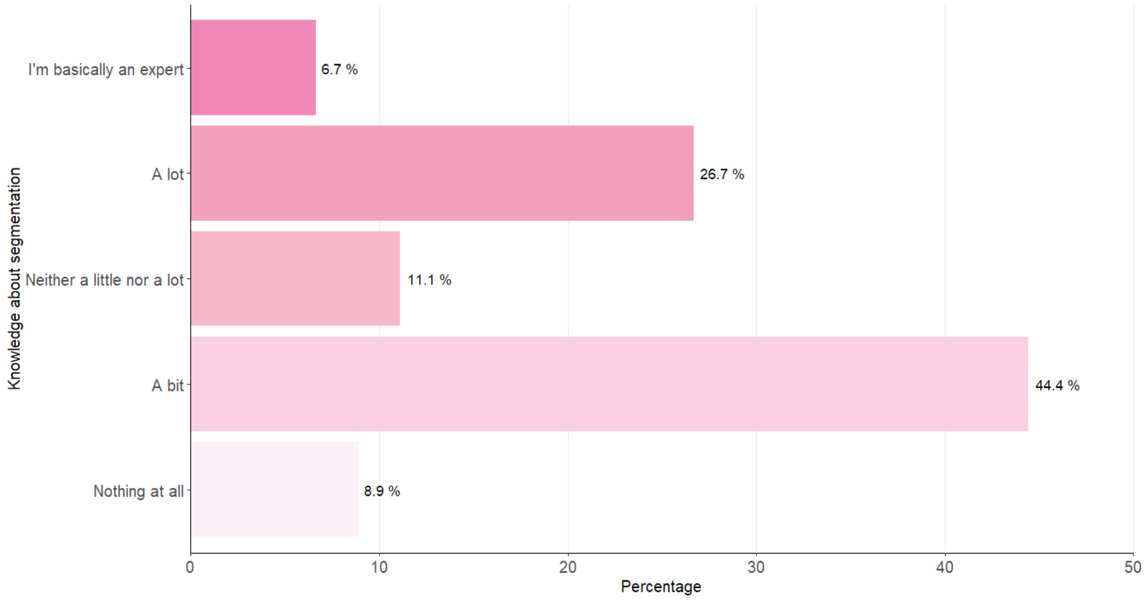
13	Mallinson, L.J., J.M. Russell, and M.E. Barker, 'Attitudes and Behaviour towards Convenience Food and Food Waste in the United Kingdom', Appetite, Vol. 103, 2016, pp. 17–28. (Mallinson, Russell, and Barker, 2016)	United Kingdom	928	1. 'Epicures' (15 %) 2. 'Traditional consumers' (28 %) 3. 'Casual consumers' (27 %) 4. 'Food detached consumers' (16 %) 5. 'Kitchen evaders' (15 %)	*No insights about targeting/tailoring*
14	Marek-Andrzejewska, E.M., and A. Wielicka-Regulska, 'Targeting Youths' Intentions to Avoid Food Waste: Segmenting for Better Policymaking', Agriculture, Vol. 11, No. 4, 2021, p. 284.	Poland	369	1. 'Control-conscious young men from urban areas' (27.37 %) 2. 'Positive-attitude young women from urban areas' (44.44 %) 3. 'Planning-seeking young women from rural areas' (28.18 %)	1. 'Control-conscious young men from urban areas': Simple tips for preparation, storage, food handling and reuse, potentially via mobile apps. Encouragement for cooking events. Price reduction for products near expiration date. Temporary price reductions for fresh produce. Support of suboptimal food and food close to expiration date. 2. 'Positive-attitude young women from urban areas': Could serve as good examples for others (including on social media). Simple tips for food storage and handling. Logos showing market actors' involvement in food waste avoidance initiatives. Increasing inspiration and knowledge about aspects of food waste. 3. 'Planning-seeking young women from rural areas': Tools to simplify household food management (e.g. mobile application for shopping lists, food waste monitoring, tips to use leftovers). Communication about the positive effect of reducing food waste on reducing hunger and undernourishment. Stressing financial aspects of food waste. Educational initiatives to highlight food waste problems. Price reductions for suboptimal food or food near expiration date. 'Happy hours' in canteens.

15	Merian, S., S. Stöeckli, K.L. Fuchs, and M. Natter, 'Buy Three to Waste One? How Real-World Purchase Data Predict Groups of Food Wasters', Sustainability, Vol. 14, No. 16, 2022, p. 10183.	European country	165 (households)	1. 'Traditionals' (49.09 %) 2.'Time constraints' (39.39 %) 3. 'Convenience lovers' (11.52 %)	1. 'Traditionals': Feedback-based interventions decreasing misperceptions about real food waste amounts (e.g. using diaries or automatic measuring bins). 2. 'Time constraints': Interventions integrating food waste avoidance in their schedules. Apps supporting planning or providing tips. Tools assisting in dealing with goal conflicts. 3. 'Convenience lovers': Interventions reducing their proneness to find 'deals', which can lead to extensive food waste. For example, by correcting price reductions by the likelihood of them creating food waste or by making the cost savings realised by avoiding food waste more salient. Framing food waste as a sustainability issue. Interventions fostering positive attitudes towards food waste avoidance, perceived behavioural control and aids to implement intentions.
16	Närvänen, E., N. Mesiranta, H. Saarijärvi, and J. Nevalainen, 'Examining Consumer Food Waste through Grocery Retailers' Customer Data: Segments and Practical Implications', International Journal of Consumer Studies, Vol. 47, No. 4, 2023, pp. 1273–1290.	Finland	12 187	1.'No food waste' (13 %) 2.'Trust in date labels' (19 %) 3.'Safety first' (9 %) 4. 'Occasional wasters' (18 %) 5.'Overpurchasers and overpreparers' (32 %) 6.'Family first' (9 %)	1.'No food waste': *No insights about targeting/tailoring* 2.'Trust in date labels': Information and tips for self-evaluation of food-edibility by consumers (e.g. explanations of date labels, assessment of how vegetables and fruits look during different ripening stages). Improved date labels (e.g. including tactile cues). 3.'Safety first': Information and tips for self-evaluation of food-edibility by consumers (e.g. explanations of date labels, assessment of how vegetables and fruits look during different ripening stages). Improved date labels (e.g. including tactile cues). Unlikely to react to interventions making 'ugly' food or food near expiration date more appealing. 4. 'Occasional wasters': Tools to facilitate planning (mobile apps for recipe suggestions). Interventions making 'ugly' food or food near expiration date more appealing. 5.'Overpurchasers and overpreparers': Interventions making 'ugly' food or food near expiration date more appealing. 6.'Family first': Communications outlining how to involve

					children in cooking practices. Possibilities to include food waste reduction practices in household management skills without compromising their good provider identity.
17	Nikravech, M., N. Langen, E. van Herpen, S. Schuster, and M. Speck, "Out of the Meal Box": A Latent Class Analysis on Dinner Leftover Management Practices, [Manuscript submitted for publication], 2023.	Belgium, Canada, Germany, Netherlands, United Kingdom, United States	868 (households)	1. 'Recyclers' (5.77 %) 2. 'Fussy pot leftovers pickers' (15.01 %) 3. 'Leftover adverse consumers' (13.39 %) 4. 'Leftover lovers' (43.07 %) 5. 'Versatile pot eaters' (22.75 %)	1. 'Recyclers': Priming the necessity of creating fewer leftovers or of developing more positive practices by drawing on role models. 2. 'Fussy pot leftovers pickers': Assistance in determining portion sizes, for example through additional options or measuring cups. 3. 'Leftover adverse consumers': Communication campaigns stimulating intention settings. 4. 'Leftover lovers': Could serve as role models. 5. 'Versatile pot eaters': Could be viable targets of information campaigns aimed at intention implementation.
18	Pearson, D., and U. Amarakoon, 'Environmentally Friendly Social Changes: Profiling Individuals for Household Food Waste Reductions', Australasian Journal of Environmental Management, Vol. 26, No. 4, 2019, pp. 311–327.	Australia	944	1. 'Self-centred' (30 %) 2. 'Uninvolved' (15 %) 3. 'Concerned' (29 %) 4. 'Passionate' (26 %)	1. 'Self-centred': Do not require customised intervention. 2. 'Uninvolved': Targeting them may be inefficient. 3. 'Concerned': Should be focused on, especially by emphasising environmental benefits of reducing food waste. 4. 'Passionate': Do not require customised intervention but may be responsive to emphasising environmental benefits.
19	Pocol, C.B., M. Pinoteau, A. Amuza, A. Burlea-Schiopoiu, and A.-I. Glogovețan, 'Food Waste Behavior among Romanian Consumers: A Cluster Analysis', Sustainability, Vol. 12, No. 22, 2020, p. 9708.	Romania	2 379	1. 'Careless' (22 %) 2. 'Precautious' (40 %) 3. 'Ignorant' (38 %)	*No insights about targeting/tailoring*
20	Richter, B., 'Knowledge and Perception of Food Waste among German Consumers', Journal of Cleaner Production, Vol 166, 2017, pp. 641–648.	Germany	1 023	1. 'Guilty food wasters' (25.94 %) 2. 'Unwitting food	1. 'Guilty food wasters': Further information deepening their knowledge. Showing them further ways to reduce food waste. 2. 'Unwitting food wasters': Information about the usage

				wasters' (42.31 %) 3. 'Careless food wasters' (31.75 %)	of food leftovers, the meaning of expiration dates and the negative impact of food waste on the environment. 3. 'Careless food wasters': Information about the usage of food leftovers, the meaning of expiration dates, and the negative impact of food waste on the environment.
21	Romani, S., S. Grappi, R.P. Bagozzi, and A.M. Bar-one, 'Domestic Food Practices: A Study of Food Man-agement Behaviors and the Role of Food Preparation Planning in Reducing Waste', Appetite, Vol. 121, 2018, pp. 215–227. (Romani et al., 2018)	Italy	456 (study 2)	1. 'Virtuous' (35 %) 2. 'Moderate' (49 %) 3. 'Waster' (16 %)	*No insights about targeting/tailoring*
22	Vittuari, M., L. Falasconi, M. Masotti, S. Piras, A. Se-grè, and M. Setti, ''Not in My Bin': Consumer's Un-derstanding and Concern of Food Waste Effects and Mitigating Factors', Sustainability, Vol. 12, No. 14, 2020, p. 5685.	Italy	938	1. 'Pragmatic con-sumers' (22 %) 2. 'Thrifty altru-ists' (45 %) 3. 'Aware wasters' (33 %)	*No insights about targeting/tailoring*

Figure 4. Responses to the question 'How much do you know about segmentation?'



NB: One response to this question was missing, therefore sums do not add up to 100 %.

Figure 5. Responses to the question 'How much do you know about targeting/tailoring interventions?'

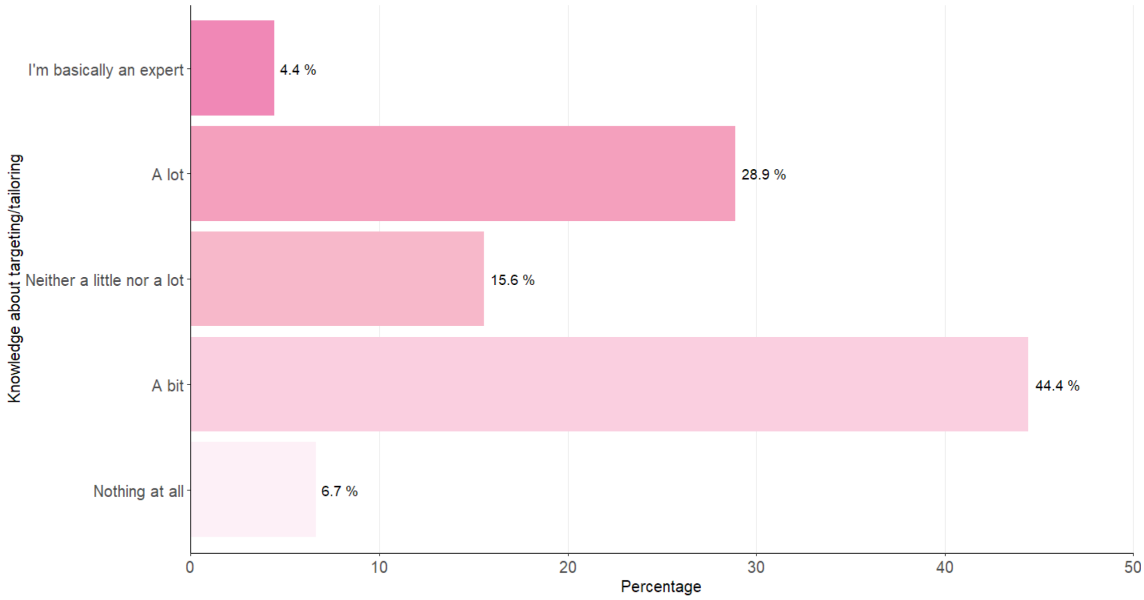
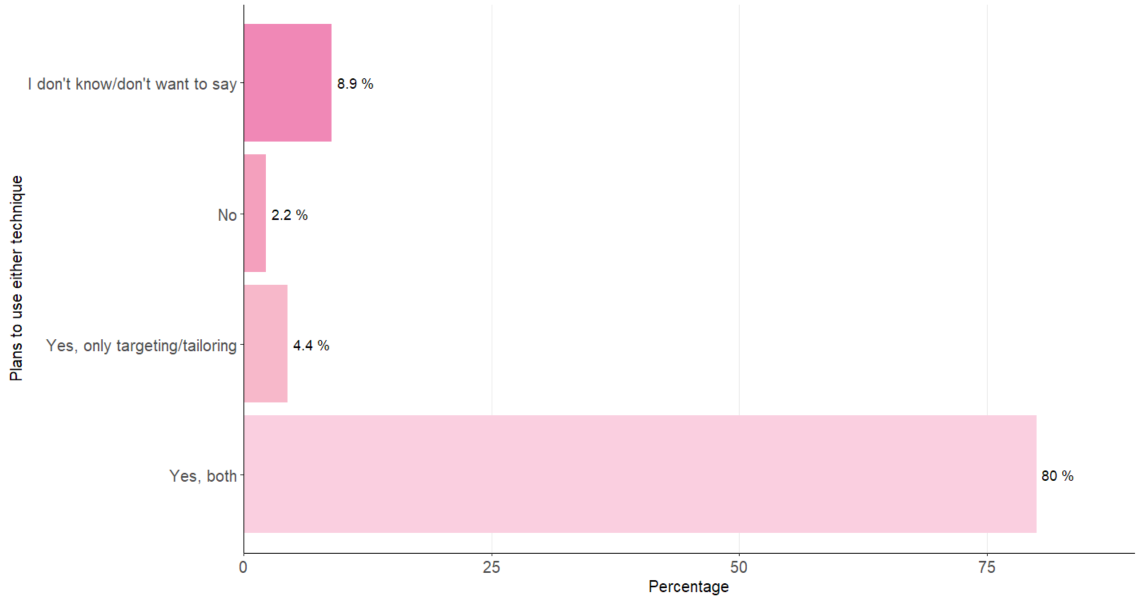
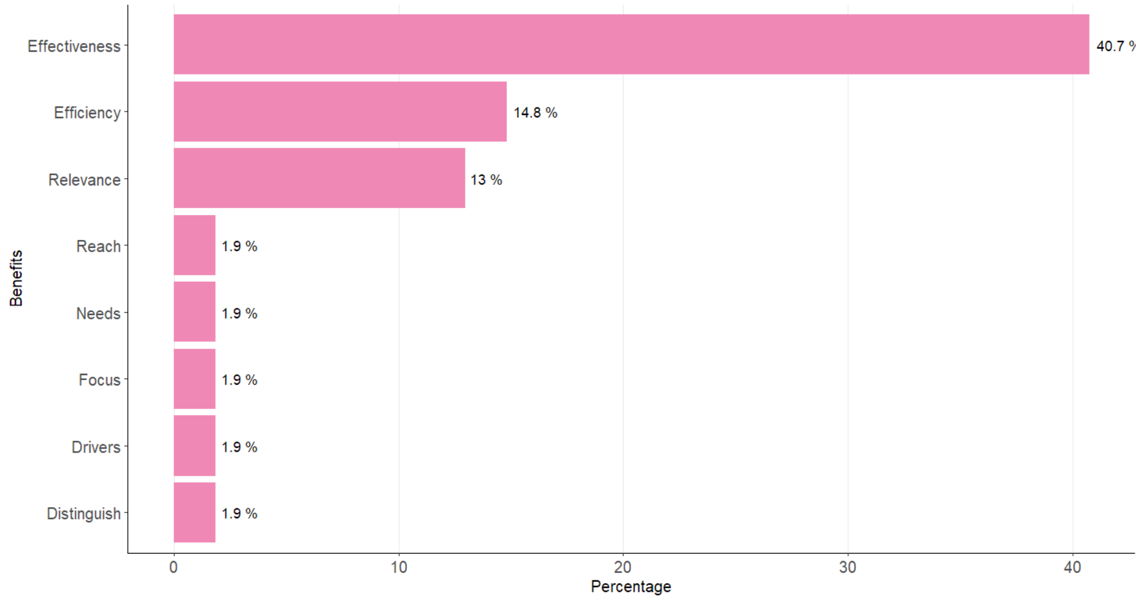


Figure 6. Responses to the question 'Do you plan to are you interested in using either technique?'



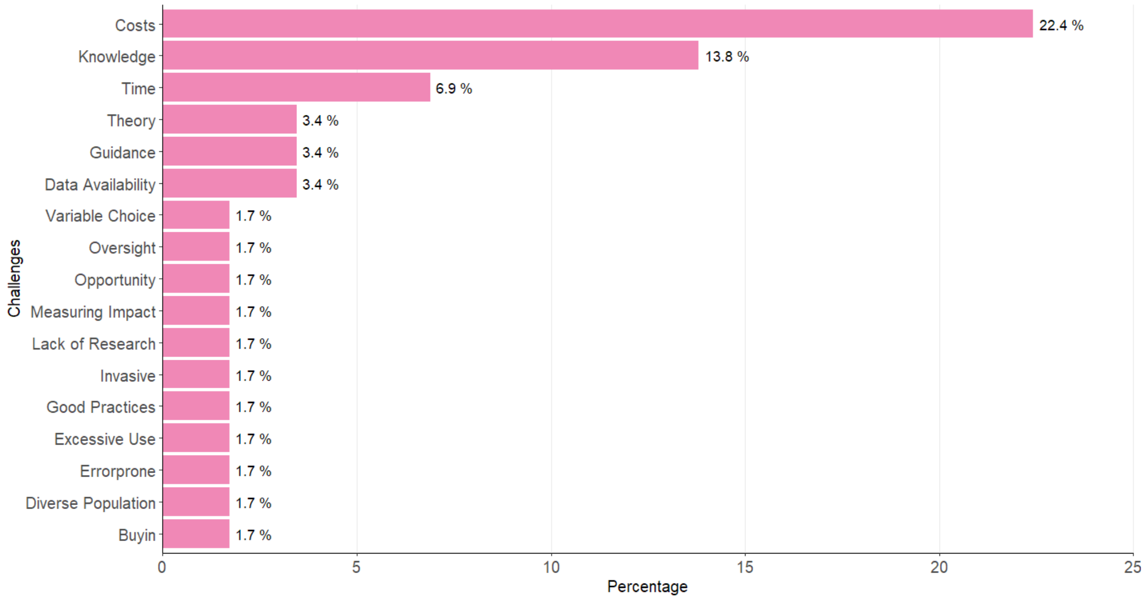
NB: Two responses to this question were missing, therefore sums do not add up to 100 %.

Figure 7. Coded responses to the question 'Please describe briefly the benefits you expect from segmentation and/or targeting/tailoring?'



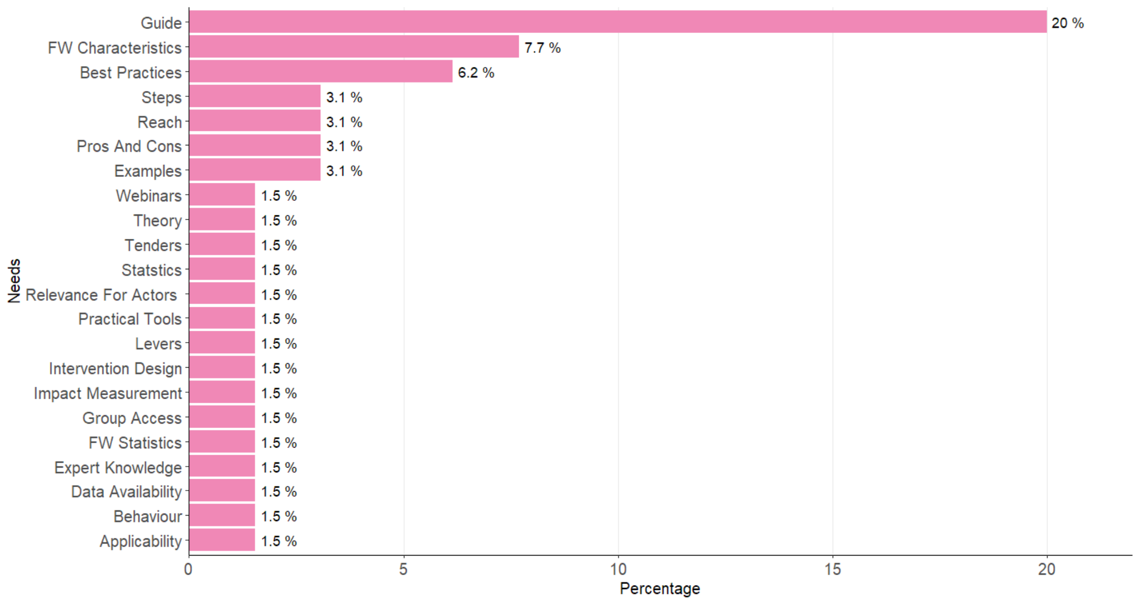
NB: Missing and uncategorisable responses are excluded, therefore sums do not add up to 100 %.

Figure 8. Coded responses to the question 'Please describe briefly the challenges keeping you from using segmentation and/or targeting/tailoring?'



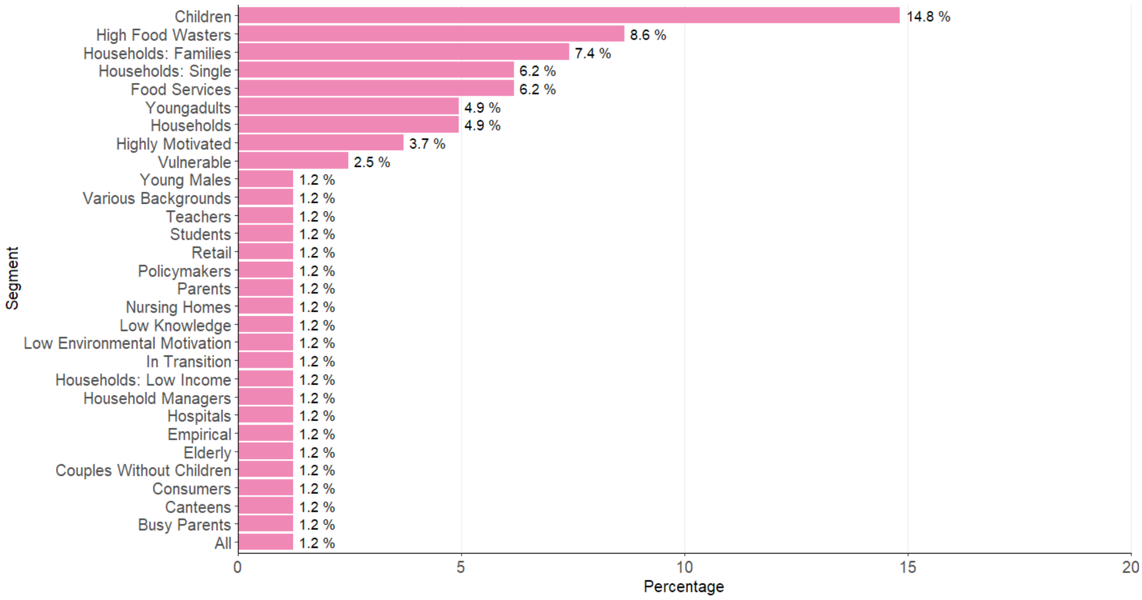
NB: Missing and uncategorisable responses are excluded, therefore sums do not add up to 100 %.

Figure 9. Coded responses to the question 'What type of information / tools / support do you need to understand and/or use either technique?'



NB: Missing and uncategorisable responses are excluded, therefore sums do not add up to 100 %.

Figure 10. Coded responses to the question 'According to you, which segments should be targeted by food waste reduction interventions?'



NB: Missing and uncategorisable responses are excluded, therefore sums do not add up to 100 %.

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